



# Falls Among Older Adults: Strategies for Prevention

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The purpose of this report is to call attention to the role that falls have in the health and longevity of people age 65 or older and to recommend strategies for preventing falls in this population.

### THE PROBLEM: OLDER ADULTS AT RISK FOR FALLS

Washington's population is aging. During the past decade, the state's population of people age 65 or older increased by 15 percent. Rapid gains in this population are expected during the next 20 years. Strategies to promote healthy aging have become increasingly important. Injuries due to falls are a major barrier to healthy aging.

- In the year 2000 alone, falls resulted in nearly 12,000 hospitalizations and 400 deaths among Washington residents age 65 or older. By comparison, there were fewer than 3,000 hospitalizations statewide due to motor vehicle occupant injuries for all ages combined.
- Falls are a high cost health care problem in our state; the public pays a very high proportion of these costs. In 1999, Medicare alone paid \$68.6 million to treat fractures among Washington's population age 65 or older; nearly all of these fractures were due to falls.
- Falls are a major threat to the independence and quality of life of older adults. Among Washington seniors who were hospitalized due to a fall in 2000, nearly two-thirds were discharged to nursing facilities for additional care. While many nursing home placements are temporary (with the patient returning home after two to three months of rehabilitation), falls remain a strong predictor of long-term placement in a nursing home.

### THE SOLUTION: STRATEGIES FOR PREVENTING FALLS AMONG OLDER ADULTS

Falls are not an inevitable consequence of aging; there are proven, effective strategies for preventing falls. The key components of a senior falls prevention program are:

- Exercise, with balance and strength training
- Gait training and training with assistive devices (e.g., canes, walkers)
- Improvements to home safety through measures such as lighting, grab bars, handrails and safe footwear
- Review and management of medications that affect balance
- Treatment of chronic health problems associated with falling
- Education for seniors on factors that contribute to falls, and effective prevention strategies

A falls risk assessment is needed to determine which components of the program are appropriate for an individual. A community-medical model that weaves together the skills and resources of public health professionals, social service agencies and health care providers can provide a solid foundation for an effective senior falls prevention program.

## Introduction

- Falls are a major threat to the independence and quality of life of older adults.
- Falls are a high incidence and high cost health care problem in Washington State.
- Falls are not an inevitable consequence of aging; there are proven, effective strategies for preventing falls.

Falls are a major threat to the independence and quality of life of older adults. Nearly one-third of people 65 years or older who live in their own homes fall each year. Falls often signal the “beginning of the end” of an older person’s life. Fearful of such an outcome, older adults often restrict their activity to avoid the risk of falling. Unfortunately, this very behavior actually increases the risk of falling by causing loss of muscle and strength.

As common as they occur, injuries and deaths due to falls are not an inevitable consequence of aging; they can be prevented. The goal of this report is to provide public health professionals, the medical community and social service providers with the information and tools needed to address the problem of falls among older adults. Its focus is on community-dwelling older adults because recent census figures show that the vast majority (95 percent) of Washington’s population age 65 or older live in households in the community, not in institutions. Special consideration is given to people age 65 or older because this is the population of adults at highest risk for falls. Specific topics addressed in this report include:

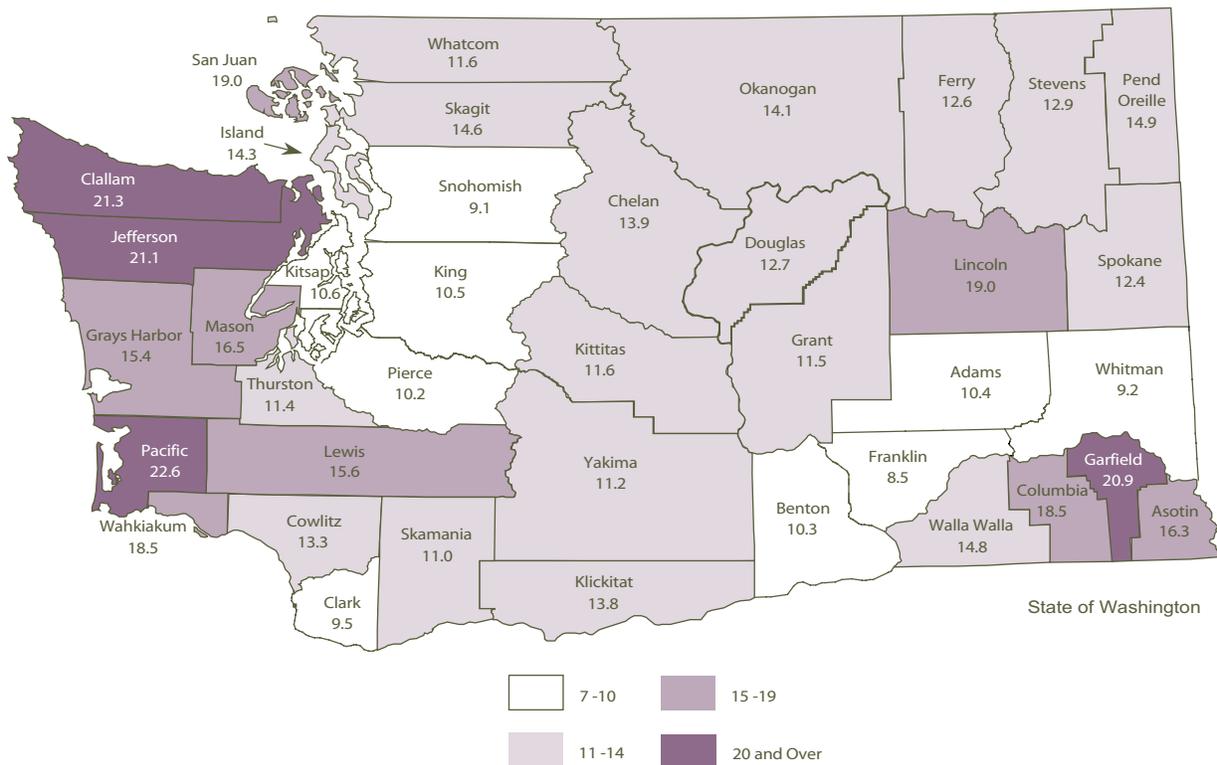
- Washington’s Aging Population
- What We Know about Falls in Older Adults (incidence, trends, costs and risk factors)
- Best Practices for Falls Prevention
- Recommendations for Developing a Senior Falls Prevention Program
- Strategies for Program Evaluation

## Washington's Aging Population

- From 1990 to 2000, Washington's population of people age 65+ increased by 15 percent. Rapid gains in this population are expected during the next 20 years.
- Strategies to promote healthy aging have become increasingly important.
- Falls are a major barrier to healthy aging.

Population estimates for Washington State show that the number of people age 65 or older increased by 15 percent during the past decade. Currently, people age 65 or older represent 11.3 percent of the total state population. In four of Washington's 39 counties, people age 65 or older make up 20 percent or more of the county population (See Figure 1). Rapid increases in this population are expected during the next 20 years.

Figure 1. Percentage by County of Population Age 65 or Over, Washington State, 2000.



Since the 1950s, life expectancy in the United States has increased by approximately eight years. Life expectancy at birth is now 79.4 years for women and 73.6 years for men.<sup>1</sup> Life expectancy for women ages 65 and 85 has also increased. Under current conditions, women who survive to age 65 can on average expect to live to age 84, and those who survive to age 85 can anticipate living to almost age 92 (men can expect to have shorter lives on average).

The aging of our state's population has led to increased concern about the health of older adults. Chronic disease and injury are the most significant health problems that prevent healthy aging. The most common cause of injury among older adults is falls.

Healthy aging, or the lack thereof, affects individuals, families and communities as a whole. Individuals who are disabled by chronic conditions or injuries have difficulty living independently and managing their personal affairs. Young and middle-aged people who care for their aging parents, grandparents, relatives and friends know firsthand how hard it is to provide emotional and financial support for an older person in declining health. For communities and society as a whole, the cost of health care services for the elderly, paid primarily through Medicare, are enormous.

Staying fit and moderately active can greatly enhance a person's chances for living a healthy, independent life, not only in younger years, but in later years as well. Survey data from the Washington State Department of Health's Behavioral Risk Factor Surveillance System for the year 2000 indicates that 77 percent of community-dwelling adults age 65 or older have no physical or mental health limitations that keep them from doing their usual activities, such as self-care, work or recreation. However, only 29 percent of this population meets recommendations for moderate physical activity (i.e., exercise, such as brisk walking at least 30 minutes per day, five or more days per week) and 17 percent report that they get no exercise at all. Only 18 percent engage in strength-building exercises, which can protect against falls and fall-related injuries.

## What We Know About Falls Among Older Adults

The term "fall" means different things to different people. For some people, a fall is any unintentional trip or stumble that causes them to fall against an object or fall to the ground. However, most research studies on the topic use a narrower definition of a fall, which is limited to falls to the ground caused by unintentional trips and stumbles or sudden loss of balance. It excludes falls caused by an overriding medical event, such as a stroke, seizure, motor-vehicle collision, loss of consciousness (syncope) or drug overdose.

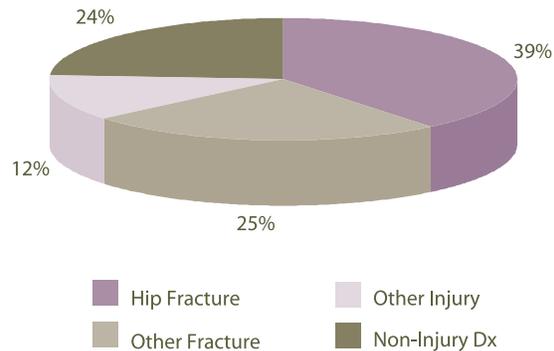
The Washington State data presented in this report include all deaths and hospitalizations due to unintentional trips, stumbles and falls to the ground. The hospitalization data also include falls reported with medical conditions such as heart disease and seizures because the computerized hospital discharge records do not contain sufficient detail to discern whether or not a medical condition caused the fall. Additional information on the Washington data sources used for this report is provided in Appendix A.

### TYPES OF INJURIES CAUSED BY FALLS

Hip fracture is the most common type of injury experienced by older adults who fall and require hospitalization. In 2000, hip fracture was the primary diagnosis for 39 percent of fall-related hospitalizations for people age 65 or older in Washington State. As shown in Figure 2, other commonly reported injuries included limb fractures, head injuries, joint dislocations, lacerations and contusions.

Medical conditions, such as heart attack or stroke, and chronic conditions affecting balance and gait were reported as the primary diagnosis in 24 percent of fall-related hospitalizations.

Figure 2. Primary Diagnosis Reported with Fall Hospitalizations, Washington State, 2000.



### FALL INCIDENCE AND TRENDS

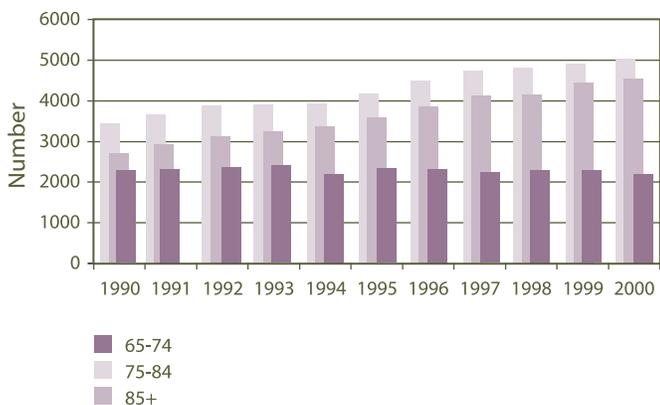
- In 2000, 11,742 Washington residents age 65 or older were hospitalized due to falls. By comparison, there were 2,843 hospitalizations statewide due to motor vehicle occupant injuries for all ages combined.

Data addressing falls among older adults tell a troubling story:

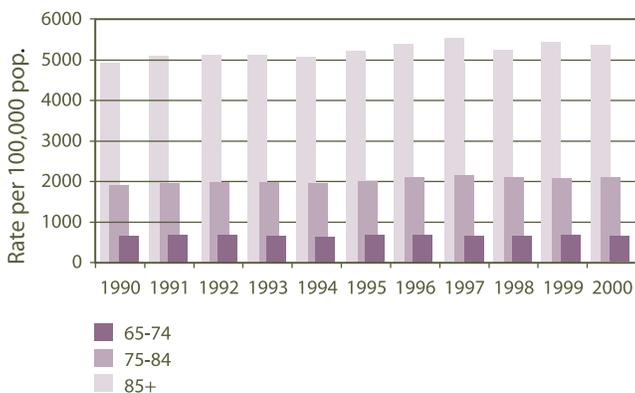
- Approximately one-third of people age 65 or older who live in their own homes fall at least once a year.<sup>2</sup>
- Nearly 80 percent of seniors who fall receive emergency-room treatment for their falls, and one in 40 is hospitalized.<sup>3,4</sup>
- In 2000, there were 393 deaths in Washington State and 11,742 hospitalizations due to falls among people age 65 or older.
- Falls are the most common injury among Washington residents age 65 or older; in 2000, falls accounted for 77 percent of unintentional injury hospitalizations and 59 percent of unintentional injury deaths in the 65 or older population.
- From 1990 to 2000, the number of hospitalizations for falls among those age 65 or older increased by 39 percent.
- Increases in the number of falls in the state's population age 65 or older largely reflects growth in the size of that population.

The trends in falls are best understood by subdividing the 65+ population into smaller age categories because the risk of falling increases substantially with age.<sup>5-9</sup> For people age 65 to 74 years, the number and rate of fall-related hospitalizations and deaths in Washington State have remained fairly stable during the past decade. Among those age 75 to 84, the number of falls has steadily increased while the rate has remained fairly stable, indicating that the increasing numbers are largely due to growth in this segment of the population. For people 85 or older, both the number and rate of falls have increased substantially, suggesting that Washington's "oldest old" are becoming a higher-risk, more frail population. These trends are illustrated in Figures 3a and 3b. (See Appendix E for specific rates and numbers used to produce Figures 3a and 3b.)

**Figure 3a. Number of Fall Hospitalizations by Age and Year, Washington State, 1990-2000.**



**Figure 3b. Rate of Fall Hospitalizations by Age and Year, Washington State, 1990-2000.**

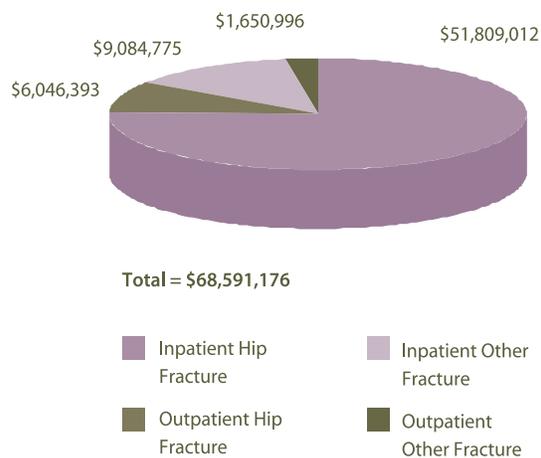


### COST OF FALLS

The public pays a very high proportion of the medical care costs associated with falls among older adults. Medicare is the primary funding source for health care provided to seniors. In 1999, Medicare paid for 89 percent of fall-related hospitalizations among people age 65 or older.

In 1999, Medicare alone paid \$68.6 million to treat fractures among Washington's population age 65 or older (Figure 4).<sup>10</sup> Nearly all (97 percent) of these fractures were due to falls. Of the total Medicare expenditure, nearly \$60.9 million was spent for inpatient treatment, including care provided in hospitals, skilled nursing facilities, home health and hospice care. An additional \$7.7 million was spent for outpatient care, including treatment provided in physician offices, ambulatory surgical centers and rural health clinics; laboratory and diagnostic services; surgical supplies; durable medical equipment; and ambulance services. These charges represent a conservative estimate of the cost of falls, taking into account the fact that fractures are only one of many adverse health outcomes that may result from a fall.

**Figure 4. Medicare Costs for Treating Fractures Among Washington State Residents Age 65 or Older, 1999.**



In addition to cost, falls often have psychological and social consequences. Falls are a common reason for admission to nursing homes; thus falls are a threat to seniors' independence and quality of life. Among Washington seniors who were hospitalized due to a fall in 2000, less than a quarter (22 percent) were able to be released to their home under self care (see Figure 5). Nearly two-thirds (64 percent) were transferred to skilled nursing facilities or intermediate care facilities for additional care. While many nursing home placements are temporary (with the patient returning home after two to three months of rehabilitation), falls remain a strong predictor of long-term placement in a nursing home.<sup>11</sup>

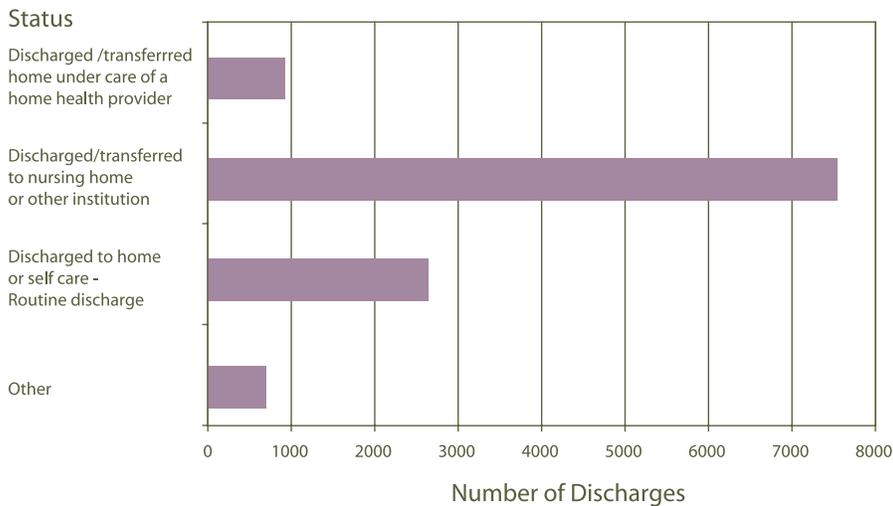
**DEMOGRAPHIC CHARACTERISTICS OF PEOPLE WHO FALL**

**Age**

Fall-related injuries can occur at any age; however, older adults suffer a disproportionate share of the burden. While people age 65 or older made up approximately 11 percent of the total state population in 2000, they accounted for 85 percent of all deaths due to falls and 69 percent of fall-related hospitalizations. Washington data show that the risk of injury or death from a fall begins to climb at about age 55 and increases dramatically after that age.

The relationship between age and falling is partly explained by physiologic changes that occur as people grow older,<sup>5-9</sup> including a decrease in vision, strength, cognition, balance and flexibility. These changes can result in a slower response time or excessive fatigue during difficult and emergency situations, which, in turn, increase the risk for falls and fall-related injuries.

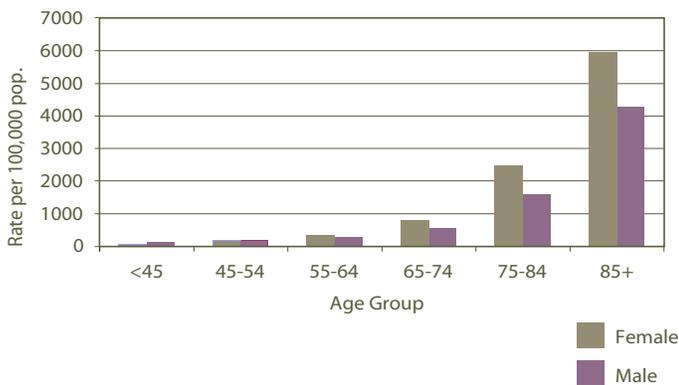
**Figure 5. Discharge Status of Washington State Residents Age 65 or Older Hospitalized for Falls, 2000.**



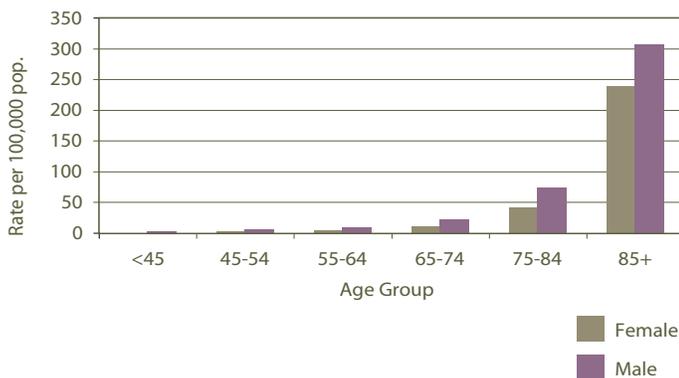
### Gender

Women age 65 or older have substantially higher rates of falls that result in hospitalization compared to men (Figure 6a); men have somewhat higher death rates due to falls (Figure 6b). (See Appendix E for specific rates and numbers used to produce Figures 6a and 6b.) There may be several reasons that women and men experience different outcomes from a fall. For example, osteoporosis may play a substantial role in hip and other limb fractures for women. Or, the circumstances of falls may differ for men and women, with women more likely to fall on their hip and men more likely to fall on their head.<sup>8</sup>

**Figure 6a: Fall Hospitalization Rates, by Age and Gender, Washington State, 2000.**



**Figure 6b: Fall Death Rates, by Age and Gender, Washington State, 2000.**



### Race

White women have the highest rate of nonfatal falls and white males have the highest rate of death due to falls. Whites of either gender have about twice the rate of hip fracture as people of all other races.<sup>9,12</sup> Possible explanations for these differences include findings that, compared to whites, the nonwhite population has stronger bones resulting from denser skeletons, thicker femoral cortices and less spinal osteoporosis.<sup>13,14</sup>

## CAUSES OF FALLS

The majority of falls among older-age people result from a combination of factors. The aging process, described in the previous section, is one factor. Other contributing factors include chronic health problems, physical and functional impairments, medications and alcohol abuse, and hazards in the home.<sup>2,4,15,16</sup>

### Chronic Health Problems

A number of chronic conditions put older adults at risk for falls. These include:

- Diseases of the heart, foot, eyes or muscles
- Postural hypotension (dizziness upon standing)
- Neurological conditions
- Arthritic diseases
- Dementia
- Depression

People who have a history of falls or hip fracture are at especially high risk for future falls.

### Physical and Functional Impairments

Several physical and functional impairments have been associated with increased risk of falls. At greatest risk are older adults with lower-extremity weakness, poor grip strength, balance disorders, visual problems and limitations in their ability to perform activities of daily living.

### Alcohol and Medication Use

Older adults who abuse alcohol or use four or more prescription medications are at increased risk for falls. The types of medications known to increase the risk of falling include sedatives, antidepressants and antipsychotics.

### Hazards in the Home

Several hazards in the home have been identified as risk factors for falls. These include poor lighting, loose carpets, clutter, lack of bathroom safety equipment (such as handrails for getting in and out of the bathtub), lack of handrails on stairs and inappropriate footwear (slippers, or tennis shoes with deep tread).

As can be seen, the number and types of conditions that lead to falls is extensive. Based on a review of the literature,<sup>15</sup> the factors most strongly associated with falling are: muscle weakness, history of falling, gait problems and balance problems.

Several studies have shown that the risk of falling increases dramatically as the number of risk factors increases. For example, one study of community-dwelling seniors showed that the percentage of people falling increased from 27 percent for those with no or one risk factor to 78 percent for those with four or more risk factors.<sup>2</sup> Another study used multivariate analysis to simplify risk factors so that maximum predictive accuracy could be obtained by using only three risk factors (e.g., hip weakness, unstable balance, taking four or more medications). With this model, the predicted one-year risk of falling ranged from 12 percent for people with none of the three risk factors to 100 percent for people with all three.<sup>17</sup>

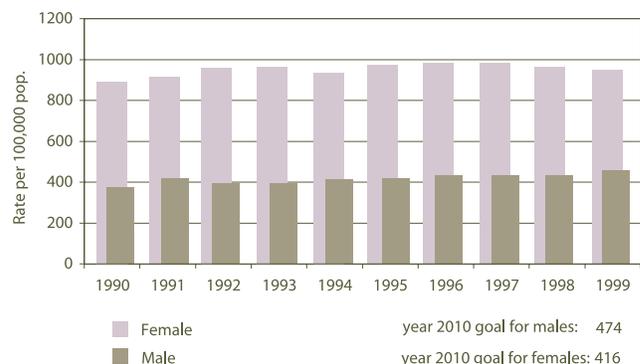
### SENIOR FALLS PREVENTION GOALS

One of the national injury prevention goals for older adults is to reduce the incidence of hip fracture, the most serious and costly injury associated with falling. For the year 2000, the national goal was to reduce the overall rate of hospitalizations for hip fracture among people age 65 or older to a rate of no more than 607 per 100,000 population.<sup>18</sup>

Historically, Washington State's senior population has had lower rates of hip fracture than the nation as a whole. In 1998, the national hip fracture rate for people age 65 or older was 1,056 for women and 593 for males per 100,000.<sup>19</sup> By comparison, Washington State's rate for that same year was 970 for women and 434 for males per 100,000.

Our state has consistently met the national goal for older males; however, we are far from achieving the goal for older females. In view of historical trends shown in Figure 7 (see Appendix E for specific rates and numbers used to produce Figure 7) and the continued aging of the population, it is highly unlikely that Washington State will be able to reduce hip fracture rates among older adults without intensive, continuous efforts to engage seniors, especially women, in health-promoting behavior and effective management of chronic conditions.

**Figure 7: Trends in Hip Fracture Hospitalization Rates for People Age 65 or Older, by Gender, Washington State, 1990-2000.**



## Best Practices for Senior Falls Prevention

Research literature outlines certain key factors that must be included for a community-based, senior falls prevention program to be effective. These factors are outlined below.

### FALLS RISK ASSESSMENT

- The incidence of falls in older adults can be reduced by targeting modifiable risk factors using proven interventions.
- A falls risk assessment is needed to determine modifiable risk factors.

Conducting a risk assessment for falls is a critical first step in implementing a falls prevention program. This assessment should be conducted in a setting that is comfortable and accessible to the potential participants (i.e., senior adults). Some commonly used community-based settings include senior centers, local health departments and community clinics. The falls assessment should be conducted by a nurse or other health professional trained to conduct tests that measure a person's level of strength, balance, gait stability and other factors linked to a person's risk for falling. The risk factors identified in the assessment may be modifiable (such as muscle weakness or medication side effects) or nonmodifiable (such as blindness); however, knowledge of all risk factors is important for identifying appropriate interventions and making appropriate referrals.

Appendix B provides recommended tools for falls risk assessment. Particular attention should be given to the "Timed Up and Go Test,"<sup>20,21</sup> which is a simple, reliable way of ascertaining whether a person has the strength and mobility needed to safely participate in a community-based exercise intervention.

### EFFECTIVE INTERVENTIONS

- Multicomponent interventions tailored to individual needs are most effective in reducing the incidence of falls.

To be effective, a falls prevention program must be tailored to meet individual needs based on the findings from the risk assessment. Further, the program must target modifiable risk factors using proven interventions.

Numerous studies have evaluated the effectiveness of interventions for preventing falls among older adults.<sup>21,22</sup> Because most falls are due to a combination of factors, it is not surprising that the most effective interventions are those that include multiple components that address multiple risk factors.

Based on a review of the literature, the key components of a falls prevention program for community-dwelling older adults are:

- Exercise, with balance and strength training
- Gait training, and training with assistive devices (e.g., canes, walkers)
- Improvements to home safety through measures such as lighting, grab bars, handrails and safe footwear
- Review and management of medications that affect balance (in particular, sedatives and antidepressants)
- Treatment of chronic health problems associated with falling
- Education for seniors on factors that contribute to falls, and effective prevention strategies

## Recommendations for Developing a Senior Falls Prevention Program

This section summarizes important considerations when starting a senior falls prevention program. It is based on a review of published literature and interviews with experts in the field.

### DEVELOPING ESSENTIAL PARTNERSHIPS

An effective senior falls prevention program typically includes public health professionals, community service providers and health care professionals. The involvement of community service and health care providers is essential to identifying, referring and providing services to older adults in a falls prevention program. The role of public health is to:

- Share information on evidence-based best practices for senior falls prevention
- Assist in developing the partnerships needed for successful program implementation
- Provide technical assistance when needed to evaluate program implementation or impact

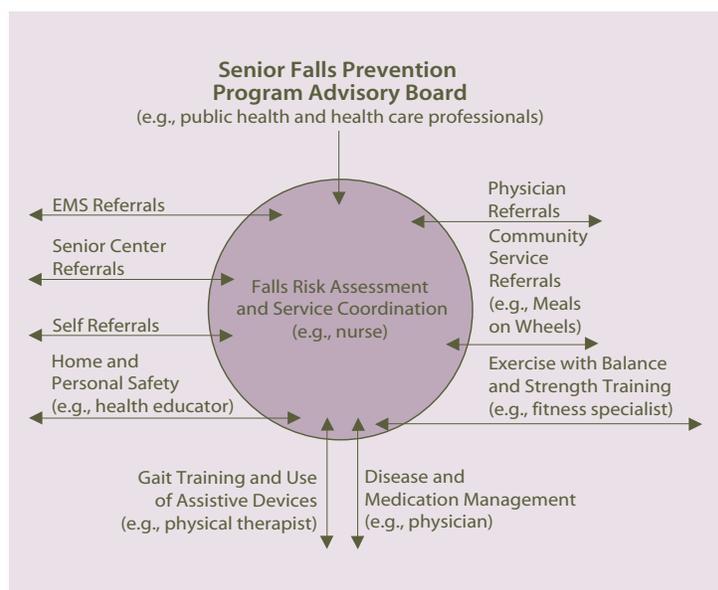
### PROVIDING THE INTERVENTION

Multicomponent interventions have the greatest chance of reducing falls and fall-related injuries among older adults. In providing the intervention, the content should be tailored to meet the needs of the individual as determined by the falls risk assessment. Typically, a multicomponent falls prevention program includes:

- Exercise, with balance and strength training
- Gait training and training with assistive devices
- Improvements to home safety
- Review and management of medications that affect balance
- Treatment of chronic health problems associated with falling
- Education for seniors

A community-medical model that weaves together the skills and resources of public health professionals, social service agencies and health care providers can provide a solid foundation for an effective senior falls prevention program. This approach can provide multiple sources of referral to the program as well as multiple opportunities to encourage the continued participation of seniors once they get started. In developing a senior falls prevention program it is advisable to have a multidisciplinary team to help guide program policies and help identify the essential services and educational messages. Figure 8 identifies potential members of a community-medical model for falls prevention, as well as their functions and relationships.

**Figure 8.** Community-Medical Model for Senior Falls Prevention.



For practitioners working in a clinical setting, the American Geriatrics Society Panel on Falls in Older Adults has published additional, specific guidelines for identifying and treating seniors at risk for falls. These guidelines are provided in Appendix D.

In practice, managers of community-based programs may find that they do not have the resources or working relationships needed to implement a comprehensive, multicomponent intervention. In creating a scaled-back program, it is important to remember that exercise with balance and strength training is known to be the most effective method for reducing falls and fall-related injuries among seniors.<sup>22</sup> Also, while health and behavior education have proven benefits when used as part of a multicomponent intervention, education alone is not an effective falls prevention strategy.

In selecting the curriculum for the exercise component, it's best to emphasize exercises that will improve functional capacity, balance and strength.<sup>26,27</sup> Decisions as to the types of exercises, intensity of exercises, size of group and ratio of staff to participants should be guided by the baseline data on each participant's level of balance, strength and endurance. In situations where there is considerable variability in these areas, it may be advisable to split the group into subgroups according to level of ability. Once the program is under way, it is important to periodically review each participant's progress and make adjustments when needed to ensure that each participant has a specific, tailored, progressive program of exercise. The length of the program should provide adequate time for building skills, followed by progressively intensive training to gain balance, strength and coordination. The program should also enable seniors to maintain their gains through continued exercise.

Two effective exercise programs for older adults in Washington, "Lifetime Fitness" and "Strong and Steady," are individually tailored and include exercises designed to progressively build balance and strength. Lifetime Fitness is offered at various sites throughout the state, and Strong and Steady is offered in Seattle through the University of Washington. Appendix A provides contact information for these programs.

A third effective program, though not currently offered in Washington, is the "Exercise Programme to Prevent Falls in Older People," developed and tested by the New Zealand Falls Prevention Research Group. Appendix C provides information on this program, including recommendations for staffing; specific exercises for balance and strength; details on duration, frequency and intensity of exercises; and safety considerations. This program is suitable for delivery in a home setting or a group setting.

## DECIDING WHO SHOULD PARTICIPATE

Determining who should participate in the program is a key consideration that must be addressed early on. Will the program be limited to people age 65 or older? Will the program use a cognitive test to ensure that participants have the ability to understand and follow simple instructions? How "healthy" does a person have to be in order to participate? It is essential to determine the extent to which pre-existing medical conditions or the use of medications limit or preclude a person's ability to participate in the program. Input from medical care providers is needed to answer these questions and develop program policies. Assessment tools can then be employed to determine the eligibility of older adults interested in participating in the program (see Appendix B).

## GETTING SENIORS TO PARTICIPATE

To get seniors to participate in a falls prevention program, they first need to know of its existence. Proven methods for reaching seniors include recommendations from physicians, advertisements in local newspapers and senior news publications, and postings on senior center bulletin boards. Notices that emphasize the potential benefits of participation, such as staying healthy and independent, have a special appeal for seniors.

It has been observed that programs offered in locations with a high concentration of ethnic minorities experience difficulty generating participation from minority residents. There is some evidence that having staff of the same race/ethnic background as the target population can help alleviate this barrier to participation.<sup>24,25</sup>

Another potential barrier to participation is that seniors may feel that they cannot keep up or perform activities in all components of a multicomponent intervention. A key to solving this problem is to tailor the program to the individual. A minimal level of participation at the beginning is better than no participation at all. As a person develops confidence and commitment, their individual program can be strengthened and broadened to help them achieve greater health benefits.

Cost often presents a barrier to participation. A collaboration among community-based organizations may be useful to identify resources to offset costs to participants. Also, for services that may be covered by Medicare or other third-party payers, efforts should be made to determine coverage and procedures for obtaining reimbursement.

## DETERMINING THE RIGHT LOCATION AND SETTING

The right location for a senior falls prevention program is one that is accessible to the target population, both in terms of transportation and ease of entry and movement within the facility. The right setting is one that has sufficient room and can accommodate the equipment needed to carry out the program. Commonly used settings include senior centers, fitness centers such as the YMCA and community hospitals. People interested in developing programs appropriate for seniors with a history of falls or fall-related injuries should consider a hospital or clinical setting that can offer resources for specialized physical and occupational therapy.

## COLLECTING BASELINE DATA ON PARTICIPANTS

At the point of entry into the program, it is essential to obtain baseline measures of each participant's health status, including risk factors for falls and functional capacity. This information should be periodically reviewed and updated.

## MINIMIZING RISK OF HARM

Generally, a program of moderate exercise does not put a healthy older adult at increased risk for injury or other adverse health effects. However, there is increased risk if the exercise requirements exceed a person's level of balance, strength or endurance. The risk of injury can be minimized by collecting baseline information on these health status measures and carefully monitoring progress.

Another approach to minimizing the risk of injury is to limit participation only to people who obtain clearance for participation from their doctor or other health care provider. We recommend notifying physicians of their patient's potential participation in an exercise program and requesting that they contact the program's risk assessment/intervention coordinator if they anticipate any problems. Physicians should be advised that the program is of moderate intensity rather than high intensity. Physician approval for participation is especially important for older adults with borderline or low scores on the "Timed Up and Go Test" (Appendix B) and those with pre-existing health conditions that place them at high risk for falls.

## EVALUATING PROGRAM IMPACT

Efforts to obtain and maintain support for a senior falls prevention program may be more successful if program administrators can demonstrate that the program is having a positive impact. Administrators also need to know which specific aspects of the program are working or not working in order to fine-tune the program for greater efficiency and effectiveness. Conducting a program evaluation can help provide data for both purposes.

Before a program can be evaluated, it is important to determine the key indicators of success. In a senior falls prevention program, possible indicators could be a reduction in the number of falls, an increase in the interval between falls or a reduction in fall-related injuries. Other possible indicators might include reductions in fall-related risk factors such as lower-extremity weakness, improved scores on gait, mobility and balance tests, or decreases in the use of psychotropic medications.

The ability to measure improvement in these areas can be difficult. It is advisable to work with a research specialist, preferably an epidemiologist, early in the program's development to determine which outcomes will be measured, what data will be collected and how the program's database will be developed and maintained. A research specialist can also prove to be a useful resource for interpreting the data and preparing reports of findings.

Program evaluation need not be limited to measures of health status among program participants. It can also be important to evaluate the characteristics of the program itself, such as the extent to which the program is simple, easy to implement, affordable, accepted and supported within the community. These measures are often key indicators of whether a program is sustainable.

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## Technical Notes

### EVALUATING THE EVIDENCE ON BEST PRACTICES FOR FALLS PREVENTION AMONG OLDER ADULTS

*Guidelines for the Prevention of Falls in Older Persons* was the primary source of information for the evaluation of best practices.<sup>22</sup> It was developed and written under the auspices of the American Geriatrics Society Panel on Falls in Older Persons. The panel was a joint effort of the American Geriatrics Society, the British Geriatrics Society and the American Academy of Orthopaedic Surgeons. While these guidelines have a strong clinical orientation that is not entirely applicable to public health practice; they provide the essential science-based assessment of potential falls prevention interventions. A copy of these guidelines, including assessment methodology, is provided in Appendix D. Copies can also be obtained online at [www.americangeriatrics.org/products/positionpapers/Falls.pdf](http://www.americangeriatrics.org/products/positionpapers/Falls.pdf).

A second resource used to evaluate best practices for prevention of falls among older adults was a Cochrane systematic review, which summarized the evidence from all the randomized controlled trials of falls prevention strategies.<sup>23</sup> This review included some additional studies published after the release of the American Geriatrics Society guidelines.

#### Contact Information for the Lifetime Fitness and Strong and Steady Programs

Lifetime Fitness  
Senior Wellness Project  
[www.seniorservices.org/wellness/wellness.htm](http://www.seniorservices.org/wellness/wellness.htm)  
Phone: 1-800-972-9990

Strong and Steady Program  
University of Washington Medical Center  
Phone: 1-206-598-2888

## WASHINGTON STATE DATA SOURCES

### Hospital Discharge Data – Comprehensive Hospital Abstract Reporting System (CHARS)

#### Purpose

Initially developed to monitor hospital charges; now used to examine trends in causes of hospitalization, establish statewide diagnosis related group (DRG) weights, create hospital-specific case mix indices, characterize access to and quality of health care, and monitor morbidity due to selected health conditions.

#### Coverage

Hospitalizations (i.e., inpatient stays) for all patients treated in state-licensed acute care hospitals in Washington, regardless of patient residence. A hospital is defined as any health care institution that is required to qualify for a license under RCW 70.41.020. CHARS does not cover private alcoholism hospitals, no-fee hospitals, U.S. military hospitals, U.S. Veterans Administration hospitals, or Washington State psychiatric hospitals. For eligible hospitals, data are received for hospital units that are Medicare-approved, including psychiatry, rehabilitation and bone marrow units.

#### Years

Although data collection began in the middle of 1984, the first complete year of reliable injury data is 1989, when cause of injury became a reporting requirement. Annual data are generally available six months after the close of the calendar year.

#### Key Data Elements

Hospital, zip code, birthdate, age, sex, length of stay, discharge status, total charges, payer, principal and secondary diagnoses, principal and secondary procedures, physician, DRGs and DRG relative weight, external cause of injury code, and encoded patient identifier.

#### Reporting System

Hospitals abstract information from the uniform bill, code diagnoses and procedures and submit the information to the state contractor by tape, cartridge or electronic file transfer 45 days following the end of the month.

### Classification and Coding for Causes of Hospitalization

Reasons for hospitalization are coded according to the International Classification of Disease, Clinical Modification of the Ninth Revision. The reason provided in the first diagnosis field is considered to be the principal reason the patient was admitted to the hospital. Since 1993, the coding system has accommodated up to eight other diagnosis fields for additional conditions that had an effect on the hospitalization. Prior to 1993, CHARS only allowed coding of up to five additional diagnoses. Separate from the diagnosis codes, CHARS also has codes that indicate the external cause of an injury or poisoning. For this report, falls included all hospitalizations with an external cause of injury code in the range E880-E886 and E888. Cases of hip fracture included records with a principal diagnosis of 820.

### Data Quality Procedures

Data are edited by the state contractor through system program checks. On a quarterly basis, hospitals certify that the number of discharges and hospital charges are 95 percent correct. Independent evaluation studies are done by data users. For falls the system has been shown to detect 95 percent of true cases.

### Caveats

- The unit of observation is hospitalization not individual. Thus, one person hospitalized several times is counted several times.
- The system excludes emergency-room visits, outpatient surgery, outpatient clinics, military and Veterans Administration hospitals (greatest impact is in Island county, because of the Whidbey Island military installation), free-standing surgeries, free-standing mental health, substance abuse and rehabilitation centers.
- CHARS does not contain data on Washington residents hospitalized outside of Washington. Based on data from the Oregon Health Department, approximately five percent of Washington residents age 65 or older obtain treatment for injuries in Oregon; however, this percentage is substantially higher for residents of Southwest Washington. Out-of-state travel for medical care is also common among Washington residents who live close to the Idaho border. Because of geographic variation in coverage, this report examines only state wide data; there are no county-level comparisons.

- Changes in hospitalization practices or coding conventions might affect trends over time. However, it is likely that hospitalization and coding practices related to falls and fractures among older adults have been fairly stable.
- Residence is based on five-digit ZIP codes. This report uses U.S. Postal Service conventions for assigning ZIP codes to counties based on the physical location of the local post offices. When ZIP codes cross county borders, some hospitalizations may be assigned the wrong county.

### Best Uses

- Monitor hospitalizations due to relatively severe diseases (severe enough to warrant hospitalization consistently over time)
- Analyze use of inpatient health care resources/medical care costs
- Analyze source of payment
- Analyze access to care by examining trends in potentially avoidable hospitalizations

### For Further Information

Washington State Department of Health,  
Center for Health Statistics (360) 236-4223.

## DEATH CERTIFICATE SYSTEM

### Purpose

To establish legal benefits; to provide public health information.

### Coverage

All deaths in Washington and those of Washington residents who die in other states; estimated 99 percent complete.

### Years

Paper records: 1907 to present; Automated records: 1968 to present; annual data generally available eight to ten months after the close of the calendar year.

### Data Elements

(*examples*) Age, gender, race/ethnicity, date of death, underlying and contributing causes of death, place of residence, place of occurrence, ZIP code of residence, occupation and education.

## Reporting System

Demographic information is gathered by the funeral director; cause of death is reported by the attending physician or the coroner/medical examiner. Certificate is filed with the local health jurisdiction, retained for about 60 days for local issuance purposes, then filed with the Washington State Department of Health.

## Classification and Coding for Causes of Death

Classification and coding of data on Washington death records follow the National Center for Health Statistics guidelines as defined in Vital Statistics Instruction Manuals parts 1 through 20 (Published by the U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Health Statistics, Hyattsville, MD). Causes of death are coded according to the International Classification of Disease, World Health Organization, Eighth Revision (ICD-8) for 1968 to 1978; Ninth Revision (ICD-9) for 1979 to 1998; Tenth Revision (ICD-10) for 1999 and later. In this report, for the period 1990 to 1998, the specific codes used to define deaths due to falls were E880-E886 or E888. From 1999 forward, the codes were W00-W19.

## Data Quality Procedures

Instruction manuals are provided to physicians, coroners and medical examiners, as well as to local health jurisdictions and others involved in completing and managing death certificates. Edits and a physician query system are used to check for internal consistency and logic/completeness of cause of death.

## Caveats

- Death rates can understate the magnitude of certain public health problems for deaths that tend to have a social stigma (such as AIDS and suicide) or that diminish the quality of life but are not necessarily fatal (such as chronic alcoholism). This is generally not a problem with deaths due to falls, however.

- Revisions in ICD codes create a discontinuity in trends that must be accounted for when comparing mortality rates between time periods using different revisions. Mortality rates from 1980 to 1998 are coded following the ICD-9. Mortality rates for 1999 and 2000 are coded following the ICD-10. Ratios of the number of deaths coded using ICD-10 to the number coded using ICD-9 (obtained from a large sample of 1996 U.S. deaths) are used to determine whether a trend noted in the 1980 to 1998 period has continued in 1999 and 2000. For falls, as defined by the ICD codes used in this report, the ratio is nearly 1.0, indicating excellent comparability of data over time.

## Best Uses

- Represent the entire population of the state.
- Examine trends in mortality over time.
- Compare local, state, national and international trends with comparable data.
- Compare population subgroups (e.g., race, age, gender, occupation).
- Investigate spatial patterns and correlates (e.g., social, environmental factors).
- Support public health surveillance in a cost-efficient manner.

## For Further Information

Washington State Department of Health,  
Center for Health Statistics, (360) 236-4324.

## BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM (BRFSS)

### Purpose

This data system provides indicators of health-risk behavior, preventive practices, attitudes, health care use and access, and prevalence of selected diseases in Washington.

### Coverage

English-speaking adults in households with telephones; sample size was 3,584 in 2000.

### Years

1987 to present; annual data generally available six months after the close of the calendar year.

**Data Elements**

(Examples) Health risk behaviors (e.g., smoking, physical inactivity, poor nutrition and eating habits), use of preventive services (e.g., cancer screening), use of health care, attitudes about health-related behavior; socio-demographics (age, income) and health conditions (e.g., asthma, diabetes).

**Reporting System**

Data are gathered from a randomly selected sample of adults living in households with telephones. Interviews are conducted in English by a survey firm under contract to the Washington State Department of Health, following survey administration protocols established by the Centers for Disease Control and Prevention (CDCP). The questionnaire includes core questions used by all states and questions on topics of specific interest to Washington State. The BRFSS is supported in part by a cooperative agreement with the CDCP, U58/CCU002118-1 through 16 (1987-2002).

**Data Quality Procedures**

Survey administration procedures (e.g., call-backs to difficult-to-reach households) are used to improve the representativeness of the sample; efforts are made to achieve response rates recommended by CDCP, and computer-assisted interviewing is used to minimize errors by interviewers. CDCP pretests most of the core questions and optional modules for reliability and validity. Interviewers are trained professionally, and calls are monitored regularly.

**Caveats**

- The response rate for the BRFSS has changed from 61 percent in 1995 to 44 percent in 2000. Similar changes have been seen in all other states and in other telephone surveys. Part of the drop is due to new technology that allows people to screen out unknown or unsolicited calls. In these instances, we are not able to try to get participation, and so we do not know whether the number is a household or business. According to the Council of American Survey Research Organizations' guideline for calculating response rates, a portion of these calls are considered as eligible nonrespondents. This decision rule lowers the overall response rate.
- BRFSS might under-represent poorer, more mobile and nonwhite populations because they are less likely to live in homes with telephones.

For example, based on 1990 census data, the mean income for households with telephones was \$37,613 and the mean income for households without telephones was \$15,650. Moreover, 3.1 percent of whites did not have a phone, compared to 8.3 percent of nonwhites.

- BRFSS does not represent people who do not speak English.
- BRFSS does not represent people who live in institutions.
- Characteristics of people who refuse to participate are unknown.
- Health risk behavior might be underestimated because people might be reluctant to report behaviors that others might not find acceptable.
- Use of preventive services might be underestimated because of recall error.
- Separate analyses of subpopulations that are too small (e.g., racial/ethnic groups, some counties) are not possible with the statewide sample.

**Best Uses**

- Provide estimates of the prevalence of health risk behaviors, use of preventive services, use of and access to health care, prevalence of selected health conditions and attitudes.
- Examine trends in risk behavior, use of preventive services and other regularly measured indicators.
- Compare local (large counties or groups), state and national BRFSS data.
- Investigate correlates of health risk behavior, health care use and other indicators, and compare subgroups.
- Identify high-risk groups.

**For Further Information**

Washington State Department of Health,  
Center for Health Statistics (360) 236-4322.

**POPULATION STATISTICS**

Population data in this report are from the decennial U.S. Census or are intercensal estimates provided by the Washington State Office of Financial Management, Forecasting Division.

## Recommended Screening, Assessment and Education Tools

- B.1 Timed Up and Go Test
- B.2 SF-36™ Health Status Survey
- B.3 Queen Mary and Westfield College and South  
East Institute of Public Health Guidelines  
— Fall Risk Assessment and Referral Tool
- B.4 Berg Balance Scale
- B.5 Pfeiffer Short Portable Mental  
Status Questionnaire
- B.6 Washington State Department of Health  
Injury Prevention Program’s Medical Referral/  
Consent Form
- B.7 Skelton and Dinan Falls Diary and  
Detail Sheet
- B.8 Centers for Disease Control and Prevention  
— Home Fall Prevention Checklist for  
Older Adults

## Timed Up and Go

### DESCRIPTION

Measures dynamic balance, gait speed, and functional capacity for household and community mobility.

### ESTIMATED TIME OF TEST

5 minutes

### ADVANTAGES

- Quick and simple.
- Measures change over time.
- Can be used as screening or descriptive tool.

### INSTRUCTIONS FOR TIMED UP AND GO

1. Client sits in an armchair (starts with back against the chair, his arms resting on the chair's arms: wears regular footwear; uses customary walking aid; no physical assistance is given).
2. Client is instructed that on the word "go" he is to get up and walk at a comfortable and safe pace to the line on the floor (3 meters away), turn, return to the chair, and sit down again.
3. Client is given a practice trial to become familiar with the test.

### SCORING

<10 seconds	Clients are freely mobile. <i>Low fall risk; encourage regular exercise or community based exercise program.</i>
<20 seconds	Clients are independent with basic transfers. Most go outside alone and climb stairs. Many are independent with tub and shower transfers. <i>Moderate fall risk; PT referral MAY be appropriate.</i> <i>May benefit from Stumble Stoppers or supervised exercise program.</i>
20-29 seconds	The "gray zone;" functional abilities vary. High fall risk; physician assessment recommended. <i>May not be appropriate for community program prior to PT intervention.</i>
≥ 30 seconds	Many are dependent with chair and toilet transfers. Most are dependent with tub and shower transfers. Most cannot go outside alone. Few, if any, can climb stairs independently. <i>Very high fall risk; physician assessment recommended.</i> <i>Clinic or home physical therapy referral MAY be appropriate.</i> <i>Not appropriate for community programs.</i>

Adapted from: Podsiadlo D, Richardson S. The Timed "Up and Go": A Test of Basic Functional Mobility for Frail Elderly Persons. **Journal of The American Geriatric Society.** 1991;39:142-148.

## Short Form 36 Health Survey Questionnaire (SF-36)

Name \_\_\_\_\_

Date of Birth \_\_\_\_\_

Date of Completion \_\_\_\_\_

The following questions ask for your views about your health, how you feel and how well you are able to do your usual activities (Please place a TICK in the relevant box)

**1. In general, would you say your health is**

- Excellent     Very Good     Good     Fair     Poor

**2. Compared to one year ago, how would you rate your health in general now?**

- Much Better     Somewhat Better     About the Same     Somewhat Worse     Much Worse

**3. Does your health limit you in any of the following activities? If so, how much?**

	YES, limited a lot	YES, limited a little	NO, not limited
a. VIGOROUS ACTIVITIES (such as running, lifting heavy objects, strenuous sport)			
b. MODERATE ACTIVITIES (such as moving a table, vacuuming, bowling or golf)			
c. Lifting or carrying groceries			
d. Climbing <i>several</i> flights of stairs			
e. Climbing one flight of stairs			
f. Bending or kneeling			
g. Walking more than a mile			
h. Walking half a mile			
i. Walking 100 yards (150-200 paces)			
j. Bathing and dressing yourself			

**4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?**

	YES	NO
a. Cut down on the amount of time you spent on work or other activities		
b. Accomplished less than you would like		
c. Were limited in the kind of work or other activities		
d. Had difficulty performing the work or other activities (i.e. took extra effort)		

5. During the past 4 weeks, have you had any of the following problems with your work or other activities as a result of any emotional problem (such as feeling depressed or anxious)?

	YES	NO
a. Cut down on the amount of time you spent on work or other activities		
b. Accomplished less than you would like		
c. Were limited in the kind of work or other activities		
d. Did not do work or other activities as carefully as usual		

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors or groups?

- Not at All     Slightly     Moderately     Quite a Bit     Extremely

7. How much bodily pain have you had during the past 4 weeks?

- None     Very Mild     Mild     Moderate     Severe     Very Severe

8. During the past 4 weeks, how much did pain interfere with your normal work (including work both outside the home and housework)?

- Not at All     A Little Bit     Moderately     Quite a Bit     Extremely

*The next few questions are about how you feel and how things have been with you during the past month. Please indicate which answer comes closest to how you feel.*

9. How much time during the past month?

	All of the Time	Most of the Time	Good bit of the Time	Some of the Time	A little of the Time	None of the Time
a. Did you feel full of life?						
b. Have you been a very nervous person?						
c. Have you felt so down in the dumps that nothing could cheer you up?						
d. Have you felt calm and peaceful?						
e. Did you have a lot of energy?						
f. Have you felt downhearted and low?						
g. Did you feel worn out?						
h. Have you been a happy person?						
i. Did you feel tired?						
j. Has your health limited your social activities (like visiting relatives or friends)?						

10. Please choose the answer that best describes how true or false each of the following statements is for you?

	Definitely True	Mostly True	Not Sure	Mostly False	Definitely False
a. I seem to get ill more easily than other people					
b. I am as healthy as anybody I know					
c. I expect my health to get worse					
d. My health is excellent					

Please check that all questions have been answered.

Thank you for completing this questionnaire.

SF36

Each answer gives an insight into the individuals perceptions of their health and function during daily tasks. Each question gets a score and the total score to each subsection of the scale is recorded. BEWARE some scores differ within the same question number – i.e., Q9 and Q10 have differing scores within their subsections. Over time, this questionnaire is sensitive to improvements in advocacy and perception.

Q1. Excellent=5, Very good=4, Good=3, Fair=2, Poor=1

Q2. Much better=5, Somewhat better=4, About the same=3, Somewhat worse=2, Much worse=1

Q3. Yes, limited a lot=1, Yes, limited a little=2, No, not limited=3

Q4. Yes=0, No=1

Q5. Yes=0, No=1

Q6. Not at all=5, Slightly=4, Moderately=3, Quite a bit=2, Extremely=1

Q7. None=6, Very Mild=5, Mild=4, Moderately=3, Quite a bit=2, Extremely=1

Q8. Not at all=5, A little bit=4, Moderately=3, Quite a bit=2, Extremely=1

Q9. For subsections a, d, e and h score All of the time=6, Most of the time=5, A good bit of the time=4, Some of the time=3, A little of the time=2, None of the time=1

For subsections b, c, f, g, i and j score All of the time=1, Most of the time=2, A good bit of the time=3, Some of the time=4, A little of the time=5, None of the time=6

Q10. For subsections a and c score Definitely true=1, Mostly true=2, Not sure=3, Mostly false=4 and Definitely False=5

For subsections b and d score Definitely true=5, Mostly true=4, Not sure=3, Mostly false=2 and Definitely False=1

Each of the following subsections are then scored:  
The equations make each score a percentage.

### PHYSICAL FUNCTION (PF)

Score added up for the following questions:

Q.  $3a+3b+3c+3d+3e+3f+3g+3h+3i+3j = PF$

The PF score =  $\frac{(PF-10)}{20} \times 100$

### ROLE LIMITATION (RL)

Score added up for the following questions:

#### a) PHYSICAL (RLP)

Q.  $4a+4b+4c+4d=RLP$  The RLP score =  $\frac{(RLP)}{4} \times 100$

#### b) MENTAL (RLM)

Q.  $5a+5b+5c=RLM$  The RLM score =  $\frac{(RLM)}{3} \times 100$

### SOCIAL FUNCTION (SC)

Score added up for the following questions:

Q.  $6+9j=SC$  The SC score =  $\frac{(SC-2)}{9} \times 100$

### MENTAL HEALTH (MH)

Score added up for the following questions:

Q.  $9b+9c+9d+9f+9h=MH$  The MH score =  $\frac{(MH-5)}{25} \times 100$

### ENERGY/VITALITY (EV)

Score added up for the following questions:

Q.  $9a+9e+9g+9i = EV$  The EV score =  $\frac{(EV-4)}{20} \times 100$

### PAIN (P)

Score added up for the following questions:

Q.  $7+8 = P$  The Pain score =  $\frac{(P-2)}{9} \times 100$

### HEALTH PERCEPTIONS (HP)

Score added up for the following questions:

Q.  $1+10a+10b+10c+10d + HP$

The HP score =  $\frac{(HP-5)}{20} \times 100$

### CHANGE IN HEALTH (CIH)

Score added up for the following questions:

Q.2 The CIH score =  $\frac{(CIH-1)}{4} \times 100$

So you will record scores for each section for each participant:

## PGCMS SCORE

- 1 point for a NO answer to Questions 1, 3, 5, 6, 7, 9, 11, 12, 13, 14, 16, and 17
- 1 point for a YES answer to Questions 2, 4, 8, 10, 15

Add up total score and record it.

Name: \_\_\_\_\_

Date of Birth: \_\_\_\_\_

Date of Questionnaire completion: \_\_\_\_\_

## SF36

PF	score	_____
RLP	score	_____
RLM	score	_____
SC	score	_____
MH	score	_____
EV	score	_____
P	score	_____
HP	score	_____
CIH	score	_____

## PCGMS

Total score (out of a total of 17): \_\_\_\_\_

## CONFBAL

Total score (out of a total of 30): \_\_\_\_\_

## VISUAL ANALOGUE SCALE (ANXIETY)

Total score (cm from left): \_\_\_\_\_

# Queen Mary and Westfield College and South West Institute of Public Health Guidelines

## Fall Risk Assessment and Referral Tool

### ASSESSMENT OF FALLS RISK IN OLDER PEOPLE

**Multi-professional guidance for use by primary health care team, hospital staff, and social care workers.**

This guidance has been derived from longitudinal studies of factors predicting falls in older people and randomised controlled trials that have shown a reduction in the risk of falling.

By falling we mean ‘a sudden unintentional change in position causing one to land on a lower level.’

### NOTES FOR USERS:

1. Complete assessment form below. The more positive factors, the higher the risk for falling.
2. If there is a **positive response to three or more of the questions on the form, then please see over** for guidance for further assessment, referral options, and interventions for certain risk factors.
3. Some users of the guidance may feel able to undertake further assessment and appropriate interventions at the time of the assessment.
4. Consider which referral would be most appropriate given the patient’s needs and local resources.

Name \_\_\_\_\_

Date of Birth \_\_\_\_\_

	YES	NO
1. Is there a history of any fall in the previous year? <b>How assessed?</b> Ask the person.		
2. Is the patient/client on four or more medications per day? <b>How assessed?</b> Identify number of prescribed medications.		
3. Does the patient/client have a diagnosis of stroke or Parkinson's Disease? <b>How assessed?</b> Ask the person.		
4. Does the patient/client report any problems with their balance? <b>How assessed?</b> Ask the person.		
5. Is the patient/client unable to rise from a chair of knee height? <b>How assessed?</b> Ask the person to stand up from a chair of knee height without using their arms.		

# Suggestions for further assessment, referral options and interventions

## Assessment by Nurse or Doctor

Risk Factor Present	Further Assessment	Referral Options	Interventions
1. History of falling in the previous year	<ul style="list-style-type: none"> <li>Review incident(s), identifying precipitating factors</li> </ul>	<ul style="list-style-type: none"> <li>Occupational Therapy</li> <li>Physical Therapy</li> </ul>	<ul style="list-style-type: none"> <li>Discuss fear of falling and realistic preventative measures.</li> </ul>
2. Four or more medications per day	<ul style="list-style-type: none"> <li>Identify types of medication prescribed</li> <li>Ask about symptoms of dizziness.</li> </ul>	<ul style="list-style-type: none"> <li>General Practitioner</li> </ul>	<ul style="list-style-type: none"> <li>Review medications, particularly sleeping tablets</li> <li>Discuss changes in sleep patterns normal with aging, and sleep promoting behavior techniques.</li> </ul>
3. Balance and gait problems	<ul style="list-style-type: none"> <li>Can they talk while walking?</li> <li>Do they sway significantly on standing?</li> <li>Can they stand on one leg?</li> </ul>	<ul style="list-style-type: none"> <li>Occupational Therapy</li> <li>Physiotherapy</li> </ul>	<ul style="list-style-type: none"> <li>Teach about risk, and how to manoeuvre safely, effectively and efficiently</li> <li>Physiotherapy evaluation for range of movement, strength, balance and/or gait exercises</li> <li>Transfer exercises</li> <li>Evaluate for assistive devices</li> <li>Consider environmental modifications (a) to compensate for disability and to maximize safety, (b) so that daily activities do not require stooping or reaching overhead.</li> </ul>
4. Postural hypotension (low blood pressure)	<p>Two readings taken</p> <ol style="list-style-type: none"> <li>After rest 5 minutes supine</li> <li>1 minute later standing</li> </ol> <p>Drop in systolic BP &gt; 20 mmHg and or drop in diastolic &gt; 10mmHg</p>	<ul style="list-style-type: none"> <li>District Nurse</li> <li>Practice nurse</li> <li>General Practitioner</li> </ul>	<ul style="list-style-type: none"> <li>Consider raising head of bed if severe</li> <li>Review medications</li> <li>Teach to stabilize self after changing position and before walking</li> </ul>

For frail or ambulatory elderly people, consider the use of hip protectors to reduce the risk of hip fracture.

- While the patient is walking ask them a question but keep them walking while you do so. If the patient stops walking either immediately or as soon as they start to answer, they are at higher risk of falling.
- The patient stands between the assessor and the examination couch (or something they can safely hold on to). First assess if the person sways significantly (raises arms or compensates foot placement) while standing freely. Then ask the person to take their weight on to one leg and try to lift the other foot off the floor by about one inch (allow a few practice attempts).

# Berg Balance Scale

Description	Score (0-4)
<p><b>1. Sitting to standing</b></p> <p>0=needs moderate of maximal assistance to stand                      1=needs minimal aid to stand or stabilize                      2=able to stand using hands after several tries                      3=able to stand independently using hands                      4=able to stand without using hands and stabilize independently</p>	
<p><b>2. Standing unsupported</b></p> <p>0=unable to stand 30 seconds unassisted                      1=needs several tries to stand 30 seconds unsupported                      2=able to stand 30 seconds unsupported                      3=able to stand 2 minutes with supervision                      4=able to stand safely for more than 2 minutes</p>	
<p><b>3. Sitting unsupported</b></p> <p>0=unable to sit 10 seconds without support                      1=able to sit 10 seconds                      2=able to sit 30 seconds                      3=able to sit 2 minutes under supervision                      4=able to sit safely and securely for over 2 minutes</p>	
<p><b>4. Standing to sitting</b></p> <p>0=needs assistance to sit                      1=sits independently but has uncontrolled descent                      2=uses back of legs against chair to control descent                      3=controls descent by using arms                      4=sits safely, minimal use of hands</p>	
<p><b>5. Transfers</b></p> <p>0=needs two people to assist or supervise to be safe                      1=needs one person to assist                      2=able to transfer with verbal cueing and /or supervision                      3=able to transfer safely with definite need of hands                      4= able to transfer safely with minor use of hands</p>	
<p><b>6. Standing with eyes closed</b></p> <p>0=needs help to keep from falling                      1=unable to keep eyes closed 3 seconds but stays steady                      2=able to stand 3 seconds                      3=able to stand 10 seconds with supervision                      4=able to stand &gt;10 - seconds safely</p>	
<p><b>7. Standing with feet together</b></p> <p>0=needs help to attain position and unable to hold for 15 seconds                      1=needs help to attain position but able to stand 15 seconds with feet together                      2=able to place feet together but unable to hold for 30 seconds                      3=able to place feet together and stand 1 minute with supervision                      4=able to place feet together and stand 1 minute or more safely</p>	
<p><b>8. Reaching forward with outstretched arm</b></p> <p>0=loses balance while trying or requires external support                      1=reaches forward but needs supervision                      2=can reach forward &gt;5 cm (2 in) safely                      3=can reach forward &gt;12 cm (5 in) safely                      4=can reach forward confidently &gt;25 cm (10 in)</p>	
<p><b>9. Retrieving object from the floor</b></p> <p>0=unable to try or needs assistance to keep from losing balance or falling                      1=unable to pick up object and needs supervision while trying                      2=unable to pick up object and needs supervision while trying                      3=able to pick up object but needs supervision                      4= able to pick up object safely and easily</p>	
<p><b>10. Turning to look behind</b></p> <p>0=needs assistance to keep from losing balance or falling                      1=needs supervision while turning                      2=turns sideways only but maintains balance                      3=looks behind one side only; other side shows less weight shift                      4=looks behind from both sides and weight shifts well</p>	
<p><b>11. Turning 360 degrees</b></p> <p>0=needs assistance while turning                      1=needs close supervision or verbal cueing                      2=able to turn 360° safely but slowly                      3=able to turn 360° safely on one side only in 4 seconds or less                      4=able to turn 360° safely in 4 seconds or less</p>	
<p><b>12. Placing alternate foot on stool (up to 4 times each foot)</b></p> <p>0=needs assistance to keep from falling or unable to try                      1=able to complete &gt;2 steps, needs minimal assistance                      2=able to complete 4 steps without aid or supervision                      3=able to stand independently and completes 4 steps each leg &gt;20 seconds                      4= completes 4 steps each leg in 20 seconds or less</p>	
<p><b>13. Standing with one foot in front</b></p> <p>0=loses balance while stepping or standing                      1=needs help to take step but can hold for 15 seconds                      2=able to take small step independently and hold for 30 seconds                      3= able to place foot ahead of the other and hold for 30 seconds                      4=able to place foot stride length ahead of other and hold for at least 30 seconds</p>	
<p><b>14. Standing on one foot</b></p> <p>0=unable to try or needs assistance to prevent fall                      1=tries to lift leg but unable to hold for 3 seconds                      2=able to lift leg independently and hold for &gt;3 seconds                      3=able to lift leg and hold 5-10 seconds                      4=able to life leg and hold for &gt;10 seconds</p>	

Adapted from Berg et al, Can.J.Pub.Health:83(suppl.2):57-11, 1992.

SPMSQ

# Pfeiffer Short Portable Mental Status Questionnaire

## INSTRUCTIONS

Ask the subject questions 1-10, record answer, and enter as "1" under appropriate column (correct/error). All responses, to be scored correct, must be given by subject without reference to calendar, newspaper, birth certificate or other memory aid.

Patient Name: \_\_\_\_\_

Date: \_\_\_\_\_

		CORRECT	ERROR
1.	WHAT IS THE DATE TODAY? (Score correct only when the exact month, day and year are given correctly.) Month _____ Day _____ Year _____		
2.	WHAT DAY OF THE WEEK IS IT? Day _____		
3.	WHAT IS THE NAME OF THIS PLACE? _____ (Score correct if any description of the location is given: "My home," accurate name of town, city or name of residence, hospital, or institution (if subject is institutionalized) are all acceptable.)		
4.	WHAT IS YOUR TELEPHONE NUMBER? (If none see 4A below) (Score correct when the correct number can be verified or when subject can repeat the same number at another point in question.) # _____		
4A.	WHAT IS YOUR STREET ADDRESS? (Ask only if subject does not have a telephone.) _____		
5.	HOW OLD ARE YOU? (Score correct when stated age corresponds to date of birth.) Age _____		
6.	WHEN WERE YOU BORN? (Score correct only when exact month, date and year are all given.) Month _____ Day _____ Year _____		
7.	WHO IS THE PRESIDENT OF THE UNITED STATES NOW? (Only the last name of the President is required.) _____		
8.	WHO WAS THE PRESIDENT BEFORE HIM? (Only the last name of the previous President is required.) _____		
9.	WHAT WAS YOUR MOTHER'S MAIDEN NAME? (Does not need to be verified. Score correct if a female name plus last name other than subject's is given.) _____		
10.	SUBTRACT 3 FROM 20 AND KEEP SUBTRACTING 3 FROM EACH NEW NUMBER ALL THE WAY DOWN. _____ (The entire series must be performed correctly in order to be scored correct. Any error in series or unwillingness to attempt series is scored as incorrect.)		
TOTAL NUMBER OF ERRORS			
<b>*Adjustment Factor</b>			
a) <b>subtract 1</b> from <b>error score</b> if subject has had only a grade school education			-
b) <b>add 1</b> to <b>error score</b> if subject has had education beyond high school			+
TOTAL ADJUSTED ERRORS			

**Scoring Key:** 0-2 errors = intellectually intact; 3-4 = mildly impaired;  
5-7 errors = moderately impaired; 8-10 errors = severely impaired.

**Information Obtained by:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Copyright © "E. Pfeiffer, 1974. All rights reserved. Reference: E. Pfeiffer, A Short Portable Mental Status Questionnaire for the Assessment of Organic Brain Deficit in Elderly Patients. Journal of the American Geriatrics Society, Vol. 23:433-441, 1975.



# Skelton and Dinan Falls Diary and Detail Sheet

## FALL DIARY (Two-week example)

Name: \_\_\_\_\_

WEEK:	Start Date:	WEEK:	Start Date:
	<b>FALL</b> (see below for code)	<b>IF FALL</b> (see below for code)	<b>FALL</b> (see below for code)
Monday			Monday
Tuesday			Tuesday
Wednesday			Wednesday
Thursday			Thursday
Friday			Friday
Saturday			Saturday
Sunday			Sunday

**CODES**

**Fall:** 0 = No fall  
1 = Fall

**If Fall:** 0 = No injury  
1 = Soft tissue injury  
2 = Bruise  
3 = Sprain

4 = Dislocation  
5 = Fracture, (non-hip)  
6 = Hip Fracture  
7 = Other (please specify)

Name: \_\_\_\_\_

Date: \_\_\_\_\_ Time of fall: \_\_\_\_\_

Please give a time if possible, if not an approximation

Locations of fall:	At home/garden or Not at home or On transport	(Please specify room/area) (Please specify where) (Please specify where)
Reason for fall (if known): And what doing		Please say if you were visiting, shopping, sight-seeing, travelling etc.
Due to loss of consciousness?	Yes/No/Don't know	Was the fall due to a blackout or loss of consciousness?
Could you get up without help?	Yes/No	Please also mention if you had help but don't think you needed it
Was there any injury?	Yes/No	Please specify area(s) of the body, side(s) of body and injury
Did you go to the GP?	Yes/No	Please give details and also specify if the GP visited you instead
Did you go to the Hospital?	Yes/No	Please specify any findings the Hospital had and whether there are any follow up appointments

# Centers for Disease Control and Prevention - Home Fall Prevention Checklist for Older Adults

## FALLS AT HOME

Each year, thousands of older Americans fall at home. Many of them are seriously injured, and some are disabled. In 1996, more than 8,500 people over age 65 died because of falls.

Falls are often due to hazards that are easy to overlook but easy to fix. This checklist will help you find and fix those hazards in your home.

The checklist asks about hazards found in each room of your home. For each hazard, the checklist tells you how to fix the problem. At the end of the checklist, you will find other tips for preventing falls.

## FLOORS

**Look at the floor in each room.**

- Q. When you walk through a room, do you have to walk around furniture?**
- Ask someone to move the furniture so your path is clear.
- Q. Do you have throw rugs on the floor?**
- Remove the rugs or use double-sided tape or a non-slip backing so the rugs won't slip.
- Q. Are papers, magazines, books, shoes, boxes, blankets, towels, or other objects on the floor?**
- Pick up things that are on the floor. Always keep objects off the floor.
- Q. Do you have to walk over or around cords or wires (like cords from lamps, extension cords, or telephone cords)?**
- Coil or tape cords and wires next to the wall so you can't trip over them. Have an electrician put in another outlet.



## STAIRS AND STEPS

Look at the stairs you use both inside and outside your home.

- Q. Are papers, shoes, books, or other objects on the stairs?**
- Pick up things on the stairs. Always keep objects off the stairs.
- Q. Are some steps broken or uneven?**
- Fix loose or uneven steps.
- Q. Are you missing a light over the stairway?**
- Have a handyman or an electrician put in an overhead light at the top and bottom of the stairs.
- Q. Has the stairway light bulb burned out?**
- Have a friend or family member change the light bulb.
- Q. Do you have only one light switch for your stairs (only at the top or at the bottom of the stairs)?**
- Have a handyman or an electrician put in a light switch at the top and bottom of the stairs. You can get light switches that glow.
- Q. Are the handrails loose or broken? Is there a handrail on only one side of the stairs?**
- Fix loose handrails or put in new ones. Make sure handrails are on both sides of the stairs and are as long as the stairs.
- Q. Is the carpet on the steps loose or torn?**
- Make sure the carpet is firmly attached to every step or remove the carpet and attach non-slip rubber treads on the stairs.

## KITCHEN

Look at your kitchen and eating area.

- Q. Are the things you use often on high shelves?**
- Move items in your cabinets. Keep things you use often on the lower shelves (about waist high).
- Q. Is your step stool unsteady?**
- Get a new, steady step stool with a bar to hold on to. Never use a chair as a step stool.

## BEDROOMS

Look at all your bedrooms.

- Q. Is the light near the bed hard to reach?**
- Place a lamp close to the bed where it is easy to reach.
- Q. Is the path from your bed to the bathroom dark?**
- Put in a night-light so you can see where you're walking. Some night-lights go on by themselves after dark.

## BATHROOMS

Look at all your bathrooms.

- Q. Is the tub or shower floor slippery?**
- Put a non-slip rubber mat or self-stick strips on the floor of the tub or shower.
- Q. Do you have some support when you get in and out of the tub or up from the toilet?**
- Have a handyman or a carpenter put in a grab bar inside the tub and next to the toilet.

## OTHER THINGS YOU CAN DO TO PREVENT FALLS

- Exercise regularly. Exercise makes you stronger and improves your balance and coordination.
- Have your doctor or pharmacist look at all the medicines you take, even over-the-counter medicines. Some medicines can make you sleepy or dizzy.
- Have your vision checked at least once a year by an eye doctor. Poor vision can increase your risk of falling.
- Get up slowly after you sit or lie down.
- Wear sturdy shoes with thin, non-slip soles. Avoid slippers and running shoes with thick soles.
- Improve the lighting in your home. Use brighter light bulbs (at least 60 watts). Use lamp shades or frosted bulbs to reduce glare.
- Use reflecting tape at the top and bottom of the stairs so you can see them better.
- Paint doorsills a different color to prevent tripping.

## OTHER SAFETY TIPS

- Keep emergency numbers in large print near each phone.
- Put a phone near the floor in case you fall and can't get up.
- Think about wearing an alarm device that will bring help in case you fall and can't get up.

### For more information contact:

The National Center for Injury Prevention and Control  
Division of Unintentional Injury Prevention  
4770 Buford Highway, NE, Mailstop K-63  
Atlanta, GA 30341

[www.cdc.gov/ncipc](http://www.cdc.gov/ncipc)  
[www.cdc.gov/safeusa](http://www.cdc.gov/safeusa)

This checklist is a publication of the National Center for Injury Prevention and Control of the Centers for Disease Control and Prevention.

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# How to do it

## Practical Implementation of an Exercise-based Falls Prevention Programme

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### ABSTRACT

Muscle weakness and impaired balance are risk factors underlying many falls and fall injuries experienced by older people. Fall prevention strategies have included exercise programmes that lower the risk of falling by improving strength and balance. We have developed an individually tailored, home-based, strength and balance retraining programme, which has proven successful in reducing falls and moderate fall injuries in people aged 80 years and older. Here we describe a simple assessment of strength and balance and the content and delivery of a falls prevention exercise programme.

*Keywords: exercise, falls, older people*

### INTRODUCTION

Exercise programmes designed for falls prevention in older people should address three major areas—strength, balance and endurance. Those programmes that have improved these have been shown in randomized controlled trials to lower the risk of falling.<sup>1-3</sup>

We describe the practical implementation of a successful home-based exercise programme designed

to improve strength, balance and endurance.<sup>4</sup> The exercise programme has been tested in four separate controlled trials involving over 1000 people aged 65 years and older. It has been found to be effective in reducing falls and moderate injuries in those aged 80 years and older. In one trial, falls risk was reduced over 2 years.<sup>5</sup> Study participants were identified from computerized registers at general practices and were not highly selected. People were eligible to take part if they were able to move around within their own home, able to comply with the study requirements and not currently receiving physiotherapy. After 1 year, about half the participants were still completing the exercise programme three or more times a week. The cost-effectiveness of the programme has been established and will be reported elsewhere.

### THE EXERCISE PROGRAMME IS BASED ON FOUR PREMISES

- The programme needs to be individually tailored because older people vary considerably in their physical capacity and health and in their response to exercise.
- The programme will need to be increased in difficulty, because there will be initial improvement in strength and balance.
- A stable, sustainable programme should be established after a series of visits from the exercise instructor and will need checking two to three times a year thereafter.
- A walking programme to increase physical capacity should complement the strength and balance programme.

Key fall risk indicators that can be used to identify those people who are at the highest risk of falling are shown in Table 1. People at high risk of falling due to muscle weakness and impaired balance should be invited to participate. These people can be identified by quick, simple tests carried out at home or in the consulting room.

**Table 1. Risk indicators useful for identifying individuals suitable for a strength and balance retraining programme**

Age 80+ years	Previous falls
Female	Recent surgery
Recent illness	Impaired balance
Impaired strength	

## Identification and assessment of impaired strength and balance

Lower limb muscle strength and balance can be assessed and scored using two quick physical functioning assessments: the chair stand test<sup>6</sup> and the four-test balance scale.<sup>7</sup> Failure to complete either of these tests indicates deficits in strength and balance.

### Chair stand test

- A straight-backed firm chair with no armrests should be used.
- Place the chair with a wall behind for safety.
- Instruct the person to stand up and sit down as quickly as possible, five times with the arms folded.
- Using a stopwatch, record in seconds the time taken to stand up and sit down five times.
- Allow a maximum of 2 minutes to complete the test.

### Four-test balance scale

- The four-test balance scale includes four timed static balance tasks of increasing difficulty that are completed without assistive devices (The tasks are illustrated in Figure 1).
- No practices are allowed for any of the four tests and they should be carried out in bare feet.
- The person can be helped by the assessor each time to assume the position and the person should then indicate when she is ready to begin the test unaided.
- If the person cannot assume the position, the test is failed at that stage.
- Each position must be held for 10 seconds before the person progresses to the next level of difficulty.
- Timing is stopped if (1) the person moves their feet from the proper position, (2) the assessor provides contact to prevent a fall or (3) the person touches the wall with a hand.

### Programme Implementation

The introduction of a personalized strength and balance retraining exercise programme is a new concept for many older people. It is essential that the older person can confidently carry out the exercises prescribed and that the rationale and benefits of strength and balance retraining are understood. Both active and frail elderly people fall,<sup>8</sup> and an exercise programme should meet the physical capabilities of different individuals.

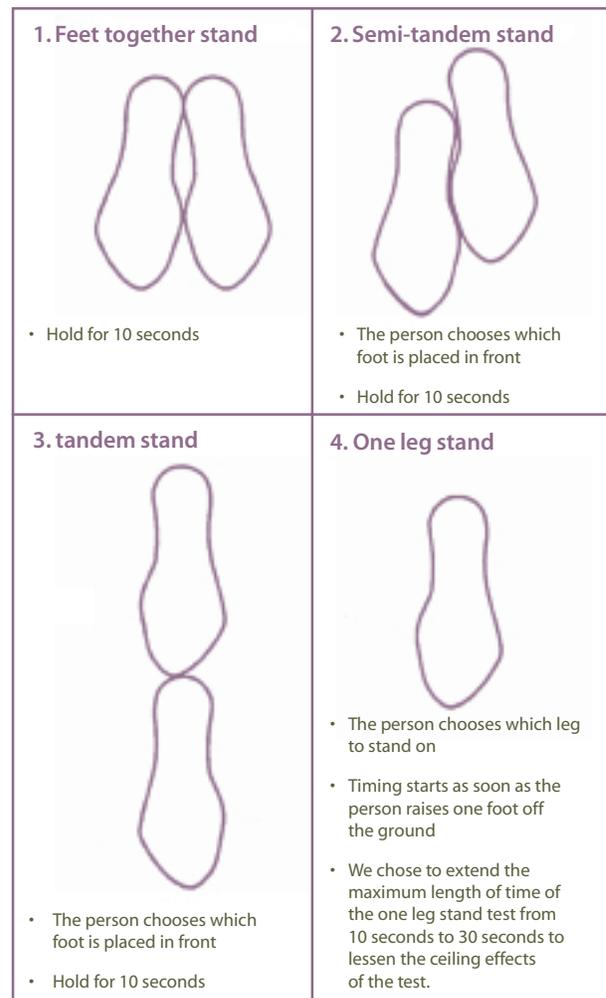


Figure 1. The four-test balance

### Exercise instructor

We recommend that physiotherapists or health professionals trained by a suitably qualified physiotherapist implement the exercise programme. The instructor should have a working relationship with the person's general practitioner so that the intensity of the exercise programme and progress with the programme can be discussed when necessary. In our trials, exercise instructors worked half-time (on average) for 18 months to recruit and deliver the programme for 1 year to around 100 people.

### Exercise programme schedule

We recommend the exercise instructor:

- Carries out four home visits over a period of 2 months, followed by booster visits every 6 months, and between home visits telephones the person every month.
- Allows up to 1 hour for each visit; the first visit is usually the longest.

### Programme resources

- Each participant receives an exercise booklet and ankle cuff weights.
- The booklet includes illustrations and instructions in large print relating to each exercise (see Figure 2).
- The exercise booklet is organized by the exercise instructor during the session as each individual exercise is prescribed.
- Ankle cuff weights are used to provide resistance during strengthening exercises. We prefer ankle cuff weights to resistance bands because we have found them easier for the older person to manage.
- Ankle cuff weights are available in a range of styles and weights. They must be able to be added to or replaced with heavier weights as the person progresses on the programme.
- We have used hospital, orthotic department weights consisting of soft cloth bags filled with lead shot (Figure 3). The weights fasten with Velcro and are wrapped around the lower leg at the ankle.
- The weight should be able to be taken on and off the leg easily by the older person.

### Starting the exercise programme

In the first visit to the participant's home the instructor should aim to establish a good working relationship, assess factors that will modify the programme, make baseline strength and balance measurements and start the exercise programme.

To start the programme we suggest showing the older person the exercise booklet with which she will be working. The instructor should take the person through the starting exercises, ensuring she is safe and confident with each one and can understand the illustrations and instructions. It may be necessary to write additional notes beside some of the exercises. The person should know that the exercises do not have to be done all at once and can be divided up over the day. The exercise booklet should include the instructor's contact telephone number.

We try to involve family members and the general practitioner in recruitment and in carrying out the programme. This may be an effective way of encouraging participation, particularly for more frail people.<sup>9</sup>

### Strength Training

A moderate-intensity strength retraining programme aimed at reducing falls should target the major muscles of the leg. The strengthening exercises we used are shown in Table 2.

#### Back on Heels

- Stand up tall side on to the bench
- Hold on with your hand
- The feet are shoulder width apart
- Come back on to the heels raising the front of both feet off the floor
- Lower the feet to the ground
- Repeat this exercise 20 times



**Figure 2. Examples of instruction and illustration from the exercise booklet.**

Hip extensors, knee extensors, hip abductors and ankle muscles are targeted because they are important for transferring, standing up from a chair and walking, and these movements are not performed as well by fallers as by non-fallers.<sup>10, 12</sup> The ankle dorsiflexor and plantarflexor muscles are targeted because they are important for recovery of balance.<sup>13</sup> Ankle cuff weights are used to provide resistance to the hip abductor, knee flexor and knee extensor muscles; the ankle muscles can be strengthened using body weight alone.<sup>14</sup> Strengthening the lower body is especially important for the prevention of falls, and lower-body strength is lost at a faster rate compared with upper-body strength.<sup>15</sup>

Table 2. Levels and number of repetitions for the strengthening and balancing exercises

Exercise	Details	Level			
		1	2	3	4
<b>Strengthening</b>					
Knee extensor, knee flexor, hip abductor		10 repetitions of each exercise with angle cuff weights to provide resistance to the muscles			
Ankle plantarflexors (up on toes)	10 repetitions, repeat	Hold support	No support	—	—
Ankle dorsiflexors (back on heels)	10 repetitions, repeat	Hold support	No support	—	—
<b>Balance Retraining</b>					
Knee bends	10 repetitions	Hold support	No support or hold support repeat	No support, repeat	No support, x3
Backwards walking	10 steps, 4 times	—	Hold support	—	No support
Walking and turning around	Make figure of 8, twice	—	Hold support	No support	—
Sideways walking	10 steps, 4 times	—	Hold support	No support	—
Tandem stance	10 s	Hold support	No support	—	—
Tandem walk	10 steps, repeat	—	—	Hold support	No support
Heel walking	10 steps, 4 times	—	—	Hold support	No support
Toe walking	10 steps, 4 times	—	—	Hold support	No support
Sit to stand	± hands for support	5 stands, two hands	5 stands, one hand or 10 stands, two hands	10 stands, no support or 10 stands, one hand, repeat	10 stands, no support, repeat

About 5 min of gentle warm-up exercises are carried out before the programme begins and a light ankle cuff weight is used initially to minimize muscles soreness. If muscle pain develops, people are advised to stop the exercises until pain lessens. The exercise instructor checks the exercise technique and reviews the amount of weight originally prescribed.



Figure 3. Ankle cuff weights: soft cloth bags filled with lead shot, wrapped round the lower leg and fastened with Velcro at the ankle.

### Choosing the right intensity

Try the ankle cuff weights on the quadriceps muscle first with the person sitting in a straight-backed chair. When sitting opposite the person in a chair, demonstrate the exercise. Ask the person to carry out a set of quadriceps strengthening exercises. The starting weight for the ankle cuff weights is chosen by determining the amount of weight the person can use to perform 8-10 good-quality repetitions before fatigue. We recommend starting people aged 80 years and older on 1 or 2 kg. In our current home programme participants are using between 1 and 8 kg.

There should be minimal substitution of other muscle groups. It is important to use the correct breathing technique (inhale before a lift, exhale during the lift, and inhale as the weight is lowered to the starting position). The exercise should be done slowly (2-3 s to lift the weight, 4-5 s to lower the weight) and through the functional range of active joint movement.<sup>16</sup>

The person should aim for two sets of 10 repetitions in the session before progressing to a heavier weight. Progressions onto a heavier weight should take place at the second visit rather than the first to allow the person to become accustomed to using the weights. The person should rest between sets for 1-2 min. For all other strengthening exercises, get the person to exercise in a standing position as this is thought to aid balance as well as strength. The starting weight will need to be reassessed for each muscle group on each leg.

### Duration and frequency

Strength training 3 days a week is recommended, although strength training twice weekly is associated with 80-90% of the benefits gained with more frequent training.<sup>17</sup> People should always have a rest day in between muscle strengthening exercises, to allow for muscle recuperation and development.

### Safety with strength training

The exercise instructor must weigh up the extra benefit to the older person associated with using heavier weights and the potential risk of adverse side effects (injury, cardiovascular events).

People do not feel unduly tired after the exercises as the programme emphasizes balancing and moderate-intensity strengthening exercises rather than high-intensity strengthening exercises.

People with rheumatoid arthritis or osteoarthritis should lift the weight within the pain-free range of movement. The person should be asked to report to the exercise instructor any changes in physical symptoms or exacerbations of existing medical conditions such as arthritic pain.

People should be advised to stop exercising and to contact their general practitioner if they experience dizziness, chest pain and/or shortness of breath while exercising or muscle pain that does not ease.

## BALANCE RETRAINING

Balance needs to be stressed to improve,<sup>18,19</sup> and dynamic balance exercises have been recommended for improving balance rather than assuming that static balance training will transfer over to improved balance during (dynamic) activities of daily living.<sup>20</sup> Balance exercises are closely related to lifestyle and function: for example, moving from a sit to stand position, walking and turning around and knee bends.<sup>21</sup>

The balance retraining exercises we used, with progressions from level 1, the first or easiest, through to level 4, the most difficult, are shown in Table 2. It is important to explain to people that the purpose of the exercises is not only to maintain balance but also to recover balance by using the legs rather than grasping furniture or benches with the arms.

### Choosing the Right Balance Exercises

Balance exercises progress from holding on to a stable supporting structure such as heavy furniture to performing the exercise independent of support. The starting level of each exercise is dependent on the baseline physical functioning and health status of the older person. Not all older people will necessarily start at the first level of each exercise or be prescribed all the balancing exercises.

### Duration and Frequency

Exercise programmes that have successfully reduced falls in older people have required the participants to carry out balancing (and strengthening) exercises 3 days a week<sup>4</sup> and twice daily for 15-20 min.<sup>1,2</sup> We recommend that balance exercises are carried out at least 3 days a week.

### Safety with Balance Training

We suggest observing the participant during the holding version of each balance exercise before prescribing the exercise without holding support. If the participant is exercising with no holding support, the instructor must be confident that the older person can recover balance using lower-body strategies.

## WALKING

We recommend that walking is included in falls prevention exercise programmes. Recent evidence suggests that moderate-intensity strength training improves gait stability.<sup>22</sup>

### Prescribing Walking Times

We suggest aiming for 30 min of walking<sup>23</sup> and the person should be instructed to walk at their usual pace. The best way to achieve 30 min or more may be to break it up into 10-min sessions over the day. Help the person incorporate walking times into daily activities by suggesting strategies such as getting off the bus a block early to walk home and using the stairs rather than lifts or escalators.

## FOLLOW-UP VISITS

The aims of the follow-up visits are to increase the difficulty of the strength and balance retraining exercises.

The instructor should be mindful that for most of the time the older person must exercise without supervision. Too rapid increases in the intensity of the exercises or the ankle cuff weights for strengthening may decrease compliance. The exercise programme may require modifying and perhaps restarting after illness. Feedback and encouragement from the exercise instructor are very important. A schedule for the exercise programme implementation and follow-up is given in Table 3.

## SUMMARY

Aim to include frail, older people in the exercise programme. These people have the most to gain from interventions that can improve strength and balance.

Start the programme slowly. Muscle strengthening and balance retraining exercises need to be continued if exercise benefits are to be sustained.<sup>18</sup> Monthly telephoning is an effective way of maintaining contact after the home visits have been completed.

Walking and other activities promoting physical activity should be encouraged but on their own will not lower falls risk. They should be part of comprehensive strength and balance training programmes.

Home-based exercise programmes may well be used in conjunction with group programmes, for example meeting once a week at a club with friends to reinforce the programme.

Most falls occur because of multiple interacting factors. Assessment and treatment of other fall-related problems will be necessary, but leg muscle weakness and poor balance are so common, in older women especially, that specific strength and balance exercises need to be part of any falls prevention programme.

## KEY POINTS

- Older people can be assessed for impairments in strength and balance using simple tests. Inability to complete these tests indicates the person may benefit from an exercise programme.
- Adequate resistance must be applied to muscles in order to increase muscle strength. This typically involves the use of strengthening equipment, such as ankle cuff weights.
- Individually tailored balancing and strengthening exercises should be carried out at least 3 days a week.
- Follow-up visits and regular contact are important for long-term compliance and programme re-evaluation.

### Table 3. Schedule for the exercise programme implementation

The exercise instructor carries out a series of home visits to prescribe and progress the individually tailored strength and balance retraining exercises. We suggest visits at week 1, week 2, week 4 and week 8 of the programme with a booster visit every 6 months.

The participant is instructed to carry out the set of exercises 3 times a week, and to walk twice a week aiming for 30 min (this can be broken down to 3 sessions of 10 min walks).

Between home visits the exercise instructor telephones the participant every month to check on his/her progress and to maintain motivation.

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## SPECIAL SERIES: CLINICAL PRACTICE

## Guideline for the Prevention of Falls in Older Persons

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*American Geriatrics Society, British Geriatrics Society, and American Academy of Orthopaedic Surgeons Panel on Falls Prevention*

Key words: falls; risk of falling; fall assessment; fall intervention; fall prevention

### BACKGROUND AND SIGNIFICANCE

Falls are among the most common and serious problems facing elderly persons. Falling is associated with considerable mortality, morbidity, reduced functioning, and premature nursing home admissions.<sup>1-5</sup> Falls generally result from an interaction of multiple and diverse risk factors and situations, many of which can be corrected. This interaction is modified by age, disease, and the presence of hazards in the environment.<sup>6</sup> Frequently, older people are not aware of their risks of falling, and neither recognize risk factors nor report these issues to their physicians. Consequently opportunities for prevention of falling are often overlooked with risks becoming evident only after injury and disability have already occurred.<sup>7-9</sup>

Both the incidence of falls and the severity of fall-related complications rise steadily after age 60. In the age 65-and-over population as a whole, approximately 35% to 40% of community-dwelling, generally healthy older persons fall annually. After age 75, the rates are higher.<sup>10,11</sup>

Incidence rates of falls in nursing homes and hospitals are almost three times the rates for community-dwelling persons aged  $\geq 65$  (1.5 falls per bed annually). Injury rates are also considerably higher with 10% to 25% of institutional falls resulting in fracture, laceration, or the need for hospital care.<sup>12</sup> Fall-related injuries recently accounted for 6% of all medical expenditures for persons age 65 and older in the United States.<sup>12,13</sup>

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This guideline was developed and written under the auspices of the American Geriatrics Society (AGS) Panel on Falls in Older Persons and approved by the AGS Board of Directors on April 5, 2001.

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A key concern is not simply the high incidence of falls in older persons (young children and athletes have an even higher incidence of falls) but rather the combination of high incidence and a high susceptibility to injury. This propensity for fall-related injury in elderly persons stems from a high prevalence of comorbid diseases (e.g., osteoporosis) and age-related physiological decline (e.g., slower reflexes) that make even a relatively mild fall potentially dangerous. Approximately 5% of older people who fall require hospitalization.<sup>14</sup>

Unintentional injuries are the fifth leading cause of death in older adults (after cardiovascular, neoplastic, cerebrovascular, and pulmonary causes), and falls are responsible for two-thirds of the deaths resulting from unintentional injuries. More pointedly, 75% of deaths due to falls in the United States occur in the 13% of the population age 65 and over.<sup>15</sup> In addition to physical injury, falls can also have psychological and social consequences. Recurrent falls are a common reason for admission of previously independent elderly persons to long-term care institutions.<sup>16,17</sup> One study found that falls were a major reason for 40% of nursing home admissions.<sup>14</sup> Fear of falling and the post-fall anxiety syndrome are also well recognized as negative consequences of falls. The loss of self-confidence to ambulate safely can result in self-imposed functional limitations.<sup>1,18</sup>

### RISK FACTORS FOR FALLING

As detailed in Table 1, a number of studies have identified risk factors for falling. These can be classified as either intrinsic (e.g., lower extremity weakness, poor grip strength, balance disorders, functional and cognitive impairment, visual deficits) or extrinsic (e.g., polypharmacy (i.e., four or more prescription medications) and environmental factors such as poor lighting, loose carpets, and lack of bathroom safety equipment). Although investigators have not used consistent classifications, a recent review of fall risk factor studies ranked the risk factors and summarized the relative risk of falls for persons with each risk factor (Table 1).<sup>11</sup> In addition, a meta-analysis that studied the relationship of falls and medications, which included studies that examined both multiple and single risk factors, found a significantly increased risk from psychotropic medication (odds ratio (OR) = 1.7), Class 1a antiarrhythmic medications (OR = 1.6), digoxin (OR = 1.2), and diuretics (OR = 1.1).<sup>32</sup>

Perhaps as important as identifying risk factors is appreciating the interaction and probable synergism between multiple risk factors. Several studies have shown that the risk of falling increases dramatically as the number of risk factors increases. Tinetti et al. surveyed community-dwelling elderly persons and reported that the percentage of persons falling increased from 27% for those with no or one risk factor to 78% for those with four or more risk factors.<sup>30</sup>

**Table 1. Results of Univariate Analysis\* of Most Common Risk Factors for Falls Identified in 16 Studies\* That Examined Risk Factors**

Risk Factor	Significant/ Total <sup>†</sup>	Mean RR-OR <sup>‡</sup>	Range
Muscle weakness	10/11	4.4	1.5-10.3
History of falls	12/13	3.0	1.7-7.0
Gait deficit	10/12	2.9	1.3-5.6
Balance deficit	8/11	2.9	1.6-5.4
Use assistive device	8/8	2.6	1.2-4.6
Visual deficit	6/12	2.5	1.6-3.5
Arthritis	3/7	2.4	1.9-2.9
Impaired ADL	8/9	2.3	1.5-3.1
Depression	3/6	2.2	1.7-2.5
Cognitive impairment	4/11	1.8	1.0-2.3
Age > 80 years	5/8	1.7	1.1-2.5

\*References: 3, 5, 19-31

<sup>†</sup>Number of studies with significant odds ratio or relative risk ratio in univariate analysis/total number of studies that included each factor.

<sup>‡</sup>Relative risk ratios (RR) calculated for prospective studies. Odds ratios (OR) calculated for retrospective studies.

ADL = activities of daily living.

Similar results were found among an institutionalized population.<sup>5</sup> In another study, Nevitt et al. reported that the percentage of community-living persons with recurrent falls increased from 10% to 69% as the number of risk factors increased from one to four or more.<sup>27</sup> Robbins et al. used multivariate analysis to simplify risk factors so that maximum predictive accuracy could be obtained by using only three risk factors (i.e., hip weakness, unstable balance, taking  $\geq 4$  medications) in an algorithm format. With this model, the predicted 1-year risk of falling ranged from 12% for persons with none of the three risk factors to 100% for persons with all three.<sup>3</sup>

There is emerging evidence of an overlap between the symptoms of falls and syncope in some older adults. This is due either to amnesia for loss of consciousness or to hypotension-induced imbalance in persons with existing gait and balance instability. To date, the overlap has been reported in selected populations with bradycardiac disorders such as carotid sinus syndrome. The prevalence of cardiovascular causes of falls in the general population is as yet unknown.

## GUIDELINE DEVELOPMENT PROCESS AND METHODS

The aim of this guideline is to assist health care professionals in their assessment of fall risk and in their management of older patients who are at risk of falling and those who have fallen. The Panel of Falls Prevention assumes that health care professionals will use their clinical knowledge and judgment in applying the general principles and specific recommendations of this document to the assessment and management of individual patients. Decisions to adopt any particular recommendation must be made by the practitioner in light of available evidence and resources.

The literature search attempted to locate systematic reviews and meta-analyses, randomized trials, controlled before-and-after studies, and cohort studies using a combination of subject heading and free text searches. The panel made extensive use of high-quality recent review articles and bibliographies, as well as contact with subject area experts. New searches were concentrated in areas of importance to the guideline development process, for which existing systematic reviews were unable to provide valid or up-to-date answers. The expert knowledge and experience of panel members also reinforced the search strategy. It is important to note that the literature upon which the guideline is based includes only those articles that were available to the Panel during its September 2000 meeting.

A literature search conducted by researchers at the RAND Corporation (RAND corporation, Santa Monica, CA) for the purpose of identifying quality of care indicators for falls and mobility problems for two ongoing national projects provided the initial set of articles reviewed for the guideline. "Included" articles were meta-analyses and systematic literature reviews, randomized controlled trials, nonrandomized clinical trials, case control studies, and cohort studies

in which outcomes involved data related to fall risk or fall prevention as well as articles that provided epidemiological or other background information. For each included article, data were extracted. Reference lists of included articles were scanned for any additional relevant studies, and further relevant articles were identified.

The Panel identified and synthesized relevant published evidence to allow recommendations to be evidence-based, whenever possible, using the grading criteria shown in Table 2. The grading criteria distinguish between category of evidence and strength of the associated recommendation. It was possible to have methodologically sound (Class I) evidence about an area of practice that was clinically irrelevant or had such a small effect that it was of little practical importance and would, therefore, attract a lower strength of recommendation. More commonly, a statement of evidence would only cover one part of an area in which a recommendation had to be made or would cover it in a way that conflicted with other evidence. Therefore, to produce comprehensive recommendations, the Panel had to extrapolate from the available evidence. This may lead to weaker levels of recommendation (B, C, or D) based on evidence Class I statements.<sup>33</sup> This is inevitably a subjective process.

It was accepted that there would be areas without evidence where recommendations should be made and that consensus would be required to address such areas. For a number of the interventions, there was not sufficient evidence to make recommendations and “Comment” sections were written. Throughout the guideline development process, the Panel identified important unanswered research questions that are listed in the “Research Agenda” section at the end of this guideline.

## ASSESSMENT OF PERSONS WHO HAVE FALLEN OR ARE AT RISK OF FALLING

### General Principles

It is a fundamental tenet of this guideline, based on a number of controlled studies, that detecting a history of falls and performing a fall-related assessment are likely to reduce future probability of falls when coupled with intervention (see Interventions to Prevent Falls, below). Because of this dependence of the assessment on subsequent intervention for effectiveness, it was more difficult to ascribe strength of recommendation

to assessment recommendations alone. Therefore, specific recommendations for assessment have been left ungraded. Likewise, prior to any intervention, assessment of an individual’s risks and deficits is required to determine specific needs and, if necessary, to deliver targeted interventions.

The recommendations for assessment came from epidemiological studies demonstrating an association between risk factors and falls (see Background and Significance) and from experimental studies in which assessment followed by intervention demonstrated benefit (see interventions to Prevent Falls, below). Thus, the suggested assessment describes what needs to be done to understand an individual’s risk factors and apply an effective intervention(s). An algorithm summarizing the assessment and management of falls is shown in Figure 1.

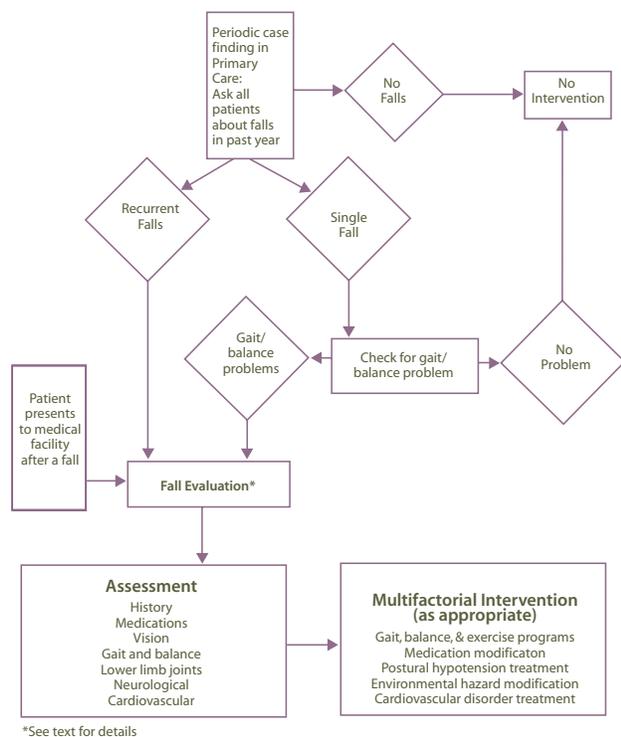
**Table 2. Categories of Evidence and Strength of Recommendation**

### Categories of Evidence

- Class I:** Evidence from at least one randomized controlled trial or a meta-analysis of randomized controlled trials.
- Class II:** Evidence from at least one controlled study without randomization or evidence from at least one other type of quasi-experimental study.
- Class III:** Evidence from nonexperimental studies, such as comparative studies, correlation studies and case-control studies.
- Class IV:** Evidence from expert committee reports or opinions and/or clinical experience of respected authorities.

### Strength of Recommendation

- A: Directly based on **Class I** evidence.
- B: Directly based on **Class II** evidence or extrapolated recommendation from **Class I** evidence.
- C: Directly based on **Class III** evidence or extrapolated recommendation from **Class I or II** evidence.
- D: Directly based on **Class IV** evidence or extrapolated recommendation from **Class I, II or III** evidence.



**Figure 1. Algorithm summarizing the assessment and management of falls.**

The intensity of assessment varies by target population. For example, fall risk assessment as part of routine primary health care visits with relatively low-risk senior populations would involve a brief assessment. In contrast, high-risk groups – such as persons with recurrent falls, those living in a nursing home, persons prone to injurious falls, or persons presenting after a fall – would require a more comprehensive and detailed assessment. The essential elements of any fall-related assessment include details about the circumstances of the fall (including a witness account), identification of the subject’s risk factors for falls, any medical comorbidity, functional status, and environmental risks. A comprehensive assessment may necessitate referral to a specialist (e.g., geriatrician).

Although development of this guideline is a joint project of two American organizations (the American Geriatrics Society and the American Academy of Orthopaedic Surgeons) and the British Geriatrics Society, the epidemiology of falls is largely based on North American data, and there are little data to inform the appropriate configuration of services within the United Kingdom National Health Service. In particular, the balance between the benefits of assessment and intervention, set against the workload and cost implications of a potential increase in referral for specialist assessment, is unclear and would need to be carefully planned when implementing this guideline within any local setting.

The risk factors identified in the assessment may be modifiable (such as muscle weakness, medication side effect, or hypotension) or nonmodifiable (such as hemiplegia or blindness). However, knowledge of all risk factors is important for treatment planning. Essential components of the fall-related patient assessment were identified whenever possible from successful controlled trials of fall-prevention interventions. The justification for assessment to identify a specific risk factor is strongest when successful treatment or other risk-reduction strategies have been explicitly based on this specific risk factor. In some cases, the link between identified risk factors and the content of interventions is not clear. When conclusive data on the importance of specific aspects of the assessment (either to prediction of falls or to responsiveness of these risk factors to the intervention) were not available, consensus from the Panel was sought.

**Specific Recommendations: Assessment**

**Approach to Older Persons as Part of Routine Care (Not Presenting After a Fall)**

1. All older persons who are under the care of a health professional (or their caregivers) should be asked at least once a year about falls.
2. All older persons who report a single fall should be observed as they stand up from a chair without using their arms, walk several paces, and return (i.e., the “Get Up and Go Test”).<sup>34, 35</sup> Those demonstrating no difficulty or unsteadiness need no further assessment.
3. Persons who have difficulty or demonstrate unsteadiness performing this test require further assessment.

**Approach to Older Persons Presenting with One or More Falls or, Have Abnormalities of Gait and / or Balance, or Who Report Recurrent Falls**

1. Older persons who present for medical attention because of a fall, report recurrent falls in the past year, or demonstrate abnormalities of gait and/or balance should have a fall evaluation performed. This evaluation should be performed by a clinician with appropriate skills and experience, which may necessitate referral to a specialist (e.g., geriatrician).
2. A fall evaluation is defined as an assessment that includes the following: a history of fall circumstances, medications, acute or chronic medical problems, and mobility levels; an examination of vision, gait and balance, and lower extremity joint function; an examination of basic neurological function, including mental

status, muscle strength, lower extremity peripheral nerves, proprioception, reflexes, tests of cortical, extrapyramidal, and cerebellar function; and assessment of basic cardiovascular status including heart rate and rhythm, postural pulse and blood pressure and, if appropriate, heart rate and blood pressure response to carotid sinus stimulation.

## INTERVENTIONS TO PREVENT FALLS

### General Principals

The literature identified for this part of the guideline was heterogeneous across most dimensions. This heterogeneity precluded the use of meta-analytic techniques and dictated the use of narrative summary. Again, the Panel identified and synthesized relevant published evidence according to the grading criteria shown in Table 2.

The populations included in the studies varied from fit older persons who had not fallen, those at risk for falls, and those experiencing single or frequent falls. The cognitive status of the study population was not reported consistently. Study environments included community settings (the majority), long-term care facilities, and acute hospital units. The method of reporting the effect of interventions on falls also varied across studies. The system used most commonly reported the total number of falls during a given interval following randomization. Other methods included reporting the number of fallers or the time to the first fall event. Evidence for compliance with the intervention(s) was not always reported. Methods for documenting fall outcomes also varied. The most frequently used method was calendar/diary cards. Other methods included telephone or personal interviews.

Most studies evaluating multifactorial interventions were conducted in community settings. The individual elements of the interventions were described inconsistently and, as a consequence of the study designs, it was not possible to determine which components were effective. However, by examining the components of studies with and without an overall positive effect, it was possible to identify specific interventions that were used more commonly in positive studies. The multifactorial intervention studies were considered for the different settings in which participants resided: community-based, long-term care, and in-hospital studies.

The intervention strategies that were evaluated for their effectiveness in preventing falls were classified as single or multifactorial strategies and as generic or individually designed. The recommendations are presented for multifactorial interventions followed by single interventions because this sequence reflects the underlying evidence.

### Specific Recommendations: Multifactorial Interventions

1. Among *community-dwelling* older persons (i.e., those living in their own homes), multifactorial interventions should include: gait training and advice on the appropriate use of assistive devices (B); review and modification of medication, especially psychotropic medication (B); exercise programs, with balance training as one of the components (B); treatment of postural hypotension (B); modification of environmental hazards (C); and treatment of cardiovascular disorders, including cardiac arrhythmias (D).
2. In *long-term care and assisted living settings*, multifactorial interventions should include: staff education programs (B); gait training and advice on the appropriate use of assistive devices (B); and review and modification of medications, especially psychotropic medications (B).
3. The evidence is insufficient to make recommendations for or against multifactorial interventions in *acute hospital settings*.

### Community-Based Studies

There were 11 randomized controlled studies of community-dwelling older adults.<sup>36-46</sup> The elements of the multifactorial interventions included education programs, self-management programs, home environment modifications, advice about medication use (with or without subsequent modification of medications), exercise, medical assessment, and management of cardiovascular disorders (such as postural hypotension and carotid sinus syndrome).

Reductions in the number and dosages of prescribed medications were associated with benefit in all three studies that included this intervention (Class I).<sup>36, 37, 43</sup> However, medication review without subsequent direct efforts to modify medications was of no benefit in three<sup>38, 39, 45</sup> of four<sup>46</sup> studies (Class I).

Exercise programs were associated with benefit in all three studies that included this intervention (Class I).<sup>36, 41, 43</sup>

Medical assessment followed by specific interventions for any medical problems that were identified (including cardiovascular disorders and visual problems) was beneficial in one study (Class I).<sup>37</sup> Referral for medical assessment was of benefit in two<sup>37, 46</sup> of three<sup>45</sup> studies (Class I).<sup>37, 44</sup> In addition, the management of postural hypotension was part of the effective intervention in two studies (Class I).<sup>37, 44</sup>

Evidence of benefit from modification of home environmental hazards was equivocal in one<sup>43</sup> study and of no benefit in a second<sup>45</sup> (Class I).

Staff education programs were not effective in reducing falls (Class I).<sup>38</sup> Self-management programs were not beneficial in the five studies in which they were reported (Class I).<sup>38, 41, 45</sup>

Advice alone about fall risk factor modification (without measures to implement recommended changes) was of equivocal benefit in three<sup>37, 41, 46</sup> and of no benefit in two<sup>39, 40</sup> studies (Class I).

### Long-Term Care-Based Studies

There were two randomized controlled studies in long-term care settings.<sup>47, 48</sup> Both showed overall benefit from multifactorial interventions, although only one<sup>47</sup> study documented significant reductions in subsequent falls. (Class I). The effective components appeared to be comprehensive assessment, staff education (in contrast to community settings), assistive devices, and reduction of medications.

### In-Hospital-Based Studies

Although the strategy is widely implemented, there are no adequate randomized controlled trials of multifactorial intervention studies to reduce falls among hospital inpatients.<sup>49</sup>

## SPECIFIC RECOMMENDATIONS: SINGLE INTERVENTION

### Exercise

1. Although exercise has many proven benefits, the optimal type, duration and intensity of exercise for falls prevention remain unclear (B).

2. Older people who have had recurrent falls should be offered long-term exercise and balance training (B).
3. Tai Chi C'uan is a promising type of balance exercise, although it requires further evaluation before it can be recommended as the preferred balance training (C).

The Panel made a number of general observations about exercise. There is good evidence of benefit from exercise in falls prevention. However, the Panel was unable to determine which configuration of exercise program to recommend. The Panel identified a number of key findings: the evidence is strongest for balance training; there is less evidence for resistance and aerobic training; there is little data regarding the intensity or type of exercise. Successful programs have consistently been over 10 weeks duration. Exercise needs to be sustained for sustained benefit. There is only preliminary evidence to support the use of Tai Chi C'uan. There is a dearth of studies involving men. In long-term care settings, there is no evidence of benefit for exercise alone.

Among relatively healthy, community-dwelling older people, a program of very intensive strength and endurance training reduced the risk of subsequent falls and the proportion of fallers (Class I).<sup>50</sup> In another study involving community-dwelling women, there was no evidence that a generic exercise program reduced falls (Class I).<sup>51</sup> In young elderly, community-dwelling women, frequent low-impact weight-bearing exercises, and calcium supplementation over a 2-year period did not significantly reduce falls (Class I).<sup>52</sup> In community-dwelling older women, individually designed exercise programs in the home that incorporated strength and balance training reduced both falls and injuries; for those who continued to exercise, the benefits were evident after a 2-year period (Class I).<sup>53</sup> In the Frailty and Injuries: Cooperative Studies of Intervention Techniques (FCSIT) meta-analysis of seven studies that featured exercise as a prominent part of multifactorial interventions, there was an overall significant reduction in falls among intervention subjects, although only three of the seven individual trials showed significant reductions (Class I).<sup>54</sup> In a randomized trial of a group exercise program held three times per week for fall-prone older men, there was improvement in strength, endurance, gait, and function as well as reduced fall rates adjusted for increased levels of activity (Class I).<sup>55</sup>

In community-dwelling women at moderate risk of falls, Tai Chi C'uan reduced the rate of falls during a short follow-up period of 4 months (Class I).<sup>56</sup> In the same population, a computerized balance training program did not reduce falls (Class I).<sup>56</sup>

Among older women who had recurrent falls, a course of physical therapy targeting strength and balance was effective in reducing falls,<sup>57</sup> while a community-based generic exercise program in older men was of no benefit in falls reduction (Class I).<sup>55,58</sup> An individually designed exercise program for nursing home patients with moderate dementia did not reduce falls (Class I).<sup>59</sup>

### Environmental Modification

1. When older patients at increased risk of falls are discharged from the hospital, a facilitated environmental home assessment should be considered (B).

In a subgroup of older patients, a facilitated home modification program after hospital discharge was effective in reducing falls (Class I).<sup>60</sup> Otherwise, modification of home environment without other components of multifactorial intervention was not beneficial (Class I).<sup>61-65</sup>

### Medications

1. Patients who have fallen should have their medications reviewed and altered or stopped as appropriate in light of their risk of future falls. Particular attention to medication reduction should be given to older persons taking four or more medications and to those taking psychotropic medications. (C)

For all settings (i.e., community, long-term care, hospital, and rehabilitation), there is a consistent association between psychotropic medication use (i.e., neuroleptics, benzodiazepines, and antidepressants) and falls. Although there are no randomized controlled studies of manipulation of medication as a sole intervention, reduction of medications was a prominent component of effective fall-reducing interventions in community-based and long-term care multifactorial studies (Class I).<sup>36,37,43,46,47</sup> Multifactorial studies suggest that a reduction in the number of medications in patients who are taking more than four preparations is beneficial. There is no clear difference in the risk for falls between long- and short-acting benzodiazepines (Class II).<sup>32</sup> Compliance with intervention needs to be sustained to be effective.

### Assistive Devices

1. Studies of multifactorial interventions that have included assistive devices (including bed alarms, canes, walkers (Zimmer frames, and hip protectors) have demonstrated benefit. However, there is no direct evidence that the use of assistive devices alone will prevent falls. Therefore, while assistive devices may be effective elements of a multifactorial intervention program, their isolated use without attention to other risk factors cannot be recommended (C).

There are few studies evaluating the effect of assistive devices (such as canes and walkers) as an intervention for preventing falls (Class IV).<sup>66</sup> Among hospitalized patients there is insufficient evidence for or against the use of bed alarms (Class I).<sup>67</sup>

Hip protectors do not appear to affect the risk of falling (Class I).<sup>68</sup> However, there are a number of studies, including three randomized trials, that strongly support the use of hip protectors for prevention of hip fractures in high-risk individuals. The Panel refers the reader to the published guidelines on the treatment and prevention of osteoporosis.<sup>69,70</sup>

### Behavioral and Educational Programs

1. Although studies of multifactorial interventions that have included behavioral and educational programs have demonstrated benefit, when used as an isolated intervention, health or behavioral education does not reduce falls and should not be done in isolation (B).

A structured group educational program among community-dwelling older people did not reduce the number of falls but did achieve short-term benefits in attitudes and self-efficacy (Class I).<sup>71</sup> Practice guidelines in the emergency department did not alter documentation of falls risk factors, causes of falls, consequences of falls, or the implementation of practice guidelines (Class I).<sup>72,73</sup>

## COMMENTS ON OTHER POTENTIAL INTERVENTIONS

### Bone Strengthening Medications

A number of medications used widely to prevent or treat osteoporosis (e.g., hormone replacement therapy (HRT), calcium, vitamin D, antiresorptive agents) reduce fracture rates. However, these agents do not reduce rates of falls per se. Given the wealth of information concerning HRT and vitamin D in osteoporotic fractures, including ample prior analyses and practice guidelines, the Panel refers the reader to published guidelines on HRT for osteoporosis.<sup>69, 70, 74</sup>

### Cardiovascular Intervention

There is emerging evidence that some falls have a cardiovascular cause that may be amenable to intervention strategies often directed to syncope, such as medication change or cardiac pacing. The role of these cardiac investigations and treatments is not yet clear.

Case series report an overlap of symptoms of falls and syncope and a causal association between some cardiovascular disorders and falls, particularly orthostatic hypotension, carotid sinus syndrome, and vasovagal syndrome.<sup>75-80</sup> In particular, up to 30% of older patients with carotid sinus syndrome present with falls and have amnesia for loss of consciousness when bradyarrhythmia is induced experimentally.<sup>81, 82</sup> Preliminary studies suggest that patients with recurrent unexplained falls and a bradycardiac response to carotid sinus stimulation experience fewer falls after implantation of a permanent cardiac pacemaker. However, pending the results of an ongoing randomized trial, pacemaker therapy for the treatment of recurrent falls cannot be recommended at this time.

### Visual Intervention

Patients should be asked about their vision and if they report problems, their vision should be formally assessed, and any remediable visual abnormalities should be treated.

There are no randomized controlled studies of interventions for individual visual problems despite a significant relationship between falls, fractures, and visual acuity.<sup>83</sup> Fall-related hip fractures were higher in patients with visual impairment.<sup>84</sup> Visual factors associated with two or more falls included poor visual acuity, reduced contrast sensitivity, decreased visual field, posterior subcapsular cataract, and nonmiotic glaucoma medication.<sup>83-85</sup>

## Footwear Interventions

Because there are no experimental studies of footwear examining falls as an outcome, the Panel is not able to recommend specific footwear changes to reduce falls. However, some trials report improvement in intermediate outcomes, such as balance and sway from specific footwear intervention. In women, results of functional reach and timed mobility tests were better when subjects wore walking shoes than when they were barefoot.<sup>86</sup> Static and dynamic balance were better in low-heeled rather than high-heeled shoes or than the patient's own footwear.<sup>87</sup> In men, foot position awareness and stability were best with high mid-sole hardness and low mid-sole thickness.<sup>88</sup> Static balance was best in hard-soled (low resistance) shoes.<sup>89</sup>

### Restraints

The Panel found no evidence to support restraint use for falls prevention. Restraints have been traditionally used as a falls prevention approach. However, they have major, serious drawbacks and can contribute to serious injuries. There is no experimental evidence that widespread use of restraints or, conversely, the removal of restraints, will reduce falls.<sup>90-93</sup>

## RESEARCH AGENDA

In the process of developing these guidelines, the Panel identified a number of issues related to falls prevention that it believes should be given high priority for future research and analysis. The Panel believes that further research will be necessary to gather sufficient evidence that will lead to meaningful conclusions about the following concerns:

1. What is the cost effectiveness of recommended strategies?
2. Can fall-prone individuals be risk stratified in terms of whom will most benefit from assessment and interventions?
3. What are the effective elements for falls prevention among hospital inpatients?
4. How can falls best be prevented in patients with cognitive impairment and dementia?
5. What are the effective elements of exercise programs (such as type, duration, intensity, and frequency)?
6. What are the effective elements of cardiovascular programs for fall prevention?
7. For whom and when is home assessment by an occupational therapist or other home care specialist effective?
8. What is the effectiveness of assistive devices (e.g., canes and walkers/Zimmer frames) used alone as a strategy for preventing falls?
9. What is the effect of restraint removal, coupled with other specific interventions, on falls and serious injuries?
10. Does treatment of visual problems prevent falls?
11. What is the safest footwear for people who have fallen or are at risk of falling?
12. What is the role of hip protectors in persons who have fallen or are at risk of falling and what are the most effective designs?

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## Statistical Supplement

Figure 3a. COUNTS  
FALL HOSPITALIZATIONS AND DEATHS BY AGE AND YEAR

Year	Hospitalizations				Deaths			
	Age 65-74	75-84	85+	Total 65+	Age 65-74	75-84	85+	Total 65+
1990	2,267	3,450	2,732	8,449	23	58	87	168
1991	2,299	3,664	2,959	8,922	32	55	99	186
1992	2,359	3,866	3,114	9,339	28	71	100	199
1993	2,405	3,898	3,243	9,546	30	55	116	201
1994	2,162	3,927	3,347	9,436	45	86	104	235
1995	2,321	4,177	3,586	10,084	29	81	132	242
1996	2,327	4,509	3,877	10,713	35	93	156	284
1997	2,240	4,745	4,145	11,130	32	94	118	244
1998	2,311	4,812	4,133	11,256	37	96	129	262
1999	2,269	4,890	4,454	11,613	28	102	144	274
2000	2,187	5,011	4,544	11,742	48	128	217	393

Figure 3b. RATES\*  
FALL HOSPITALIZATIONS AND DEATHS BY AGE AND YEAR

Year	Hospitalizations				Deaths			
	Age 65-74	75-84	85+	Total 65+	Age 65-74	75-84	85+	Total 65+
1990	677	1,902	4,929	1,479	7	32	157	29
1991	674	1,955	5,097	1,522	9	29	171	32
1992	683	2,004	5,128	1,560	8	37	165	33
1993	691	1,965	5,121	1,566	9	28	183	33
1994	620	1,921	5,071	1,523	13	42	158	38
1995	662	1,986	5,232	1,602	8	39	193	38
1996	664	2,077	5,396	1,676	10	43	217	44
1997	646	2,123	5,529	1,725	9	42	157	38
1998	669	2,100	5,273	1,725	11	42	165	40
1999	661	2,090	5,451	1,763	8	44	176	42
2000	649	2,080	5,404	1,773	14	53	258	59

\* rate per 100,000 population

Figure 6a.  
RATES AND COUNTS OF FALL HOSPITALIZATIONS BY AGE AND GENDER, 2000

Rates*			Counts			
Age Group	Female	Male	Age Group	Female	Male	Total
<45	52.1	87.5	<45	992	1,737	2,729
45-54	143.4	160.5	45-54	610	675	1,285
55-64	294.3	239.7	55-64	736	591	1,327
65-74	766.2	513.6	65-74	1,381	806	2,187
75-84	2,448.4	1,550.9	75-84	3,478	1,533	5,011
85+59	25.6	4,253.0	85+	3,429	1,115	4,544
<b>Total</b>	<b>359.0</b>	<b>220.1</b>	<b>Total</b>	<b>10,626</b>	<b>6,457</b>	<b>17,083</b>

\*rate per 100,000 population

Figure 6b.  
RATES AND COUNTS OF FALL DEATHS BY AGE AND GENDER, 2000

Rates*			Counts			
Age Group	Female	Male	Age Group	Female	Male	Total
<45	0.2	0.8	<45	4	15	19
45-54	0.5	4.5	45-54	2	19	21
55-64	2.8	7.3	55-64	7	18	25
65-74	9.4	19.8	65-74	17	31	48
75-84	39.4	72.8	75-84	56	72	128
85+	236.7	305.1	85+	137	80	217
<b>Total</b>	<b>7.5</b>	<b>8.0</b>	<b>Total</b>	<b>223</b>	<b>235</b>	<b>458</b>

\*rate per 100,000 population

Figure 7.  
TRENDS IN HIP FRACTURE HOSPITALIZATION RATES AMONG PEOPLE AGE 65+ BY GENDER, 1990-2000

Gender	Year	Counts	Population	Rates per 100,000
Female	1990	2,959	330,920	894.2
Female	1991	3,102	339,604	913.4
Female	1992	3,313	346,864	955.1
Female	1993	3,404	352,942	964.5
Female	1994	3,351	358,408	935.0
Female	1995	3,558	363,814	978.0
Female	1996	3,620	369,059	980.9
Female	1997	3,661	372,361	983.2
Female	1998	3,631	376,307	964.9
Female	1999	3,598	379,607	947.8
Female	2000	3,316	380,163	872.3
Male	1990	889	240,484	369.7
Male	1991	1,024	246,761	415.0
Male	1992	1,004	251,953	398.5
Male	1993	1,015	256,819	395.2
Male	1994	1,064	260,968	407.7
Male	1995	1,095	265,571	412.3
Male	1996	1,180	270,330	436.5
Male	1997	1,194	272,892	437.5
Male	1998	1,193	276,403	431.6
Male	1999	1,273	279,227	455.9
Male	2000	1,180	281,985	418.5