

A CDC Compendium of Effective Fall Interventions:

What Works for Community-Dwelling Older Adults

2nd Edition

Exercise-based Interventions



Home Modification Interventions

Multifaceted Interventions



National Center for Injury Prevention and Control
Division of Unintentional Injury Prevention



A CDC Compendium of Effective Fall Interventions:

What Works for
Community-Dwelling Older Adults

2nd Edition

by

Judy A. Stevens, PhD

Division of Unintentional Injury Prevention
National Center for Injury Prevention and Control
Centers for Disease Control and Prevention (CDC)

Atlanta, Georgia

2010

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

Centers for Disease Control and Prevention

Thomas R. Frieden, MD, MPH, Director

National Center for Injury Prevention and Control

Linda C. Degutis, DrPH, MSN, Director

Division of Unintentional Injury Prevention

Grant Baldwin, PhD, MPH, Director

Home and Recreation Injury Prevention Team

Rita Noonan, PhD, Team Leader

Author

Judy A. Stevens, PhD

Acknowledgements for First Edition

We acknowledge and appreciate the contributions of Dr. Christine Branche who provided encouragement and unwavering support of this project; Dr. Patricia D. Nolan and Mr. David Ramsey who developed the *Compendium* data base; and Ms. Lisa Jeanette who produced the initial draft.

Acknowledgements for Second Edition

We acknowledge and appreciate the contributions of Ms. Bonny Bloodgood and Ms. Sondra Dietz for their persistence in collecting data and drafting the second edition; and Dr. Rita Noonan, Dr. David Sleet and Dr. Michael Ballesteros who provided thoughtful and constructive suggestions.

A Special Acknowledgement

To Dr. Ellen Sogolow, my co-author on the first edition, in appreciation of her foresight and leadership in developing the *Compendium*, a document that has been instrumental in promoting the dissemination and implementation of effective evidence-based fall interventions for older adults.

Suggested Citation: Stevens JA. A CDC Compendium of Effective Fall Interventions: What Works for Community-Dwelling Older Adults. 2nd ed. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2010.

Disclaimer: Reference herein to any specific commercial products, programs, or services by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government and shall not be used for advertising or product endorsement purposes.

Preface

to the Second Edition

The first edition of the *CDC Compendium of Effective Fall Interventions* (2008) was developed to give public health practitioners and aging services providers detailed information about interventions that were scientifically proven to reduce falls in older adults. The first edition included 14 studies of effective falls interventions that were published before 2005. The second edition maintains the original format—study summaries, intervention descriptions, and summary tables—and provides this information for 8 additional fall intervention studies published between 2005 and 2009.

The 22 interventions included in this second edition address a variety of audiences. Some are suitable for the very old (e.g., The Otago Exercise Programme), some are appropriate for specific populations such as the visually impaired (e.g., The VIP Trial), and others are designed for specific situations such as walking on ice and snow (e.g., Yaktrax® Walker). The *Compendium* will provide public health organizations and aging services providers with the information they need to identify effective fall interventions that are most appropriate for their communities' particular needs, resources, and population.

Contents

| | |
|--------------------|---|
| Introduction | 1 |
|--------------------|---|



Exercise-based Interventions

| | |
|--|----|
| Stay Safe, Stay Active (Barnett, et al.) | 6 |
| The Otago Exercise Programme (Campbell, et al. and Robertson, et al.) | 10 |
| Erlangen Fitness Intervention (Freiberger, et al.) | 14 |
| Tai Chi:® Moving for Better Balance (Li, et al.) | 16 |
| Australian Group Exercise Program (Lord, et al.) | 18 |
| Yaktrax Walker (McKiernan)..... | 20 |
| Veterans Affairs Group Exercise Program (Rubenstein, et al.) | 22 |
| Falls Management Exercise (FaME) Intervention (Skelton, et al.) | 24 |
| Central Sydney Tai Chi Trial (Voukelatos, et al.) | 28 |
| Simplified Tai Chi (Wolf, et al.) | 30 |



Home Modification Interventions

| | |
|--|----|
| The VIP Trial (Campbell, et al.) | 34 |
| Home Visits by an Occupational Therapist (Cumming, et al.) | 36 |
| Falls-HIT (Home Intervention Team) Program (Nikolaus, et al.)..... | 38 |



Multifaceted Interventions

| | |
|--|----|
| Stepping On (Clemson, et al.) | 42 |
| PROFET (Prevention of Falls in the Elderly Trial) (Close, et al.) | 46 |
| Accident & Emergency Fallers (Davison, et al.) | 48 |
| The NoFalls Intervention (Day, et al.) | 52 |
| The SAFE Health Behavior and Exercise Intervention (Hornbrook, et al.) | 56 |
| Multifactorial Fall Prevention Program (Salminen, et al.) | 60 |
| The Winchester Falls Project (Spice, et al.) | 64 |
| Yale FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) (Tinetti, et al.)..... | 68 |
| A Multifactorial Program (Wagner, et al.) | 72 |

| | |
|---|-----|
| Appendix A Intervention Study Selection Process..... | 75 |
| Appendix B Bibliography of <i>Compendium</i> Studies..... | 81 |
| Appendix C Tables | 89 |
| Table 1 Overall Population Characteristics | 90 |
| Table 2 Study Characteristics | 92 |
| Table 3 Intervention Characteristics | 102 |
| Appendix D Original Intervention Materials..... | 107 |
| Appendix D-1 Barnett Materials | 109 |
| Appendix D-2 Skelton Materials | 121 |
| Appendix D-3 Voukelatos Materials..... | 125 |
| Appendix D-4 Wolf Materials | 129 |
| Appendix D-5 Close Materials | 133 |
| Appendix D-6 Spice Materials..... | 145 |

Introduction

More than one-third of people aged 65 and older fall each year, and those who fall once are two to three times more likely to fall again.

Older adults value their independence and a fall can significantly limit their ability to remain self-sufficient. More than one-third of people aged 65 and older fall each year, and those who fall once are two to three times more likely to fall again. Fall injuries are responsible for significant disability, loss of independence, and reduced quality of life. In 2000, direct medical costs for fall injuries totaled \$19 billion. However, we know that falls are not an inevitable result of aging. In recent years, systematic reviews of fall intervention studies have established that prevention interventions can reduce falls.

Purpose

The Centers for Disease Control and Prevention (CDC) developed the *CDC Compendium of Effective Fall Interventions* to help public health practitioners use the best scientific evidence to effectively address the problem of falls. The *Compendium* includes 22 specific interventions for community-dwelling older adults that have rigorous scientific evidence of effectiveness, and provides relevant information about these interventions to public health practitioners, aging service providers, and others who wish to implement fall prevention programs.

Process

CDC gathered information about science-based fall prevention intervention studies that met the following criteria:

- Published in the peer-reviewed literature
- Included community-dwelling adults aged 65 or older
- Used a randomized controlled study design
- Measured falls as a primary outcome (did not include intervention studies using other outcomes such as balance improvement or reduced fear of falling)
- Demonstrated statistically significant positive results in reducing older adult falls

This selection process was used by CDC in the first edition of the *Compendium* to identify 14 studies of effective fall interventions published before December 31, 2004. Another literature review was conducted in 2010 that identified an additional 8 interventions published from January 1, 2005 to December 31, 2009; these are included in this second edition.

See Appendix A for details about the selection process.

Content

The *Compendium* categorizes interventions into 3 groups: exercise-based, home modification, and multifaceted interventions. Information about each intervention was obtained from the published study and by directly contacting the principal investigator. Each is presented using a standardized format that includes a short summary of the research study and results as well as a longer section describing relevant details about the intervention. The intervention description includes information about the purpose, program setting, content, number of sessions, duration, provider, provider's training, key elements, available intervention materials, and contact information for the study's principal investigator.

The *Compendium* also contains appendices. These include figures illustrating the intervention study selection process; a bibliography of the research studies; tables comparing the participating populations, study characteristics, and intervention characteristics of the 22 studies; and supplemental materials, such as assessment instruments and evaluation materials, provided by the principal investigators.

A large, stylized graphic in shades of blue and white. It depicts a hand holding a circle, with the hand's fingers and palm visible. The background is a light blue gradient, and the hand and circle are rendered in white and darker blue. The graphic is partially obscured by a dark blue horizontal bar.

Exercise-based Interventions

| | |
|--|----|
| Stay Safe, Stay Active (Barnett, et al.) | 6 |
| The Otago Exercise Programme (Campbell, et al. and Robertson, et al.) | 10 |
| Erlangen Fitness Intervention (Freiberger, et al.)..... | 14 |
| Tai Chi: Moving for Better Balance (Li, et al.)..... | 16 |
| Australian Group Exercise Program (Lord, et al.)..... | 18 |
| Yaktrax® Walker (McKiernan)..... | 20 |
| Veterans Affairs Group Exercise Program (Rubenstein, et al.) | 22 |
| Falls Management Exercise (FaME) Intervention (Skelton, et al.)..... | 24 |
| Central Sydney Tai Chi Trial (Voukelatos, et al.) | 28 |
| Simplified Tai Chi (Wolf, et al.)..... | 30 |

Stay Safe, Stay Active

This study used weekly structured group sessions of moderate-intensity exercise, held in community settings, with additional exercises performed at home. Participants were 40 percent less likely to fall and one-third less likely to suffer a fall-related injury compared with those who did not receive the intervention.

Population: Participants were individuals at risk for falling because of lower limb weakness, poor balance, and/or slow reaction time. All were aged 67 or older and lived in the community. About two-thirds of participants were female.

Geographic Locale: Southwest Sydney, Australia

Focus: Improve balance and coordination, muscle strength, reaction time, and aerobic capacity.

Program Setting: Classes were conducted in local indoor lawn bowling and sports clubs that hosted community programs for various sports and exercise activities, comparable to United States. community exercise, sports, and recreation facilities. Many lawn bowling and sports clubs also included other indoor attractions such as restaurants, meeting facilities, and movies.

Content: The classes were designed by a physical therapist to address physical fall risk factors: balance and coordination, strength, reaction time, and aerobic capacity. Each class began with 5 to 10 minutes of warm-up that included stretching of the major lower limb muscle groups and 10 minutes of cool-down that included gentle stretching, relaxation, and controlled-breathing practice. Each class included music chosen by the participants.

The classes included the following types of exercises:

- Balance and coordination exercises, including modified Tai Chi exercises, practice in stepping and in changing direction, dance steps, and catching and throwing a ball
- Strengthening exercises, including exercises that used the participant's weight (e.g., sit-to-stand, wall press-ups) and resistance-band exercises that worked both upper and lower limbs
- Aerobic exercises, including fast-walking practice with changes in pace and direction



As the classes progressed, the complexity and speed of the exercises and the resistance of the bands were steadily increased.

Participants also took part in a home exercise program using content from the exercise class and recorded their participation in a home exercise diary.

Duration: A total of 37 1-hour classes were conducted once a week over a 1-year period.

Delivered by: Nationally accredited exercise instructors who had been trained to conduct this exercise program by a licensed physical therapist (accredited by Australia's National Association for Gentle Exercise). The study used currently accredited exercise leaders who already had a good understanding of the exercise principles.

Before classes began, regular meetings were held with the exercise leaders to discuss the content and how the classes would be run, giving leaders ownership in the program. Training included approximately 6 hours of additional meetings, discussion, and practice sessions before beginning the program. During the classes, instructors were visited by the physical therapist for support once each term.

Minimum Level of Training Needed: Information was not provided by the principal investigator.

Key Elements:

- This study used health practitioners to assess and recruit participants. General practitioners are in an ideal position to both identify older people at risk of falls and to support their participation in an exercise program when appropriate.
- The program used existing services and facilities in the community, so it is likely to be sustainable and transferable to other settings.

Available Materials: In addition to the guidance received during the exercise sessions, participants received:

- A home exercise program based on class content*
- A “hot tips” sheet listing practical strategies for avoiding falls such as where to place hands and feet if a loss of balance occurs*

* See Appendix D-1.

Study Citation: Barnett A, Smith B, Lord S, Williams M, Baumand A. Community-based group exercise improves balance and reduces falls in at-risk older people: A randomized controlled trial. *Age and Ageing*. 2003 Jul;32(4):407-14.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Anne Barnett, MPH
Physiotherapy Department
Bankstown Hospital, Locked Mailbag 1600
Bankstown NSW 2200, Australia
Tel: +61 (9) 722 7154
Fax: +61 (9) 722 7125
E-mail: anne.barnett@swsahs.nsw.gov.au

The Otago Exercise Programme

This intervention, tested in 4 randomized controlled trials and 1 controlled multi-center trial, was an individually tailored program of muscle-strengthening and balance-retraining exercises of increasing difficulty, combined with a walking program. This extensively tested fall prevention program is now used worldwide.

Overall, the fall rate was reduced by 35 percent among program participants compared with those who did not take part. The program was equally effective for men and women. Participants aged 80 years and older who had fallen in the previous year showed the greatest benefit.

Population: Participants were aged 65 to 97 years and lived in the community.

Geographic Locale: Dunedin, New Zealand.

Focus: Improve strength and balance with a simple, easy-to-implement, and affordable home-based exercise program.

Program Setting: The program was conducted in participants' homes and was intended for people who did not want to attend, or could not reach, a group exercise program or recreation facility.

Content: A physical therapist (PT) or nurse visited each participant 4 times at home over the first 2 months (at weeks 1, 2, 4, and 8) and visited again for a booster session at 6 months. To maintain motivation, participants were telephoned once a month during the months when no visits were scheduled.

The first home visit lasted an hour; all subsequent visits took about half an hour. During the visits, the PT or nurse prescribed a set of in-home exercises (selected at appropriate and increasing levels of difficulty) and a walking plan.



The exercises included:

- Strengthening exercises for lower leg muscle groups using ankle cuff weights
- Balance and stability exercises such as standing with one foot in front of the other and walking on the toes
- Active range of motion exercises such as neck rotation and hip and knee extensions

Participant safety was ensured by tailoring the exercise program and by giving participants instructions and an illustration for each exercise.

Duration: The exercises took about 30 minutes. Participants were encouraged to complete the exercises 3 times a week and to walk outside the home at least 2 times a week. Exercises then were continued on an ongoing basis. In 3 trials, the exercise program was prescribed for 1 year and in 1 trial was extended to 2 years.

Delivered by: The program was delivered by either a PT experienced in prescribing exercises for older adults, or a nurse who was given special training and received ongoing supervision from a PT.

Minimum Level of Training Needed: PTs can deliver the program immediately after reading the manual. Nurses can be trained to deliver the program after a 2-day training program and with ongoing supervision by a PT.

Key Elements: PTs should understand the research evidence on which the program is based and avoid adding or subtracting exercises from the set used in the trials, as this particular combination of exercises worked to reduce falls.

Available Materials: The Otago Exercise Programme instruction guide, which describes the program exercises, is available to health professionals at www.acc.co.nz/PRD_EXT_CSMP/idcplg?IdcService=GET_FILE&dID=8311&dDocName=PRD_CTRB118334&allowInterrupt=1.

Study Citation:

Primary studies

Campbell AJ, Robertson MC, Gardner MM, Norton RN, Tilyard MW, Buchner DM. Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. *British Medical Journal*. 1997 Oct 25;315(7115):1065-9.

Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Falls prevention over 2 years: A randomized controlled trial in women 80 years and older. *Age and Ageing*. 1999 Oct;28(6):513-8.

Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Psychotropic medication withdrawal and a home-based exercise program to prevent falls: A randomized controlled trial. *Journal of the American Geriatrics Society*. 1999 Jul;47(7):850-3.

Campbell AJ, Robertson MC, La Grow SJ, Kerse NM, Sanderson GF, Jacobs RJ, Sharp DM, Hale LA. Randomised controlled trial of prevention of falls in people aged ≥ 75 with severe visual impairment: The VIP trial. *British Medical Journal*. 2005 Oct 8;331(7520):817-20.

Robertson MC, Devlin N, Gardner MM, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 1: Randomised controlled trial. *British Medical Journal*. 2001 Mar 24;322(7288):697-701.

Robertson MC, Gardner MM, Devlin N, McGee R, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 2: Controlled trial in multiple centres. *British Medical Journal*. 2001 Mar 24;322(7288):701-4.

Supplemental articles

Gardner MM, Buchner DM, Robertson MC, Campbell AJ. Practical implementation of an exercise-based falls prevention programme. *Age and Ageing*. 2001 Jan;30(1):77-83.

Robertson MC, Campbell AJ, Gardner MM, Devlin N. Preventing injuries in older people by preventing falls: A meta-analysis of individual-level data. *Journal of the American Geriatrics Society*. 2002 May;50(5):905-11.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

M. Clare Robertson, PhD
Research Associate Professor
Department of Medicine, Dunedin School of Medicine
University of Otago, P.O. Box 913
Dunedin 9054, New Zealand
Tel: +64 (3) 474 7007 extension 8508
Fax: +64 (3) 474 7641
E-mail: clare.robertson@otago.ac.nz

Erlangen Fitness Intervention

This study examined 2 interventions to reduce falls: a psychomotor intervention that focused on body awareness, body experience, and coordination; and a fitness intervention that focused on functional skills, strength, endurance, and flexibility. Both interventions included group classes, home-based exercises, and physical activity recommendations.

Only the fitness intervention was effective in reducing falls. Compared to the control group, participants in the fitness group experienced 23 percent fewer falls.

Population: The participants were community-dwelling, physically active people in very good health, aged 70 or older. Slightly more than half were male.

Geographic Locale: Erlangen, Germany

Focus: Improve functional skills, strength, endurance, and flexibility.

Program Setting: The group classes were conducted at the University of Erlangen-Nuremberg, Institute of Sport Science, and the home-based portion was carried out in participants' homes.

Content: This program consisted of group exercise classes, home-based exercises, and recommendations for increasing physical activity levels such as daily walking or biking.

Each session lasted 1 hour. Approximately one-third of the time was spent on each of the components:

- Strength and flexibility training (including the use of dumbbells, ankle weights, weight-bearing exercises, and joint flexibility)
- Balance and motor coordination training (including standing balance, dynamic weight transfers, stepping strategies, motor control when performing activities of daily living, motor control under time pressure and sensory awareness)
- Endurance training (including normal walking and Nordic walking)

Group discussions were conducted at the beginning and end of each session to outline the goals of the program and to review progress.

Duration: One-hour classes were held twice a week for 16 weeks. In addition, participants were instructed to perform selected exercises at home on a daily basis between sessions and after the program ended.



Delivered by: The program was supervised by 2 trainers, preferably a man and a woman, who had backgrounds in sports science. This training is similar to that received by physical education teachers. It included knowledge of physical education, kinesiology, motor control, and motor learning. Trainers also had experience working with older persons, which they generally gained during the course of their academic studies.

Minimum Level of Training Needed: Trainers need to have a background in physical therapy, psychology, sports science, or as a personal trainer. Trainers also need to have experience working with older adults and attend a 2-day training session, or to attend a comprehensive 4-day training if they do not have experience working with older adults. Training should include age-related changes in physical, cognitive and social dimensions (e.g., changes in muscle mass, loss of strength and power); fear of falling and how to address it; how to perform the strength, balance, and gait training exercises; and an introduction to public health theories and models, such as the Health Belief Model.

Key Elements:

- Strength, endurance, and functional skill exercises, including balance and gait training, should increase in intensity over the duration of the program.
- Trainers must attend the program training.

Available Materials: A course manual has been published in German (Freiberger E, Schöne D. *Sturzprophylaxe im Alter*. Deutscher Aertzeverlag: Köln). In addition, there is a German web site with information about fall prevention and trainers' education at www.standfestimalter.de.

Study Citation: Freiberger E, Menz HB, Abu-Omar K, Rütten A. Preventing falls in physically active community-dwelling older people: A comparison of two intervention techniques. *Gerontology*. 2007 Aug;53(5):298-305.

Supplemental article

Freiberger E, Menz HB. Characteristics of falls in physically active community-dwelling older people. *Zeitschrift für Gerontologie und Geriatrie*. 2006 Aug;39(4):261-7.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Dr. Ellen Freiberger
Institut für Sportwissenschaft und Sport
Friedrich-Alexander-Universität Erlangen-Nürnberg
Gebbertstrasse 123b, DE-91058, Erlangen, Germany
Tel: +49 9131 852 5464
Fax: +49 9131 852 5002
E-mail: ellen.freiberger@sport.uni-erlangen.de

Tai Chi: Moving for Better Balance

This study compared the effectiveness of a 6-month program of Tai Chi classes with a program of stretching exercises. Participants in the Tai Chi classes had fewer falls and fewer fall injuries, and their risk of falling was decreased 55 percent.

Population: Participants were inactive seniors aged 70 or older. Three-quarters were female. All participants lived in the community.

Geographic Locale: Portland, Oregon, United State.

Focus. Improve balance and physical performance with Tai Chi classes designed for older adults.

Program Setting: The Tai Chi programs were conducted in community settings such as local senior centers and adult activity centers.

Content: The program included 24 Tai Chi forms that emphasized weight shifting, postural alignment, and coordinated movements. Synchronized breathing aligned with Tai Chi movements was integrated into the movement routine.

Each session included instructions in new movements as well as review of movements from previous sessions. Each practice session incorporated musical accompaniment.

Each hour-long session included:

- A 5- to 10-minute warm-up period
- Practice of Tai Chi movements
- A 5- to 10-minute cool-down period

Practicing at home was encouraged and monitored using a home-practice log.

Duration: One-hour classes were held 3 times a week for 26 weeks, followed by a 6-month period in which there were no organized classes.

Delivered by: Experienced Tai Chi instructors who followed the classical Yang style, which emphasizes multidirectional weight shifting, body alignment, and coordinated movement of the arms, legs, and trunk.



Minimum Level of Training Needed: Instructors should be familiar with the fundamental principles of Tai Chi and the major postures and movements, be able to follow the training protocol, and have experience teaching physical activity to older adults.

Key Elements:

- Program settings can include facilities such as senior centers, adult activity centers, and community centers.
- An average class size of 15 is ideal for effective learning and teaching.
- For this program to be successful, participants should attend Tai Chi classes at least 2 times a week and participate actively in class.
- Tai Chi can also be used in rehabilitative settings where the emphasis is on retraining balance in older adults.

Available Materials: The *Tai Chi: Moving for Better Balance* program package, specifically designed for community-dwelling older adults and senior service providers, is available from Dr. Fuzhong Li. The package contains an implementation plan, training manuals, and class materials on videotape and/or DVD.

Study Citation: Li F, Harmer P, Fisher KJ, McAuley E, Chaumeton N, Eckstrom E, Wilson NL. Tai Chi and fall reductions in older adults: A randomized controlled trial. *Journal of Gerontology*. 2005 Feb;60A(2):187-94.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Fuzhong Li, PhD
Oregon Research Institute
1715 Franklin Boulevard
Eugene, OR 97403, United States
Tel: 541-484-2123
E-mail: fuzhongli@ori.org

Australian Group Exercise Program

This study evaluated a 12-month group exercise program for frail older adults. The program was tailored to each participant's abilities. Overall, the fall rate was 22 percent lower among people who took part in the program, and 31 percent lower among participants who had fallen in the previous year, compared with those who were not in the program.

Population: Ages ranged from 62 to 95 although nearly all were 70 years or older. Most study participants were female. Participants lived in retirement villages and most were independent.

Geographic Locale: Sydney and Wollongong, Australia

Focus: Increase participants' strength, coordination, balance and gait, and increase their ability to carry out activities of daily living such as rising from a chair and climbing stairs.

Program Setting: Programs were conducted in common rooms in residential care community centers and senior centers within the retirement villages.

Content: The group classes included weight-bearing exercises and balance activities that were challenging but not so difficult as to discourage participation or cause any adverse events. The program emphasized social interaction and enjoyment.

The program consisted of 4 successive 3-month terms. The first term included understanding movement, how the body works, training principles, and basic exercise principles. This was followed by progressive strength training and increasingly challenging balance exercises, using equipment to maintain interest. In each term, the exercise sessions built on the skills acquired in the previous term.

Each hour-long class had 3 segments:

- A 5- to 15-minute warm-up period that included chair-based activities, stretching large muscle groups, and later in the program, slow to moderate walking
- A 35- to 40-minute conditioning period that included aerobic exercises, strengthening exercises, and activities to improve balance, hand-eye and foot-eye coordination, and flexibility. As the program progressed, the number of repetitions of each exercise increased, beginning with 4 repetitions at week 2 and reaching 30 by week 10. Thirty repetitions were maintained for rest of the program



- A 10-minute cool-down period that included muscle relaxation, controlled breathing, and guided imagery

Duration: One-hour classes were held twice a week for 12 months. The program consisted of 4 successive 3-month terms.

Delivered by: Six exercise instructors were trained to deliver the program. All had previously completed a training course conducted by the Australian Council for Health, Physical Education, and Recreation on leading exercise programs for frail, older people. The project coordinator regularly observed the instructors to provide support and to monitor program fidelity and consistency.

Everyone involved in implementing the program received specific 1-day training and met regularly to discuss issues and training updates.

Minimum Level of Training Needed: Instructors should have taken an exercise instructor course as well as a specific course on teaching exercise to older adults.

Key Elements: Information was not provided by the principal investigator.

Available Materials: No intervention materials were available at the time of publication.

Study Citation: Lord SR, Castell S, Corcoran J, Dayhew J, Matters B, Shan A, Williams P. The effect of group exercise on physical functioning and falls in frail older people living in retirement villages: A randomized, controlled trial. *Journal of the American Geriatrics Society*. 2003 Dec;51(12):1685-92.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Stephen R. Lord, PhD
Neuroscience Research Australia
Barker Street, Randwick,
Sydney NSW 2031, Australia
Tel: +61 (2) 9399 1061
Fax: +61 (2) 9399 1005
E-mail: s.lord@neura.edu.au

Yaktrax® Walker

This study tested the effectiveness of the Yaktrax® Walker, a lightweight traction device that fits over shoes, to prevent falls among older adults when walking outdoors on ice and snow.

During the winter months, participants in the Yaktrax® intervention group were half as likely to slip and about 60 percent less likely to fall compared to the group that wore their usual winter footwear. Participants in the intervention group also experienced significantly fewer minor fall-related injuries.



Reprinted with permission of the Yaktrax® Walker. Yaktrax® is a Registered Trademark of Implus Footcare LLC.

Population: Participants were community-dwelling adults aged 65 or older who had fallen at least once in the previous year. About 60 percent were female.

Geographic Locale: Rural central and northern Wisconsin, United States

Focus: Using a traction device that fits on shoes to improve stability when walking on ice and snow.

Program Setting: Participants used the Yaktrax® Walker on their own in the community.

Content: Participants were given a Yaktrax® Walker that was sized to fit the external length of their usual winter footwear. Participants had to be able to put on the Yaktrax® Walker correctly.

After reviewing the Yaktrax® Walker instruction manual with participants, the research study coordinator spent approximately 30 minutes training the participant and then had the participant practice putting on the Yaktrax® Walker.

Participants were told to only wear the device outdoors when there was ice or snow. They were instructed that the Yaktrax® Walker should never be worn indoors or on smooth outdoor non-ice surfaces.

Duration: This study took place during the winter of 2003–04.

Delivered by: Research study coordinator.



Minimum Level of Training Needed: Instructors should read the manual and practice putting the Yaktrax® Walker on themselves and others.

Key Elements:

- People must be able to safely put on and take off the Yaktrax® Walker or leave the device on a dedicated pair of shoes or boots that are only worn out of doors.
- Shoes should be measured to assure proper fit of Yaktrax® Walker.
- Yaktrax® Walker must not be worn indoors.
- Yaktrax® Walker should be inspected for breakage and replaced if broken.

Available Materials: Instructions that accompany the device are sufficient for consumer use.

Study Citation: McKiernan FE. A simple gait-stabilizing device reduces outdoor falls and non-serious injurious falls in fall-prone older people during the winter. *Journal of the American Geriatrics Society*. 2005 Jun;53(6):943-7.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Fergus Eoin McKiernan, MD
Center for Bone Diseases
Marshfield Clinic
1000 North Oak Avenue
Marshfield, WI 54449, United States
E-mail: mckiernan.fergus@marshfieldclinic.org

Veterans Affairs Group Exercise Program

This study evaluated a structured group exercise program for fall-prone older men. During the 3-month program, participants were two-thirds less likely to fall compared with those who did not take part in the program.

Note: This study calculated the fall rate as the number of falls per hour of physical activity.

Population: All participants were aged 70 or older and lived in the community. All were males who had at least 1 of these fall risk factors: leg weakness; impaired gait, mobility, and/or balance; and had fallen 2 or more times in the previous 6 months.

Geographic Locale: Los Angeles, California, United States

Focus. Increase strength and endurance and improve mobility and balance using a low- to moderate-intensity group exercise program.

Program Setting: The program was conducted at a Veterans Affairs ambulatory care center.

Content:

- Strength training included hip flexion, extension, abduction, and adduction; knee flexion and extension; squats, dorsiflexion, and plantar flexion. Over the first 4 weeks, participants increased each exercise from 1 to 3 sets of 12 repetitions. Resistance levels also were increased progressively. The rate of progression was modified for subjects with physical limitations.
- Endurance training used bicycles, treadmills, and indoor walking sessions. Endurance training alternated between cycling (once a week), using a treadmill (twice a week), and indoor walking that included a walking loop as well as 2 flights of stairs (twice a week). Heart rates were monitored to ensure that participants did not exceed 70 percent of their heart rate reserve.
- Balance training used a rocking balance board, balance beam, obstacle course, and group activities such as balloon volleyball and horseshoes. Balance training sessions were held twice a week and increased in difficulty over the 12-week program.



Duration: Three 1½-hour sessions a week for 12 weeks.

Delivered by: Exercise physiology graduate students with training from experienced exercise physiologists or physical therapists.

Minimum Level of Training Needed: Facilitators should have approximately 2 weeks of on-the-job training by an experienced exercise physiologist or physical therapist.

Key Elements:

- Using a group format and providing a wide variety of exercise activities
- Focusing on strength, balance, and endurance
- Providing personal encouragement and reinforcement

Available Materials: No materials were available at time of publication.

Study Citation: Rubenstein LZ, Josephson KR, Trueblood PR, Loy S, Harker JO, Pietruszka FM, Robbins, AS. Effects of a group exercise program on strength, mobility, and falls among fall-prone elderly men. *Journal of Gerontology: Medical Sciences*. 2000 Jun;55A(6):M317-21.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Laurence Z. Rubenstein, MD, MPH
VA Medical Center, GRECC (11e)
16111 Plummer St.
Sepulveda, CA 91343, United States
Tel: 818-895-9311
Fax: 818-891-8181
E-mail: laurence.rubenstein@va.gov

Falls Management Exercise (FaME) Intervention

This study examined the effectiveness of an individualized, tailored group and home-based exercise intervention designed to improve participants' dynamic balance and core and leg strength, and to recover their ability to get down to and up from the floor.

After 36 weeks, the fall rate in the exercise group was reduced by one-third. Over the entire study, which included a 50-week follow-up period, the fall rate was reduced by 54 percent.

Population: Participants were women aged 65 or older, living independently, who had fallen 3 or more times in the previous year.

Geographic Locale: London, United Kingdom

Focus: Improve balance and strength.

Program Setting: Group classes were conducted at 4 locations in London in Community Leisure Centers (gym facilities that have rooms for exercise classes). Home exercises were performed in participants' homes.

Content: Before starting the program, participants were assessed for asymmetry in strength or balance and specific problems with strength, balance, and flexibility. Five basic functional tests were used:

- Shoulder flexibility
- Hamstring flexibility
- Timed up and go
- 180 degree turn
- Functional reach

Participants also received a health screening and were evaluated for fear of falling (FES-I), fracture risk (Black score), quality of life (SF12), and confidence in maintaining balance (ConfBal).

Falls Management Exercise (FaME) group classes are based on the Otago Exercise Programme, which includes exercises for endurance and flexibility as well as floor exercises. The exercises meet the American College of Sports Medicine guidelines for adults over age 65.

Class exercises were tailored to the abilities of the group and home exercises were tailored to each participant's needs and abilities. All exercises became



more challenging (that is, increased in intensity or difficulty) as the program progressed. For example, classes used individualized resistance bands and progressively reduced levels of support (seated and supported options moving to unsupported options). Home exercises addressed asymmetry in strength or balance by prescribing additional repetitions or sets for the weaker side.

Class exercises focused on:

- Improving first static then dynamic balance
- Muscle and bone strength (e.g., Thera-Bands, free weights, low-impact side stepping and standing squats, etc.)
- Endurance (e.g., marching, side stepping)
- Flexibility of 5 major muscle groups
- Gait (e.g., side and backward walking)
- Functional skills (e.g., sit to stand)
- How to avoid falling (e.g., compensatory stepping)
- Functional floor exercises (e.g., crawling, rolling, back extensions, and side leg lifts)

Note: These exercises were introduced after at least 8 weeks of preparatory physical therapy to restore the skills needed to get down to and up off the floor.

The home exercise program consisted of:

- Warm-up
- 10-minute endurance session
- Otago exercises along with additional resistance-band strengthening exercises
- Developmental flexibility exercises
- Cool-down

Participants wore hip protectors during the exercise sessions in group classes and at home to reduce the risk of hip fractures. They were not encouraged to wear them at other times.

Duration:

- The pre-exercise assessment lasted about 40 minutes.
- One-hour group classes were held once a week for 36 weeks.
- 30 minutes of home exercises were done twice a week.

Delivered by: Postural Stability Instructors. These are qualified “exercise for the older person” instructors, physical therapists, and occupational therapists who have taken the 5-day training course, “Exercise for the Prevention of Falls and Injuries in Frailer Older People.” See standards and requirements in Appendix D-2, Form D514.

Minimum Level of Training Needed: The United Kingdom has national education standards governing the training content for exercise instructors working with special populations, including older people. Further information can be found at www.skillsactive.com/training/standards.

Standards for adapting an exercise program for older adults can be found in Appendix D-2, Form D467.

After instructors are trained to work with older people, they can train as Postural Stability Instructors, focusing on older people at high risk of falling. Physical therapists and occupational therapists do not have to become an exercise instructor in order to take this training.

The 5-day training course to become a Postural Stability Instructor is considered postgraduate-level training. It involves 54 contact hours of theory and practical delivery and 100 noncontact hours. The qualification is based on successfully completing a 40-minute practical exam, a case study on a faller, and a theoretical paper.

Additional information about the course content can be found at www.laterlifetraining.co.uk/page5.html.

The United Kingdom Chartered Society of Physiotherapists endorses the Postural Stability Instructor training course. Additional information can be found at [www.csp.org.uk/director/members/careersandprofessionaldevelopment/courses/otherendorsedprogrammes/](http://www.csp.org.uk/director/members/careersandprofessionaldevelopment/courses/otherendorsedprogrammes/laterlifetraining.cfm)
[laterlifetraining.cfm](http://www.csp.org.uk/director/members/careersandprofessionaldevelopment/courses/otherendorsedprogrammes/laterlifetraining.cfm).

Key Elements:

- To be successful, the exercise program should last at least 36 weeks.
- It should include a minimum of 2 hours per week of combined group and home exercises.
- Exercise must be progressive, continually increasing in intensity, resistance, weight, and challenging balance.
- Exercises must be tailored to each individual's needs and abilities, both in group classes and at home.

It is desirable but not essential to include floor work to reduce fear of falling and improve falls self efficacy.

Available Materials: The participants' home exercise booklet is available at www.ageuk.org.uk/Documents/EN-GB/ID8950%20Strength%20And%20Balance%20Book.pdf?dtrk=true.

Information about the accredited Postural Stability Instructor course in the United Kingdom is available at www.laterlifetraining.co.uk.

The training manual for the Postural Stability Instructor course can be purchased from www.laterlifetraining.co.uk.

Study Citation: Skelton D, Dinan S, Campbell M, Rutherford O. Tailored group exercise (Falls Management Exercise—FaME) reduces falls in community-dwelling older frequent fallers (an RCT). *Age and Ageing*. 2005 Nov;34(6):636-9.

Supplemental articles

Skelton DA, Dinan SM. Exercise for falls management: Rationale for an exercise program aimed at reducing postural instability. *Physiotherapy Theory and Practice*. 1999 Jan;15(2):105-20. Available at: www.laterlifetraining.co.uk/documents/ExerciseFallsManage.PDF.

Iliffe A, Kendrick D, Morris R, Skelton D, Gage H, Dinan S, Stevens Z, Pearl M, Masud T. Multi-centre cluster randomised trial comparing a community group exercise programme with home based exercise with usual care for people aged 65 and over in primary care: Protocol of the ProAct 65+ trial. *Trials*. 2010 Jan;11(1):6-10.

Skelton DA, Stranzinger K, Dinan SM, Rutherford O. BMD improvements following FaME (falls management exercise) in frequently falling women age 65 and over: An RCT. *Journal of Aging and Physical Activity*. 2008 Jul;16(Suppl):S89-90.

Skelton DA. The Postural Stability Instructor: Qualification in the United Kingdom for effective falls prevention exercise. *Journal of Aging and Physical Activity*. 2004 Jul;12(3):375-6.

Skelton DA. Effects of physical activity on postural stability. *Age and Ageing*. 2001 Nov;30(Suppl 4):33-9.

Exercise-based
Interventions

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Dr. Dawn Skelton
Reader in Ageing and Health
School of Health, HealthQWest
A236 Govan Mbeki Building
Glasgow Caledonian University
Cowcaddens Road,
Glasgow G4 0BA, United Kingdom
Tel: +44 (0) 141 331 8792
E-mail: dawn.skelton@manchester.ac.uk

Central Sydney Tai Chi Trial

This study evaluated the effectiveness of a community-based Tai Chi program to reduce falls among people aged 60 or older. One-hour classes were offered once a week for 16 weeks in community settings by experienced instructors who taught their regular programs using several styles of Tai Chi.

After the 24-week follow-up period, the fall rate among Tai Chi participants was one-third lower and the rate of multiple falls was 46 percent lower than the rates for participants who did not take Tai Chi.

Population: Participants were healthy people aged 60 or older who lived in the community. About 84 percent were female.

Geographic Locale: Sydney, Australia

Focus: Improve balance and reduce falls.

Program Setting: Tai Chi classes were conducted at community locations such as town halls and senior centers. Locations were chosen based on accessibility (e.g., accessible by public transportation, room accessible without climbing stairs), geographic diversity, and options for no- or low-cost sustainability after the study was completed.

Content: The majority of classes used modified Sun-style Tai Chi although a small proportion used Yang-style Tai Chi or a mixture of several styles. Detailed information about Tai Chi styles was not collected.

Instructors followed a set of guidelines that focused on teaching physical activity to older people and contained suggestions about how to incorporate key elements, such as relaxation, into the Tai Chi program. Some classes had the option to buy a video and/or booklet about the type of Tai Chi they were learning.

Duration: One-hour per week for 16 weeks.

Delivered by: Experienced Tai Chi instructors or instructors experienced in teaching physical activity to older people.

Minimum Level of Training Needed: Instructors must have at least 5 years experience as a Tai Chi instructor or have experience teaching physical activity to older people and attend an intensive weekend workshop about the basic principles of Tai Chi.



Key Elements:

- Limit class size to 12 people to maximize the attention each participant can get from the instructor.
- Incorporate relaxation and lowered center of gravity exercises into each class.
- It is important that participants maintain an upright (straight) posture at all times to reduce the risk of falling. Forms of Tai Chi that require participants to squat while moving or to get into positions that are not totally upright should be modified appropriately.
- Instructors need to be aware of participants' comfort levels as well as any medical or physical conditions that may limit their ability to perform certain Tai Chi movements.
- Tai Chi movements should be introduced gradually so that participants are not exposed to too many new movements at once.

Available Materials:

- Tai Chi Principles for Falls Prevention in Older People*
- Guidelines for Instructors Working with Older People*

*See Appendix D-3.

Study Citation: Voukelatos A, Cumming RG, Lord SR, Rissel C. A randomized, controlled trial of Tai Chi for the prevention of falls: The Central Sydney Tai Chi trial. *Journal of the American Geriatrics Society*. 2007 Aug;55(8):1185-91.

Supplemental article

Voukelatos A. The Central Sydney Tai Chi trial: A randomized controlled trial investigating the effectiveness of Tai Chi in reducing falls in older people. PhD thesis, University of Sydney, 2010.

Exercise-based
Interventions

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Alexander Voukelatos, PhD
Sydney Southwest Area Health Promotion Service
Level 9 (North), KGV building
Missenden Road, Camperdown
New South Wales 2050, Australia
E-mail: avouk@email.cs.nsw.gov.au

Simplified Tai Chi

This study compared a 15-week program of Tai Chi classes that used 10 simplified movements, with a balance training program. After 4 months, the risk of falling more than once among participants in the Tai Chi classes was almost half that of people in the comparison group.

Participants reported that after the study they were better able to stop themselves from falling by using their environment and appropriate body maneuvers. After the study ended, almost half the participants chose to continue meeting informally to practice Tai Chi.

Population: All were 70 years or older and lived in the community. Most study participants were female.

Geographic Locale: Atlanta, Georgia, United States

Focus: Improve strength, balance, walking speed, and other functional measures among seniors using Tai Chi.

Program Setting: The program used facilities in a residential retirement community.

Content: Participants were taught a simplified version of Tai Chi. The 108 existing Tai Chi forms were synthesized into a series of 10 composite forms (see Appendix D-4) that could be completed during the 15-week period. The composite forms emphasized all elements of movement that generally become limited with age.

Exercises systematically progressed in difficulty. The progression of movements led to gradually reducing the base of standing support until, in the most advanced form, a person was standing on one leg. This progression also included increasing the ability to rotate the body and trunk as well as performing reciprocal arm movements. These exercises were led during the group sessions; however, individuals were encouraged to practice these forms on their own, outside of the group setting.

Example of a simplified Tai Chi form:

FORM 6



Duration: The 15-week program included:

- Twice weekly 25-minute group sessions
- Weekly 45-minute individual contact time with the instructor
- Twice daily 15-minute individual practice sessions at home without an instructor

Delivered by: A Tai Chi Quan grand master with 50 years of experience instructed the classes and met individually with participants. A nurse/coordinator maintained contact with participants to ensure their participation.

Minimum Level of Training Needed: Information was not provided by the principal investigator.

Key Elements: This program needs to be led by a very experienced Tai Chi grand master. No elements should be changed in order to replicate these results among seniors who are similar to study participants.

Available Materials: Illustrations of the 10 Tai Chi exercises are found in Appendix D-4.

Study Citation: Wolf SL, Barnhart HX, Kutner NG, McNeely E, Coogler C, Xu T. Reducing frailty and falls in older persons: An investigation of Tai Chi and computerized balance training. *Journal of the American Geriatrics Society*. 1996 May;44(5):489-97.

Supplemental article

Wolf SL, Coogler C, Xu T. Exploring the basis for Tai Chi Chuan as a therapeutic exercise approach. *Archives of Physical Medicine and Rehabilitation*. 1997 Aug;78(8):886-92.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Steven L. Wolf, PhD, PT, FAPTA
Department of Rehabilitation Medicine
Emory University School of Medicine
1441 Clifton Road NE
Atlanta, GA 30322, United States
Tel: 404-712-4801
Fax: 404-712-5895
E-mail: swolf@emory.edu



Home Modification Interventions

| | |
|---|----|
| The VIP Trial (Campbell, et al.) | 34 |
| Home Visits by an Occupational Therapist (Cumming, et al.)..... | 36 |
| Falls-HIT (Home Intervention Team) Program (Nikolaus, et al.) | 38 |

The VIP Trial

This study looked at the effectiveness of 2 interventions to reduce falls and fall injuries in older people with poor vision. The home safety program consisted of a home hazard assessment by an occupational therapist followed by home modifications and recommendations for behavior change. The home exercise program consisted of a combination of strength and balance exercises (the Otago Exercise Programme modified for people with poor vision) plus vitamin D supplements.

Only the home safety program was effective in reducing falls. The home safety group had 61 percent fewer falls and 44 percent fewer injuries compared to those who received social visits.

Population: Participants were community-dwelling seniors aged 75 or older with poor vision. Two-thirds of the participants were female.

Geographic Locale: Dunedin and Auckland, New Zealand

Focus. Assess and reduce home hazards and encourage changes in behavior.

Program Setting: The program took place in participants' homes.

Content: An occupational therapist conducted a home safety assessment and made suggestions for modifications. The assessment consisted of a walk-through of the participant's home using a checklist to identify hazards as well as a discussion about items, behavior, or lack of equipment that could lead to falls. The occupational therapist and participant then agreed on which recommendations to implement.

The occupational therapist helped the participant obtain any necessary equipment and oversaw payment for the home modifications. Home modifications and equipment costing more than NZ\$200 were funded by the local Board of Health and items costing less than this were funded by the participant or from research funds. The occupational therapist made a follow-up visit if equipment needed to be installed.

Duration: The intervention consisted of 1 or 2 home visits. The first visit lasted about 2 hours. If the occupational therapist needed to approve new equipment, they made a second visit 2 to 3 weeks later. The second visit lasted about 45 minutes.

Delivered by: Occupational therapists who attended a 2-day training course.



Minimum Level of Training Needed: One half-day training is necessary for occupational therapists to become familiar with the specific focus on falls prevention in people with poor vision.

Key Elements:

- The occupational therapist's advice rather than the environmental changes was key.
- A trained and experienced occupational therapist is critical to the success of this intervention.

Available Materials: The *Westmead Home Safety Assessment* checklist is available but not the modified version used in the VIP trial.

Clemson L. *Home fall hazards: A guide to identifying fall hazards in the homes of elderly people and an accompaniment to the assessment tool, the Westmead Home Safety Assessment (WeHSA)*. West Brunswick, Victoria: Co-ordinates Publications, 1997.

Study Citation: Campbell AJ, Robertson MC, La Grow SJ, Kerse NM, Sanderson GF, Jacobs RJ. Randomised controlled trial of prevention of falls in people aged ≥ 75 with severe visual impairment: The VIP trial. *British Medical Journal*. 2005 Oct 8;331(7520):817-25.

Supplemental article

La Grow SJ, Robertson MC, Campbell AJ, Clarke GA, Kerse NM. Reducing hazard related falls in people 75 years and older with significant visual impairment: How did a successful program work? *Injury Prevention*. 2006 Oct;12(5):296-301.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

A. John Campbell, MD
Department of Medical and Surgical Sciences
Dunedin School of Medicine
Dunedin, New Zealand
E-mail: john.campbell@otago.ac.nz

Cumming,
et al.

Home Visits by an Occupational Therapist

This intervention used an occupational therapist (OT) who visited participants in their homes, identified environmental hazards and unsafe behaviors, and recommended home modifications and behavior changes. Fall rates were reduced by one-third but only among men and women who had experienced 1 or more falls in the year before the study.

Population: All participants were 65 or older and lived in the community. More than half of the participants were female.

Geographic Locale: Sydney, Australia

Focus: Assess and reduce home hazards.

Program Setting: The program was conducted in participants' homes.

Content: The OT visited each participant's home and conducted an assessment using the standardized *Westmead Home Safety Assessment* form (see Available Materials below). The OT identified environmental hazards such as slippery floors, poor lighting, and rugs with curled edges, and discussed with the participant how to correct these hazards.

Based on standard occupational therapy principles, the therapist also assessed each participant's abilities and behaviors, and how each functioned in his or her home environment. Specific unsafe behaviors were identified such as wearing loose shoes, leaving clutter in high-traffic areas, and using furniture to reach high places. The OT discussed with the participants ways to avoid these unsafe behaviors.

Two weeks after the initial home visit the OT telephoned each participant to ask whether they had made the modifications and to encourage them to adopt the recommended behavioral changes.



Duration: One-hour home visit with a follow-up telephone call 2 weeks later. Total contact time was approximately 2 hours.

Delivered by: An occupational therapist with 2 years experience.

Minimum Level of Training Needed: A degree in occupational therapy is the minimum qualification needed to conduct the home assessments, develop the recommendations, and supervise the home modifications.

Key Elements:

- Using an experienced occupational therapist is critical.
- These researchers emphasized that this study should not be used to justify widespread, untargeted home modification programs implemented by people who do not have skills in caring for older people.

Available Materials: Information on the falls prevention kit, which includes the *Westmead Home Safety Assessment* form and a booklet that gives background information on falls and hazards can be purchased from the following company:

Co-ordinates Therapy Services
PO Box 59, West Brunswick
Victoria 3055, Australia
Tel: +61 (3) 9380 1127
Fax: +61 (3) 8080 5996
E-mail: jenny@therapybookshop.com

Study Citation: Cumming RG, Thomas M, Szonyi M, Salkeld G, O'Neill E, Westburg C, Frampton G. Home visits by an occupational therapist for assessment and modification of environmental hazards: A randomized trial of falls prevention. *Journal of the American Geriatrics Society*. 1999 Dec;47(12):1397-1402.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Robert G. Cumming, PhD
School of Public Health, Building A27
University of Sydney
Sydney NSW 2006, Australia
Tel: +61 (2) 9036 6407
Fax: +61 (2) 9351 5049
E-mail: robert.cumming@sydney.edu.au

Nikolaus,
et al.

Falls-HIT (Home Intervention Team) Program

This intervention provided home visits to identify environmental hazards that can increase the risk of falling, provided advice about possible changes, offered assistance with home modifications, and provided training in using safety devices and mobility aids. The fall rate for participants was reduced 31 percent. The intervention was most effective among those who had experienced 2 or more falls in the previous year; the fall rate for these participants was reduced 37 percent.

Population: Participants were frail community-dwelling older adults who had been hospitalized for conditions unrelated to a fall, and then discharged to home. Participants showed functional decline, especially in mobility. All were 65 or older and lived in the community. Three-quarters were female.

Geographic Locale: Mid-sized town, Southern Germany

Focus: Assess and reduce fall hazards in participants' homes.

Program Setting: Intervention team members contacted patients once or twice while they were hospitalized to explain the program. The program took place in participants' homes.

Content: The first home visit was conducted while the participant was still hospitalized. Two team members, an occupational therapist with either a nurse or a physical therapist, depending on patient's anticipated needs, conducted a home assessment. They identified home hazards using a standardized home safety checklist and determined what safety equipment a participant needed.

During 2 to 3 subsequent home visits, an occupational therapist or nurse met with the participant to:

- Discuss home hazards
- Recommend home modifications
- Facilitate necessary modifications
- Teach participants how to use safety devices and mobility aids when necessary



Duration: The program consisted of 2 or more home visits, each lasting about 1½ hours. After the participant was discharged from the hospital, 3 home visits typically were needed to provide advice on recommended home modifications and to teach the participant how to use safety devices and mobility aids. On average, the total individual contact time was 8 hours.

Delivered by: The home intervention team was composed of a physical therapist, occupational therapist, 3 nurses, a social worker, and a secretary. Occupational therapists generally worked with all participants. Depending on individual need, either a physical therapist or nurse also helped the participant. The social worker was available to provide information about ambulatory services and to help participants complete applications for additional money from the mandatory care insurance.

Minimum Level of Training Needed: Information was not provided by the principal investigator.

Key Elements: Participants met all intervention team members at the hospital before they were discharged, which facilitated follow-up.

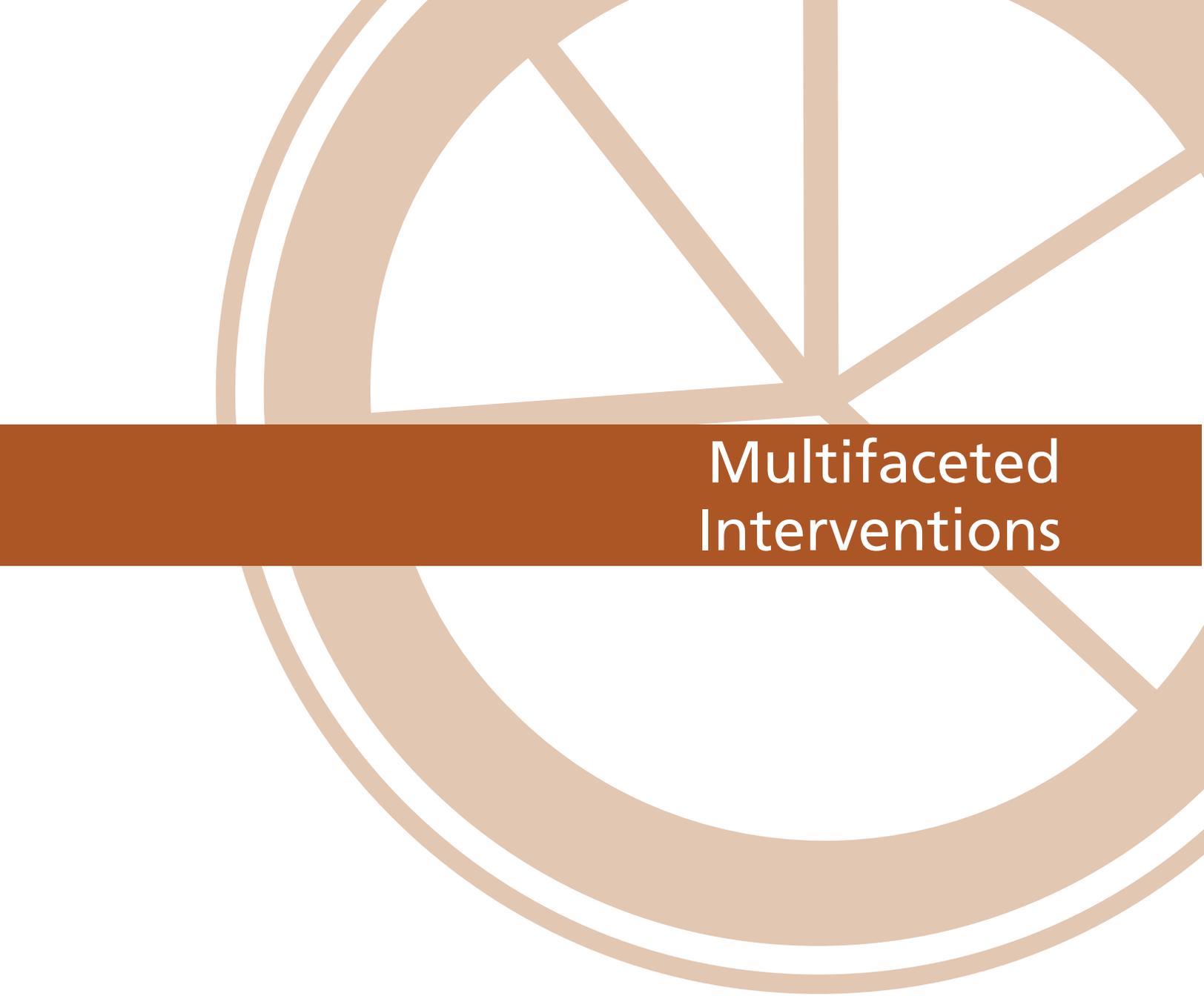
Available Materials: A standardized home safety checklist is available in German only.

Study Citation: Nikolaus T, Bach M. Preventing falls in community-dwelling frail older people using a home intervention team (HIT): Results from the randomized falls-HIT trial. *Journal of the American Geriatrics Society*. 2003 Mar;51(3):300-5.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Thorsten Nikolaus, MD
Medical Director/CEO
Bethesda Geriatric Clinic and Professor of Geriatric Medicine
University of Ulm
Zollernring 26, 89073 Ulm, Germany
Tel: +49 731 187 185
Fax: +49 731 187 389
E-mail: thorsten.nikolaus@bethesda-ulm.de



Multifaceted Interventions

| | |
|---|----|
| Stepping On (Clemson, et al.) | 42 |
| PROFET (Prevention of Falls in the Elderly Trial) (Close, et al.) | 46 |
| Accident & Emergency Fallers (Davison, et al.) | 48 |
| The NoFalls Intervention (Day, et al.) | 52 |
| The SAFE Health Behavior and Exercise Intervention (Hornbrook, et al.) | 56 |
| Multifactorial Fall Prevention Program (Salminen, et al.) | 60 |
| The Winchester Falls Project (Spice, et al.) | 64 |
| Yale FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) (Tinetti, et al.) | 68 |
| A Multifactorial Program (Wagner, et al.) | 72 |

Stepping On

This study used a series of small group sessions to teach fall prevention strategies to community-dwelling older adults. The fall rate among participants was reduced about 30 percent compared with those who did not receive the intervention. The intervention was especially effective for men. The fall rate among male participants was reduced almost two-thirds.

Population: Participants were individuals who had fallen in the previous year or who were concerned about falling. All were 70 or older and lived in the community. Most study participants were female.

Geographic Locale: Sydney, Australia

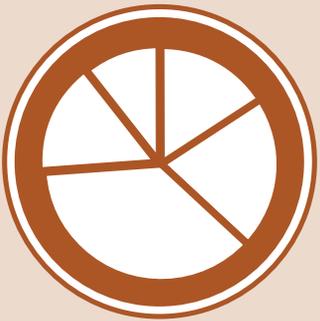
Focus: Improve self-efficacy, empower participants to make better decisions and learn about fall prevention techniques, and make behavioral changes.

Program Setting: Initial sessions were conducted in easily accessible community settings. Refreshments were provided before and after the sessions to give participants an opportunity to talk to each other and with the facilitators and content experts. Follow-up visits took place in the participants' homes.

Content: The program addressed multiple fall risk factors: improving lower limb balance and strength, improving environmental and behavioral safety in both the home and community, and encouraging visual and medical screenings to check for low vision and possible medication problems.

Each session covered a different aspect to reducing fall risk:

- Session 1: Risk appraisal; introducing balance and strength exercises
- Session 2: Review and practice exercises; how to move safely in the home
- Session 3: Hazards in and around the home and how to remove or reduce them
- Session 4: How to move safely in the community; safe footwear and clothing
- Session 5: Poor vision and fall risk; the benefits of vitamin D, calcium, and hip protectors



- Session 6: Medication management; review of exercises; more strategies for moving safely in the community
- Session 7: Review of topics covered in program
- Follow-up home visit: Review fall prevention strategies; assist with home adaptations and modifications, if needed
- Three-month booster session: Review achievements and how to maintain motivation

Duration:

- Seven weekly 2-hour program sessions
- A 1- to 1½-hour home visit, 6 weeks after the final session
- A 1-hour booster session 3 months after the final session

Delivered by: An occupational therapist (OT) facilitated the program and conducted the home visits.

A team of content experts, trained by the OT and guided by the *Stepping On* manual, led the sessions. These included:

- A physical therapist who introduced the exercises and led a segment on moving about safely.
- An OT who led segments on home safety, community safety, behavioral methods to sleeping better, and hip protectors.
- An older adult volunteer from the Roads and Traffic Authority who spoke on pedestrian safety.
- A retired volunteer nurse from the Medicine Information Project who discussed how to manage medications.
- A mobility officer from the Guide Dogs who spoke on coping with low vision (The *Stepping On* manual has a topics section that outlines the information required to run this session).

Minimum Level of Training Needed: The program should be facilitated by a health professional with experience both in group work and in working with older adults in community settings.

This program requires a physical therapist, an OT, a person trained in road safety for older drivers who can discuss pedestrian safety, a low vision expert, and a nurse or community pharmacist who can discuss medications. Other potentially useful content experts include a podiatrist or perhaps a nutritionist. All content experts need to receive training in fall prevention.

Key Elements: Using content experts is critical. It is also important to let each expert know what is expected of them, to provide feedback, and to make sure each focuses on fall prevention.

The *Stepping On* manual is essential for all program facilitators and provides a step-by-step guide to running the 7-week group program. It outlines topic areas and provides the background information for each content expert.

Chapters include:

- Essential background information for understanding the conceptual underpinning of the program and the group process
- Valuable content information for all the key fall prevention areas that can be used to train local experts participating in the program
- A guide to useful resources
- Handouts for group participants
- Ideas on recruitment and evaluation

Work is ongoing to develop training workshops and certification for *Stepping On* program leaders.

Available Materials: The program manual *Stepping On: Building Confidence and Reducing Falls. A Community-Based Program for Older People* by Dr. Lindy Clemson is available at

Freiberg Press Inc.
PO Box 612
Cedar Falls, IA 50613, United States
E-mail: bfreiberg@cfu.net

Study Citation: Clemson L, Cumming RG, Kendig H, Swann M, Heard R, Taylor K. The effectiveness of a community-based program for reducing the incidence of falls in the elderly: A randomized trial. *Journal of the American Geriatrics Society*. 2004 Sep;52(9):1487-94.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Lindy Clemson, PhD
Associate Professor in Ageing, Head of Discipline (Occupational Therapy)
Faculty of Health Sciences, The University of Sydney
Cumberland Campus, PO Box 170
Lidcombe 1825, Australia
Tel: +61 (2) 9351 9372
Fax: +61 (2) 9351 9166
E-mail: lindy.clemson@sydney.edu.au

Close,
et al.

PROFET (Prevention of Falls in the Elderly Trial)

This intervention provided medical assessments for fall risk factors with referrals to relevant services and an occupational therapy home hazard assessment with recommendations for home modifications. After 12 months, those in the intervention group were 60 percent less likely to fall once and 67 percent less likely to fall repeatedly (at least 3 times), compared with those who did not receive the intervention.

Population: Participants were seniors who had been treated for a fall in a hospital emergency department. All were aged 65 or older and lived in the community. Two-thirds of participants were female.

Geographic Locale: London, United Kingdom

Focus: Identify medical risk factors and home hazards, and provide referrals and/or recommendations to reduce fall risk and improve home safety.

Program Setting: The medical assessment took place in an outpatient hospital clinic. The occupational therapy assessment took place in participants' homes.

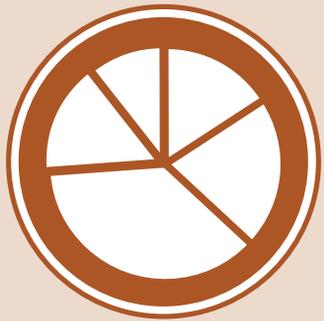
Content: The medical assessment was conducted soon after the fall that was treated in the emergency room. It included assessments of visual acuity, postural hypotension, balance, cognition, depression, and medication problems. The results were used to identify and address problems that could contribute to fall risk. Participants received referrals to relevant services, as appropriate, based on identified risk factors.

The home assessment was conducted during a single visit. The occupational therapist (OT) identified environmental hazards in the home such as uneven outdoor surfaces, loose rugs, and unsuitable footwear. Based on findings, the OT provided advice and education regarding safety within the home, made safety modifications to the home with the participant's consent, and provided minor safety equipment.

The OT made social service referrals for participants who required hand rails, other technical aids, adaptive devices such as grab bars and raised toilet seats, and additional support services.

Duration: The average length of the medical assessment was 45 minutes. The average length of the home assessment was 60 minutes.

Delivered by: A physician specializing in geriatrics conducted the medical assessment. An OT delivered the home hazard assessment.



Minimum Level of Training Needed: This program could be implemented by:

- Appropriately trained geriatricians
- General practitioners with a strong interest in older adult health
- Trained physical therapists or nurses with the support of a general practitioner in case medication modification, referrals to specialists, or other medical services were required

Key Elements: For medication review and modification, a medical specialist rather than a general practitioner is recommended.

Available Materials:

- Folstein mini-mental state examination (see Supplemental articles)
- Modified Geriatric Depression Scale (see Supplemental articles)
- Snellen vision assessment chart
- Medical assessment form*—the form used in the outpatient hospital clinic setting
- Accident and emergency assessment tool*—the instrument used in the emergency department to identify people at high risk of falling and those who should be referred for a comprehensive geriatric assessment
- Environmental hazards checklist*—the checklist used to guide the home assessment

* See Appendix D-5.

Study Citation: Close J, Ellis M, Hooper R, Glucksman E, Jackson S, Swift C. Prevention of Falls in the Elderly Trial (PROFET): A randomised controlled trial. *Lancet*. 1999 Jan 9;353(9147):93-7.

Supplemental articles

Folstein MF, Folstein SE, McHugh PR. “Mini-mental state.” A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*. 1975 Nov;12(3):189-98.

Sheikh J, Yesavage J. Geriatric Depression Scale (GDS): Recent evidence and development of a shorter version. *Clinical Gerontology*. 1986;5(1/2):165-72.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Jacqueline Close, MD
Neuroscience Research Australia
Barker Street, Randwick
Sydney NSW 2031, Australia
Tel: +61 (2) 9399 1055
Fax: +61 (2) 9399 1005
E-mail: j.close@neura.edu.au

Davison,
et al.

Accident & Emergency Fallers

This multifaceted intervention was designed for people who fell repeatedly. Participants received a medical fall risk assessment by a geriatrician at the hospital and had in-home assessments by physical and occupational therapists. Each participant received an individualized intervention designed to reduce their fall risk factors.

After 12 months, the fall rate in the intervention group was 36 percent lower than the rate in the comparison group.

Population: Participants were men and women aged 65 or older. All had experienced at least 1 fall in the past year and also had been treated in the emergency department for another fall or fall injury. About three-quarters of participants were female.

Geographic Locale: Newcastle, United Kingdom

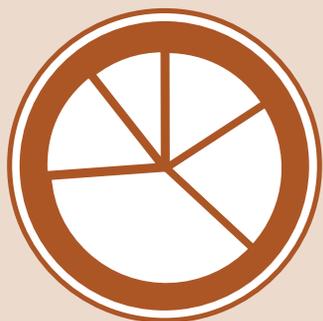
Focus: Identify and modify each participant's fall risk factors.

Program Setting: The medical assessment was conducted in a hospital and the physical therapy and home assessments were conducted in participants' homes.

Content: After taking a medical and fall history, a physician conducted a full clinical examination that included vision, medication review, a neurological examination, and a cardiovascular assessment. Postural blood pressure was assessed and laboratory tests and an electrocardiogram were performed.

Interventions for identified fall risk factors followed recognized treatment recommendations. Each participant was referred to relevant specialists as needed, such as to an optometrist for vision correction or cataract removal; given advice or medication to reduce orthostatic hypotension; and had medications associated with falls stopped, reduced, or modified.

The physical therapist evaluated each participant's gait and balance and, if necessary, provided gait re-education and the functional training program used in the Yale FICSIT (Frailty and Injuries: Co-operative Studies of Intervention Studies) study (See Koch, et al. and Tinetti, et al. under Supplemental articles). The main intervention was exercise to strengthen the proximal leg muscles and ankle dorsiflexion muscles. If needed,



participants were given assistive devices, had their footwear modified or replaced, and were referred to a podiatrist.

An occupational therapist used a room-by-room environmental fall hazard checklist, the *User Safety and Environmental Risks* (USER) checklist, to identify potential hazards throughout the home including the kitchen, bathroom, bedroom, and stairs (See Hagedorn, et al. under Supplemental articles). Specific areas included the position and condition of furniture, cabinets and shelving heights, loose rugs and tripping hazards, grab bars and handrails, toilet height, and lighting (including the use of night lights).

Environmental interventions followed published criteria (See Tideiksaar under Supplemental articles) and included advice about reducing home hazards as well as suggestions for specific home modifications.

Duration: On average, participants visited the hospital twice for the medical intervention. The initial hospital assessment took 1 hour and the medical intervention visit was 20 minutes. Participants received 2 physical therapy intervention visits; the initial physical therapy assessment took 45 minutes and the intervention lasted 15 minutes. The occupational therapy visit took 45 minutes and the follow-up visit about 1 month later lasted 20 minutes.

Delivered by: A physician performed the medical assessments and made appropriate referrals to specialists; a physical therapist conducted the gait and balance assessment and re-education; and an occupational therapist conducted the home hazard assessment and recommended home modifications.

Minimum Level of Training Needed: This intervention requires a variety of highly trained health care professionals. Complex individualized interventions of this type cannot be implemented by individuals with lower levels of training.

Key Elements: Multifactorial assessments and interventions conducted by highly trained individuals in each of the 3 disciplines.

Available Materials: No additional materials are available.

Study Citation: Davison J, Bond J, Dawson P, Steen IN, Kenny RA. Patients with recurrent falls attending accident and emergency benefit from multifactorial intervention: A randomised controlled trial. *Age and Ageing*. 2005 Mar;34(2):162-8.

Supplemental articles

Koch M, Gottschalk M, Baker DI, Palumbo S, Tinetti ME. An impairment and disability assessment and treatment protocol for community-living elderly persons. *Physical Therapy*. 1994 Apr;74(4):286-94.

Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett, P, Gottschalk M, Koch ML, Trainor K, Horwitz RI. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *New England Journal of Medicine*. 1994 Sept 29;331(13):821-7.

Hagedorn R, McLafferty S, Russell D. The *User Safety and Environmental Risk Checklist* (USER). In: Anonymous falls: Screening and risk assessment for older people in the community. *Worthing Priority Care NHS Trust*. 1998:48-57.

Tideiksaar R. Preventing falls: Home hazard checklists to help older patients protect themselves. *Geriatrics*. 1986 May;41(5):26-8.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Dr. John Davison
Falls and Syncope Service and Institute for Ageing & Health
Royal Victoria Infirmary
Newcastle upon Tyne NE1 4LP, United Kingdom
Fax: (+44) 191 222 5638
E-mail: john.davison@ncl.ac.uk

Day,
et al.

The NoFalls Intervention

This study looked at the effectiveness of group-based exercise in preventing falls when used alone or in combination with vision improvement and/or home hazard reduction. The intervention components focused on increasing strength and balance, improving poor vision, and reducing home hazards.

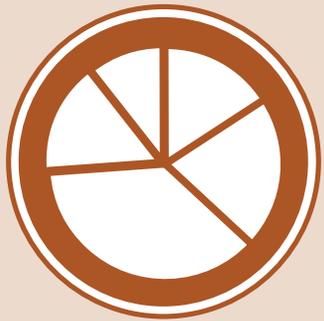
The group-based exercise was the most potent single intervention; when used alone, it reduced the fall rate by 20 percent. Falls were reduced further when vision improvement or home hazard reduction was combined with exercise. The most effective combination was the group-based exercise with both vision improvement and home hazard reduction. Participants who received all 3 components were one-third less likely to fall.

Population: All participants were aged 70 and older and lived in the community. Sixty percent were female.

Geographic Locale: City of Whitehorse, Melbourne, Australia

Focus: Increase strength and balance, improve poor vision, and reduce home hazards.

Program Setting: The exercise program was delivered in community settings such as exercise rooms in fitness centers and community health centers. The vision intervention was delivered via usual services available in the community. Participants went to their optometrist or ophthalmologist if they had one. If any further action was required, it was facilitated using normal services such as hospitals for cataract surgery, optometrists for new glasses, and general practitioners or ophthalmologists for medication if required. The home hazard intervention was conducted in participants' homes.



Content:

Exercise: The exercise intervention consisted of weekly 1-hour classes plus daily home exercises. Classes were designed by a physical therapist to improve flexibility, leg strength, and balance. About one-third of the exercises were devoted to balance improvement. Exercises were adjusted for participants with limitations. Music was played during the sessions.

Leaders provided a social time with coffee and tea after each session to talk informally about exercise improvements and opportunities.

Vision improvement: The vision intervention included referral to an appropriate eye care provider if a participant's vision fell below predetermined criteria during the baseline assessments for visual acuity, contrast sensitivity, depth perception, and field of view. Criteria for referral included more than 4 lines difference between the line of smallest letters read correctly on the high and low contrast sections of the vision chart or any loss of field of view.

A referral was recommended if:

- (1) A potential visual deficit was identified and the participant was not already receiving treatment, or
- (2) If a deficit had been identified previously but the participant had not received treatment during the previous 12 months. The intervention consisted of the participant receiving the recommended treatment by an appropriate specialist.

Home hazard reduction: The home hazard assessment consisted of a walk-through using a checklist for those rooms used in a normal week. The checklist included a comprehensive section defining the different areas of the house and specific hazards. The checklist was divided into rooms or areas of the house—access points (main entry door, back door, etc.), hallways, stairwells, dining room, living room, den, bedrooms, and wet areas (kitchen, bathroom, laundry rooms). Within each of these areas, the focus was on steps and stairs, floor surfaces, lighting, and some key furniture items or fixtures such as a favorite chair or bathroom fixtures.

After the assessment, the results were discussed with the participant and potential interventions described in the checklist were suggested. If the participant agreed to the intervention, it was determined who would carry it out. Hazards could be removed or modified by the participant, their family, the City of Whitehorse home maintenance program, or some other person. Study staff visited the participants' homes and provided quotes for the materials needed for the suggested modifications; labor was provided free of charge.

Duration:

Exercise: Weekly 1-hour group classes for 15 weeks and 25 minutes of daily home exercises.

Vision improvement: Duration depended on the specific intervention (such as cataract surgery or new glasses).

Home hazard reduction: Duration depended on the length of time the home modifications were left in place by the participant.

Delivered by:

Exercise: Classes were led by trainers who were accredited to lead exercise classes for older adults, and were trained in the NoFalls program by the physical therapist who designed the program.

Vision improvement: Initial assessment was conducted by nurses with up to a half-day training required on the vision assessment. Detailed vision assessment was conducted by each participant's usual eye care provider, general practitioner, local optometrist, or ophthalmologist.

Home hazard reduction: Home assessments were conducted by research nurses who followed the study protocol for assessment with 1 day of training required on the home hazard assessment. Modifications were undertaken by participants, their family or a private contractor, or by the City of Whitehorse home maintenance program.

Minimum Level of Training Needed: Exercise: Requires a basic level of exercise leadership training such as that received by a physical therapist or certified fitness instructor.

Vision and home hazard assessments: Nurses or other allied health professionals with the appropriate training.

Key Elements: Although the most effective single component was the NoFalls exercise program, the complete program should be followed because partial implementation may not reduce falls.

Available Materials: The NoFalls exercise program manual, which was developed for trained professionals, is available free of charge in electronic format at www.monash.edu.au/muarc/projects/nofalls/.

These researchers have not made the home assessment protocol available because this intervention component by itself was not effective.

Study Citation: Day L, Fildes B, Gordon I, Fitzharris M, Flamer M, Lord S. Randomised factorial trial of falls prevention among older people living in their own homes. *British Medical Journal*. 2002 Jul 20;325(7356):128-33.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Lesley Day, PhD, MPH
Accident Research Centre
Building 70, Monash University
Wellington Road
Clayton Victoria 3800, Australia
Tel: +61 (3) 9905 1811
Fax: +61 (3) 9905 1809
E-mail: NoFalls.enquire@general.monash.edu.au

The SAFE Health Behavior and Exercise Intervention

The Study of Accidental Falls in the Elderly (SAFE) health behavior intervention was a program of 4 group classes on how to prevent falls. The classes addressed environmental, behavioral, and physical risk factors and included exercise with instructions and supervised practice. The home safety portion included a home inspection with guidance and assistance in reducing fall hazards.

Overall, participants were 15 percent less likely to fall compared with those who did not receive the intervention. Male participants showed the greatest benefit.

Population: All were participants were 65 or older and lived in the community. About 60 percent of participants were female.

Geographic Locale: Portland, Oregon, and Vancouver, Washington, United States

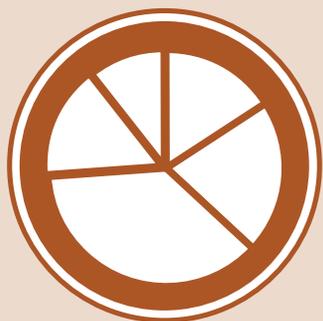
Focus: Reduce risky behaviors, improve physical fitness through exercise, and reduce fall hazards in the home.

Program Setting: No information was available on where risk education and group exercise classes took place. Home safety inspections were conducted in participants' homes.

Content: The SAFE health behavior intervention consisted of 4 1½-hour group classes that used a comprehensive approach to reducing fall risks. Classes addressed environmental, behavioral, and physical risk factors.

Classes included:

- A slide presentation on common household risks
- Discussions of behavioral risks such as walking on ice or using a chair to reach high places
- A self-appraisal of home hazards using a specially designed form
- Small group sessions during which participants worked together to develop action plans



Each class session also had an exercise component that included a brief demonstration of fall prevention exercises and about 20 minutes of supervised practice. Participants received a manual describing the exercises and were encouraged to begin walking at least 3 times a week.

The exercises were chosen to:

- Actively involve all parts of the body
- Maintain full range of motion of all joints
- Strengthen muscles
- Improve posture
- Improve balance

During the home safety inspection, the assessor inspected the participant's home and identified fall hazards using a standard protocol. The assessor encouraged the participant to remove or repair the hazards identified during this initial visit. The participant was also given fact sheets on how to obtain technical and financial assistance for making repairs and modifications to his or her home.

After the 4 classes were completed, the assessor returned to the participant's home to check on the progress of repairs and to offer financial and technical assistance if needed, as well as discounts on safety equipment.

Duration:

- Two home visits, each lasting about 15 minutes
- Four weekly 1½-hour classes (including 20 minutes of supervised exercise) over a 1-month period

Delivered by:

- The home inspection was performed by a BA-level home assessor who was trained during a 2-day program that included practice assessments of elderly volunteers' homes.
- The fall prevention program and exercise sessions were delivered by MA-level lifestyle change experts with various backgrounds including health behavior change and sports training. Each group meeting was conducted by a team consisting of a lifestyle change expert and a physical therapist.

Minimum Level of Training Needed: Information was not provided by the principal investigator.

Key Elements: Information was not provided by the principal investigator.

Available Materials: No intervention materials were available for distribution at the time of publication. Please contact the principal investigator for information on how to obtain the exercise manual.

Study Citation: Hornbrook MC, Stevens VJ, Wingfield DJ, Hollis JF, Greenlick MR, Ory MG. Preventing falls among community-dwelling older persons: Results from a randomized trial. *The Gerontologist*. 1994 Feb;34(1):16-23.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Mark C. Hornbrook, PhD
Chief Scientist
The Center for Health Research, NW/HI/SE
Kaiser Permanente Northwest
3800 North Interstate Avenue
Portland, OR 97227-1110, United States
Tel: 503-335-6746
Fax: 503-335-2428
E-mail: mark.c.hornbrook@kpchr.org

Multifactorial Fall Prevention Program

This multifaceted fall intervention consisted of a geriatric fall risk assessment with counseling and guidance in fall prevention; home hazards assessment and modification; group and home-based exercise; group lectures on topics related to fall prevention; and monthly participation in a psychosocial group.

The intervention did not reduce falls overall. However, falls were decreased 41 percent in participants who had experienced 3 or more falls in the previous year and 50 percent in participants with more symptoms of depression.

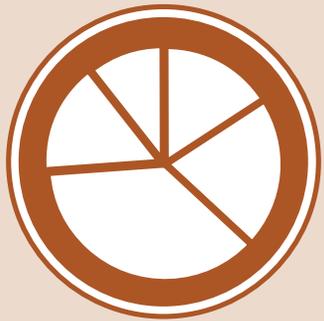
Population: Participants were seniors aged 65 or older who lived in the community or in housing that provided occasional assistance, had no or little cognitive impairment, and had experienced at least 1 fall in the past year. Eighty-four percent of participants were female.

Geographic Locale: Pori, Finland

Focus: Assess and address each participant's specific fall risk factors, improve physical fitness, provide information and counseling on fall prevention, assess and modify home hazards, and provide psychological support.

Program Setting: The fall risk assessment, counseling, and group exercise classes were conducted in the Pori Health Center or at home for those participants living in assisted housing. Lectures and psychosocial groups were held in a senior center. The home-based exercises and home assessment were carried out in participants' homes.

Content: A geriatrician assessed each participant for medical factors that could increase their risk of falling such as disorders affecting balance and gait, the use of psychoactive medications, depression, and poor eyesight. If needed, referrals were made to an ophthalmologist for vision correction and to the primary care physician for follow-up on recommended medication changes. All participants who were not already taking calcium and vitamin D supplements were prescribed 500 mg calcium and 400 IU of vitamin D per day.



A public health nurse provided oral and written information about reducing personal fall risk factors as well as facts about safe environments, healthy diets, calcium and vitamin D supplements, and the use of hip protectors.

Trained nursing students conducted home hazard assessments using a detailed form. Participants were given oral and written instructions for safety modifications. A follow-up of the home modifications was made 1 year later.

A physical therapist led a group exercise class every 2 weeks. This included:

- 5 minutes of warm-up
- 15 minutes of balance, coordination, and weight-shifting exercises. Each exercise was performed for 45 seconds followed by 30 seconds of rest.
- 20 minutes of circuit training for muscle strength. Two to 4 circuits were performed with 3 to 5 minutes of rest between circuits.
- 5 to 10 minutes of cool-down

The intensity of the exercises was increased progressively over time, based on the physical therapist's judgment of each person's fitness level.

Participants also performed similar exercises at home 3 times a week. Participants received written information on performing home exercises based on the physical therapist's judgment of their physical condition.

Once a month, a lecture was given by a health professional on various topics including causes of falling, fall prevention, medications that can increase fall risk, nutrition, exercise, and home hazards.

Also once a month, participants attended a psychosocial group that provided recreational activities (e.g., discussing various topics such as news headlines, a musical performance, memory disorders, or exercise; reading poetry) and psychological support.

Duration:

- 45-minute fall risk assessment
- 45-minute home hazard assessment
- 45-minute information and counseling session
- 45- to 50-minute group exercise class once every 2 weeks plus 25 minutes of exercise at home 3 times per week
- 1-hour health lecture once a month
- 1-hour psychosocial group session once a month

Delivered by: A geriatrician conducted the fall risk assessment; a trained public health nurse provided information and counseling on fall prevention; trained nursing students conducted the home hazards assessment and psychosocial group sessions; a

physical therapist facilitated the group exercise sessions; and various health professionals (e.g., geriatricians, public health nurses, physical therapists, dietitians, podiatrists) gave lectures on topics related to falling.

Minimum Level of Training Needed: Risk assessments can be conducted by a trained nurse with referrals, if needed, to a general practitioner who specializes in geriatrics. Exercise groups can be supervised by a well-trained volunteer or physical therapy student.

Key Elements:

- Individual risk factor assessment, treatment, and/or referral by a physician
- Exercise classes led by a trained physical therapist or physical therapy student, combined with at-home exercises tailored to each participant
- Exercise intensity must increase progressively over time
- Monthly lectures by various health professionals on topics related to falling, followed by a question and answer period
- Individual guidance on fall prevention
- Home hazards assessment and written safety recommendations
- Monthly psychosocial group sessions

Available Materials: Materials are available only in Finnish.

Study Citation: Salminen MJ, Vahlberg TJ, Salonoja MT, Aarnio PTT, Kivelä SL. Effect of a risk-based multifactorial fall prevention program on the incidence of falls. *Journal of the American Geriatrics Society*. 2009 Apr;57(4):612-9.

Supplemental articles

Sjösten NM, Salonoja M, Piirtola M, Vahlberg T, Isoaho R, Hyttinen H, Aarnio P, Kivelä SL. A multifactorial fall prevention programme in home-dwelling elderly people: A randomized-controlled trial. *Public Health*. 2007 Apr;121(4):308-18.

Sjösten NM, Salonoja M, Piirtola M, Vahlberg TJ, Isoaho R, Hyttinen HK, Aarnio PT, Kivelä SL. A multifactorial fall prevention programme in the community-dwelling aged: Predictors of adherence. *European Journal of Public Health*. 2007 Oct;17(5):464-70.

Vaapio S, Salminen M, Vahlberg T, Isoaho R, Aarnio P, Kivelä S-L. Effects of risk-based multifactorial fall prevention on health-related quality of life among the community-dwelling aged: A randomized controlled trial. *Health and Quality of Life Outcomes*. 2007 Apr;5:20-7.

Salminen M, Vahlberg T, Sihvonen S, Piirtola M, Isoaho R, Aarnio P, Kivelä SL. Effects of risk-based multifactorial fall prevention on maximal isometric muscle strength in community-dwelling aged: A randomized controlled trial. *Aging Clinical and Experimental Research*. 2008 Oct;20(5):487-93.

Salminen M, Vahlberg T, Sihvonen S, Sjösten N, Piirtola M, Isoaho R, Aarnio P, Kivelä SL. Effects of risk-based multifactorial fall prevention on postural balance in the community-dwelling aged: A randomized controlled trial. *Archives of Gerontology and Geriatrics*. 2009 Jan-Feb;48(1):22-7.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Marika J. Salminen, PhD
Family Medicine
Lemminkäisenkatu 1
FI-20014
University of Turku
Turku, Finland
E-mail: majosa@utu.fi

The Winchester Falls Project

This study evaluated the effectiveness of 2 fall interventions. The primary care intervention consisted of fall risk assessments by nurses followed by referrals to other professionals. The secondary care intervention involved multidisciplinary fall risk assessments (by a doctor, nurse, physical therapist, and occupational therapist), followed by appropriate interventions and follow-up if necessary. Only the secondary care intervention was effective in reducing falls.

Compared to the group who received usual care, participants in the secondary care multidisciplinary intervention were half as likely to fall, a third less likely to sustain a fall-related fracture, and 55 percent less likely to die in the year following the intervention.

Population: Participants were community-dwelling adults aged 65 or older who had sustained 2 or more falls in the previous year. About three-quarters were female.

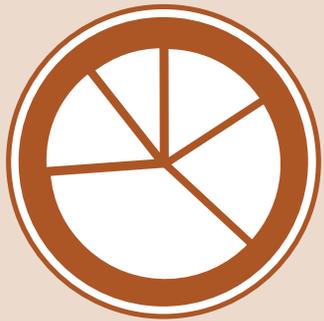
Geographic Locale: Mid Hampshire, United Kingdom

Focus: Assess fall risk factors and provide individualized interventions.

Program Setting: Baseline assessments were conducted in a multidisciplinary clinic with referrals for interventions and follow-up if necessary.

Content: Participants received a standardized assessment for fall risk factors that included psychoactive medications; visual impairment; neurological, musculoskeletal, and/or cardiovascular problems; poor mobility; postural hypotension; improper footwear; environmental hazards; and alcohol use.

Individualized interventions included medication changes; physical therapy interventions such as strength, balance, and gait training; occupational therapy interventions such as corrective shoes, adaptive equipment, and home visits to reduce fall hazards; nursing interventions such as monitoring postural hypotension; and social services interventions such as increasing home help.



| Risk Factor | Intervention |
|--|---|
| Assessed by a doctor: | |
| General medical history and examination | Refer to appropriate specialists |
| Medications | Stop medications when possible; add medication where appropriate; make recommendations to primary care physician; reduce or stop psychoactive medications |
| Visual impairment | Recommend optician if one has not been seen in 2 years or if there is a change in vision; refer to ophthalmologist when appropriate (e.g., cataracts) |
| Alcohol use | Advise to reduce or stop |
| Assessed by a nurse: | |
| Postural hypotension | Refer to primary care nurse for monitoring |
| Review of continence | Refer to community nurse |
| Assessed by a physical therapist: | |
| Poor mobility | Physical therapy interventions such as strength, balance, and gait training; exercise instruction; provide mobility aids |
| Assessed by an occupational therapist: | |
| Improper footwear | Information on footwear; refer for orthotics or corrective shoes |
| Environmental hazards | In-home visit; suggest adaptive equipment; recommend grab bars; refer to local organizations specializing in home safety assessments for security advice, and to install window or door locks, security lights, smoke alarms etc., if necessary |
| Personal and domestic activities of daily living | Daily living advice; refer to social services for assistance |

Multifaceted Interventions

Duration: Fall risk assessments took about 2 hours. The amount and duration of the follow-up interventions varied by the type of interventions received.

Delivered by: Assessments and individualized interventions were implemented by doctors, nurses, physical therapists, and occupational therapists.

Minimum Level of Training Needed: This intervention requires a variety of highly trained health care professionals. Preparation for conducting the baseline assessments requires a half-day training session.

Key Elements: Doctors, nurses, physical therapists, and occupational therapists used a structured in-depth assessment instrument.

Available Materials: Structured assessment instrument*
*See Appendix D-6.

Study Citation: Spice CL, Morotti W, George S, Dent THS, Rose J, Harris S, Gordon CJ. The Winchester falls project: A randomised controlled trial of secondary prevention of falls in older people. *Age and Aging*. 2009 Jan;38(1):33-40.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Dr. Claire Spice
Department of Medicine for Older People
Portsmouth Hospitals NHS Trust
Queen Alexandra Hospital
Southwick Hill, Cosham PO6 3LY, United Kingdom
E-mail: claire.spice@porthosp.nhs.uk

Tinetti,
et al.

Yale FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques)

This study used a tailored combination of intervention strategies based on an assessment of each participant's fall risk factors. Participants were about 30 percent less likely to fall compared with people who did not receive the intervention.

Population: Participants were members of a health maintenance organization. All were 70 or older and lived in the community. Most participants were female.

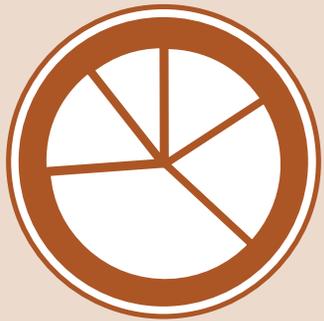
Geographic Locale: Farmington, Connecticut, United States

Focus: Identify and modify each participant's risk factors.

Program Setting: The intervention was delivered to participants in their homes.

Content: This program provided an individualized intervention for each participant. The content varied based on the fall risk factors identified. Possible intervention components included medication adjustment, recommendations for behavioral change, education and training, home-based physical therapy, and a home-based progressive balance and strengthening exercise program.

The selection of interventions was guided by decision rules and priorities. No participant received more than 3 balance and strength training programs.



| Risk Factor | Intervention |
|---|--|
| Assessed by a nurse practitioner: | |
| Postural hypotension | Behavioral recommendations such as elevating the head of the bed and using ankle pumps; made changes in medications |
| Use of sedative-hypnotic medication | Education; discontinued medication; non-pharmacological alternatives |
| Use of 4+ prescription medications | Reviewed medications with primary physician; the final decision on medication changes was made by the primary physician |
| Inability to transfer safely to bathtub or toilet | Training in transfer skills; home modifications (e.g., installing grab bars and a raised toilet seat) |
| Environmental hazards | Home modifications (e.g., removing rugs and installing railings) |
| Assessed by a physical therapist: | |
| Gait impairments | Gait training; use of assistive devices; balance and/or strengthening exercises |
| Impairments in transfer skills or balance | Training in transfer skills; home modifications; balance exercises (progressing through 4 levels of difficulty) |
| Impairment in leg or arm strength or in range of motion | Progressive strengthening exercises with resistance bands and putty, increasing resistance after participant could complete 10 repetitions; exercises were performed for 15-20 minutes twice a day |

Multifaceted Interventions

Duration: The intervention was conducted over a 3-month period. The amount and duration of contacts varied by the type of interventions received.

Delivered by: A nurse practitioner and physical therapist (PT) conducted the risk factor assessments. Medication adjustments were undertaken in cooperation with the participant's primary physician who made the final decision on medication changes. The PT conducted all physical therapy and supervised exercise sessions.

Minimum Level of Training Needed: The assessment requires at least a well trained paraprofessional such as a PT assistant or licensed practical nurse (LPN). The intervention needs at least a BA-level nurse. The physical therapy portion requires a physical or occupational therapist, or a physical or occupational therapy assistant with supervision by a physical or occupational therapist.

Key Elements: The assessments need to be clearly linked to the intervention components. The minimum risk factor interventions include (1) postural blood pressure and behavioral recommendations; (2) medication review and reduction (especially psychoactive medications); (3) balance, strength, and gait assessments and interventions; and (4) environmental assessment and modification.

It is essential that the progressive balance and strength exercise program includes both supervised and at-home (unsupervised) components.

Available Materials: Intervention materials including risk factor assessments and treatment worksheets, medication reduction strategies, balance exercises, home safety checklists, and information sheets can be requested through the intervention web site www.fallprevention.org.

Study Citation: Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, Koch ML, Trainor K, Horwitz RI. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *New England Journal of Medicine*. 1994 Sept 29;331(13):821-7.

Supplemental articles

Koch M, Gottschalk M, Baker DI, Palumbo S, Tinetti ME. An impairment and disability assessment and treatment protocol for community-living elderly persons. *Physical Therapy*. 1994 Apr;74(4):286-94.

Tinetti ME, Baker DI, Garrett PA, Gottschalk M, Koch ML, Horwitz RI. Yale FICSIT: Risk factor abatement strategy for fall prevention. *Journal of the American Geriatrics Society*. 1993 Mar;41(3):315-320.

Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Mary Tinetti, MD
Department of Epidemiology and Public Health
Yale University School of Medicine
Internal Medicine-Geriatrics
PO Box 208025
New Haven, CT 06520-8025, United States
Tel: 203-688-5238
Fax: 203-688-4209
E-mail: mary.tinetti@yale.edu

Wagner,
et al.

A Multifactorial Program

This study tested a moderate-intensity intervention that used tailored strategies based on assessments of each participant's risk factors. After 1 year, participants were 10 percent less likely to fall and 5 percent less likely to have an injurious fall, compared with people who received usual medical care.

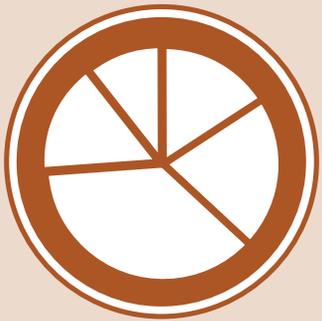
Population: All participants were 65 or older and lived in the community. About 60 percent of participants were female.

Geographic Locale: Seattle, Washington, United States

Focus: Reduce disability and/or falls by: improving physical fitness, modifying excessive alcohol use, improving home safety, reducing psychoactive medication use, and improving hearing and vision.

Program Setting: Participants received the assessments and interventions from a nurse at local health maintenance organization (HMO) centers. Participants conducted a home assessment or had it done by a family member or volunteer.

Content: The assessments consisted of simple screening tests for 6 risk factors. The intervention content varied based on the individual's risk factors.



| Risk Factor | Intervention |
|---------------------------|---|
| Inadequate exercise | Participated in a 2-hour exercise orientation class testing fitness, given exercise instruction, and encouraged to begin a program of brisk walking |
| Use of psychoactive drugs | Reviewed medications using a pharmacist and sent written recommendations to the participant's primary care provider |
| Impaired vision | Corrected when possible. Participants with uncorrectable visual impairments received information about available community resources |
| Impaired hearing | Had a hearing aid evaluation. Program provided behavioral intervention classes for participants with uncorrectable deficits |
| Excessive alcohol use | Referred to an alcohol treatment program if alcoholism was suspected, or given an instructional booklet that provided strategies for limiting use |
| Home hazards | Assessed home safety using an instructional home safety checklist |

Duration: The initial visit consisted of a 1- to 1½-hour interview. The length and number of subsequent sessions varied by the type of interventions selected for each participant.

Delivered by: The program was delivered by a single nurse educator who received brief training by the research team. There was no formal curriculum because only 1 nurse was involved. Either trained volunteers or participants' family members completed the home safety assessment using the provided checklist.

Minimum Level of Training Needed: Information was not provided by the principal investigator.

Key Elements: The nurse's follow-up phone contacts and home visits may have had positive effects on participants' health that were independent of the interventions for specific risk factors.

Available Materials: No intervention materials were available for distribution at the time of publication.

Study Citation: Wagner EH, LaCroix AZ, Grothaus L, Leveille SG, Hecht J, Artz K, Odle K, Buchner DM. Preventing disability and falls in older adults: A population-based randomized trial. *American Journal of Public Health*. 1994 Nov;84(11):1800-6.

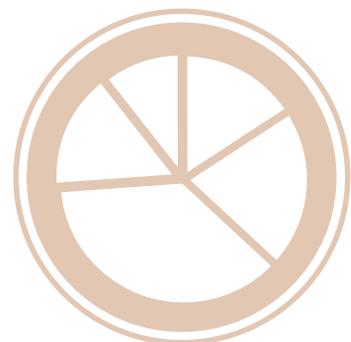
Contact

Practitioners interested in using this intervention may contact the principal investigator for more information:

Edward H. Wagner, MD, MPH
Group Health Research Institute
1730 Minor Avenue, Ste. 1290
Seattle, WA 98101, United States
Tel: 206-287-2877
E-mail: wagner.e@ghc.org

Appendix A

Intervention Study Selection Process



Intervention Study Selection Process

In 2003, the RAND Corporation was commissioned by the Centers for Medicare and Medicaid Services (CMS) to review and analyze the existing research on fall prevention interventions. They conducted a comprehensive literature search and reviewed 826 intervention studies, of which 95 met the following selection criteria: (1) included adults aged ≥ 65 years; (2) used a randomized controlled trial or controlled clinical trial study design; (3) identified falls as an outcome; and (4) measured the number of falls at least 3 months after the start of the intervention. Of the 95 studies, 57 had falls as a primary outcome and 38 of the 57 reported either the number of subjects who fell at least once or the monthly rate of falling. RAND included these 38 studies in their meta-analyses to determine the effectiveness of fall prevention interventions (categorized as exercise, education, environmental modification, or multiple component interventions).*

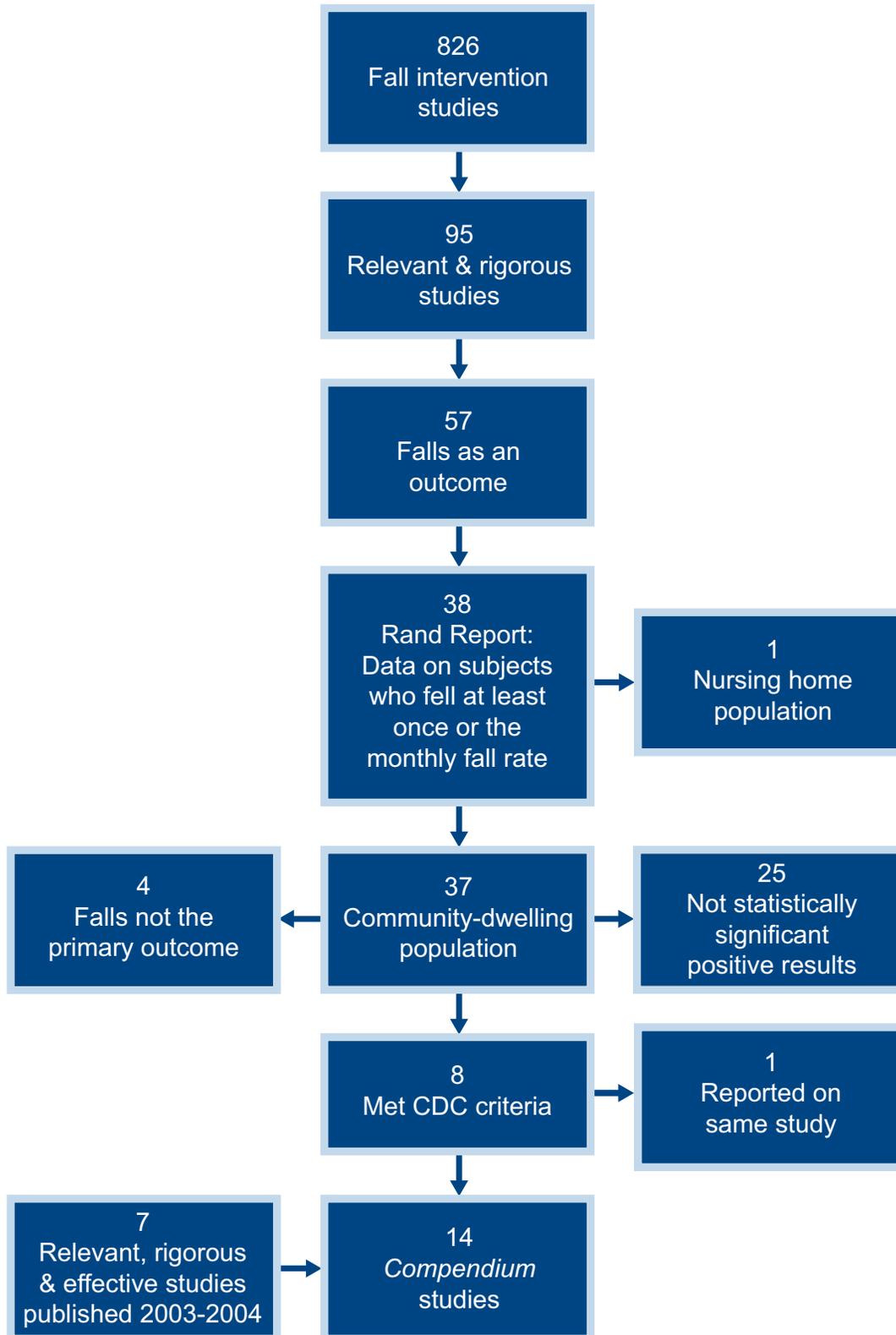
Beginning with the 38 studies RAND included in their meta-analysis (used by permission, L. Rubenstein, personal communication), CDC identified those that met the following inclusion criteria: (1) included community-dwelling adults aged ≥ 65 years; (2) used a randomized controlled study design; (3) measured falls as a primary outcome; and (4) demonstrated statistically significant positive results for at least 1 fall outcome (e.g., showed statistically fewer falls for intervention participants). As illustrated in Figure 1, CDC excluded 1 study that focused on nursing home residents, 4 that did not include falls as a primary outcome, and 25 that did not demonstrate statistically significant, positive results. Of the remaining 8, 2 described the same study and were combined. Lastly, CDC identified 7 studies published after the RAND Report that met the established criteria. In total, the first edition of the *Compendium* included 14 studies published before December 31, 2004.

Updates in the Second Edition:

In 2009, CDC undertook to update the original *Compendium*. A comprehensive literature search of randomized controlled trials of fall interventions published between January 1, 2005 and December 31, 2009 identified 86 studies. As Figure 2 illustrates, 2 interventions were excluded because they were already in the *Compendium*. Of the remaining 84 studies, CDC excluded 20 that were not randomized controlled trials, 15 that did not focus on community-dwelling adults aged ≥ 65 years, 27 that did not include falls as a primary outcome, and 14 that did not demonstrate statistically significant, positive results. In total, 8 studies published between January 2005 and December 2009 were added to the *Compendium*.

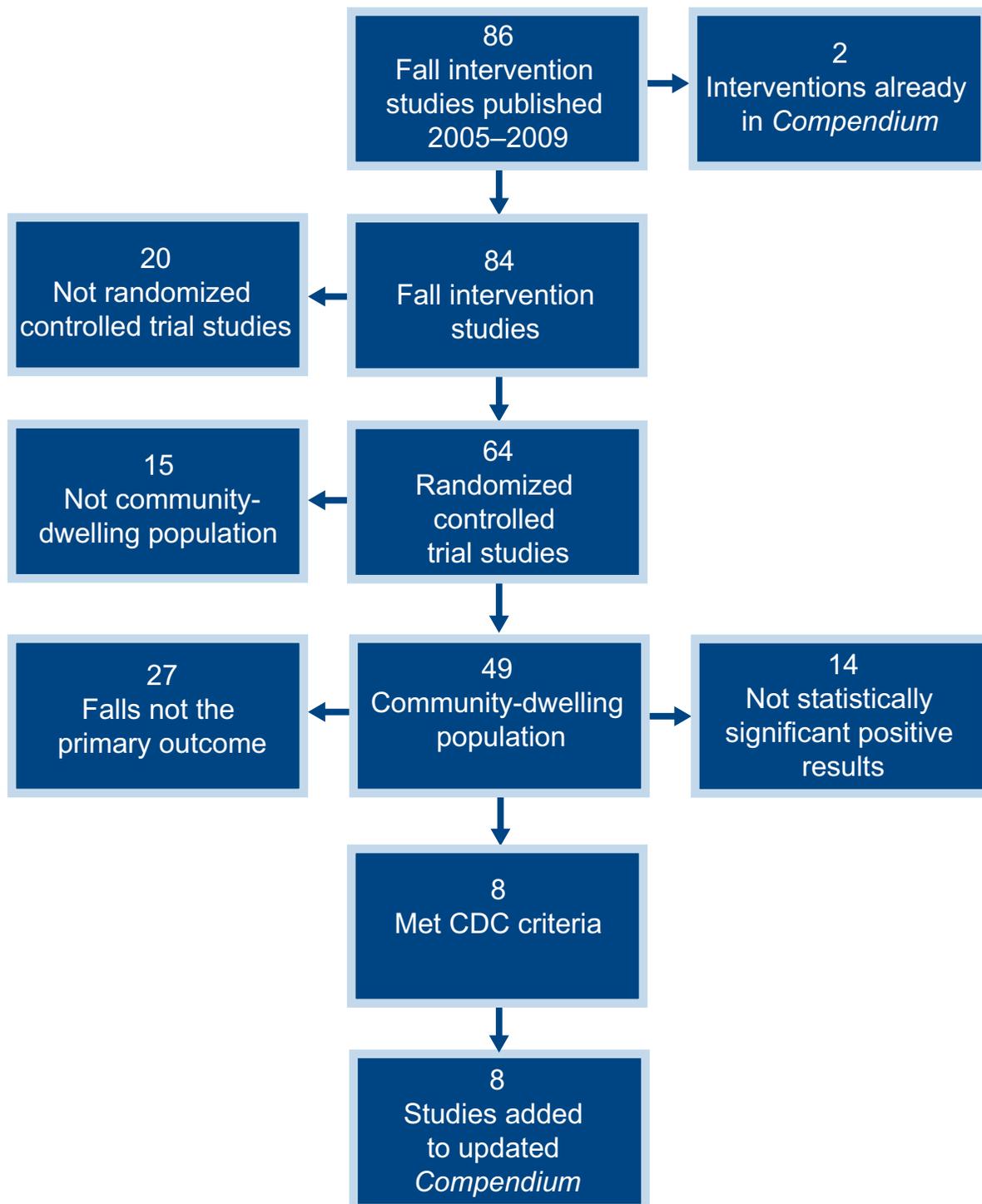
* Available at www.cms.gov/PrevntionGenInfo/Downloads/Exercise%20Report.pdf

Figure 1. Flow chart showing the selection process for studies used in the first edition of the *Compendium*



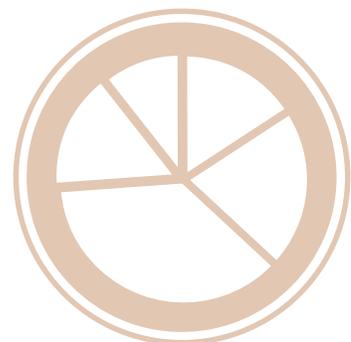
Appendix A

Figure 2. Flow chart showing the selection process for studies used in the second edition of the *Compendium*



Appendix B

Bibliography of *Compendium Studies*



Bibliography of Compendium Studies and Supplemental Articles

Barnett A, Smith B, Lord SR, Williams M, Baumann A. Community-based group exercise improves balance and reduces falls in at-risk older people: A randomized controlled trial. *Age and Ageing*. 2003 Jul;32(4):407-14.

*Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Psychotropic medication withdrawal and a home-based exercise program to prevent falls: A randomized controlled trial. *Journal of the American Geriatrics Society*. 1999 Jul;47(7):850-3.

*Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Falls prevention over 2 years: A randomized controlled trial in women 80 years and older. *Age and Ageing*. 1999 Oct;28(6):513-8.

Campbell AJ, Robertson MC, Gardner MM, Norton RN, Tilyard MW, Buchner DM. Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. *British Medical Journal*. 1997 Oct 25;315(7115):1065-9.

Campbell AJ, Robertson MC, La Grow SJ, Kerse NM, Sanderson GF, Jacobs RJ, Sharp DM, Hale LA. Randomised controlled trial of prevention of falls in people aged ≥ 75 with severe visual impairment: The VIP trial. *British Medical Journal*. 2005 Oct 8;331(7520):817-20.

Clemson L, Cumming RG, Kendig H, Swann M, Heard R, Taylor K. The effectiveness of a community-based program for reducing the incidence of falls in the elderly: A randomized trial. *Journal of the American Geriatrics Society*. 2004 Sep;52(9):1487-94.

Close J, Ellis M, Hooper R, Glucksman E, Jackson S, Swift C. Prevention of Falls in the Elderly Trial (PROFET): A randomized controlled trial. *Lancet*. 1999 Jan 9;353(9147):93-7.

Cumming RG, Thomas M, Szonyi G, Szonyi M, Salkeld G, O'Neill E, Westburg C, Frampton G. Home visits by an occupational therapist for assessment and modification of environmental hazards: A randomized trial of falls prevention. *Journal of the American Geriatrics Society*. 1999 Dec;47(12):1397-1402.

Davison J, Bond J, Dawson P, Steen IN, Kenny RA. Patients with recurrent falls attending accident and emergency benefit from multifactorial intervention: A randomised controlled trial. *Age and Ageing*. 2005 Mar;34(2):162-8.

Day L, Fildes B, Gordon I, Fitzharris M, Flamer H, Lord S. Randomized factorial trial of falls prevention among older people living in their own homes. *British Medical Journal*. 2002 Jul 20;325(7356):128-33.

*Folstein MF, Folstein SE, McHugh PR. "Mini-mental state." A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*. 1975 Nov;12(3):189-98.

*Freiberger E, Menz HB. Characteristics of falls in physically active community-dwelling older people. *Zeitschrift für Gerontologie und Geriatrie*. 2006 Aug;39(4):261-7.

Freiberger E, Menz HB, Abu-Omar K, Rütten A. Preventing falls in physically active community-dwelling older people: A comparison of two intervention techniques. *Gerontology*. 2007 Aug;53(5):298-305.

*Gardner MM, Buchner DM, Robertson MC, Campbell AJ. Practical implementation of an exercise-based falls prevention programme. *Age and Ageing*. 2001 Jan;30(1):77-83.

*Hagedorn R, McLafferty S, Russell D. The *User Safety and Environmental Risk Checklist (USER)*. In: Anonymous falls: Screening and risk assessment for older people in the community. *Worthing Priority Care NHS Trust*. 1998:48-57.

Hornbrook MC, Stevens VJ, Wingfield DJ, Hollis JF, Greenlick MR, Ory MG. Preventing falls among community-dwelling older persons: Results from a randomized trial. *The Gerontologist*. 1994 Feb;34(1):16-23.

*Iliffe A, Kendrick D, Morris R, Skelton D, Gage H, Dinan S, Stevens Z, Pearl M, Masud T. Multi-centre cluster randomised trial comparing a community group exercise programme with home based exercise with usual care for people aged 65 and over in primary care: Protocol of the ProAct 65+ trial. *Trials*. 2010 Jan;11(1):6-10.

*Koch M, Gottschalk M, Baker DI, Palumbo S, Tinetti ME. An impairment and disability assessment and treatment protocol for community-living elderly persons. *Physical Therapy*. 1994 Apr;74(4):286-94.

*La Grow SJ, Robertson MC, Campbell AJ, Clarke GA, Kerse NM. Reducing hazard related falls in people 75 years and older with significant visual impairment: How did a successful program work? *Injury Prevention*. 2006 Oct;12(5):296-301.

Li F, Harmer P, Fisher KJ, McAuley E, Chaumeton N, Eckstrom E, Wilson NL. Tai Chi and fall reductions in older adults: A randomized controlled trial. *Journal of Gerontology: Medical Sciences*. 2005 Feb;60A(2):187-94.

Lord SR, Castell S, Corcoran J, Dayhew J, Matters B, Shan A, Williams P. The effect of group exercise on physical functioning and falls in frail older people living in retirement villages: A randomized, controlled trial. *Journal of the American Geriatrics Society*. 2003 Dec;51(12):1685-92.

McKiernan FE. A simple gait-stabilizing device reduces outdoor falls and non-serious injurious falls in fall-prone older people during the winter. *Journal of the American Geriatrics Society*. 2005 Jun;53(6):943-7.

Nikolaus T, Bach M. Preventing falls in community-dwelling frail older people using a home intervention team (HIT): Results from the randomized falls-HIT trial. *Journal of the American Geriatrics Society*. 2003 Mar;51(3):300-5.

*Robertson MC, Campbell AJ, Gardner MM, Devlin N. Preventing injuries in older people by preventing falls: A meta-analysis of individual-level data. *Journal of the American Geriatrics Society*. 2002 May;50(5):905-11.

*Robertson MC, Devlin N, Gardner MM, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 1: Randomised controlled trial. *British Medical Journal*. 2001 Mar 24;322(7288):697-701.

*Robertson MC, Gardner MM, Devlin N, McGee R, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 2: Controlled trial in multiple centres. *British Medical Journal*. 2001 Mar 24;322(7288):701-4.

Rubenstein LZ, Josephson KR, Trueblood PR, Loy S, Harker JO, Pietruszka FM, Robbins, AS. Effects of a group exercise program on strength, mobility, and falls among fall-prone elderly men. *Journal of Gerontology: Medical Sciences*. 2000 Jun;55A(6):M317-21.

Salminen MJ, Vahlberg TJ, Salonoja MT, Aarnio PTT, Kivelä SL. Effect of a risk-based multifactorial fall prevention program on the incidence of falls. *Journal of the American Geriatrics Society*. 2009 Apr;57(4):612-9.

*Salminen M, Vahlberg T, Sihvonen S, Piirtola M, Isoaho R, Aarnio P, Kivelä SL. Effects of risk-based multifactorial fall prevention on maximal isometric muscle strength in community-dwelling aged: A randomized controlled trial. *Aging Clinical and Experimental Research*. 2008 Oct;20(5):487-93.

*Salminen M, Vahlberg T, Sihvonen S, Sjösten N, Piirtola M, Isoaho R, Aarnio P, Kivelä SL. Effects of risk-based multifactorial fall prevention on postural balance in the community-dwelling aged: A randomized controlled trial. *Archives of Gerontology and Geriatrics*. 2009 Jan-Feb;48(1):22-7.

*Sheik J, Yesavage J. Geriatric depression scale (GDS): Recent evidence and development of a shorter version. *Clinical Gerontology: A Guide to Assessment and Intervention*. New York: The Haworth Press, Inc. 1986:165-73.

*Sjösten NM, Salonoja M, Piirtola M, Vahlberg T, Isoaho R, Hyttinen H, Aarnio P, Kivelä SL. A multifactorial fall prevention programme in home-dwelling elderly people: A randomized-controlled trial. *Public Health*. 2007 Apr;121(4):308-18.

*Sjösten NM, Salonoja M, Piirtola M, Vahlberg T, Isoaho R, Hyttinen H, Aarnio P, Kivelä SL. A multifactorial fall prevention programme in the community-dwelling aged: Predictors of adherence. *European Journal of Public Health*. 2007 Oct;17(5):464-70.

*Skelton DA. Effects of physical activity on postural stability. *Age and Ageing*. 2001 Nov;30(Suppl 4):33-9.

*Skelton DA. The Postural Stability Instructor: Qualification in the United Kingdom for effective falls prevention exercise. *Journal of Aging and Physical Activity*. 2004 Jul;12(3):375-6.

*Skelton DA, Dinan SM. Exercise for falls management: Rationale for an exercise program aimed at reducing postural instability. *Physiotherapy Theory and Practice*. 1999 Jan;15(2):105-20. Available at www.laterlifetraining.co.uk/documents/ExerciseFallsManage.PDF.

Skelton D, Dinan S, Campbell M, Rutherford O. Tailored group exercise (Falls Management Exercise—FaME) reduces falls in community-dwelling older frequent fallers (an RCT). *Age and Ageing*. 2005 Nov;34(6):636-9.

*Skelton DA, Stranzinger K, Dinan SM, Rutherford O. BMD improvements following FaME (falls management exercise) in frequently falling women age 65 and over: An RCT. *Journal of Aging and Physical Activity*. 2008 Jul;16(Suppl):S89-90.

Spice CL, Morotti W, George S, Dent THS, Rose J, Harris S, Gordon CJ. The Winchester falls project: A randomised controlled trial of secondary prevention of falls in older people. *Age and Ageing*. 2009 Jan;38(1):33-40.

*Tideiksaar R. Preventing falls: Home hazard checklists to help older patients protect themselves. *Geriatrics*. 1986 May;41(5):26-8.

*Tinetti ME, Baker DI, Garrett PA, Gottschalk M, Koch ML, Horwitz RI. Yale FICSIT: Risk factor abatement strategy for fall prevention. *Journal of the American Geriatrics Society*. 1993 Mar;41(3):315-20.

Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, Koch ML, Trainor K, Horwitz RI. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *New England Journal of Medicine*. 1994 Sept 29;331(13):821-7.

*Vaapio S, Salminen M, Vahlberg T, Isoaho R, Aarnio P, Kivelä S-L. Effects of risk-based multifactorial fall prevention on health-related quality of life among the community-dwelling aged: A randomized controlled trial. *Health and Quality of Life Outcomes*. 2007 Apr;5:20-7.

*Voukelatos A. The Central Sydney Tai Chi trial: A randomized controlled trial investigating the effectiveness of Tai Chi in reducing falls in older people. PhD thesis, University of Sydney, 2010.

Voukelatos A, Cumming RG, Lord SR, Rissel C. A randomized, controlled trial of Tai Chi for the prevention of falls: The Central Sydney Tai Chi trial. *Journal of the American Geriatrics Society*. 2007 Aug;55(8):1185-91.

Wagner EH, LaCroix AZ, Grothaus L, Leveille SG, Hecht J, Artz K, Odle K, Buchner DM. Preventing disability and falls in older adults: A population-based randomized trial. *American Journal of Public Health*. 1994 Nov;84(11):1800-6.

Wolf SL, Barnhart HX, Kutner NG, McNeely E, Coogler C, Xu T. Reducing frailty and falls in older persons: An investigation of Tai Chi and computerized balance training. *Journal of the American Geriatrics Society*. 1996 May;44(5):489-97.

*Wolf SL, Coogler C, Xu T. Exploring the basis for Tai Chi Chuan as a therapeutic exercise approach. *Archives of Physical Medicine and Rehabilitation*. 1997 Aug;78(8):886-92.

*Supplemental article

Appendix C

Tables

Table 1 Overall Population Characteristics

Table 2 Study Characteristics

Table 3 Intervention Characteristics

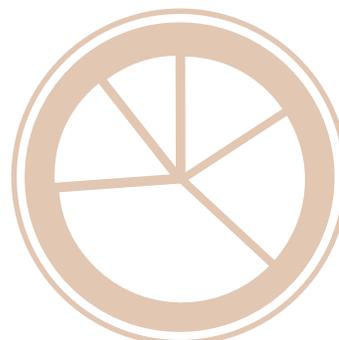


Table 1. Overall Population Characteristics (1 of 2)

| Study | No. Study Participants | Mean Age | % Female | Race/Ethnicity | Socioeconomic Status | Previous Falls | Other Characteristics |
|-----------------|------------------------|----------|----------|---|--|---|---|
| Barnett 2003 | 163 | 75 | 67% | 90% used English as primary language | Study conducted in low SES areas | 42% fell in past year | 27% lived alone |
| Campbell 1997 | 233 | 84 | 100% | Most were White | 20% used community services | 44% fell in past year | |
| Campbell 2005 | 391 | 84 | 68% | 99% European 0.3% Maori 0.5% Other | NA* | 45% fell in past year | 53% lived alone 10% received home health (personal care) services 84% age-related macular degeneration 43% cataract 3% diabetic retinopathy 15% glaucoma |
| Clemson 2004 | 310 | 78 | 74% | NA | 52% had below average weekly income | 65% fell in past year | |
| Close 1999 | 397 | 78 | 68% | NA | NA | 65% fell in past year | 61% lived alone |
| Cumming 1999 | 530 | 77 | 57% | 100% White | NA | 31% fell in past year | 37% used a walking aid |
| Davison 2005 | 313 | 77 | 72% | Most were White; none were Asian or Black | 70% education <8th grade 4% education >HS Participants included all social classes | 100% fell in past year; average was 3 falls | |
| Day 2002 | 1,090 | 76 | 60% | 77% born in Australia | Study conducted in mainly middle class area | 6% fell in past month | 54% lived alone 47% married |
| Freiberger 2007 | 152 | 75 | 39% | 100% White | 33% education >HS Mean income \$5,458 | 34% fell in past 6 months | |

Table 1. Overall Population Characteristics continued (2 of 2)

| Study | No. Study Participants | Mean Age | % Female | Race/Ethnicity | Socioeconomic Status | Previous Falls | Other Characteristics |
|-----------------|------------------------|----------|----------|-----------------|---|--|---|
| Hornbrook 1994 | 3,182 | 73 | 62% | 90% White | 33% education >HS | 15% fell in past year | 37% lived alone 56% married |
| Li 2005 | 256 | 77 | 70% | 90% White | 92% education ≥HS 68% income <\$35,000 | 37% fell in past 3 months | 48% lived alone |
| Lord 2003 | 551 | 80 | 86% | 100% White | NA | 34% fell in past year | 22% in assisted living housing |
| McKiernan 2005 | 113 | 74 | 60% | 100% White | NA | 100% fell in past year | |
| Nikolaus 2003 | 360 | 82 | 73% | 98% White | NA | 30% ≥2 falls in past year | All showed functional decline, especially in mobility |
| Rubenstein 2000 | 59 | 75 | 0% | 95% White | 63% education >HS | 56% fell in past 6 months | 73% married |
| Salminen 2009 | 591 | 74 | 84% | 100% White | 27% education >6th grade 72% completed 6th grade 2% education <6th grade All participants were retired | 100% fell in past year 41% fell once in past year | 53% lived alone 45% married |
| Skelton 2005 | 81 | 73 | 100% | Most were White | Most were retired health-care workers w/ at least some HS education | 100% ≥3 falls in past year | Took on average 4 medications 15% used canes |
| Spice 2009 | 375 | 82 | 74% | Most were White | NA | 100% ≥2 falls in past year | 59% lived alone |
| Tinetti 1994 | 301 | 78 | 69% | NA | 31% education >HS | 43% fell in past year | 44% married |
| Voukelatos 2007 | 702 | 69 | 84% | Most were White | 44% education ≥HS | 34% fell in past year | |
| Wagner 1994 | 1,559 | 73 | 59% | 93% White | 25% education >16 years 35% income <\$15,000 | 33% fell in past year | |
| Wolf 1996 | 200 | 76 | 81% | Most were White | 77% education >HS | 36% fell in past year | |

* No information available

Table 2. Study Characteristics (1 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|------------------|--|---|--|---|-----------------|
| Barnett 2003 | Southwest Sydney, Australia | Recruited while patients in general practice clinics or attending hospital-based physical therapy clinics | Age 65+ & >1 physical impairment associated w/ fall risk (lower limb weakness, poor balance, slow reaction time) | Cognitively impaired or had degenerative or medical conditions that precluded participating in an exercise program | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Postal surveys sent to participants each month. If not received within 2 weeks, participant was interviewed by telephone. | 12 months | Fall rate Fall w/ injury | RR = 0.60 (0.36-0.99) RR = 0.66 (0.38-1.15) | None |
| Campbell 1997 | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Dunedin, New Zealand | Women registered with a general practice in Dunedin were invited by general practitioner to take part | Age 80+ & able to move around within their own home | Cognitively impaired or receiving physical therapy | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Participants given 12 pre-addressed & stamped monthly fall calendar postcards. If one was not received, participant was interviewed by telephone. | 12 months | Fall rate First fall First fall w/ injury | RR = 0.67 (p<0.05) HR = 0.81 (0.56-1.16) HR = 0.61 (0.39-0.97) | None |
| Campbell 2005 | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Dunedin & Auckland, New Zealand | Participants identified from the Royal New Zealand Foundation of the Blind, university & hospital low vision clinics, & private ophthalmology practices | Age 75+, poor vision (visual acuity 6/24 or worse) | Unable to walk around own residence, currently receiving physical therapy, or unable to understand study requirements | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Pre-paid, addressed, tear-off monthly postcard calendars. Independent assessors called participants to record circumstances of falls & any resulting injuries. | 12 months | Number of falls Number of fall injuries | IRR = 0.39 (0.24-0.62) IRR = 0.56 (0.36-0.87) | None |

Table 2. Study Characteristics continued (2 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|-----------------|---|--|---|--|-----------------|
| Clemson 2004 | Sydney, Australia | Community residents recruited through referrals, advertisements, & community organizations | Age 70+, had a fall in past year or fear of falling, & spoke English | Cognitively impaired or home-bound | No |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Participants mailed in a pre-addressed, stamped calendar each month. | 14 months | Fall rate, overall Fall rate, males Fall rate, females | RR = 0.69 (0.50-0.96) RR = 0.32 (0.17-0.59) RR = 0.96 (0.50-1.85) | None |
| Close 1999 | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | London, United Kingdom | Community residents treated in an ED for a fall, sent letters & contacted by telephone | Age 65+, ambulatory, & had been treated for a fall | Cognitively impaired & had no regular caregiver, or spoke little or no English | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| Cumming 1999 | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Sydney, Australia | Recruited while hospital patients or from among people attending outpatient clinics or a local senior center | Age 65+ & ambulatory | Cognitively impaired & not living with someone who could give informed consent & report falls, or planned to have a home assessment by an occupational therapist | No |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| Cumming 1999 | Method of Recording Falls | Length of Follow-up | Fall rate for participants w/ no falls at baseline Fall rate for participants w/ falls at baseline | RR = 1.03 (0.75-1.41) RR = 0.64 (0.50-0.83) | None |
| | Monthly falls calendar was completed daily & returned by mail each month. If not received within 10 days, participant was interviewed by telephone. | 12 months | | | |
| | | | | | |

Table 2. Study Characteristics continued (3 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|-----------------|--|--|---|---|-----------------|
| Davison 2005 | Newcastle, United Kingdom | Community seniors treated in EDs for a fall were mailed a questionnaire to determine their fall history. Repeat fallers were recruited by telephone. | Age 65+, treated in ED for a fall or fall injury, & had a fall in past year | Cognitively impaired, had >1 previous episode of syncope, immobile, blind, aphasic, or had a clear medical explanation for their fall | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Participants completed weekly fall diaries that they returned every month for 12 months. After 1 year, all participants' hospital records were reviewed for falls. | 12 months | Number of falls % fallers Number of fallers Hip fractures Other fractures Fall-related ED visit Fall-related hospital admission | RR = 0.64 (0.46-0.90) RR = 0.95 (0.81-1.12) RR = 0.48 (0.04-5.29) RR = 0.53 (0.20-1.39) RR = 0.90 (0.55-1.47) RR = 0.80 (0.41-1.56) RR = 3.60 (0.10-7.60) | None |
| Day 2002 | Melbourne, Australia | Identified from electoral roll & through general practitioners. Subjects were sent letters & then contacted by telephone. | Age 70+, owns or leases home & able to make home modifications | Planning to move within 2 years, recent physical activity with a balance component, unable to walk 10-20 m w/o rest, help, or angina, severe respiratory or cardiac disease, cognitively impaired, had made recent major home modifications, or did not have physician approval | No |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Monthly calendar postcards completed daily & returned by mail. If not received within 5 working days after end of month, participant was interviewed by telephone. | 18 months | Fall rates | Exercise alone: RR = 0.82 (0.70-0.97) Exercise + vision: RR = 0.73 (0.58-0.91) Exercise + home mod: RR = 0.76 (0.60-0.95) Exercise + vision + home mod: RR = 0.67 (0.51-0.88) | None |

Table 2. Study Characteristics continued (4 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|--------------------|---|---|--|---|--------------------------|
| Freiberger 2007 | Erlangen, Germany | Recruited from a health insurance company membership database | Age ≥70, community-dwelling, & able to walk independently | Unable to walk independently or cognitively impaired | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | A fall calendar was returned each month. If not returned, participants received a follow-up telephone call. If a fall occurred, the participant was interviewed by telephone. | 12 months | Number of fallers Number of multiple fallers Fall rate Time to first fall | RR = 0.77 (0.60-0.97) RR = 0.87 (0.75-1.01) RR = 0.64 (0.38-1.06) 337 ±9 days (fitness group) vs. 216 ±15 days (control) | None |
| Hornbrook 1994 | Portland, Oregon & Vancouver, Washington metro area, United States | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Fall reported by postcard as soon as it occurred. Participant interviewed by telephone about circumstances & consequences. Monthly diaries monitored quarterly by mail or telephone for self-reported falls & associated injuries & medical care. | 24 months | Age 65+ & ambulatory | Blind, deaf, housebound, non-English speaking, severely mentally ill, terminally ill, not willing to travel or lived >20 mi. from research center | Yes Also "near falls" |
| | | | Fall risk, overall Fall risk, males Fall risk, males age 75+ | OR = 0.85 (p<0.05) OR = 0.82 (p<0.05) OR = 0.53 (p<0.05) | None |

Table 2. Study Characteristics continued (5 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|--------------|--|--|---|---|----------------------|
| Li 2005 | Portland, Oregon, United States | Subjects enrolled in the Legacy Health System in Portland, OR were sent letters from their physicians encouraging them to participate | Age 70+, inactive, ambulatory, no chronic medical problems that would limit participation, had a physician's clearance to participate | Cognitively impaired, in poor health, or had difficulty with language or transportation | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Falls recorded daily in a fall calendar that was collected by a research assistant. | 12 months | Fall rate Multiple fall rate | RR = 0.35 (p<0.001) RR = 0.45 (0.30-0.70) | None |
| Lord 2003 | Sydney & Wollongong, Australia | Study Population & Recruitment Residents of self-care & intermediate-care retirement villages attended information sessions & then were approached individually | Inclusion Criteria Age 62+ | Exclusion Criteria Cognitively impaired, had a medical condition that prevented participation in an exercise program, or already attended exercise classes of equivalent intensity | Defined Falls Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Completed monthly questionnaires. If not received within a week after end of month, received home visits or telephone calls. Nursing staff at each intermediate-care site also kept a falls record book. | 12 months | Fall rate Fall rate for participants w/ no falls at baseline Fall rate for participants w/ falls at baseline | RR = 0.78 (0.62-0.99) RR = 0.88 (0.65-1.20) RR = 0.69 (0.48-0.99) | None |

Table 2. Study Characteristics continued (6 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|-------------------|--|---|---|---|-----------------|
| McKiernan 2005 | Rural central & northern Wisconsin, United States | Recruited using a database of people who had fallen in the past year & had been treated in a clinic or ED, one direct mailing or an announcement in local print media | Age 65+, community-dwelling, had a fall in past year, ambulatory w/o a walking aid, capable of putting on Yaktrax® Walker & using it appropriately, able & willing to maintain a fall diary | Incapable of walking w/o a walking aid or unable to use Yaktrax Walker correctly | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Participants kept a fall diary which they submitted at the end of the study. | 10,724 observation-days | Outdoor slip Outdoor fall Outdoor fall on day walked on snow or ice Outdoor injurious fall Outdoor injurious fall on day walked on snow or ice | RR = 0.50 (0.26-0.96) RR = 0.45 (0.23-0.85) RR = 0.42 (0.26-0.92) RR = 0.10 (0.02-0.53) RR = 0.13 (0.03-0.66) | None |
| Nikolaus 2003 | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Mid-sized town, Southern Germany | Recruited while inpatients at a geriatric clinic | Lived at home before hospital admission, had multiple chronic conditions or functional deterioration, & were discharged to home | Severe cognitive impairment, terminal illness, or lived >15 km away | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Kept a falls diary & also contacted monthly by phone. | 12 months | Fall rate Fall rate for participants w/ ≤1 fall at baseline Fall rate for participants w/ ≥2 falls at baseline | IRR = 0.69 (0.51-0.97) IRR = 0.91 (0.72-1.22) IRR = 0.63 (0.43-0.94) | None |

Table 2. Study Characteristics continued (7 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|-----------------|--|---|--|--|---|
| Rubenstein 2000 | Los Angeles, California, United States | Male patients at VA Ambulatory Care Center recruited through flyers & telephone screening | Age 70+, ambulatory, had at least 1 of 4 risk factors (lower extremity weakness, impaired gait, impaired balance, or >1 fall in past 6 months) | Exercised regularly, had cardiac or pulmonary disease, a terminal illness, severe joint pain, dementia, medically unresponsive depression, or progressive neurologic disease | No |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Questioned about falls & injuries every 2 weeks by phone or in-person during exercise class. | 12 weeks (at end of intervention) | Activity-adjusted fall rate** | RR = 0.37 (p=0.027) | None |
| Salminen 2009 | Pori, Finland | Announcements in local newspapers, pharmacies, health centers, hospitals, & private clinics; also through written invitations from health professionals | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Participants mailed fall diaries monthly. If one was not received, participants were reminded by telephone. Participants also reported falls as they occurred by phone to research assistants. | 12 months | Fall rate for participants w/ ≥3 falls in previous year Fall rate for participants w/ more symptoms of depression | Cognitively impaired, unable to walk 10 m independently w/ or w/o walking aids IRR = 0.59 (0.38-0.91) IRR = 0.50 (0.28-0.88) | Yes 2 participants stopped while exercising because they felt unwell 3 falls w/o injury occurred during the exercise sessions |

Table 2. Study Characteristics continued (8 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|-----------------|--|---|--|--|-----------------|
| Skelton 2005 | London, United Kingdom | Posters, local & national newspapers, local radio stations | Female, age 65+, ≥3 falls in past year | Acute rheumatoid arthritis, uncontrolled heart failure or hypertension, significant neurological disease or impairment, or previously diagnosed osteoporosis | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Falls diaries were returned every 2 weeks by mail. Every fall was followed up by questionnaire & telephone to determine the circumstances & outcome. | 20 months | Number of falls Number of injurious falls | IRR = 0.66 (0.49-0.90) IRR = 0.60 (0.33-1.07) | None |
| Spice 2009 | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Mid Hampshire, United Kingdom | Fallers identified at 18 general practices using a standard fall definition | Age 65+, ≥2 falls in past year | Life expectancy <1 year, plans to move from area within 1 year, abbreviated mental test score <7, non-English speaking w/o available interpreter, or a nursing home resident | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Participants kept a monthly fall diary that was returned at the end of each month & indicated how many times they had fallen. | 12 months | Number fell during follow-up Time to first fall | OR = 0.52 (0.35-0.79) HR = 0.72 (0.56-0.93) | None |

Table 2. Study Characteristics continued (9 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|--------------------|--|---|---|--|---|
| Tinetti 1994 | Southern Connecticut, United States | Members of an HMO, contacted first by letter & then screened by telephone | Age 70+, ambulatory in own home, had at least 1 of 9 risk factors (postural hypotension, used sedatives, ≥4 medications, inability to transfer, gait impairment, loss of strength or range of motion, home hazards) | Cognitively impaired or had participated in vigorous sports or walking for exercise in previous month | No |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | A monthly falls calendar was returned by mail. If a calendar was not received or if it indicated any falls, participant was interviewed by telephone. | 12 months | Fall rate Fall per person-week | RR = 0.76 (0.58-0.98) RR = 0.69 (0.52-0.90) | None |
| Voukelatos 2007 | Sydney, Australia | Recruited through advertisements in local community newspapers | Age 60+, had not practiced Tai Chi in past 12 months | Degenerative neurological condition, dementia, severely debilitating stroke, severe arthritis, marked vision impairment, or unable to walk across a room unaided | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Participants recorded falls daily & mailed calendars to study coordinator monthly. If one was not received within 2 weeks of the end of the month, the participant was contacted by telephone. | 24 weeks | Number of falls 16 weeks follow-up 24 weeks follow-up Participants w/ ≥2 falls after 24 weeks follow-up | IRR = 0.73 (0.50-1.07) IRR = 0.67 (0.47-0.94) RR = 0.54 (0.28-0.96) HR = 0.27 (0.12-0.59) | An instructor tried to help a participant into a movement & the participant twisted a ligament. |

Table 2. Study Characteristics continued (10 of 10)

| Study | Location | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
|----------------|---|---|--|--|-----------------|
| Wagner 1994 | Seattle, Washington, United States | Random sample of HMO members sent an introductory letter followed by a mail questionnaire | Age 65+, ambulatory, & independent in ADLs | Institutionalized or seriously ill | Yes |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Mailed questionnaires at baseline, at 1 & 2 years. If not returned, participants were interviewed by telephone. Falls were identified through self-report & hospital discharge files. | 24 months | Difference in % falling Falls, Year 1 Falls, Year 2 Falls w/ injury, Year 1 Falls w/ injury, Year 2 | -9.3% (4.1-14.5) +2.2% n.s. -4.6% (p<0.01) +3.3% n.s. | None |
| Wolf 1996 | Atlanta, Georgia, United States | Study Population & Recruitment | Inclusion Criteria | Exclusion Criteria | Defined Falls |
| | Method of Recording Falls | Length of Follow-up | Fall Outcomes | Results* | Adverse Effects |
| | Monthly calendar or monthly phone calls from staff. | 7-20 months | Fall risk ≥1 falls w/ injury | RR = 0.53 (0.32-0.86) RR = 0.81 (0.33-2.02) | None |

Results shown with 95% confidence intervals. *RR = Relative Rate, HR = Hazard Ratio, OR = Odds Ratio, IRR = Incidence Rate Ratio **per 1,000 hrs of activity

Table 3: Intervention Characteristics continued (1 of 4)

| Study | Focus | Providers | Structure | Number of Sessions | Provider Contact Time |
|---------------|--|---|--------------------------------------|---|---|
| Barnett 2003 | Exercise program to improve balance, coordination, strength, reaction time, & aerobic capacity | Accredited exercise instructors trained to provide intervention | Group exercise classes | 37 weekly 1-hour classes | Classes: 37 hours |
| Campbell 1997 | Improve strength & balance w/ simple home-based exercise program | Physical therapist or nurse | One-on-one exercise training at home | ½ hour exercise program 3 times a week ½ hour walking 3 times a week | 4 home visits: 1-hour each |
| Campbell 2005 | Assess & reduce home hazards & encourage changes in behavior | Occupational therapist | One-on-one | 1-2 home visits | Initial home visit: 2 hours Follow-up visit: 45 minutes |
| Clemson 2004 | Learn fall prevention techniques, improve self-efficacy, & make behavioral changes | Occupational therapist & team of trained content experts | Small group classes | 7 weekly 2-hour classes 1 home visit 6 weeks after the final class 1 booster session 3 months after the final class | Classes: 14 hours Home visit: 1 to 1½ hours Booster: 1½ hours |
| Close 1999 | Identify medical risk factors & home hazards, provide referrals & recommendations to reduce fall risk, & improve home safety | Physician & occupational therapist | One-on-one | 1 medical assessment 1 home assessment | Medical assessment: 45 minutes Home assessment: 1 hour |
| Cumming 1999 | Assess & reduce home hazards | Occupational therapist | One-on-one | 1-hour home assessment & follow-up telephone call | Total about 2 hours |

Table 3: Intervention Characteristics continued (2 of 4)

| Study | Focus | Providers | Structure | Number of Sessions | Provider Contact Time |
|-----------------|--|---|---|---|---|
| Davison 2005 | Identify & modify each participant's fall risk factors | Physicians, physical therapists, & occupational therapists | Hospital-based medical exam & treatment followed by physical therapy & occupational therapy in-home assessments & risk factor reduction | 2 hospital sessions 2 physical therapy visits | Medical assessment: 1 hour Medical intervention: 20 minutes Physical therapy assessment: 45 minutes Physical therapy intervention: 15 minutes |
| Day 2002 | Improve strength & balance, improve poor vision, & reduce home hazards | Exercise instructors accredited by State-recognized institute & trained for intervention | Group exercise classes | 1 occupational therapy visit w/ 1 follow-up visit | Occupational therapy assessment: 45 minutes Follow-up visit: 20 minutes Classes: 15 hours Vision management: NA Home modification: NA |
| Freiberger 2007 | Improve functional skills, strength, endurance, & flexibility | Specially trained instructors with a background in sport science & experience working w/ older adults | Group classes w/ individual practice at home | 1-hour class 2 times a week for 16 weeks | Classes: 32 hours |
| Hornbrook 1994 | Reduce risk behaviors, improve physical fitness, & reduce home hazards | BA-level assessor trained for intervention, health behaviorist, & physical therapist | Group exercise classes & home visits | 4 weekly 1½-hour classes (incl. 20 minutes group exercise) 2 15-minute home visits | Classes: 6 hours Home visits: ½ hour |
| Li 2005 | Improve balance & physical performance | Experienced Tai Chi instructors who followed the classical Yang style | Group exercise classes | 1-hour class 3 times a week for 26 weeks | Classes: 78 hours |
| Lord 2003 | Increase strength, coordination, balance & gait, & improve ADLs | Trained exercise instructors certified for leading programs for older adults | Group exercise classes | 1-hour class 2 times a week for 12 months (4 3-month terms) | Classes: 96 hours |

Table 3: Intervention Characteristics continued (3 of 4)

| Study | Focus | Providers | Structure | Number of Sessions | Provider Contact Time |
|-----------------|--|---|---|---|---|
| McKiernan 2005 | Using a traction device that fits on shoes to improve stability when walking on ice & snow | Research coordinator | Participants used the device on their own | 1 introductory session | Introductory session: ½ hour |
| Nikolaus 2003 | Assess & reduce home hazards | Home intervention team incl. 3 nurses, a physical therapist, an occupational therapist, a social worker, & a secretary | Home visits | 2+ (usually 3-4) home visits, about 1½ hours each visit | Home visits: 8 hours on average |
| Rubenstein 2000 | Increase strength & endurance, improve mobility & balance | Exercise physiology graduate students with on-the-job training or experienced physical therapist | Group exercise classes | 1½-hour class 3 times a week for 12 weeks | Classes: 54 hours |
| Salminen 2009 | Assess & address each participant's specific fall risk factors, improve physical fitness, provide information & counseling on fall prevention, assess & modify home hazards, & provide psychological support | Geriatrician, trained public health nurse, trained nursing students, physical therapist, & various health professionals | One-on-one combined w/ group classes | 1 fall risk assessment 1 counseling & information session 1 home assessment 12 1-hour health lectures 12 1-hour psychosocial group sessions 45- to 50-minute group exercise classes every 2 weeks for 26 weeks Home exercises 3 times a week for 52 weeks | Risk assessment: 45 minutes Counseling: 45 minutes Home assessment: 45 minutes Health lectures: 12 hours Psychosocial group sessions: 12 hours Exercise classes: 10-11 hours |

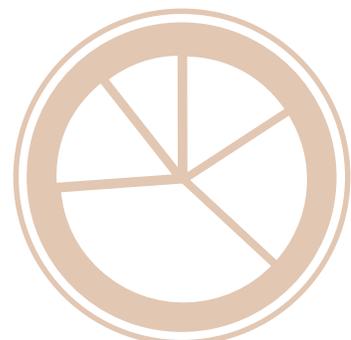
Table 3: Intervention Characteristics continued (4 of 4)

| Study | Focus | Providers | Structure | Number of Sessions | Provider Contact Time |
|-----------------|--|--|--|---|--|
| Skelton 2005 | Improve balance & strength | Postural Stability Instructors | Group exercise classes & home-based exercises | 1 pre-exercise assessment 36 weekly 1-hour group exercise classes ½-hour home exercise sessions 2 times a week for 36 weeks | Pre-exercise assessment: 40 minutes Classes: 36 hours |
| Spice 2009 | Assess fall risk factors & provide individualized interventions | Doctor, nurse, physical therapist, & occupational therapist | One-on-one assessment with follow-up interventions | 1 fall risk assessment Length & number of subsequent sessions varied by type of intervention(s) | Risk assessment: 2 hours Intervention: Varied |
| Tinetti 1994 | Identify & modify each participant's fall risk factors | Medication adjustments coordinated w/ participant's primary physician; exercise sessions conducted by physical therapist | Varied by type of intervention | Varied by type & number of interventions received | Varied |
| Voukelatos 2007 | Improve balance & reduce falls | Community-based Tai Chi instructors | Group exercise classes | 16 weekly 1-hour classes | Classes: 16 hours |
| Wagner 1994 | Reduce disability &/or falls by addressing 6 specific risk factors | Specially trained nurse-educator | Home visit with follow-up behavioral intervention | 1 initial interview 1 to 1½ hours Length & number of subsequent sessions varied by type of intervention(s) | Initial interview: 1 to 1½ hours Intervention: Varied |
| Wolf 1996 | Improve strength, balance, walking speed, & physical functioning | Tai Chi master | Group classes w/ individual practice at home | 25-minute group classes 2 times a week for 15 weeks 15-minute practice at home 2 times a week | Classes: 12 hours |

Appendix D

Original Intervention Materials

- Appendix D-1 Barnett Materials
- Appendix D-2 Skelton Materials
- Appendix D-3 Voukelatos Materials
- Appendix D-4 Wolf Materials
- Appendix D-5 Close Materials
- Appendix D-6 Spice Materials



Appendix D-1 Barnett Materials



**South Western Sydney Area Health Service
Health Promotion
A Unit of the Division of Population Health**

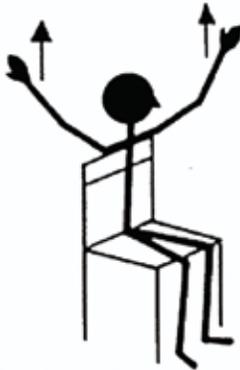


Falls Prevention Project Stay Safe Stay Active



EXERCISES

1. Warm up



Breathe in deeply through nose, lift arms above head and stretch. Lower arms and breathe out 6 times.

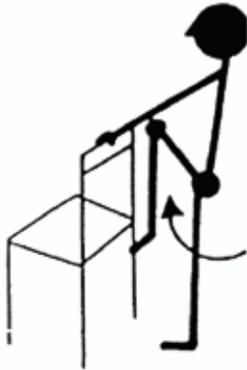
2. Shoulder rolls (Flexibility)



Gently rotate shoulders up to ceiling, backwards, and down. Then reverse; up, forward and down. 6 times each way.

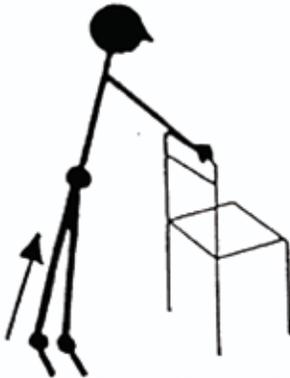
Exercises

3. March on spot (mobility)



Hold onto chair with 2 hands. Walking on the spot. Try to lift knees a bit higher than usual. Step 10 times with each leg.

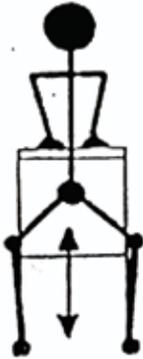
4. Ankle (strength)



Hold onto chair. Rise up onto toes of both feet, hold for 5 seconds, then lower. Keep heels on the floor and lift toes off the floor hold for 5 seconds. Repeat both movements 6 times.

Exercises

5. Knee bend (strength)



Hold on to chair. Stand with knees soft and back straight. Keep knees pointing over toes. Bend your knees gently, and then raise your body by straightening your knees. Do this 6 times.

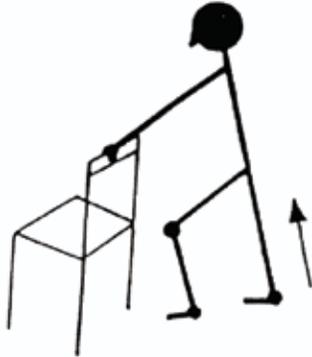
6. Sit to Stand (strength)



Sit in chair against wall. Stand up without using your hands 6 times. If this is too hard use a pillow on the chair to start until you get stronger.

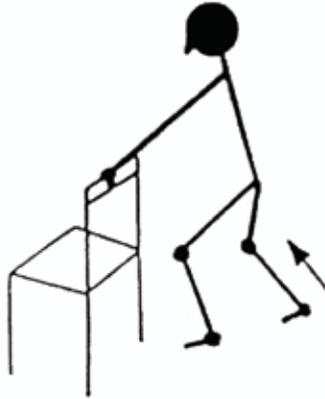
Exercises

7. Calf (stretch)



Hold onto chair; stretch one leg behind, toes facing forward, gently bend front knee until you feel a stretch in your calf. Hold stretch for 10 seconds. Do 6 stretches.

8 Calf (stretch)



Hold onto chair, stretch as in previous picture. When you feel the stretch in your back calf, keep the heel of that foot on the ground, and slightly bend the back knee.

General Information on Exercise

As we age our muscles tend to become less flexible and strong, and our joints become stiffer. This can affect our balance. Exercise is the best way to improve strength and mobility. Greater strength and mobility means you may be able to recover your balance if you lose it, therefore avoiding a fall.

Tips for Exercising

- **Wear comfortable clothes and shoes**
- **Drink some water before and after exercise**
- **Do exercises slowly and gently**
- **If you feel pain STOP that exercise and discuss with your exercise leader or project manager**
- **If you feel breathless or dizzy STOP and rest**

Well done you have now completed all the exercises. If you have any questions or concerns regarding the exercise program please don't hesitate to contact your gentle exercise leader or the project manager.

Project Manager

Anne Barnett
Health Promotion Unit
Hugh Jardine Building
Locked Mail Bag 7017
Liverpool NSW 1871

Tel. 9828 6008

C 1999

Stage 1 home program - Stay Safe Stay Active: Falls prevention in Primary Care 2001, SWSAHS.

Stay Safe Stay Active Daily Exercise Program

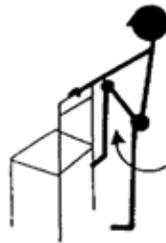
1. Warm up



2. Shoulder rolls (Flexibility)



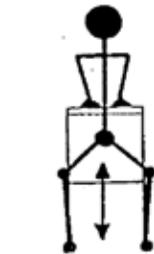
3. March on spot (mobility)



4. Ankle (strength)



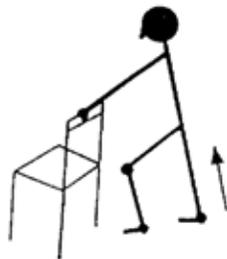
5. Knee bend (strength)



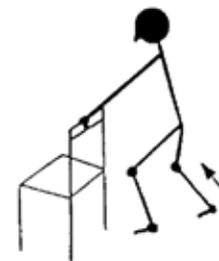
6. Sit to Stand (strength)



7. Calf (stretch)



8. Calf (stretch)



Thank you Sally Castell for your diagrams

Stay Safe Stay Active

Daily Exercise Program (Stage 2)

1. Hip to the side *



2. Foot Circles *



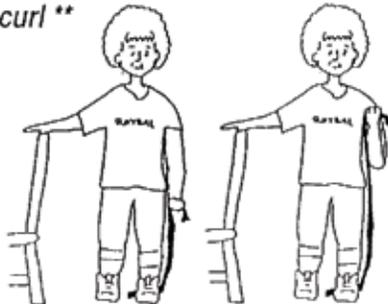
3. Lift leg backwards *



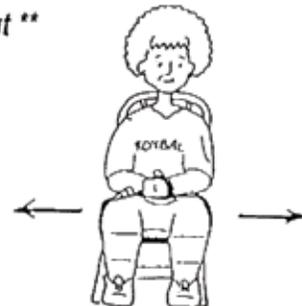
4. Shoulder blade exercises**



5. Arm curl **



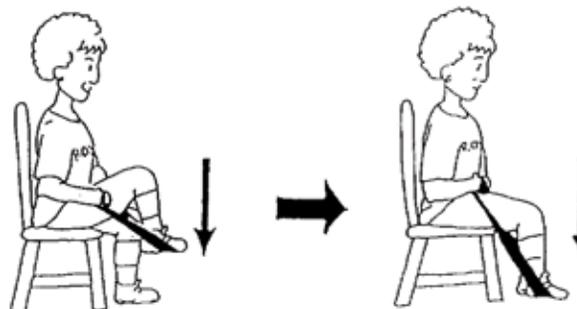
6. Knees in and out **



7. Ankle Pumps **



8. Hip extension **



Thank you to Stay on Your Feet* and Roybal - Boston University** for allowing us to use your diagrams

Tips to Prevent Falling

1 Medications

Discuss with GP or Pharmacist if you feel they may be causing drowsiness or dizziness

2 The environment

Loose rugs, slippery surfaces, unsecured cords, poor lighting especially at night, and spills of water or grease, all increase the risk of falling. Try and clear away clutter, especially where you need to walk, and secure rugs with grippers to the floor. Mop up any spills immediately.

3 Shoes

Wear non-slip shoes that fit well, and have laces or Velcro fastening. Shoes with medium or low heels, which are rounded, are better than high thin heels. Slippers and thongs are not a good idea, as they do not offer enough support. Be careful of wet or slippery surfaces.

4 Hearing

A loss of hearing can cause dizziness and balance problems, see your GP if this occurs. It could be something as simple as a lump of wax.

5 Vision

Adequate lighting is very important, do not forget to turn light on if you get up at night, or keep a nightlight on – keep your glasses by your bed! Bifocals can make going up and down stairs difficult as they alter the perception of where the stair edges are. When walking outside in the sun it is useful to wear a broad rimmed hat, it helps you pick up contrasts on the ground such as steps and edges. Remember to have annual eye tests, as this can detect any changes in your vision.

6 Good diet

Eat a well balanced diet, and don't allow yourself to become too thin.

7 Colds/Sinus

If you have a cold or sinus problems then take extra care as this can affect your balance

8 Walking aid

If you use a walking aid, make sure the rubber on the bottom is not worn, and keep it by the bed at night in case you need to get up.

If you do fall in the house do not panic. Stay still for a few minutes to get over the shock. If you are OK try to slide yourself over to a sturdy piece of furniture, sofa, bed or chair and position yourself along side of it. Get into a kneeling position and gradually push yourself up and sit down until you recover. If you are unable to move try and cover yourself with something to keep warm, until help arrives.

Appendix D-2 Skelton Materials

Unit D514 Design, agree and adapt a physical activity programme with older adults with a history or high risk of falls

Introduction

In everyday clinical practice, presentation following a fall represents a critical point in the health of an older person. Falls are not accidents but are the symptomatic manifestation of underlying causal factors. Falls, fall related injuries and the fear associated with falling or postural instability have a significant cost to the National Health Service, the individual and their family and carers. Exercise has been shown to have a central role to play in preventing and managing falls. The provision of specific, progressive strength and balance exercises tailored to individual need and delivered by specialist exercise professionals is positioned as a core component of multi-factorial interventions to prevent and manage falls in frailer older people.

Advanced instructors who are responsible for designing, delivering, monitoring and evaluating structured, individualised physical activity programmes for patients/clients with a history or high risk of falls, must have a range of appropriate knowledge and skills that are aligned with current evidence-based, best practice guidelines. These instructors should have established close liaison with falls and fracture and rehabilitation services in their local area and with relevant carers where appropriate with agreement.

This unit is designed to cover the multi-factorial nature of falls prevention and management, including the skills and knowledge required to prescribe safe and effective exercise programmes for this patient/client group. These programmes must be based on relevant information from assessment, diagnosis and treatment/management as well as on a sound understanding of the risk factors and risk stratification involved. There are particular challenges associated with the physical activity management of this client group as they may have movement control, balance and gait problems associated with ageing, inactivity, significant loss of muscle strength and power; visual, vestibular or proprioceptive disorders and neuromuscular/cognitive effects resulting from inappropriate medication. They may also have psychological issues such as fear of falling, loss of confidence, feelings of isolation and dependence. An understanding of the aims of rehabilitation, and the potential effects of therapy led approaches, assessed through relevant outcomes will inform and integrate the physical activity intervention for both clients and professionals involved. The unit is divided into two parts. The first part (pages 2 and 3) describes the two things you have to do. These are:

D514.1 Design and agree a physical activity programme with patient/client with a history or high risk of falls

D514.2 Deliver, review and adapt a physical activity programme with patient/client with a history or high risk of falls

The second part (pages 4 – 7) covers the unit specific knowledge and understanding you must have.

Target Group

This unit is for advanced fitness instructors who plan, conduct and review programmes to address the needs of patients/clients with a history or high risk of falls. They will normally be working without direct supervision.

Linked Units

This unit is one of a suite of Level 4 national occupational standards and should only be attempted on completion of the core Level 3 physical activity and exercise units.

D467 Adapt a physical activity programme to the needs of older adults

Introduction

Summary

Physical activity and physical fitness can make a major contribution to the continued health and functional capacity of people aged 50 and over. Increased, regular physical activity improves physical fitness despite the physical decline associated with ageing. It also helps to preserve functional capacity and improve quality of life which will become increasingly important with advanced age. It is crucial that instructors who work with this age group understand the ageing process and its implications for practice in order to meet the higher duty of care. Instructors need to be able to apply this knowledge when conducting pre-participation screening, and developing, adapting and implementing appropriate physical activity programmes to meet the diverse needs of older adults. Highly competent communication skills are also important. This unit, however, only covers working with apparently healthy (i.e. asymptomatic) older adults or those with medical conditions carrying a low risk of adverse, exercise-related events.

The document is divided into two parts. The first part describes what you have to do. This is:

D467.1 Adapt a physical activity programme to the needs of older adults

The second part covers the specific knowledge and understanding you must have.

Target Group

This standard is for fitness instructors/personal trainers who plan, conduct and review programmes to address the needs of older adults. They will normally be working without direct supervision.

Appendix D-3

Voukelatos Materials

Tai Chi Principles for Falls Prevention in Older People

The following notes are suggestions for incorporation into a Tai Chi program specifically targeting falls prevention in older people.

BALANCE – the key element to preventing a fall

Balance has been shown to decrease with age; however, some aspects of balance can be enhanced through training.

Key elements to incorporate into a Tai Chi program

Relaxation → relaxes muscles → lowers center of gravity

Lowered center of gravity → increases load on lower limbs → over time increases sensation and awareness of lower limb movement.

- **Transfer of weight**

Shifting body weight from leg to leg through incremental movements. Start with a small range of movement and gradually build up to a wide, square base stance.

- **Muscle strength**

Muscle bulk and therefore strength decrease with age. A bent knee stance and movement works to strengthen lower limb muscle (particularly the quadriceps muscles) (however, always work to an individual's limitations. If a bent knee stance is too difficult, then do the movement without bent knees).

- **Instability**

This involves issues such as increased body sway, low mobility, and postural instability. Increasing age is also associated with reduced sensation in lower limbs and is consequently associated with a loss of righting reflexes and an increase in body sway, which can lead to falls.

- **Gait:** decreased stepping height and decreased stride length.

Women tend to have a narrow walking and standing base, closer foot placement, erect posture → difficult to step down from stools/benches.

Men tend to have a small-stepped gait, wider walking and standing base, and stooped posture.

Tai Chi addresses gait problems by teaching “correct” movement of lower limbs. This is done by lifting lower limbs from the knee rather than the foot; lifting lower limbs without misaligning the pelvis; and teaching to place heel down first when moving forward (toes first when moving back). Also, teaching movement with appropriate weight transfer, posture, and slightly bent knees improves stride length

- **Posture:** Tai Chi also teaches participants to maintain a relaxed posture with an elongated spine.

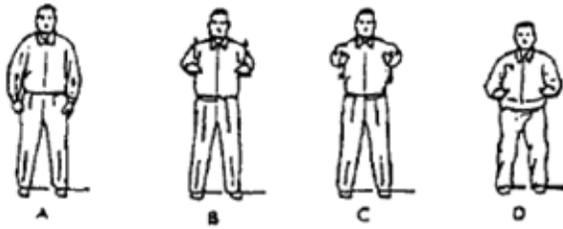
- **Coordination/Mobility:** Tai Chi consists of a moving from one stance to another in a slow, coordinated, and smooth way. This trains students in improved mobility and increased body awareness.

Guidelines for Instructors Working with Older People

- Important to maintain an upright (straight) posture at all times.
- Incremental movement is needed in teaching older people.
- Instructors need to be well aware of an individual's comfort level and not go beyond that.
- In bent knee stance, must remember to introduce bent knee gradually throughout the 16-week period while staying within comfort levels of individuals.
- Remember to keep the center line of gravity as perpendicular as possible and center within the base stance.
- Tai Chi leaders also have to be mindful of any medical or physical conditions students might have that would interfere with standard Tai Chi movements. For example, if a practitioner has had a hip replacement then the range of movements involving hips may be limited.

Appendix D-4 Wolf Materials

FORM 1. OPENING FORM



FORM 6



FORM 2



FORM 7



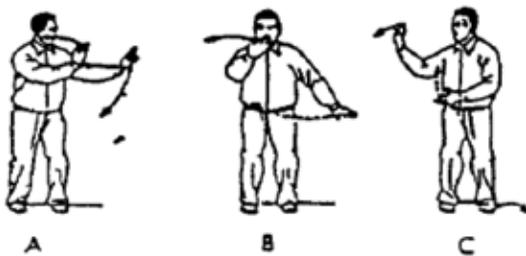
FORM 3



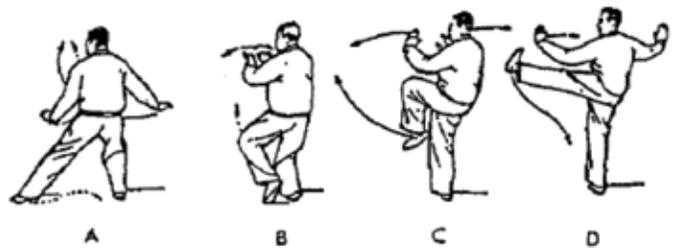
FORM 8



FORM 4



FORM 9



FORM 5



FORM 10



APPENDIX: DIRECTIONS AND THERAPEUTIC ELEMENTS FOR LEARNING 10 FORMS OF TC

FORM 1. Directions

- (1) Stand upright with feet shoulder-width apart, toes pointing forward, arms hanging naturally at sides. Look straight ahead (1A).
- (2) Raise arms slowly forward to shoulder level, palms down. The hands do not go above the shoulders and the elbows are held in (1B & 1C).
- (3) Bend knees as you press palms down gently, with elbows dropping towards knees. Look straight ahead (1D).

FORM 1. Therapeutic elements 3, 4

This "warmup" form begins with nonstressful bilateral stance where all thoughts other than those about movement clear the head. Attention is directed to relaxing all muscles except those of the legs--the feet are to "stick to the ground." As movement begins, concentration is directed to move all four extremities at the same constant speed that begins and ends concomitantly in the arms and legs.

FORM 2. Directions

The body is turned slightly to the left, with left foot at 9 o'clock for a left bow stance. The left forearm and back of hand are at shoulder level, while right hand is at the side of right hip, palm down. Look at left forearm (2A). Turn torso slight to left (9 o'clock) while extending left hand forward, palm down. Turn torso slightly right while pulling both hands down in a curve past abdomen, until right hand is extended sideways at shoulder level, palm up, and left forearm is across chest, palm turned inward. Shift weight onto right leg. Look at right hand (2B). Turn torso slightly right, palm turned slowly outward, while left hand moves in a curve past abdomen up to shoulder level with palm turned slowly obliquely inward (4B & 4C).

FORM 2. Therapeutic elements 1-7

The trunk and head rotate while both feet remain on floor. The arms move in asymmetrical positions so that the center of mass is extended further from left to right due to arm positions. The trunk and head are kept erect so that rotation is around a central axis. The body weight is predominantly on a flexed leg for greater balance and strength mechanism.

FORM 3. Directions

Look straight ahead; face 9 o'clock with weight on left leg in a bow stance and hands forward at shoulder height in a pushing position (3A). Turn both palms downward as right hand passes over left wrist, moves forward, then to the right until it is on the same level with left hand. Separate hand shoulder-width apart and draw them back to the front of abdomen, palms facing obliquely downward. At the same time, sit back and shift weight onto right leg, slightly bent, raising toes of left foot. Look straight ahead (3B & 3C).

FORM 3. Therapeutic elements 1-4 & 7

The body center of mass moves diagonally posteriorly than other forms with a decreased base of support from only heel contact of the left leg, demanding greater balance and strength than the previous form. The trunk rotation is decreased and the arm movement is symmetrical

FORM 4. Directions

Turn torso to the left (10-11 o'clock), shifting weight to left leg. Move left hand in a curve past face with palm turned slowly leftward, while right hand moves up to the front of left shoulder with palm turned obliquely inward. As right hand moves upward, right foot and left foot are parallel and 10 to 20cm apart. Look at right hand (4A). Turn torso gradually to the right (1 to 2 o'clock), shifting weight onto right leg. At the same time, move right hand continuously to right

FORM 4. Therapeutic elements 1-7

While the legs are symmetrical, weight is shifted laterally. The arms are asymmetrical, the trunk and head rotate with arm movement. Both knees are flexed and weight shifts to the leg on the side to which the arms are moving.

FORM 5. Directions

Turn torso slightly to the right, moving right hand down in a curve past abdomen and then upward to shoulder level, palm up and arm slightly bent. Turn left palm up and place toes of left foot on floor. Eyes first look to the right as body turns in that direction, and then to look at left hand (5A & 5B).

FORM 5. Therapeutic elements 1-7

Again a smaller base of support with the majority of weight on one extremity. The arm on the weight bearing side is curved back into shoulder extension. Done on the right leg and then reversed and done on the left leg. Again trunk rotates at the end of the movement.

FORM 6.Directions

Hold torso erect and keep chest relaxed. Move arms in a curve without stretching them when you separate hands. Use waist as the axis in body turns. The movements in taking a bow stance and separating hands must be smooth and synchronized in tempo. Place front foot slowly in position, heel coming down first. The knee of front leg should not go beyond toes while rear leg should be straightened, forming a 45 with ground. There should be a transverse distance of 10 to 30cm between heels. Face 9 o'clock in final position.

FORM 6. Therapeutic elements 1-7

Hand assumes a position of holding a ball initially. Movements in the form are diagonals and rotations of the trunk and head. Movements slide back and forth in and out of 6A and 6B, and then position is reversed for right and left.

FORM 7. Directions

Turn torso to the right (11 o'clock) as right hand circles up to ear level with arm slightly bent and palm facing obliquely upward, while left hand moves to the front of the right part of chest, palm facing obliquely downward. Look at right hand (7A). Turn torso to the left (9 o'clock) as left foot takes a step in that direction for a left bow stance. At the same time, right hand draws leftward past right ear and, following body turn, pushes forward at nose level with palm facing forward, while left hand circles around left knee to stop beside left hip, palm down. Look at fingers of right hand (7B & 7C).

FORM 7. Therapeutic elements 1-7

This form begins in the position of 7A, but with both feet flat on the floor. They remain on the floor throughout the exercise. Move in and out of the position 7A, B, C, A, B, C, then reverse right-left positions.

FORM 8. Directions

Continue to move hands in a downward-inward-upward curve until wrists come in front of chest, with right hand in front and both palms turned inward. At the same time, draw right foot to the side of left foot, toes on floor. Look forward to the right (8A). Separate hands, turning torso slightly to 8 o'clock and extending both arms sideways at shoulder level with elbows slightly bent and palms turned outward. At the same time, raise right knee and thrust foot gradually towards 10 o'clock. Look at right hand (8B & 8C).

FORM 8. Therapeutic elements 1-7

With the elderly, the kick is only a small part of their available range. The form is utilized for kicking with both dorsiflexion and plantar flexion of the foot. Forms 8 and 9 are the most stressful for maintaining balance due to the small base of support and the extreme movement of the kicking leg. However, forms are done continuously with slow movements and a strong degree of concentration. The range for the kick is not extreme in the elderly.

FORM 9. Directions

Shift weight onto right leg and draw left foot to the side of right foot, toes on floor. At the same time, move both hands in a downward-inward-upward curve until wrists cross in front of chest, with left hand in front and both palms facing inward. Look forward to the left (9A & 9B). Separate hands, extending both arms sideways at shoulder level, elbows slightly bent and palms facing outward. Mean-while, raise left knee and thrust foot gradually towards 4 o'clock. Look at left hand (9C & 9D).

FORM 9. Therapeutic elements 1-7 The same as Form 8 but right and left are reversed.

FORM 10. Directions

Turn palms forward and downward while lowering both hands gradually to the side of hips. Look straight ahead (10A, 10B & 10C).

FORM 10. Therapeutic elements

This is a warm-down form like Form 1 and constitutes both a physical and mental ending of the exercise.

Appendix D-5 Close Materials



Falls Clinic

Day Hospital, Department of Health Care of the Elderly

Name:

Hosp No:

D.O.B.:

GP:

Referred from:

Date referred:

Clinic Dr:

Date of clinic:

Fall History

First fall: Y / N

No of falls in previous year:

Location of fall: Outdoors /Stairs / Kitchen / Bathroom / Living Room / Bedroom / Other

Was fall witnessed: Y / N

Definite slip/trip: Y / N

Associated dizziness: Y / N

LOC: Y / N

Palpitations: Y / N

Able to get self off floor: Y / N

Time on floor (mins):

Injuries sustained from fall _____

Medical History

Full Drug History

Heart disease

Stroke

COPD/Asthma

Hypertension

Diabetes

Degenerative joint disease

Cognitive impairment

Visual impairment

Syncope

Epilepsy

Incontinence

Other - (please state) _____

Alcohol: _____ units/week

Smoking: _____ cigarettes/day

Social Circumstances

Lives in: Flat / House / Bungalow / WCF / Residential Home / Nursing Home

Lives alone: Y / N

Stairs: Yes / No

Lambeth / Southwark / Other

Usually able to go out: Yes / No

Mobility: Independent

Services: MOW

Carer: None

Stick

HH

Spouse

Frame

Personal Care

Other family

Wheelchair

District Nurse

Friend/neighbour

Day Centre

Day Hospital

Examination

AMT

Age

Time (to nearest hour)

Address for recall

Year

Location

Recognition of two persons

Date of Birth

WW2

Present monarch

Count backwards 20 – 1

Weight: _____ kg

Height: _____ m

Pulse: _____ bpm

regular / irregular

BP sitting:

BP standing:

Visual acuity

R Eye

L Eye

Score: _____ /10 (If <8 do MMSE)

CVS:

Carotid bruits: Yes / No

Valvular defect: Yes / No

LVF: Yes / No

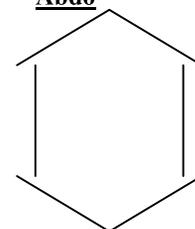
RHF: Yes / No

CCF: Yes / No

RS



Abdo



Cranial Nerve Deficit:

Visual Fields: L Eye R Eye



Cataract Formation: Yes / No

Hearing: Normal / Shout / Hearing Aid

PNS:

Tone

| | |
|-------|-------|
| R Arm | L Arm |
| R Leg | L Leg |

Reflexes

| | R | L |
|-----------|---|---|
| Biceps | | |
| Triceps | | |
| Supinator | | |
| Knee | | |
| Ankle | | |
| Plantars | | |

Power

| | R | L |
|--------------------|---|---|
| <i>Arms</i> | | |
| Shoulder abduction | | |
| Shoulder adduction | | |
| Elbow flexion | | |
| Elbow extension | | |
| Wrist flexion | | |
| Wrist extension | | |
| Finger abduction | | |
| Finger adduction | | |
| Opposition | | |

| | R | L |
|---------------------|---|---|
| <i>Legs</i> | | |
| Hip flexors | | |
| Hip extensors | | |
| Knee flexion | | |
| Knee extension | | |
| Ankle dorsiflexion | | |
| Ankle plantiflexion | | |

Lower limb

Sensation Intact: Yes / No

Proprioception intact: Yes / No

Vibration intact: Yes / No

Joint deformities

- Hands
- Elbows
- Shoulders
- Spine
- Hips Knees
- Ankles

Good foot care: Yes / No

Sensible footwear: Yes / No

Timed Up and Go: _____secs

MMSE (if indicated) _____/30

GDS – 15 Question Form _____/15

Summary

Likely Cause of Fall

Risk Factors for Falls

Planned investigations and/or modifications

Follow up Arrangements

Referrals

FBC

LFT's

U&E

TFT's

ECG

Vit D

Urinalysis

Signature:

Print

Date:

PROFET – Environmental Assessment

Name:

Number:

| | | | At time of fall | In the home | In the environment |
|---------------------|-----------|--|-----------------|-------------|--------------------|
| Slip Hazards | 1 | Liquid/solid spills | | | |
| | 2 | Wet floors | | | |
| | 3 | Incorrect footwear | | | |
| | 4 | Loose mats on polished floors | | | |
| | 5 | Rain, sleet, snow, ice | | | |
| | 6 | Change from wet to dry surface | | | |
| | 7 | Unsuitable floor surface | | | |
| | 8 | Dusty floors | | | |
| | 9 | Sloping surfaces | | | |
| Trip Hazards | 10 | Loose floorboards / tiles | | | |
| | 11 | Loose and worn mats / carpets | | | |
| | 12 | Uneven outdoor surfaces | | | |
| | 13 | Holes / cracks | | | |
| | 14 | Change in surface level – ramps, steps, stairs | | | |
| | 15 | Cables across walking areas | | | |
| | 16 | Obstructions | | | |
| | 17 | Bumps, ridges and protruding nails etc | | | |
| | 18 | Low wall and floor fixtures, door catches, door stops etc. | | | |
| Risk Factors | 19 | Organisation of walkways | | | |
| | 20 | Badly placed mirrors / reflections from glazing | | | |
| | 21 | Poor or unsuitable lighting | | | |
| | 22 | Wrong cleaning regime / materials | | | |
| | 23 | Moving goods, carrying, pushing or pulling a load | | | |
| | 24 | Rushing around | | | |
| | 25 | Distractions | | | |
| | 26 | Fatigue | | | |
| | 27 | Effects of alcohol | | | |
| | 28 | Effects of other drugs | | | |
| | 29 | Other factor (describe) | | | |

Falls Assessment Proforma

Accident & Emergency, Department of Health Care of the Elderly
Falls Specialist Practitioner – Bleep 929 Mon-Fri

Name: _____ Hosp No _____ Attending Dr _____
Date of attendance: _____ Time: _____

Fall History

First fall: _____ Y / N

***No of falls in previous year:** (**>1 = high risk**)

***Location of fall: Indoors / Outdoors** (**(indoors = high risk)**)

Was fall witnessed: _____ Y / N

Definite slip/trip: _____ Y / N Associated dizziness: _____ Y / N

LOC: _____ Y / N Palpitations: _____ Y / N

***Able to get self off floor:** _____ Y / N (**N=high risk**) Time on floor (mins): _____

Medical History

***Full Drug History (4+ meds = high risk)**

| | |
|------------------------------|-------|
| Heart disease | _____ |
| Stroke | _____ |
| COPD/Asthma | _____ |
| Hypertension | _____ |
| Diabetes | _____ |
| Degenerative joint disease | _____ |
| Cognitive impairment | _____ |
| Visual impairment | _____ |
| Syncope | _____ |
| Epilepsy | _____ |
| Incontinence | _____ |
| Other - (please state) _____ | _____ |

Smoking: _____ no/week

Alcohol: _____ units/week

Social Circumstances

Lives in: Flat / House / Bungalow /Maisonette/ WCF / Residential Home / Nursing Home

Lives alone: Y / N Stairs: Yes / No

Lambeth / Southwark / Other Usually able to go out: Yes / No

| | | |
|------------------------------|----------------------|--------------------|
| Mobility: Independent | Services: MOW | Carer: None |
| Stick | HH | Spouse |
| Frame | Personal Care | Other family |
| Wheelchair | District Nurse | Friend/neighbour |
| | Day Centre | |
| | Day Hospital | |

Examination

GCS: BM
Temp: Pulse: BP; Lying / Standing /

AMT

- Age
- Time (to nearest hour)
- Address for recall
- Year
- Location
- Recognition of two persons
- Date of Birth
- WW2
- Present monarch
- Count backwards 20 – 1

Injuries Sustained

- Head injury – no laceration
- Head injury - laceration
- Fracture _____
- Laceration requiring stitches _____
- Laceration but no stitches _____
- Superficial bruising _____
- No injury

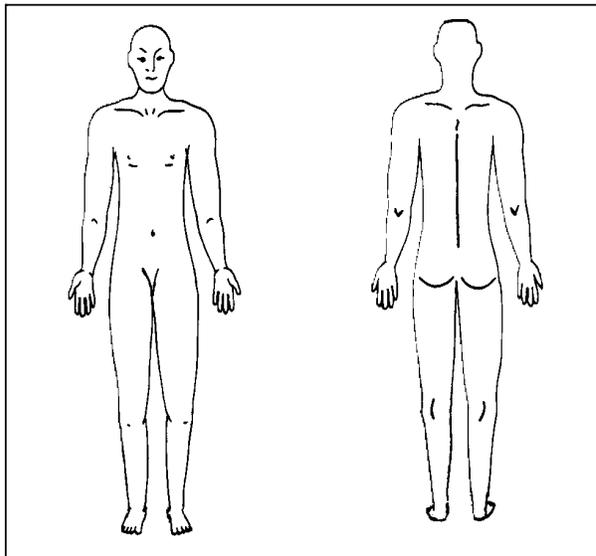
Score: /10

Relevant Systems Examination

Current Level of Function

- No change from pre-fall level of function
- Decreased mobility/function but able to go home
- Decreased mobility/function – unable to discharge

Indicate site of injury including pressure areas



Results

Conclusions

Likely cause of fall: simple slip/trip, acute illness, multifactorial, unexplained

Comments

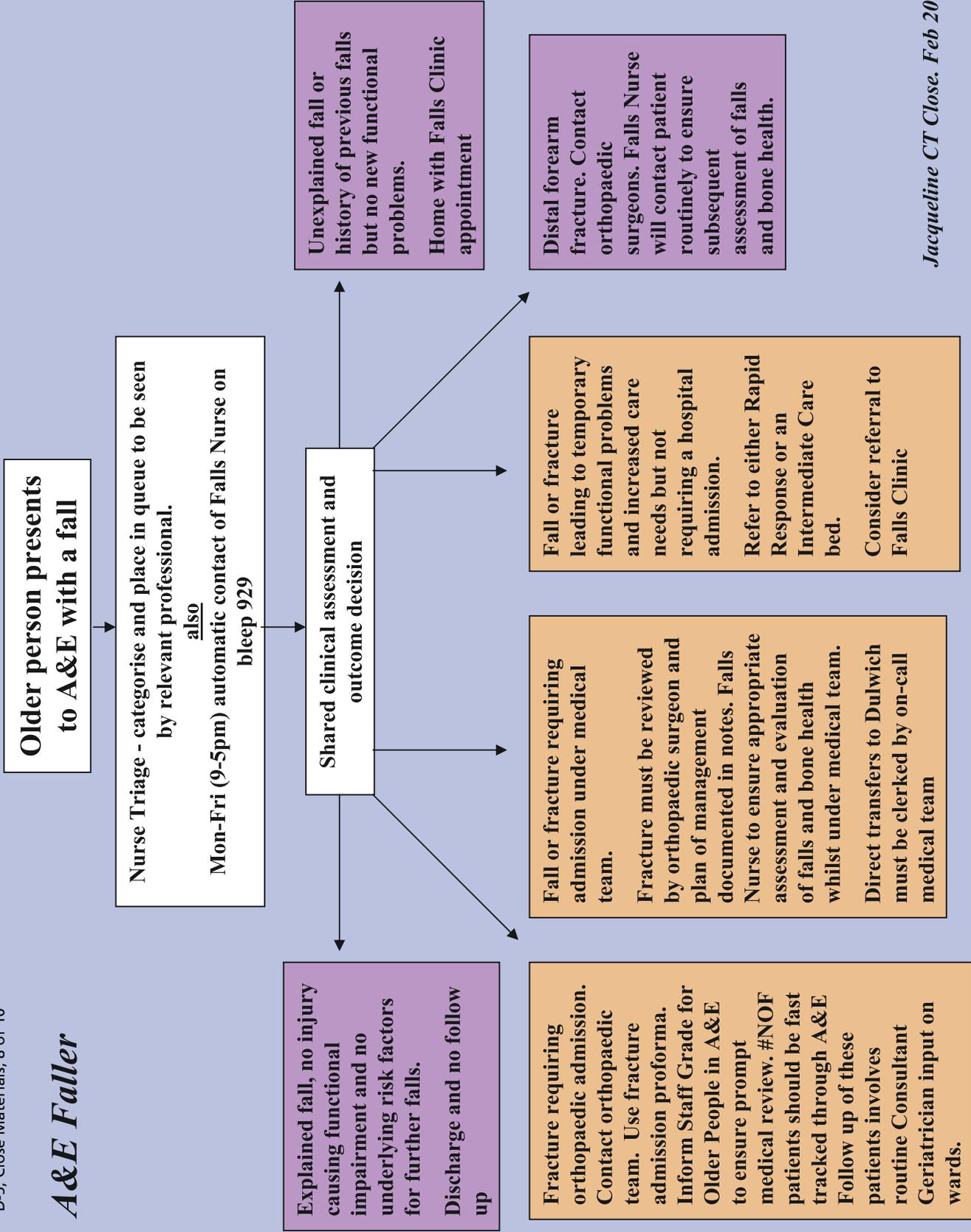
*** High risk – recommend referral to Falls Clinic if Falls Nurse not available to assess**

Outcome:

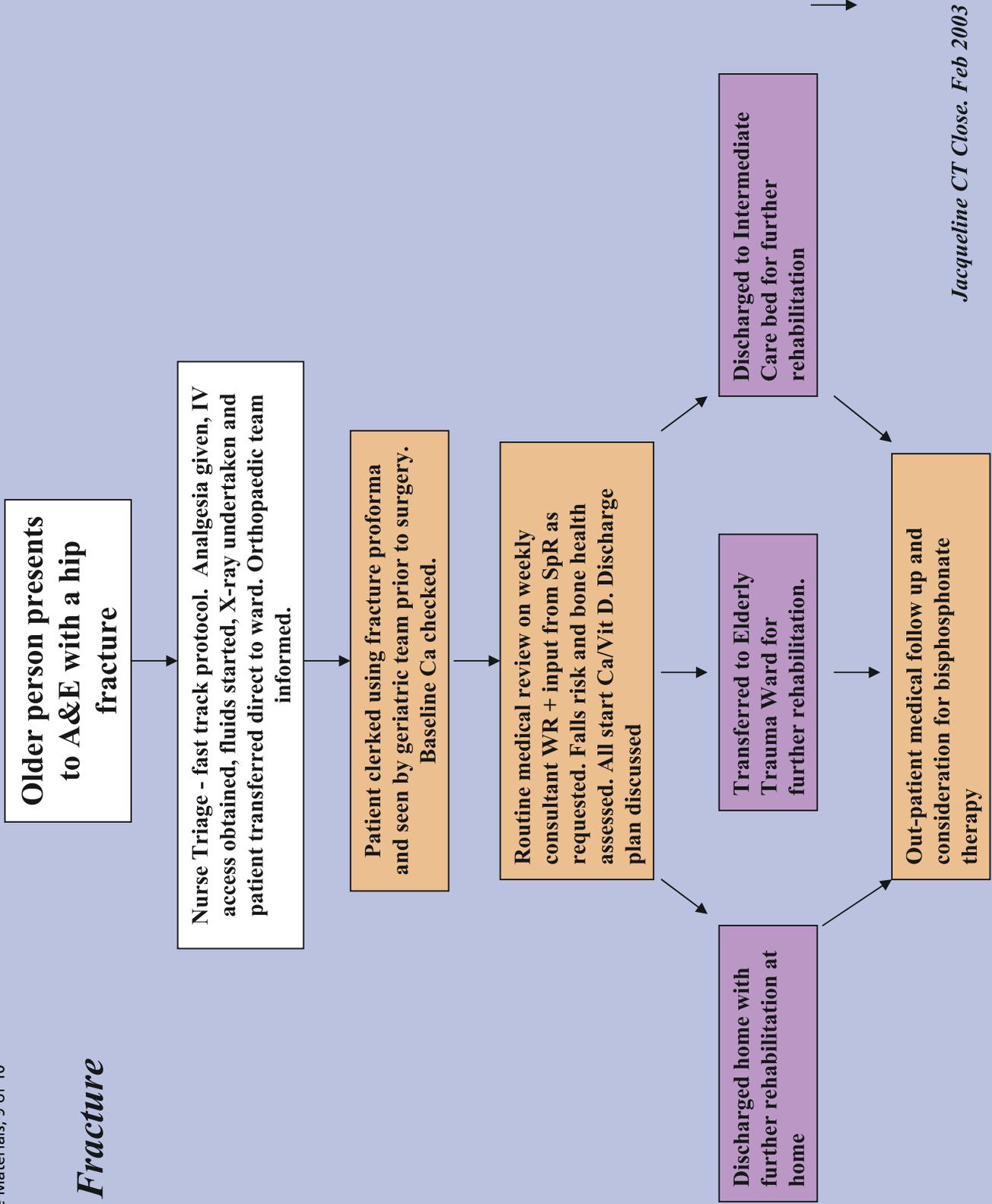
- Home with GP letter
- Admit to CDU
- Refer to Falls Clinic / Day Hospital
- Refer to Rapid Response
- Refer to DHE (Out-Patients)
- Refer for hospital admission

Signature: _____ Print Name: _____ Date: _____

A&E Faller

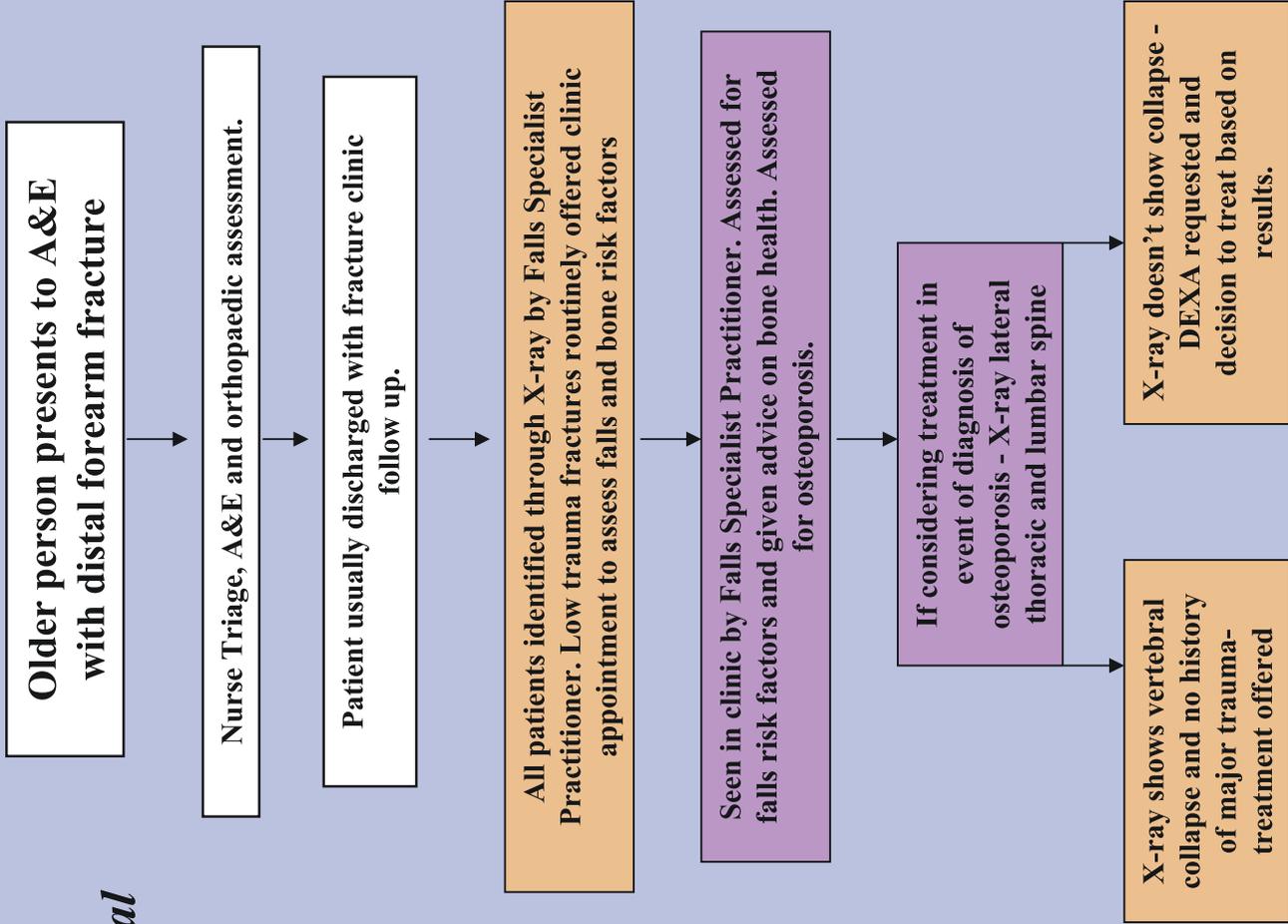


Hip Fracture



Jacqueline CT Close. Feb 2003

Low trauma distal forearm fracture



Appendix D-6 Spice Materials

Winchester Falls Project – Structured Secondary Assessment Domains

Question 1 – Basic information

Name:

Address:

GP:

DOB:

Date of assessment:

Date of referral:

Question 2 – Home

House/flat/bungalow/sheltered/RH/NH/independent

Question 3 – Walks

Independent/stick/frame

Question 4 – Carers

Independent/family/carers

Question 5 – Bowels

Independent/continent or continent with help or incontinent occasionally or incontinent or stoma

Continence aids

Question 6 – Bladder

Independent/continent or continent with help or incontinent occasionally or incontinent or catheter

Continence aids

Question 7 – Falls history

How many times has/she or he fallen before this last fall: once/2-5/>5

Has the patient sustained an injury during any fall: yes/no

If yes, which sort:

Head injury: yes/no

Fracture/dislocation: yes/no (please specify)

Laceration requiring medical attention: yes/no

Bruising: yes/no

Others: yes/no (please specify)

Definite slip/trip: yes/no

Loss of consciousness: yes/no

Associated dizziness/palpitations: yes/no

Vertigo: yes/no

Presyncope: yes/no

Question 8 – Drug history

List all medications (including over the counter and prescribed)

Question 9 – Drugs

Is the patient taking any of the following drugs:

- Diuretics
- Hypnotic/sedative
- Antidepressant
- Digoxin
- Cardiovascular
- Anti-parkinsonian

Question 10 – Alcohol consumption

CAGE score

Total number of units/week

Question 11 – Smoking

Do you smoke: yes/no

If yes: cigarettes/pipe/cigars

Question 12 – Past medical history

Heart disease

Stroke/TIA

Respiratory disease

Hypertension

Diabetes

Epilepsy

Parkinson's disease

Visual problems: wears glasses and last eye check within 2 years

Joint disease

Other neurological disease

Other diseases:

Question 13 – Examination BP

Weight

BP lying

BP standing immediately

BP at 1 minute

BP at 3 minutes

Question 14 – MTS

Question 15 – Vision

Visual acuity with glasses/pin hole:

Right

Left

Question 16 – Pulse

Question 17 – Rhythm

Question 18 – Heart sounds

Question 19 – Cranial nerves

Range of eye movements

Visual fields

Fundi

Pupils

Other findings

Question 20 – Peripheral neurology

Tone (right and left)

Power (right and left)

Reflexes (right and left)

Sensation (right and left)

Cerebellar (right and left)

Question 21 – Chest examination

Question 22 – Abdominal examination

Question 23 – Other findings

Question 24 – Mobility/gait

Aid used and pattern

Pattern

Heel strike

Stance

Stride

Other

Stairs

Question 25 – Joint range and muscle strength

Joint range

Upper limbs

Cervical spine

Lower limbs

Lumbar spine

Muscle strength

Upper limbs

Cervical spine

Lower limbs

Lumbar spine

Question 26 – Getting up from the floor

Pattern: independently/assistance x 1/assistance x 2/unable

Comment:

Question 27 – Transfers

Bed

Chair

Toilet

Bath (reported)

Question 28 – Equipment

Equipment already in situ

Question 29 – Domestic activities of daily living (reported)

Make a hot drink

Prepare a meal

Washing up

Use cooker

Cleaning

Laundry

Shopping

Carrying and lifting

Question 30 – Personal activities of daily living (reported)

Wash and dry self

Dress and undress

Clothes fastenings

Stockings and socks

Shoes and slippers

Personal care

Question 31 – Timed unsupported steady stand

Time in seconds for unsupported/single hand/ double hand stand

Distance between heels

Question 32 – 180 degree turn

Number of steps

Time in seconds

Question 33 – Functional reach

Done standing in dominant arm (measured in inches)

Question 34 – 6 meter timed walk

Time in seconds

Number of steps

Question 35 – Single leg stand

Right leg

Left leg

Question 36 – Clothing and footwear hazards

Clothing

Footwear

Chiropodist: yes/no

Question 37 – Pain

Pain: no pain/ongoing chronic pain/acute and intermittent pain/ongoing and acute

Description

Question 38 – Problem list

Question 39 – Action list

Question 40 – Likely cause of fall

Musculoskeletal

Cardiovascular

Environmental

Medication

Vision

Alcohol

Other

Combination

Comments

Question 41 – Risk factor for falls

Medication

Vision

Alcohol

Postural hypotension

Footwear

Mobility

Medical – neurological

Medical – musculoskeletal

Medical – cardiovascular

Environmental

Other

Combination

Comment

Question 42 – Planned investigations and/or interventions

Question 43 – Follow-up arrangements/referrals

Question 44 – Timings

Doctor:

Physiotherapist:

Nurse:

Occupational therapist:

Other (please specify):