# Management for Prevention:

## Falls and Falls Injury Prevention

**Ian D Cameron**

**Rehabilitation Studies Unit, and**

**Royal Rehabilitation Centre Sydney**


Rehabilitation Studies Unit
The University of Sydney

# Summary

- Falls and fractures in context
- Assessments in addition to the physiological approach
- The evidence: management for prevention
- Relevant guidelines for fall and fracture prevention

# Definitions

- Fall – “an unexpected event in which the participant comes to rest on the ground, floor or lower level”
- Fractures – “radiologically confirmed peripheral fracture events ... this should include the limbs and limb girdles”

Lamb et al 2005 for the ProFaNE group

# Falls and Falls Injury / Fracture

- Older people - 30% yearly prevalence
- Institutionalised older people - 50% yearly prevalence
- Older patients of rehabilitation services –

  ~ 50% yearly prevalence

# Falls and Falls Injury / Fracture

- ~ 5% of falls → fracture
- ~ 1% of falls → hip fracture

- Hip fractures in hospital → very poor outcomes

  (Murray et al, JAGS 2007;55:577–582)

Table 2. Comparison of Outcomes of Subjects with Hospital- and Community-Acquired Proximal Femoral Fracture (PFF)

| Outcomes | Hospital PFF (n = 43) | Community PFF (n = 43) | *P*-value | Relative Risk (95% Confidence Interval) |
|---|---|---|---|---|
| In-hospital mortality, n (%) | 12 (28) | 4 (9) | .03 | 3.00 (1.05–8.57) |
| Discharged to nursing home, n (%) | 14 (33) | 5 (12) | .02 | 2.80 (1.10–7.09) |
| Discharged to hostel, n (%)* | 7 (16) | 3 (7) | .18 | 2.30 (0.64–8.43) |
| Discharged to community, n (%) | 10 (23) | 31 (72) | < .001 | 0.32 (0.18–0.57) |
| Retained ADL status, n (%)† | 4 (9) | 24 (56) | < .001 | 0.17 (0.06–0.44) |
| Retained ambulation status, n (%)‡ | 6 (14) | 18 (42) | .004 | 0.33 (0.15–0.76) |
| Postfracture length of stay, days, median (interquartile range) | 46 (30.5–72.5) | 32 (23–42) | < .01 | — |

*One subject with hospital-acquired PFF and all three subjects with community-acquired PFF resided in hostels before admission.
†Activity of daily living (ADL) status was classified as high-level nursing care, low-level nursing care, dependent on community assistance in the home, or independent of community assistance.
‡Ambulation status was classified as being independent, dependent with a cane, dependent on a walking frame, or dependent on a person.

Murray et al, JAGS 2007;55:577–582

# The physiological approach to falls prevention

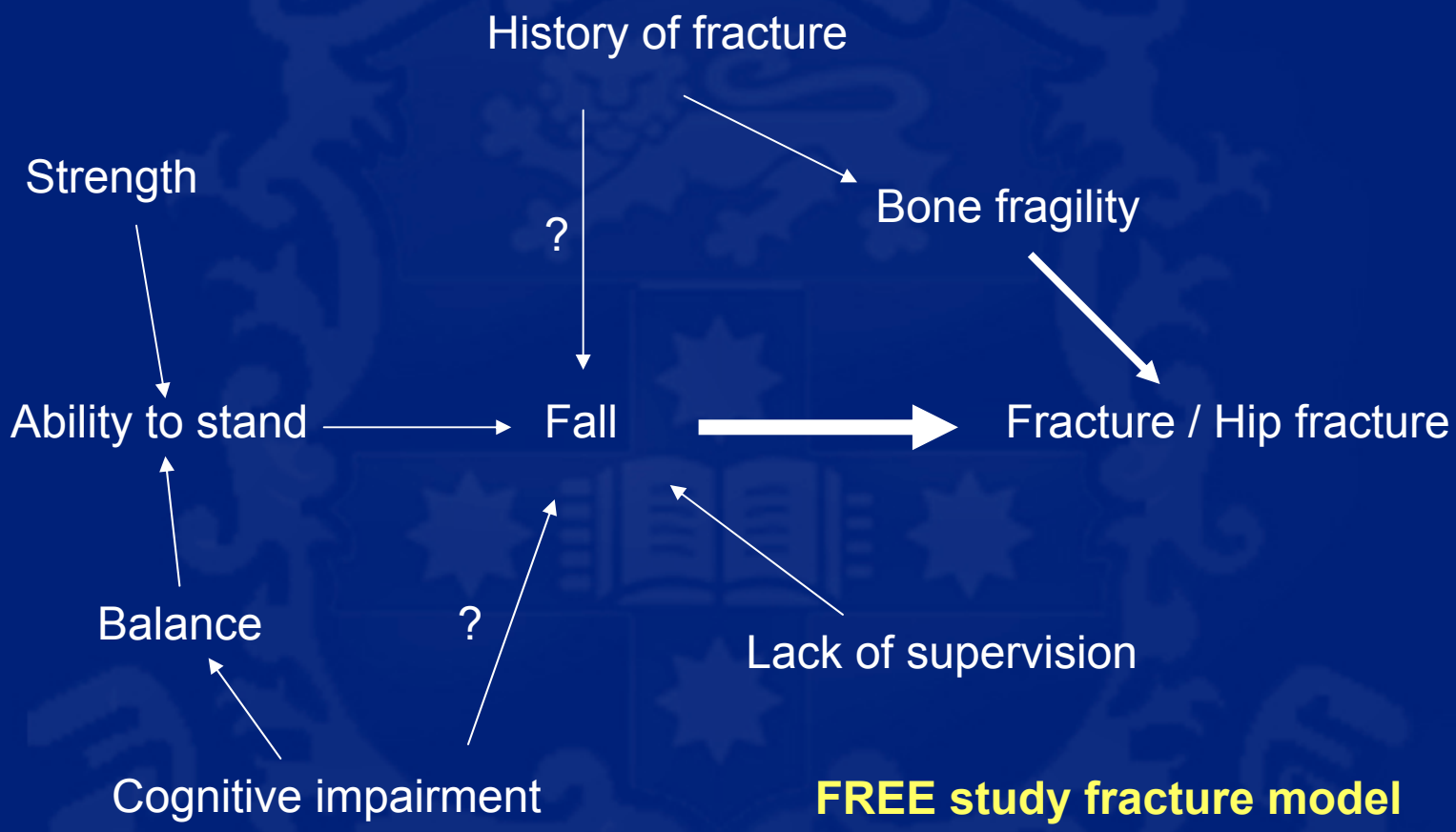
- Strength
- Balance
- Reaction time
- Sensation
- Visual function

# Other factors to assess in **falls** and falls injury prevention

- Cognitive impairment
- Intercurrent illness (particularly delirium)
- Iatrogenic factors (for example, inappropriate bed rest, non weight bearing status)
- Psychotropic medications
- Vitamin D deficiency
- Postural hypotension
- Other

# Other factors to assess in falls and **falls injury** prevention

- **Bone parameters (bone mineral density)**
- Cognitive impairment
- Intercurrent illness (particularly delirium)
- Iatrogenic factors
- Psychotropic medications
- Vitamin D, and **Calcium,** deficiency
- Postural hypotension
- Other




**FREE study fracture model**

Simplified version

Not shown: body weight (padding)

/ nutrition; leg length

# Conceptual issues in management for falls and fracture prevention

- Baseline risk status
  - Fall history
  - Level of functioning, particularly mobility
  - Age and bone mineral density

# Context of the older person

Table 7 **Absolute annual risk of osteoporotic fracture (%) for women with no other clinical risk factors**

Adapted from Tables 68–74 in Appendix 10 of the Strontium ranelate Assessment Report.

| | T-score | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Age band** | **–5** | **–4.5** | **–4** | **–3.5** | **–3** | **–2.5** | **–2** | **–1.5** | **–1** |
| 50–54 | 6.0 | 3.6 | 2.3 | 1.5 | 1.1 | 0.9 | 0.7 | 0.6 | 0.5 |
| 55–59 | 5.5 | 3.5 | 2.3 | 1.7 | 1.2 | 1.0 | 0.8 | 0.7 | 0.6 |
| 60–64 | 5.3 | 3.5 | 2.5 | 1.8 | 1.3 | 1.1 | 0.8 | 0.7 | 0.6 |
| 65–69 | 5.9 | 4.1 | 3.0 | 2.3 | 1.7 | 1.4 | 1.1 | 0.9 | 0.8 |
| 70–74 | 7.0 | 5.2 | 3.9 | 3.0 | 2.4 | 1.9 | 1.5 | 1.3 | 1.1 |
| 75–79 | 8.5 | 6.4 | 4.9 | 3.8 | 2.9 | 2.3 | 1.8 | 1.6 | 1.4 |
| 80–84 | 10.0 | 7.6 | 5.9 | 4.5 | 3.5 | 2.8 | 2.2 | 1.9 | 1.6 |

Fracture risk increases with increasing age and with worsening BMD (i.e. decreasing T-score). Table 7 shows that a 50-year-old woman with a T-score of –3.5 has a similar absolute fracture risk to an 80-year-old woman with a T-score of –1.

NICE: … prevention of osteoporotic fragility fractures … http://www.nice.org.uk/page.aspx?o=273891

# Conceptual issues in management for falls and fracture prevention

- Setting / location
  - Community
  - Institutional
    - Hospital
    - Residential Aged Care Facility

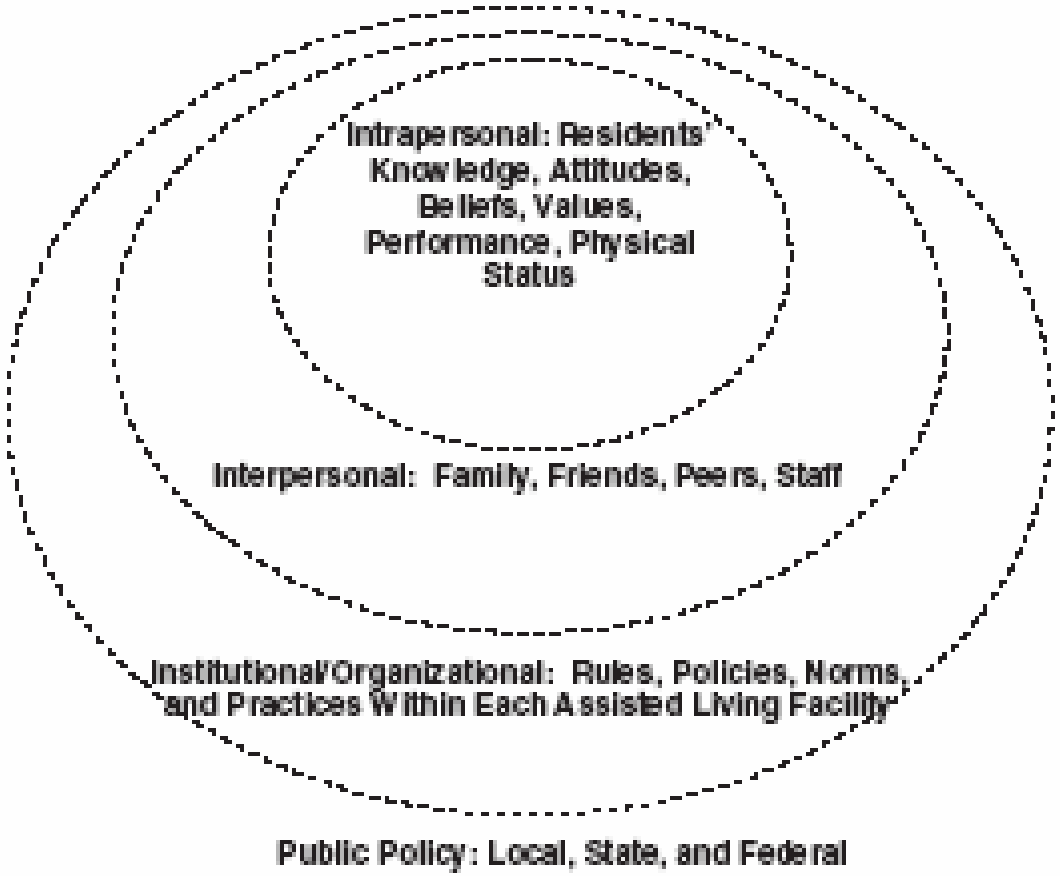



Figure 1. A social ecological model.

# The Social Ecological Model for falls prevention

Magaziner et al JAGS 2007;55:464–466

# Conceptual issues in management for prevention: falls and fractures

- Target – falls, fractures (**both usually**)

- Taxonomy of interventions
  - Single
  - Multiple
  - Multifactorial

# The evidence

# INTERVENTIONS FOR PREVENTING FALLS IN ELDERLY PEOPLE

Gillespie LD, Gillespie WJ, Robertson MC, Lamb SE, Cumming RG, Rowe BH

Date of most recent amendment: 15 July 2003
Date of most recent substantive amendment: 14 July 2003

This review should be cited as: Gillespie LD, Gillespie WJ, Robertson MC, Lamb SE, Cumming RG, Rowe BH. Interventions for preventing falls in elderly people (Cochrane Review). In: *The Cochrane Library*, Issue 3, 2004. Chichester, UK: John Wiley & Sons, Ltd.

## ABSTRACT

**Background**

Approximately 30 per cent of people over 65 years of age and living in the community fall each year; the number is higher in institutions. Although less than one fall in 10 results in a fracture, a fifth of fall incidents require medical attention.

**Objectives**

To assess the effects of interventions designed to reduce the incidence of falls in elderly people (living in the community, or in institutional or hospital care).

**Search Strategy**

We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2003), Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 1, 2003), MEDLINE (1966 to February 2003), EMBASE (1988 to 2003 Week 19), CINAHL (1982 to April 2003), The National Research Register, Issue 2, 2003, Current Controlled Trials (www.controlled-trials.com accessed 11 July 2003) and reference lists of articles. No language restrictions were applied. Further trials were identified by contact with researchers in the field.

**Selection Criteria**

Randomised trials of interventions designed to minimise the effect of, or exposure to, risk factors for falling in elderly people. Main outcomes of interest were the number of fallers, or falls. Trials reporting only intermediate outcomes were excluded.

**Data collection and analysis**

Two reviewers independently assessed trial quality and extracted data. Data were pooled using the fixed effect model where appropriate.

**Main Results**

Sixty two trials involving 21,668 people were included.

Interventions likely to be beneficial:

- Multidisciplinary, multifactorial, health/environmental risk factor screening/intervention programmes in the community both for an unselected population of older people (4 trials, 1651 participants, pooled RR 0.73, 95%CI 0.63 to 0.85), and for older people with a history of falling or selected because of known risk factors (5 trials, 1176 participants, pooled RR 0.86, 95%CI 0.76 to 0.98), and in residential care facilities (1 trial, 439 participants, cluster-adjusted incidence rate ratio 0.60, 95%CI 0.50 to 0.73)
- A programme of muscle strengthening and balance retraining, individually prescribed at home by a trained health professional (3 trials, 566 participants, pooled relative risk (RR) 0.80, 95% confidence interval (95%CI) 0.66 to 0.98)
- Home hazard assessment and modification that is professionally prescribed for older people with a history of falling (3 trials, 374 participants, RR 0.66, 95% CI 0.54 to 0.81)
- Withdrawal of psychotropic medication (1 trial, 93 participants, relative hazard 0.34, 95%CI 0.16 to 0.74)

# Classifying the evidence

- **Exercise / Physical Therapy interventions (23 studies)**

  Exercise / physical therapy alone versus control (UNTARGETED, COMMUNITY DWELLING) RR 0.89, 95%CI 0.78 to 1.01

  Exercise / physical therapy alone versus control (INDIVIDUALLY TARGETED, COMMUNITY DWELLING) RH 0.69 (95%CI 0.47 to 0.97)

- Home hazard modification (9 studies)

  Home safety intervention alone versus control (INDIVIDUALLY TARGETED INTERVENTIONS) RR 0.66, 95%CI 0.54 to 0.81 for prior fallers

- Cognitive/behavioural interventions (7 studies)

  No evidence that cognitive/behavioural interventions alone are effective in reducing the frequency of falls in elderly people

# Classifying the evidence

- Medication withdrawal/adjustment (2 studies)
  Falls reduced - RH 0.34, 95%CI 0.16 to 0.74

- Nutritional/vitamin supplementation (6 studies)
  Vit D in community RR 0.87, 95%CI 0.70 to 1.08

- **Multidisciplinary, multifactorial, health/environmental risk factor screening and intervention (21 studies)**

  Community dwelling, unselected (FALLERS AND NON-FALLERS IN THE POPULATION STUDIED) RR 0.73, 95%CI 0.63 to 0.85

  Community dwelling, targeted (POPULATION STUDIED ARE KNOWN FALLERS OR HAVE IDENTIFIED RISK FACTORS PRIOR TO ENROLMENT IRR 0.69, 95%CI 0.52 to 0.90

- Vision

- Cardiovascular

# The older person in the **community**: falls prevention

- Multifactorial strategies
- Exercise interventions
- Environmental interventions
- Psychotropics ↓
- Vision
- Cardiovascular disease
  - Postural hypotension
  - Pacing in syncope

## fracture prevention

- As above
- Treatment of osteoporosis (bisphosphonate, Ca and Vitamin D)

## Table 1. Targeted Risk Factors and Corresponding Interventions.

| Risk Factor | Intervention |
|---|---|
| **Assessed by a nurse** | |
| Postural hypotension: drop in systolic blood pressure ≥20 mm Hg or to <90 mm Hg on standing | Behavioral recommendations, such as ankle pumps or hand clenching and elevation of head of bed; decrease in dosage, discontinuation, or substitution for medications that may contribute to hypotension* |
| Use of any benzodiazepine or other sedative–hypnotic agent | Education about the appropriate use of sedative–hypnotic agents; nonpharmacologic treatment of sleep problems, such as sleep restriction; tapering and discontinuation of medications* |
| Use of ≥4 prescription medications | Review of medications with primary physician* |
| Inability to transfer safely to bathtub or toilet | Training in transfer skills; environmental alterations, such as grab bars or raised toilet seats |
| Environmental hazards for falls or tripping | Appropriate changes, such as removal of hazards, safer furniture (correct height, more stable), installation of structures such as grab bars or handrails on stairs |
| **Assessed by a physical therapist** | |
| Any impairment in gait | Gait training; use of an appropriate assistive device; balance or strengthening exercises if indicated† |
| Any impairment in transfer skills or balance | Balance exercises; training in transfer skills if indicated; environmental alterations† |
| Impairment in leg or arm muscle strength or range of motion (hip, ankle, knee, shoulder, hand, elbow)‡ | Exercises with resistive bands and putty; resistance was increased when the subject was able to complete 10 repetitions through the full range of motion† |

*The primary physician made the final decision on adjustments in medication.

†Balance exercises included the performance of four levels of progressively more destabilizing maneuvers with decreasing amounts of support. Subjects were instructed to perform resistive and balance exercises twice daily for 15 to 20 minutes.

‡Listed in descending order of priority. Subjects underwent no more than three programs to improve balance or of individual resistive exercise.

Tinetti NEJM 1994

# The older person in the **residential aged care facility**: falls prevention

- Multifactorial strategies
- Vitamin D

# The older person in the hospital: falls prevention

- Multifactorial strategies

# Caution with interpretation:

## falls prevention in nursing care facilities and hospitals

Clinicians will need to apply the available evidence in the context of the institutional setting, local policies and guidelines, and available resources. Key interventions are those that are cornerstones of appropriate care for elderly people. These include adequate supervision, encouragement of supervised mobility and exercise, individually prescribed aids, a safe institutional environment, avoidance of psychotropic drugs where possible, and recognition of changes in health status that predispose to falls, such as delirium. The combination of these can be considered a multifactorial intervention. Researchers should use the available

"Inconclusive evidence means uncertainty remains"

BMJ 2007;334:53

Lack of evidence of effect ≠ Evidence of lack of effect

# Guidelines

- American Geriatrics Society (AGS) / BGS Guideline for falls prevention 2001 – in revision
- Presented at 2006 AGS Meeting – still not published
- "No major changes, but some new elements to assessment"

http://www.medscape.com/viewarticle/532942

American Geriatric Society, British Geriatrics Society, American Academy of Orthopaedic Surgeons. Guideline for the prevention of falls in older persons. J Am Geriatr Soc. 2001;49:664-672. Available from: www.americangeriatrics.org/products/positionpapers/Falls.pdf

# Guidelines

- SIGN 56 – Prevention and Management of Hip Fracture
  - Assess falls risk, assess BMD if feasible
  - Ca, Vit D
  - Bisphosphonates
  - Consider hip protectors

Scottish Intercollegiate Guidelines Network. Prevention and Management of Hip Fracture in Older People. SIGN Publication No. 56, 2002. ISBN 1899893 72 5. Available from: http://www.sign.ac.uk/guidelines/fulltext/56/

# How could a falls rehabilitation program operate?

- Multidisciplinary / interdisciplinary approach
- Target high risk people
- Brief specific risk assessment
- Coordinated individualised interventions, as a group sometimes
- Access to wide variety of interventions – in health system and outside health system
- Mechanism for follow-up and review

# A falls rehabilitation program: implementing the evidence

- Program components
  - Common educational elements, with addition of targeted options
  - Screening, then refer to directly for intervention
  - Review
  - Follow-up

# Available interventions

- Muscle strengthening
- Gait or balance training
- Modify medications
- Recognise / treat illness (stroke, Parkinson's Disease, dementia)
- Improve vision
- Treat foot problems / footwear issues
- Improve layout of home / institutional environment
- Use assistive devices
- Suggest fracture prevention interventions
- Provide support services, etc

# How to organise the falls prevention / rehabilitation service

- Embedded model
  - Falls ‘coordinator’ / specialist
  - A routine component of the aged care service (ie part of the expected service standard)
- Specialised service model
  - Falls and fracture clinic / program