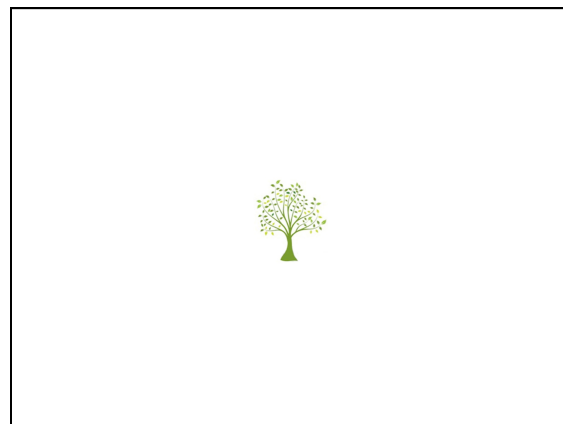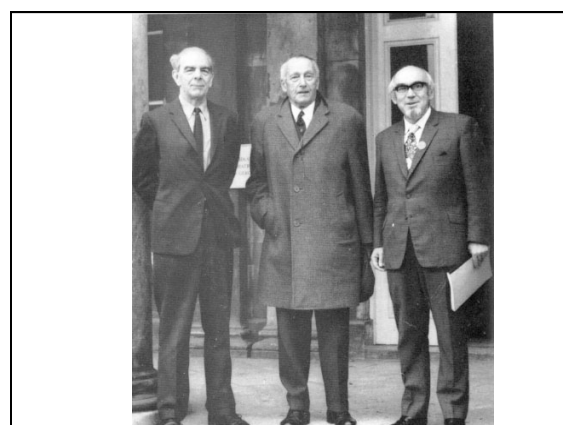# Modern concepts and models for fall prevention

A. John Campbell

University of Otago Medical School
New Zealand

Observation – clinical, epidemiological and trials

Recognition of complex age related conditions

"The liability of old people to tumble and often to injure themselves is such a commonplace of experience that it has been tacitly accepted as an inevitable aspect of ageing, and deprived of the exercise of curiosity"

J H Sheldon. On the natural history of falls in old age. BMJ 1960; II: 1685 - 90

Recognition of complex age related conditions

It will not be much good looking up "Incontinence" in the text books, because they are written by people who do not have a problem with it."

J L Newman. Old folk in wet beds.
BMJ 1962; I: 1824 - 7

Natural history of 500 falls

"The environment contributed a quota to the causation of 224 falls, whereas the cause lay within the old person in the remaining 276, though effective separation is difficult"
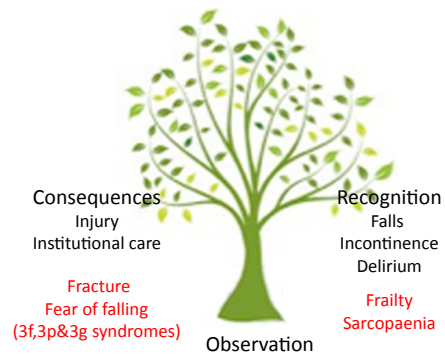
Sheldon JH BMJ 1960; ii: 1685 - 90

Natural history of 500 falls

- Accidental   171
- Drop attacks   125
- Trips   53
- Vertigo   37
- CNS lesion   27
- Head back   20
- Postural hypotension   18
- Weakness in leg   16
- Falling out of bed   10
- Uncertain   23

Changed models

- Interacting multiple causes
- Predisposition and precipitation
- "..evidence suggests that this defect is central and that possible peripheral effects, such as muscular wasting or sensory defect, are unlikely to play more than an adjuvant role.."
- Existence of "drop attacks"

Consequences
Injury
Institutional care

Fracture
Fear of falling
(3f,3p&3g syndromes)

Recognition
Falls
Incontinence
Delirium

Frailty
Sarcopaenia

Observation

Essentials for growth

- Observation
- Risk factor identification
- Pathophysiological / psychosocial basis
- Hypothesis driven
- Agreed terminology, approach and analysis
  - ProFaNE

Risk factors
Predictive
Causative

Consequences

Recognition

Observation
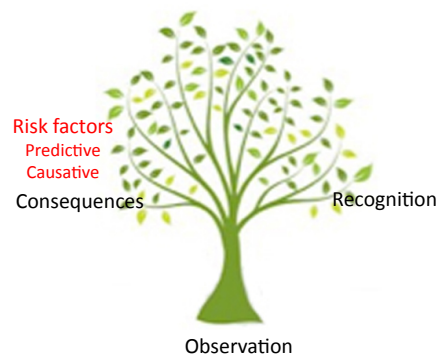
Predictive RFs - Longitudinal Aging Study Amsterdam

- Two or more previous falls
- Dizziness
- Functional limitation
- Weak grip strength
- Low body weight
- Fear of falling
    Osteoporos Int 2006;17:417-25

© University of Otago 2010

Longitudinal Aging Study Amsterdam

- Dogs/cats in household
- High educational level
- 18 or more units alcohol per week
- High education x 18 units alcohol
- Two or more falls x fear of falling

    – Osteoporos Int 2006;17:417-25

© University of Otago 2010

Predictive value

- Cut off 5 on total risk score (0-30)
    - Sensitivity of 59%
    - Specificity of 71%
- Cut off 10 on total risk score (0-30)
    - Sensitivity of 31%
    - Specificity of 92%

© University of Otago 2010

Causative risk factors

- Any fall compared no fall
- No or one fall compared two or more
- Indoor or outdoor fall compared no fall
    - MOBILIZE Boston study
    - Kelsey et al J Am Geriatr Soc 2010

© University of Otago 2010

Site of fall - outdoor

- Younger
- Male
- Better educated
- White
- Characteristics indicative of better health

© University of Otago 2010

Site of fall - indoor

- More physical disabilities
- More medications
- More psychotropic medications
- Lower cognitive function
- More previous falls
- Low score on FES

© University of Otago 2010

Causative risk factors

- Any fall compared no fall
- No or one fall compared two or more
- Indoor or outdoor fall compared no fall
- Major external / internal single or multiple
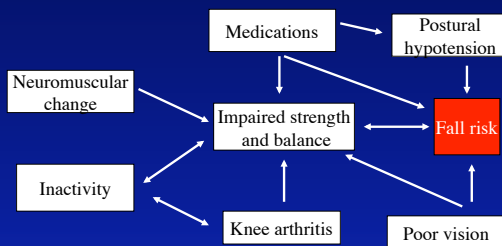
Cause of falls

- Total falls   507
- Single external cause   84
- Single internal cause   88
  - Syncope   23
  - Psychotropic drugs   27
  - Neurological disease   38
- Multiple internal causes   335

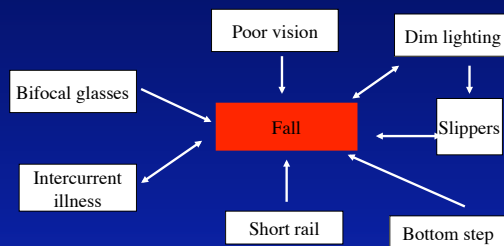Campbell AJ *et al.* J Gerontol: Med Sci 1989;44:M112-7

Fall risk - predisposition

Medications → Postural hypotension

Neuromuscular change

Impaired strength and balance → Fall risk

Inactivity

Knee arthritis

Poor vision

Elderly woman in winter living alone in unsafe home

Fall risk - precipitation

Poor vision   Dim lighting

Bifocal glasses

Fall

Slippers

Intercurrent illness

Short rail   Bottom step

Elderly woman in winter living alone in unsafe home

Fall analysis

- Type of fall
  - basic
  - extended
  - extreme
    - Isaacs B Clin Geriatr Med 1985;1:513-24
- Causative risk factors
- Reasons for loss of function

Reasons for loss of function

- Change due to age
- Lifestyle and inactivity
- Disease processes
- Therapeutic interventions
- Personal environment
- Socioeconomic factors
- External environment

Impaired vision

- Age
- Lifestyle
- Disease
- Therapeutic
- Personal environment
- Socioeconomic
- External environment

- Lens & dark/light
- Smoking & ARMD
- Glaucoma
- Multifocal glasses
- Poor lighting & clutter
- Vision assessment, new glasses, lighting
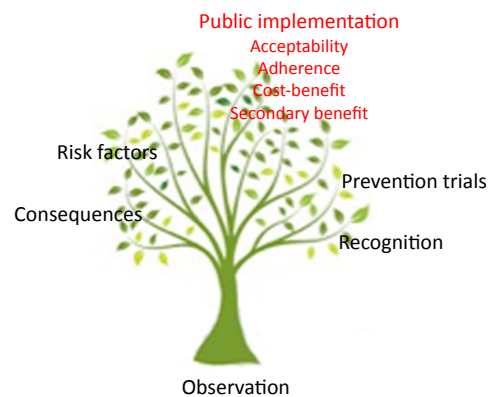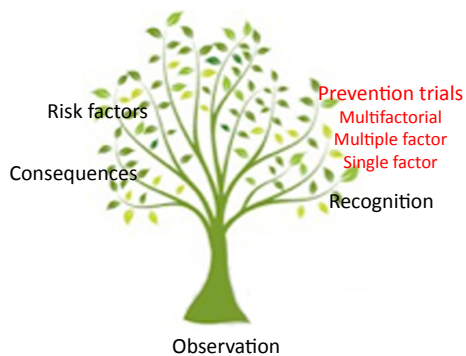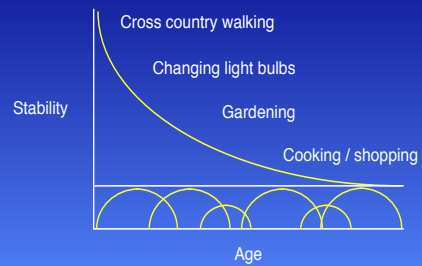- Pavements, health funding

Strength and balance

- Age
- Lifestyle
- Disease
- Therapeutic
- Own environment
- Socioeconomic
- External environment

- Muscle & response
- Inactivity, obesity
- Osteoarthritis knees
- Steroids, sedatives
- Stairs, hazards
- Nutrition, transport, heating
- Temperature, vitamin D

Risk factor research growth

- Racial differences – falls and injury
- Sex differences in the cause of falls
- Social interaction and isolation
- Alcohol and the U shaped relationship
- New drugs and new usages for old drugs
- Functional loss and fall threshold

© University of Otago 2010

Stability and Fall Threshold

Cross country walking

Changing light bulbs

Stability

Gardening

Cooking / shopping

Age

Risk factors

Consequences

Prevention trials
Multifactorial
Multiple factor
Single factor

Recognition

Observation

Public implementation
Acceptability
Adherence
Cost-benefit
Secondary benefit

Risk factors

Consequences

Prevention trials

Recognition

Observation

Risk factors

- Intervene with causative risk factors
- Target with predictive risk factors
- Identify falls that are significant

© University of Otago 2010

Falls that count

- Falls at basic and extended activities
- Falls that occur during daily activities
- Falls as part of a downward spiral – physical and social
- Falls with loss of consciousness or no clear recall
- Falls with injury, a long lie, loss of confidence

© University of Otago 2010

Risk factors

- Intervene with causative risk factors
- Target with predictive risk factors
- Identify falls that are significant
- Identify any dominant or final common pathway risk factor

© University of Otago 2010

Dominant or final pathway

- Remediable and common (poor S & B)
  - community programmes
  - improve function above threshold
- Remediable and uncommon (syncope)
  - identify and individual treatment
- Irremediable (dementia, ARMD)
  - advice to patient and carers
  - ensure a safe environment

© University of Otago 2010

Key points

- Clinical observation should stimulate curiosity
- Observational research should be based on a clear pathophysiological / psychosocial hypothesis
- Risk factors are multiple and interactive but some risk factors are dominant
- Interventions have taught us that we are treating people not risk factors

© University of Otago 2010