


Prevention and Management of Falls

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Summary of session

- The size of the problem
- The risk factors
- The Interventions
- (New CMO Physical Activity Guidelines)
- Adherence to interventions
- Presentation will be available on www.profane.co



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Falls in the UK

- 11 million people aged > 65 yrs
 - Currently 1 in 6, by 2030 1 in 4
- 28,000 women aged > 90 yrs
- Fractures costs £1.8 billion pa
- 1 Hip Fracture every 10 mins
- 1 Wrist Fracture every 9 mins
- 1 Spine Fracture every 3 mins
- 500 admitted to Hospital every day
- 33 never go home

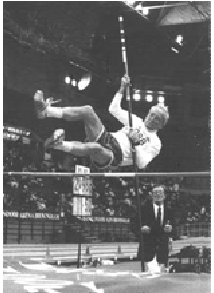


Annual European Home and Leisure Accident Surveillance Survey (EHLASS) Report UK 2000

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How common are falls?

- In > 75s, falls are the leading cause of death resulting from injury
- 1 in 3 >65's increasing to 1 in 2 >80's fall annually. Higher percentages of nursing care residents.
- 10% of all call-outs for UK Ambulance Service are for people aged 65+ who have 'fallen' but nearly half are not taken to Hospital.
- 75-80% of falls are not reported




Skelton & Todd, WHO 2004; Gillespie et al. 2009

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Cost to the Individual

- **Injuries include:**
 - Cuts and lacerations,
 - Deep bruises, Soft Tissue Injuries,
 - Dislocations, Sprains
 - Increase in joint pain
- Less than 10% of falls result in a fracture
- Long lie's & complications
- Depression, fear of falling
- Avoidance of activities and social isolation



Skelton & Todd, WHO 2004; DoH Prevention Package 2009; Gillespie 2009

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When do we become "fallers" instead of "trippers"?



When intrinsic abilities to remain upright cannot cope with extrinsic risk factors

Nervous system, reaction times and gait speed slows

Balance and strength deteriorates

Fracture site changes with age, wrist fractures more common in younger people, hip fractures more common in older people

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3 Dimensions of Human Frailty

HUMAN FRAILTY

TIME

DISEASE

DISUSE

Spiriduso W, 1995

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Sedentary Behaviour = Active bone and strength loss

- No standing activity leads to active loss of bone and muscle
 - 1 week bed rest ↓ leg strength by ~ 20%
 - 1 week bed rest ↓ spine BMD by ~1%
- Sedentary behaviour = worse balance
- Nursing home residents spend 80-90% of their time seated or lying down

Krolner 1983; Tinetti 1988; Skelton 2001; Dallas Bed Rest Studies 1966-present; Beyer 2002

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Making activity choices.....

- >3 hrs per week targeted exercise
 - Osteoporosis - 2 x less likely
 - Hip fracture - 2 x less likely
- Also reduces risk of high blood pressure, obesity, stroke and diabetes and improves quality of life with medical conditions
- >3 hrs per week on your feet
 - Reduced risk of falls and fractures
- Active people are more likely to have better mood, be less anxious, have better memory, sleep better and have more social contacts

ACSM 2007; CDC 1996, 2002; Sesso 2000; Nicholl 1994; WHO 1997; NIA 1998; BHF 2010.

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Risk factors for falls

- Identified from variable quality epidemiological studies; n=200 risk factors!
- Recent systematic review
 - Original Studies on risk factors for fall
 - At least 80% of the sample aged 65 years or older.
 - Prospective study design.
 - Sample size greater than 200 subjects.
 - At least 80% of subjects living in the community.
 - Number of subjects experiencing one or more falls during follow-up as an outcome.
- N=74 studies, mean age 75, risk factor analysis performed on 31 risk factors studied in at least 5 different studies

Deandrea S et al. Epidemiology. 2010;21: 658-668.

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Major risk factors

	All fallers (Odds Ratio)	Recurrent Fallers (Odds Ratio)
History of Falls	2.8	3.5
Gait Problems	2.1	2.2
Walking Aids Use	2.2	3.1
Vertigo	1.8	2.3
Parkinson's Disease	2.7	2.8
Antiepileptic Drug Use	1.9	2.7
Physical Disability	1.6	2.4
Disability in Instrumental Activities in Daily Life	1.5	2.0
Fear of Falling	1.6	2.5

All fallers = fell at least once during follow up
 Recurrent fallers = fell at least twice during follow up

Deandrea S et al. Epidemiology. 2010;21: 658-668.

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But...

- For some important factors (eg, balance and muscle weakness), Deandrea could not compute a summary estimate because the measures used in various studies were not comparable.
- ORs were generally higher for recurrent fallers than for all fallers.
- For some factors, there was substantial heterogeneity among studies.

Deandrea S et al. Epidemiology. 2010;21: 658-668.

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Other identified risk factors

- Prescribed medications / multiple drug regimes
 - Analgesics- Antidepressants
 - Sedatives - Antipsychotics
 - Diuretics - ANY 4 OR MORE MEDICATIONS
- Alcohol (>7 units per week)
- Poor foot health and foot pain
- Poor vision (acuity, contrast, depth perception)
- Multiple conditions and co-morbidities (esp. Stroke, PD, dementias)
- Continence (urge, frequency, overactive bladder, nocturia)
- Environment

Skelton & Todd 2004; NICE 2004; ABS BGS 2010

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Fear of Falling

- Fear and lack of confidence in balance predict
 - Deterioration in physical functioning (Arfken 1994, Vellas 1997)
 - Decreases in physical activity, indoor and outdoor (Arfken 1994, Finch 1997)
 - Increase in fractures (Arfken 1994)
 - Admission to Institutional Care (Cumming 2000, Vellas 1997)



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Interventions in the community



- Update of 2009 review
- 159 trials with 79,193 participants
- most common interventions tested
 - exercise as a single intervention (59 trials)
 - Multi-factorial programmes (40 trials)

Conclusions:

- Group and home-based **exercise programmes**, and **home safety interventions** delivered by an occupational therapist reduce **rate of falls and risk of falling**.
- **Multi-factorial** assessment and **intervention** programmes reduce **rate of falls** but not risk of falling;
- **Tai Chi** reduces **risk of falling**.
- Insufficient evidence that interventions designed to prevent falls will also prevent hip or other fall-associated fractures.

Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

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Exercise interventions

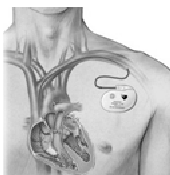
- **Multiple-component group exercise** significantly reduced rate of falls (RaR 0.71; 16 trials) and risk of falling (RR 0.85; 22 trials)
- **Multiple-component home-based exercise** (RaR 0.68; 7 trials; and RR 0.78; 6 trials).
- Multiple-component **exercise** (balance and strength training) **embedded in activities of daily living** in people with a history of falls significantly reduced rate of falls (RaR 0.21; 1 trial) but not risk of falling.
- **Tai Chi**, the reduction in rate of falls bordered on statistical significance (RaR 0.72; 5 trials) but Tai Chi did significantly reduce risk of falling (RR 0.71; 6 trials).

Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

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Home Safety & Pacemakers

- Home safety interventions when delivered by an occupational therapist reduced rate of falls (RaR 0.69; 4 trials) and risk of falling (RR 0.79; 5 trials).
- Pacemakers reduced rate of falls in people with carotid sinus hypersensitivity (RaR 0.73; 3 trials) but not risk of falling.



Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

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Multi-factorial & Vit D

- Multi-factorial interventions, which include individual risk assessment, **reduced rate of falls** (RaR 0.76; 19 trials), but **not** risk of falling (RR 0.93; 34 trials).
- Overall, vitamin D did not reduce rate of falls (RaR 1.00; 7 trials) or risk of falling (RR 0.96; 13 trials), **but may do so** in people with lower vitamin D levels.



Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

Vision



- An intervention to treat vision problems resulted in a significant **increase** in the rate of falls (RaR 1.57) and risk of falling (RR 1.54).
- Regular wearers of multifocal glasses given single lens glasses, **all falls and outside falls were significantly reduced** in the subgroup that regularly took part in outside activities. BUT there was a **significant increase in outside falls** in those who took part in little outside activity.
- **First** eye cataract surgery in women **reduced rate of falls** (RaR 0.66; 1 trial), but second eye cataract surgery did not.

Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

CBT & Medication Withdrawal

- There is **no evidence** that cognitive behavioural interventions reduced the rate of falls (RaR 1.00; 1 trial) or risk of falling (RR 1.11; 2 trials).
- Gradual withdrawal of psychotropic medication **reduced rate of falls** (RaR 0.34; 1 trial), but not risk of falling.
- A prescribing modification programme for primary care physicians **significantly reduced risk of falling** (RR 0.61; 1 trial).



Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

Feet



- An anti-slip shoe device **reduced rate of falls in icy conditions** (RaR 0.42; 1 trial).
- One trial comparing multifaceted podiatry including foot and ankle exercises with standard podiatry in people with disabling foot pain **significantly reduced the rate of falls** (RaR 0.64) but not the risk of falling.

Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

Education

- Trials testing interventions to increase knowledge/educate about fall prevention alone **did not significantly reduce the rate of falls** (RaR 0.33; 1 trial) or **risk of falling** (RR 0.88; 4 trials).



Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

Different costs to interventions

Davis 2010

Intervention type	Intervention Components	Delivered by	High risk Cost analysis per fall prevented	Low risk or unspecified risk Cost analysis per fall prevented
Individualised multi-factorial interventions (1 study)	Assessment, education, behaviour modification, medication	Multi-disciplinary	Total health care costs per fall prevented - in those at high risk* Cost saving*	Total health care costs per fall prevented - in those at low risk* EUK 2636*
Same multiple risk factors targeted to all participants (1 study)	Falls related knowledge, attitude, behaviours, and risk factor awareness campaign	Multi-disciplinary	-	Net monetary benefit to cost ratio for the intervention of 20.6 to 1*
Single Factor interventions (7 studies)	Strength and balance training	Physiotherapists and Nurse trainers delivery of exercise	For those aged 85 years or older Cost saving*	Main cost EUK 173 in research setting* EUK 542 in community health care setting*
Home Safety and modification (3 studies)	Occupational Therapist	Occupational Therapist	In visually impaired older people, cost EUK 304*	-
		Occupational Therapist	In those recently discharged from hospital (fall in last year) Cost saving*	In those recently discharged from hospital (no fall in last year) EUK 304*
		Occupational Therapist	Hypothetical cost modelling EUK 1052**	-
Cataract Removal (1 study)	Ophthalmic surgeon	Base case one year incremental cost effectiveness ratio EUK 473*	-	

Cost effectiveness?


- There is some evidence that a home-based exercise programme **can be cost saving within one year** in over 80's and group exercise is cost effective for over 65's.
- similarly home safety assessment and modification in those with a previous fall,
- and one multi-factorial programme targeting eight specific risk factors.



Gillespie et al. Interventions for preventing falls in older people living in the community. Cochrane Library 2012

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Interventions in nursing care and hospitals



- 41 trials with 25,422 participants
- Nursing care facilities
 - 7 trials testing supervised exercise interventions were **inconsistent**.
 - multi-factorial interventions, overall **did not** significantly reduce the rate of falls or risk of falling unless provided by a multidisciplinary team, then **reduced rate of falls** (RaR 0.60; 4 trials) and **risk of falling** (RR 0.85; 5 trials).
 - vitamin D supplementation **reduced the rate of falls** (RaR 0.72; 4 trials), but not risk of falling (RR 0.98; 5 trials).



Cameron et al. Interventions for preventing falls in older people in nursing care facilities and hospitals. Cochrane Library 2010

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Interventions in nursing care and hospitals

- In hospitals
 - multifactorial interventions **reduced the rate of falls** (RaR 0.69; 4 trials) and **risk of falling** (RR 0.73; 3 trials).
 - Supervised exercise interventions showed a **significant reduction in risk of falling** (RR 0.44; 3 trials).



Cameron et al. Interventions for preventing falls in older people in nursing care facilities and hospitals. Cochrane Library 2010

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Summary of interventions


- **multi-factorial interventions**
 - In the community, reduce rate of falls but not risk of falling
 - In hospitals, they reduce rate of falls and risk of falling and may do so in nursing care facilities
- **group and home-based exercise programmes**, delivered by trained professionals
 - In the community, reduce rate of falls and risk of falling, and Tai Chi reduces risk of falling
 - In sub-acute hospital settings appears effective but its effectiveness in nursing care facilities remains uncertain
- **home safety interventions delivered by an occupational therapist**
 - In the community, reduce rate of falls and risk of falling
- **vitamin D supplementation**
 - In nursing care facilities, reduce the rate of falls

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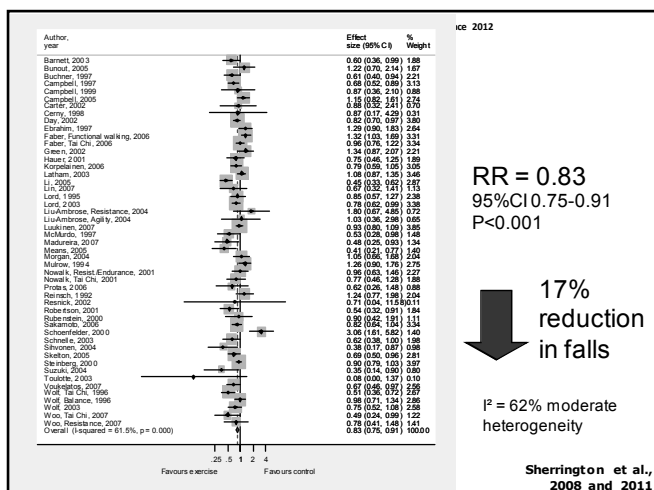
Exercise to Prevent Falls

Exercise **could** help fallers in a number of ways:

- Reducing Falls (or injurious falls)
- Reducing known Risk Factors for
- Reducing "long-lies" on the floor
- Reducing Fractures? (or changing of fracture)
- Increasing Quality of Life & Social
- Improving bone density
- Reducing Fear
- Reducing Institutionalisation




Skelton & Dinan 1999; Campbell 2007; Sherrington et al 2008, 2011; DoH Prevention Package 2009; Davis 2010;



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What makes the difference?


- Greatest effects of exercise on fall rates from interventions including:
 - Highly challenging balance training
 - High dose (50+ hours)
 - No walking program
- These 3 factors explained 68% of variance




Sherrington et al., JAGS 2008, NSWPHB 2011

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Highly challenging Balance Training



- Exercise in standing involving:
 - movement of the centre of mass
 - narrowing of the base of support
 - minimising upper limb support

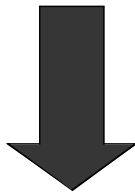


24%
(95%CI=0.62 to 0.93)
73 studies

Sherrington, 2011

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++ Balance, high dose and NO walking



If include studies with a walking programme as well as ++ balance and high dose then the reduction in risk of falls is more modest = 21% (95% CI = 11 to 30%), 14 studies


38%
(95%CI = 27 to 46%)
8 studies

Sherrington, 2011

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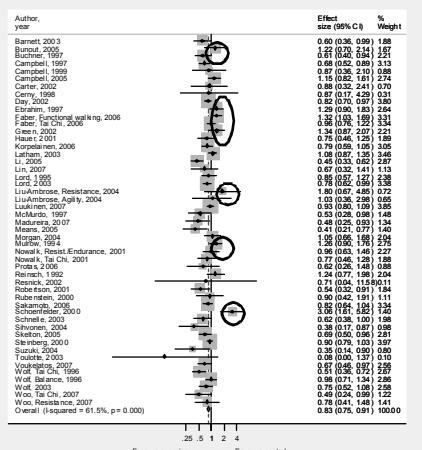
Does all exercise reduce risk?

- BUT.....Did any exercise programmes increase risk??**



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Hidden perils



Author, year	Effect size (95% CI)	Weight
Barnett 2003	0.60 (0.38, 0.99)	1.88
Burout 2000	1.22 (0.20, 2.14)	1.67
Bushnell 1997	0.68 (0.32, 0.89)	3.13
Campbell 1999	0.87 (0.38, 1.37)	2.98
Campbell 2005	1.18 (0.60, 1.71)	2.74
Carrier 2002	0.48 (0.32, 2.41)	0.70
Carry 1998	0.81 (0.17, 1.45)	0.21
Day 2002	0.52 (0.70, 0.97)	3.80
Ebrahim 1997	1.28 (0.90, 1.83)	2.64
Faber, Functional walking, 2006	1.32 (1.02, 1.69)	3.31
Faber, Tai Chi, 2006	1.34 (0.67, 2.07)	2.21
Geelen 2002	0.75 (0.46, 1.05)	1.69
Hewitt 2001	0.45 (0.33, 0.62)	2.97
Korpelainen 2006	0.79 (0.69, 1.05)	3.06
Latham 2003	1.08 (0.87, 1.35)	3.69
Li 2006	0.45 (0.33, 0.62)	2.97
Li 2007	0.47 (0.32, 1.41)	1.13
Lord 1995	0.56 (0.42, 0.73)	3.38
Li/Ambrose, Resistance, 2004	1.60 (0.67, 2.66)	0.72
Li/Ambrose, Agility, 2004	1.03 (0.38, 1.68)	0.65
Liu 2006	0.31 (0.01, 0.61)	3.26
McMurdo 1997	0.53 (0.28, 0.88)	1.48
Maurtua 2007	0.41 (0.21, 0.77)	1.40
Means 2006	1.58 (0.99, 2.17)	1.24
Mulrow 1994	1.26 (0.50, 1.76)	2.75
Nesherk, Resist, Endurance, 2001	0.98 (0.63, 1.48)	2.27
Nesherk, Tai Chi, 2001	0.77 (0.48, 1.08)	1.88
Probst 2006	0.65 (0.28, 1.08)	0.88
Reinach 1992	1.24 (0.77, 1.88)	2.04
Reynolds 2002	0.71 (0.04, 1.18)	0.11
Robinson 2000	0.64 (0.32, 0.91)	1.84
Sakuma 2006	0.62 (0.41, 0.83)	3.26
Schoenmaker 2010	0.62 (0.38, 0.89)	1.88
Schneid 2003	0.38 (0.17, 0.57)	0.88
Sherrington 2004	0.28 (0.10, 0.56)	2.81
Sherrington 2009	0.90 (0.79, 1.03)	3.97
Stank 2004	0.38 (0.14, 0.69)	0.88
Toulot 2003	0.68 (0.00, 1.37)	0.10
Vosper 2007	0.51 (0.38, 0.72)	2.97
Walt Tai Chi 1996	0.98 (0.71, 1.34)	2.98
Walt Balance 1996	0.76 (0.52, 1.08)	2.58
Woo 2003	0.46 (0.24, 0.69)	1.22
Woo, Tai Chi, 2007	0.78 (0.41, 1.48)	1.41
Woo, Resistance, 2007	0.78 (0.41, 1.48)	1.41
Overall (I-squared = 61.5%, p = 0.000)	0.63 (0.36, 0.91)	100.00

Sherrington et al., JAGS 2008, 2011

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Some exercise can increase falls and fractures...

- Women, upper arm fracture seen in fracture clinic
- Intervention: Brisk walking
- Control: exercise of upper arm
- Falls risk (Brisk walking > control)
- Fractures (>in brisk walking group)
- Repeated in 3 other trials now!
- Relative risk of falls 1.2



Ebrahim et al. (1997); Sherrington et al. (2011)

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Frailty & Exercise

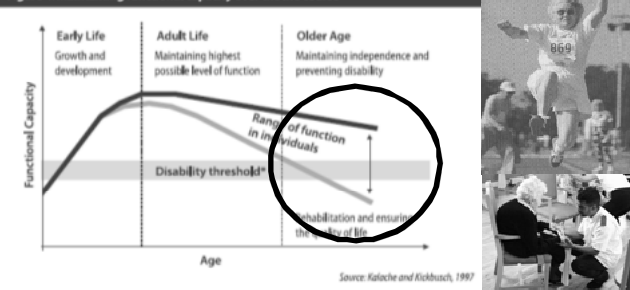
Too confident too soon?

- Frailty index applied to participants in an exercise programme.
 - Those considered frail had RR 2.95 (95% CI 1.64 to 5.32 for a fall compared to those considered pre-frail who decreased risk of falls RR 0.39 (95% CI 0.18 to 0.88)
- Three trials have reported more falls in the intervention groups DURING the intervention.
 - There is a risk of a persons confidence increasing before they have improved balance and strength to cope with increased exposure to risk
 - In Stroke patients, practicing sit to stand manoeuvre without then training gait and mobility, increased falls....

Faber 2006; Mulrow 1994, Barreca 2004, Kerse 2004

Wide range of abilities and needs

Figure 4. Maintaining functional capacity over the life course



Unipedal standing for the oldest?

- RCT, n= 94 postmenopausal women
 - Control vs Exercise
 - Exercise – 6 months, single leg stand for 1 min per leg 3 x per day
 - Those aged ≥ 70 years (n=31) had **significant increase in hip BMD**
 - Those aged < 70 did not
 - Suggesting different exercise for different aged populations?



J Bone Min Metab 2009 - Sakai et al

Falls exercise in the UK

- Otago Home Exercise Programme (OEP)
 - 1 yr; 3 x p/w; standing strength and balance; graded walking programme; 6 home visits (physiotherapist, nurse) to progress and tailor exercise but otherwise unsupervised
 - 6 mths; 3 x p/w (1 p/w group, 2 p/w home) exercise instructor
- Falls Management Exercise Programme (FaME/PSI)
 - 9 mths; 3 x p/w (one group, two home); standing strength and balance plus floorwork; specialist exercise instructor to progress and tailor exercise

Falls Injuries
Cost effective >80s
Cost neutral >65s

Cognitive Function

Falls
Quality of Life
Bone Mineral Density
Change of residence
Coping strategies
Long lies

Campbell 1997; Robertson 2001; Campbell 2005; Liu_Ambrose 2008; Skelton 2005, 2008

New CMO Guidelines for Older adults (Start Active, Stay Active 2011)

- Older adults should **aim to be active daily**. Over a week, activity should add up to **at least 150 minutes** of moderate intensity activity in **bouts of 10 minutes or more**.
- Older adults should **also** undertake physical activity to improve muscle **strength** on at least **two** days a week.
- Older adults at risk of falls should incorporate physical activity to **improve balance and co-ordination** on at least **two** days a week.
- All older adults should **minimise** the amount of **time spent being sedentary** (sitting) for extended periods.



40

Uptake and Adherence?

We have a strong evidence base. Now we have to understand more about what encourages people to take up and adhere to these interventions

- Using median rates for recruitment (50%), attrition (15%) and adherence (80%), by 12 months, it is estimated that on average only **one third** of nursing care facility residents will adhere to falls prevention interventions ¹.
- Using median rates for recruitment (70%), attrition (10%) and adherence (80%), by 12 months, it is estimated that on average **half** of community-dwelling older people will adhere to falls prevention interventions ².

1. Nyman SR, Victor CR. Age Ageing. 2011;40(4):430-6.
2. Nyman SR, Victor CR. Age Ageing. 2012;41(1):16-23.

Conclusions

- Falls are preventable
- Strength and balance exercise targets bone health and falls prevention
- Those with osteoporosis are at far more risk following a fall
- Important that those working with bone health consider falls prevention
- Important that those working with falls prevention consider bone health
- Our challenge now is to encourage older people to uptake and adhere to interventions

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If you are interested in finding out more about Active Ageing research into benefits, barriers, tips for practice and implementation, visit us in Glasgow!



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