

EVIDENCE TABLES
ASSOCIATED WITH INTERVENTION RECOMMENDATIONS AND COMMENTS
IN
“THE PREVENTION OF FALLS IN OLDER PERSONS”
MAY 2001

Interventions:

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Abbreviation Glossary:

ADL	Activities of Daily Living
BMI	Body Mass Index
HCFA	Health Care Financing Administration
IADL	Instrumental Activities of Daily Living
LTC	Long Term Care
MMSE	Mini-Mental State Examination
RCT	Randomized Controlled Trial
SD	Standard Deviation

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors and Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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Psychotropic medication withdrawal and a home-based exercise program to prevent falls: a randomized controlled trial

<i>MULTIFACTORIAL</i>							
Campbell AJ et al 1999 J Am Geriatr Soc REFERENCE 36	Community	<p>N = 93</p> <p>n = 24 med w/d* + exercise (mean age, 75.6, SD 7.3)</p> <p>n = 24 med w/d + no exercise (mean age 74.6, SD 5.5)</p> <p>n = 21 orig med** + exercise (mean age 73.1, SD 6.3)</p> <p>n = 24 orig med + no exercise (mean age 75.2, SD 5.6)</p> <p>Women and men aged 65 and older</p> <p>44 weeks follow up</p> <p>*medication withdrawal **original medication</p>	RCT 2x2 factorial design	<p>Risk factors: Demographic data Falls history Psychotropic medication use Mental status Muscle strength Balance Endurance</p> <p>Outcomes: Falls</p>	<p>Home visit to complete baseline assessment</p> <p>Interventions included Psychotropic drug withdrawal and/or Strength and balance retraining exercise</p> <p>Fall data collected from monthly postcards</p>	<p>Falls: 57 falls at 44 weeks</p> <p>% of fallers in each group: 30% = med withdrawal 70% = orig. med continued 39% = exercise group 61% = no exercise 51% = orig. med/no exercise</p> <p>No interaction effect was found between the two interventions.</p> <p>The withdrawal of psychotropic medication significantly reduced the risk of falling (66%)</p> <p>The exercise program reduced falling to the same degree shown in the meta-analysis of FICSIT</p> <p>Permanent withdrawal is very difficult to achieve - additional work is needed on the most effective way of supporting people coming off these medications.</p>	<p><i>In community dwelling older persons, withdrawal of psychotropic medication combined with a home-based exercise program reduces falls</i></p> <p>Author comment: This should be regarded as a pilot study</p>

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Prevention of falls in the elderly trial (PROFET): a randomized controlled trial

<i>MULTIFACTORIAL</i>							
Close J et al 1999 Lancet REFERENCE 37	Hospital – Emergency Department	N=397 n=184 intervention n=213 control Men and women aged 65 and older (mean age 78.2, SD 7.6) Follow up every 4 months for 1 year	RCT	Risks factors Sociodemographic data Fall history Concurrent disorders Drug history Functional ability (before fall) Cognitive status Visual acuity Balance Affect (depression) Postural hypotension Environmental hazards Outcomes: Falls Injuries Resource utilization	Detailed medical and occupational therapy assessment with referral to relevant services, if indicated (intervention occurred after discharge to home). Control group = usual care Follow up was done by postal question- naire	65% of the subjects had fallen in the previous year Falls: 183 – intervention 510 – control There were significantly fewer falls in the inter- vention group than in the control group (p=0.0002). Risk of falling reduced in the intervention group (OR 0.39) Risk of recurrent falls reduced in intervention group (0.33) The multifactorial approach is consistent with the prospective identification of risk factors. The primary attributable cause was frequently related to an environmental hazard, but many patients had multiple risk factors; this highlights the dynamic interaction between intrinsic and extrinsic risk and the relevance of an interdisciplinary assessment	Prevention of Falls in the Elderly Trial (PROFET) <i>In an ED setting, a multidisciplinary program for patients which includes medical assessment and environmental modification but not physiotherapy, reduces falls.</i> EVIDENCE (continued) 17% of patients had evidence of 1 or more cardio- vascular disorders which were risk factors for falls. 59% had visual impairment; 62% had poor stereoscopic vision and 35% had cataracts

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Chronic care clinics: a randomized controlled trial of a new model of primary care for frail older adults

<i>MULTIFACTORIAL</i>							
Coleman E, et al 1999 J Am Geriatr Soc REFERENCE 38	Community (HMO)	N = 169 n = 96 (intervention patients; 5 physicians) n = 73 control patients; 4 physicians) Men and women age 65 and older Intervention mean age = 77.3 Control mean age = 77.4 Randomization by physician practice Follow up 24 months	RCT	Risk factors Age Gender Chronic conditions (esp diabetes and heart disease) Comorbid conditions Hospitalization in prior 12 months; or 6 outpatient visits in prior 12 months Frailty Urinary incontinence Depression Functional status Falls history Medication use Cognitive status Postural hypotension Outcomes: Prevalence of geriatric syndromes Utilization of resources Patient rating of care received Physician support for CCC	Training of team members in popula- tion-based medicine and management strategies for geriatric syndromes Intervention - Half day Chronic Care Clinic (CCC) with primary care team every quarter --Extended physician/nurse visit --Pharmacist consult --Self management group (facilitated by nurse) --Team review of health status Controls – usual care	Management of geriatric syndromes did not improve as shown by no significant improvements in --Incontinence --Proportion of falls --Depression scores --Physical function scores --Prescriptions for high risk medications Also, no significant improvements in --Costs of medical care --Frequency of hospitalization --Hospital days --Emergency and ambulatory visits --Total costs of care Significantly more intervention patients rated the overall quality of their medical care as excellent (40% vs 25.3%)	<i>Regular chronic care team input did not reduce falls</i>

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Head over heels: impact of a health promotion program to reduce falls in the elderly

<i>MULTIFACTORIAL</i>							
Gallagher EM et al 1996 Canadian J Ageing REFERENCE 39	Community	N = 100 n=50 intervention n = 50 control Men and women age 60 and over (mean age 75.4 intervention; 73.8 control) All had experienced a fall in the preceding 3 months 6 month follow up	RCT	Risks assessed: Physical health IADLs Ambulation and mobility Blood pressure Vision MMSE Gait and balance Handgrip strength Chair stand Medications Home safety Outcomes: Fall incidence Falls self-efficacy Fear of falling Social functioning Health service utiliz Quality of life	Intervention: Comprehensive risk assessment, indivi- dualized feedback (treatment visit) and motivational video and booklet (Head Over Heels) Inter-views and treatment visits conducted by trained nurse inter- viewers; post cards every 2 weeks with telephone interview for reported falls. Controls = baseline interview only; did receive post-cards and telephone inter- view regarding falls	Fall reduction = 30% Average number of falls: 1.9 falls = intervention 3.0 falls = control Other significant reductions: --Fear of falling --Quality of life --Falls self efficacy Although there were no differences in any major outcome variables between treatment and control groups at baseline or 6 month follow up, when data from treatment and control groups were combined, the above significant differences between baseline and 6 month follow up measures were found.	<i>In community dwelling indivi- duals, we do not recommend unsupervised self- assessment</i> Cochrane 1998: No significant dif- ference between intervention and control group at 6 months, but insufficient data were given to permit pooling.

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Preventing falls among community dwelling older persons: results of a randomized controlled trial (Hornbrook)

Design and implementation of a falls prevention intervention for community dwelling older persons (Stevens)

<i>MULTIFACTORIAL</i>							
<p>Hornbrook MC et al 1994 Gerontologist</p> <p>AND</p> <p>Stevens VJ et al 1992 Behavior Health and Aging</p> <p>REFERENCES 40, 42</p>	<p>Community (HMO)</p>	<p>N = 3182 n=1611 intervention n=1571 control</p> <p>Men and women aged 65 and older (mean age 73.6 (6.1 SD) intervention; 73.2 (6.0 SD) control)</p> <p>Follow up 23 months</p>	<p>RCT</p>	<p>Risks assessed: <i>Environmental hazards</i> Poor lighting Lack of handrails Objects in pathways Slippery rugs</p> <p><i>Behavioral risk-taking</i> Climbing on chairs Running while carrying bulky or heavy objects Poor lighting</p> <p>Outcomes: Falls Injury falls</p>	<p>Home visit by project staff to assess fall hazards with advice for removal, repair (Financial /technical assistance offered to complete environ- mental repairs)</p> <p>Four 90 minute presentations of a comprehensive approach to dealing with falls hazards (environmental, behavioral, physical risk factors).</p> <p>Description and demonstration of fall prevention exer- cises. 20 minutes supervised practice and take-home manual for unsuper- vised continuation of exercises. Also encouraged to begin walking and chart minutes of exercise</p> <p>Mail and telephone falls monitoring Quarterly (immediate postcard reporting of fall occurrence)</p>	<p>Total falls: 39% = intervention 44% = control</p> <p>2 or more falls 16% = intervention 20% = control</p> <p>Decreased odds of falling by 0.85</p> <p>Reduced average number of falls by 7%</p> <p>The effect was strongest among men age 75 and older.</p> <p>The likelihood of avoiding falls requiring medical treatment was not significantly affected by the intervention.</p> <p>Behavioral programs can achieve significant, sustained changes related to prevention of falls</p>	<p>Study of Accidental Falls in the Elderly (SAFE)</p> <p><i>A self-sufficiency oriented behavioral program, aimed at getting individuals to reduce environ- mental hazards and increase physical activity, is perhaps mildly effective in falls reduction.</i></p> <p>Cochrane 1998: Hornbrook individually demonstrates significant benefit. The number who sustained two or more falls was statistically significantly less in the intervention group.</p>

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A sustainable programme to prevent falls and near falls in community dwelling older people: results of a randomized trial

<i>MULTIFACTORIAL</i>							
Steinberg M et al 2000 J Epidemiol Community Health REFERENCE 41	Community	N = 252 Group 1 n = 63 (control) Group 2 n = 69 Group 3 n = 61 Group 4 n = 59 Men and women, age 50 and over (75% under age 75) 1 year intervention 17 months falls monitoring	RCT	Risk factors: Demographic data Falls history Fear of falling Medical history Home environment Outcomes: Slips Trips Falls	Baseline question- aire on risk factors Interventions (add on approach) Group 1: oral presentation, home safety video, risk factor/prevention pamphlet (Control) Group 2: Group 1 plus 1 hr exercise 1 x month, handouts/ video encouraged at home exercise Group 3: Group 1 & 2, plus home safety assessment with financial/prac- tical assistance for modifications Group 4: all of above plus clinical assessment and advice on medical risk factors on falls Monitoring of slips, trips or falls on daily calendar (mailed monthly); telephone follow up for non response and interview re fall incidents	Fall risk reduction: 58% reduction in slips risk 64% reduction in trips risk 30% reduction in falls risk Statistically significant reductions in the risk of slips and trips in groups 2, 3 & 4 compared with group 1 Except for trips, there was no evidence to support the hypothesis that reductions in risk declined with increase in the number of intervention strategies used. The hypothetical model of incidence rates suggested that further significant reductions in the probability of an event were achieved when awareness-raising in the control group, specifically through calendar monitoring, was considered an intervention in its own right.	<i>In community dwelling elderly, the incidence of slips trips and falls are reduced in community-based programs incor- porating education exercise,,environ- mental modifica- tion, financial assistance with modifications and clinical assess- ment. Education programs alone are ineffective.</i>

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A multifactorial intervention to reduce the risk of falling among elderly people living in the community (1994)

Does multiple risk factor reduction explain the reduction of fall rate in the Yale FICSIT trial? (1996)

<i>MULTIFACTORIAL</i>							
<p>Tinetti ME et al 1994 N Engl J Med</p> <p>AND</p> <p>Tinetti ME et al 1996 Am J Epidemiol</p> <p>REFERENCES 43, 44</p>	<p>Community (HMO)</p>	<p>N = 301 n = 153 intervention n = 148 control</p> <p>Men and women at least 70 years of age and who had at least 1 risk factor for falling</p> <p>Study = 4 years (1990-1993) 1994: 1 year follow up; 1996: 4 years follow up</p>	<p>RCT (matched block design)</p>	<p>Risk factors Postural hypo-tension Use of sedatives Use of 4 rx meds Impairment of arm or leg strength Impairment of arm or leg range of motion Balance Transfer skills Gait</p> <p>Outcomes: 1994: Falls Injuries Episodes of medical care Cost of care associated with falls</p> <p>1996: Falls Changes in targeted risk factors</p>	<p>Intervention subjects were given a targeted intervention (TI) aimed at modifying their risk factors (e.g., medication adjustment, behavioral instruc- tions and/or exercise programs).</p> <p>Controls received usual care and social vis its (SV)</p> <p>EVIDENCE (1994): Falls: 35% = intervention 47% = control Significant reduc- tion in risk of falling</p> <p>Significant changes in risk factor reduction between intervention/control: -4 prescription meds (63% vs 86%) -balance impairment (21% vs 46%) -toilet-transfer skills impairment (49% vs 65%) -gait impairment (45% vs 62%)</p>	<p>1994 (continued) --The proportion of persons who had targeted risk factors for falling was reduced in the intervention group, as compared with the control group. --Risk factor reduction may partially explain the reduction in the risk of falling. --Subjects in the intervention group also reported fewer injuries.</p> <p>1996 A 39% reduction in falling was associated with the TI. --Reduction in fall rate was strongly associated with the extent of risk factor reduction.</p> <p>The TI group showed significantly greater improvements in --postural BP change, --stride length, --use of 4 or more meds --unsafe transfers</p> <p>Risk factor reductions independently associated with a reduction in fall rate: --changes in balance --postural blood pressure --stride length.</p>	<p>1994: <i>At risk community dwelling elderly who have postural hypotension, who have at least one risk factor for falling benefit from adjustment of medication, behav- ioral instruction and exercise pro- gram aimed at modifying their risk factors. Pro- gressive tailored exercise programs reduce falls.</i></p> <p>1996: <i>The changes that contributed most to reduction of fall rates were improvement in orthostatic hypo- tension, gait and balance, transfers, and medication modifications</i></p> <p>Cochrane 1998 – A statistically significant effect was achieved in Tinetti (1994)</p>

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Can health visitors prevent fractures in elderly people

<i>MULTIFACTORIAL</i>							
Vetter NJ et al 1992 BMJ REFERENCE 45	Community	N = 674 n = 354 intervention n = 324 control (N at 4 years = 450; 240, intervention; 210 control) Households of general practice patients, aged 70 and older 4 years	RCT	Risk factors: Physical disability based on 9 item ADL score Fall/fracture history Nutrition Medical conditions Medications Environmental hazards General muscle tone and fitness Outcomes: Falls Fractures	A health care visitor who: --Assessed and corrected nutritional deficiencies --Assessed and referred medical conditions (including inappropriate medications) --Assessed and corrected environ- mental hazards (eg, poor lighting) --Assessed and made recommendations for improvement of muscle tone and fitness (eg, exercise classes) Controls received usual care	Falls: 28% = intervention 15% = control Falls by subjects with moderate and severe disabilities 31% = intervention 28% = control A health visitor visiting a group of people aged 70 and over and using simple preventive measures had no effect on the incidence of fractures. In the group with no initial disability the health visitor may have instilled confidence in the elderly people and persuaded them to take more exercise and this may have put more of them in situations where falls were more likely	<i>Targeted assess- ment and one time intervention in high risk groups of highly motivated community dwelling elderly does not reduce falls</i> Cochrane 1998: Vetter found the intervention to be ineffective, even adverse, and in their discussion speculated that persuading participants to take more exercise may have put them into situations where falls were more likely.

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Preventing disability and falls in older adults: a population-based randomized trial

<i>MULTIFACTORIAL</i>							
Wagner, EH et al 1994 Am J Public Health REFERENCE 46	Community (HMO)	N = 1559 Group 1 n = 635 (mean age 72.5) Group 2 n = 314 (mean age 72.6) Group 3 n = 607 (control) (mean age 72.5) Ambulatory enrollees age 65 and older Follow up 2 years	RCT	Risk factors: Physical inactivity Excess alcohol consumption Environmental hazards Medication use Mental impairment Uncorrected hearing impairment Visual impairment Outcomes: Change in disability days Change in physical function Falls Prevalence of health behaviors	Group 1: Nurse assessment visit and follow up interven- tions targeting identified risk factors for disability and falls. Group 2: General health promotion nurse visit Group 3 (control): Usual care Intervention at baseline, plus annual follow up for two years	Falls (Year 1-%/Year 2-%) Intervention: 27.5 / 31.4 Visit only: 29.6 / 29.3 Usual care: 36.8 / 29.2 Fall rates in all categories did not differ between intervention and visit only groups. After 1 year Group 1 subjects reported a significantly lower incidence of declining functional status and a significantly lower incidence of falls than Group 3 subjects. Group 2 subjects had intermediate levels of most outcomes. After two years of follow up, the differences narrowed	Cochrane 1998: The odds ratio and confidence limits for the number of participants falling indicate a small but significant effect in Wagner.

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A randomized trial of a consultation service to reduce falls in nursing homes

<i>MULTIFACTORIAL</i>							
Ray WA et al 1997 JAMA REFERENCE 47	LTC	N = 482 n = 221 intervention n = 261 control 7 pairs of nursing homes; pairs were matched according to the number of beds; one facility in each pair randomly assigned to the intervention Follow up for one year after assessment	RCT	Risk factors: Demographics Restraint use Falls history Environmental safety Functional status Ambulation Dementia Mobility Personal safety Wheelchair use Psychotropic drugs Transferring Ambulation Outcomes: Recurrent fallers Injurious falls Changes in functional status Deaths	Intervention: An intensive, comprehensive structured individual assessment with specific safety recommendations targeted to suboptimal practices for environmental and personal safety, wheelchair use, psychotropic drug use, transferring and ambulation Compliance with recommendations was verified by direct inspection Control: There were no program activities in the matched control facilities	Recurrent fallers: 91 = intervention 129 = control Injurious falls: 28 = intervention 44 = control Fall reduction was 19% greater in intervention facilities and there were 31% fewer injurious falls Intervention facilities had a nonsignificant trend toward a lower mean rate of injurious falls. Intervention residents with 3 or more falls had 50% fewer injurious falls than controls Greatest benefits were suggested for residents for whom the recommended interventions were carried out or who had 3 or more falls in the preceding year As compliance with the safety recommendations increased, the proportion of residents who were recurrent fallers and the rate of injurious falls decreased	<i>Staff education addressing transfers, ambulation, psychotropic drugs and wheelchair use is beneficial</i> Author comments: The the effectiveness of the intervention program was reduced through inability to target the most important risk factors, limited capacity to monitor progress in risk factor abatement and partial implementation of the safety recommendations. This suggests that future programs that address these limitations could be even more effective. The high rate of falls and related injuries in nursing homes should be viewed as outcomes that can be substantially improved through structured safety programs.

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The value of assessing falls in an elderly population

<i>MULTIFACTORIAL</i>							
Rubenstein LZ et al 1990 Ann Intern Med REFERENCE 48	LTC	N = 160 n = 79 intervention n = 81 control Men and women, mean age 87 years Follow up for 2 years	RCT	Risk factors Age Gender Level of care Medical conditions Medications used Medication dosages Functional status Mental status ADLs Assistive device use Detailed falls history (location, time, injury, probable cause) Secondary risk factors: Weakness (general) Weakness (focal) Environmental hazards Orthostatic hypo- tension Acute illness Gait/balance disorder Drug effect Poor vision Drug reaction Arrhythmia Neuropathy Diminished cog- nition Urinary tract infec- tion Arthritis (Outcomes – see column 3)	All fallers completed a detailed “fall history” Detailed review of medical record of all fallers Intervention fallers received a comprehensive post fall assessment within 7 days of falling. Post fall assessment included a detailed physical examination and environmental assessment by a nurse practitioner; laboratory tests; electrocardiogram; and 24-hour Holter monitoring. Probable cause or causes of the fall, identified risk fac- tors, and therapeutic recommendations were given to the patient’s primary physician. Controls did not receive the post fall assessment	Fall reduction 9% - intervention (not significant) Recurrent fallers: 71% - intervention 75% - control Most intervention subjects fell because of interacting and progressive chronic conditions. Intervention group had: --26% fewer hospitalizations --52% reduction in hospital days --17% fewer deaths (trends were not statistically significant) The assessment identified remediable problems (weakness, environmental hazards, orthostatic hypo- tension, drug side effects, gait dysfunction) Over 95% of the problems were identified from the history and physical exam- ination alone. Study suggests falls are a marker of underlying disorders easily identifiable by careful post-fall assessment, which can also reduce disability and costs	<i>Among people who fall in nursing home populations, referrals for com- prehensive assess- ment does not reduce falls</i> Cochrane 1998: Pooling of data suggests that an intervention in which older people are assessed by a health profes- sional trained to identify intrinsic and environmental risk factors is likely to reduce the number of people sustaining falls. Author comments: The reduction in hospital days sug- gests significant implications for cost savings

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Do hospital fall prevention programs work? A systematic review

<i>MULTIFACTORIAL</i>							
Oliver D et al 2000 J Am Geriatr Soc REFERENCE 49	Hospital	21 papers identified 10 contained sufficient data for calculation of confidence intervals (CI) on interventions 3 RCTs 7 prospective studies with historical control 11 prospective studies with historical control describing fall rates only	Systematic review – meta analysis		10 studies (rate ratio; 95% CI): Education program (0.81: 0.58-1.12) Equipment checks (0.81: 0.58-1.12) “High risk” labels or bracelets (0.94: 0.67- 1.32) Alarms (0.32: 0.01- 7.28) Physical restraints (0.74: 0.49-1.13) Tailored nursing care plan (1.14: 0.80 – 1.62)	Pooled effect of about 25% reduction in fall rate (prospective interventions with historical controls) May be biased by studies that used historical controls not allowing for historical trends in the fall rate before and during the intervention. No effect in RCTs (singly or pooled) No analysis of compliance with the intervention No analysis of opportunity costs Research and clinical programs should pay more attention to study design and the nature of interventions	10 studies pooled: Mayo 1994 Tideiksaar 1993 Fife 1984 Barker 1993 Craighead 1991 Hill 1988 Kilpack 1991 Kuipers 1993 Mitchell 1996 Sweeting 1994 11 studies (fall rates only) Brady 1993 Cannard 1996 Cohen 1991 Hendrich 1988 Hemande 1986 Inres 1985 Kostopolos 1985 Morton 1989 Rainville 1984 Schmid 1990 Zepp 1991

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The effect of strength and endurance training on gait, balance, fall risk, and health services use in community-living older adults

<i>EXERCISE</i>							
Buchner DM et al 1997 J Gerontol A Biol Sci Med Sci REFERENCE 50	Community (HMO)	N = 105 n = 25 strength n = 25 endurance n = 25 strength & endurance n = 30 controls Men and women; age range 68 – 85 2 years follow up	RCT Single blind	Risk factors Age Gender Race Health status IADL dependency Falls history (prior year) Outpatient visits Inpatient days Strength Endurance Screening for inclusion: -unable to do 8-step tandem gait without errors; -below 50 th percentile in knee extensor strength for the subjects height and weight. Outcomes: Strength Aerobic capacity Balance Gait Physical health status Falls Health care use Health care costs	Intervention Supervised followed by unsupervised exercise ET = Endurance training (stationary bicycle) ST = Strength training (weight machines) ET + ST = Both 24-26 weeks 1 hour, 3 days/week 6 months 10-25 months follow up Controls were instructed to maintain usual activity levels Falls data collected from monthly postcards with telephone contact for non-return	Falls in the year after randomization, --42% exercise subjects --60% control subjects Significantly higher fall rate in controls: -- 0.49 falls/year exercise -- 0.81 falls/year control Exercise may have beneficial effects on fall rates and health care use in some subgroups of older adults. In community living adults with mainly mild impairments in gait, balance and physical health status, short-term exercise may not have a restorative effect on these impairments	Seattle FICSIT <i>Among relatively healthy community dwelling older people, very inten- sive strength and endurance training reduces fall risk and the percentage of fallers.</i>

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The effect of a 12-month exercise trial on balance, strength, and falls in older women: a randomized controlled trial

<i>EXERCISE</i>							
Lord SR et al 1995 J Am Geriatr Soc REFERENCE 51	Community	N = 197 n = 100 intervention n = 97 control Women, aged 65 and older Intervention: 71.6, SD 5.5 years Control: 71.7, SD 5.3 years 1 year intervention	RCT	Risk factors: Evaluation pretest: Medical conditions Stability Drug use Activity level Outcomes: Accidental falls Postural sway Reaction time Neuromuscular control Lower limb muscle strength	Evaluation pretest administered to exercise and control subjects Exercise subjects: 1 hour exercise sessions, twice weekly for four 10- 12 week terms Exercise subjects retested at 22 weeks and 12 months; controls retested at 12 monthss Falls questionnaires mailed to exercise subjects and controls every 2 months; telephone follow up for non- response	There was no significant difference in the proportion of fallers between the exercise (34.7 falls) and control (35.1 falls) subjects Exercise subjects showed improved performance in --all five strength measures --reaction time --neuromuscular control --body sway. Trends were evident between falls frequency and adherence to the exercise program. (the lowest falling rate was noted in exercisers who attended 75% or more of the classes) Fewer fallers in the exercise group stated that their falls were due to a loss of balance or lower limb weakness than did fallers in the control group. There was a reduction in multiple falls frequency among high exercise adherers.	Randwick Falls and Fractures Study <i>In community dwelling older women there is no evidence that a conditioning exercise program reduces falls</i> Cochrane 1998: (Lord 1995; McMurdo 1997; Reinsch 1992; Mulrow 1994) No study specific comments; general conclusions: individually these studies lacked the power to confirm any benefit of the exercise interven- tion; there was no evidence for any protection against sustaining two or more falls Author comment: A uniform exercise program will not provide a complete intervention for falls prevention

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Controlled trial of weight-bearing exercise in older women in relation to bone density and falls

<i>EXERCISE</i>							
McMurdo, ME et al 1997 BMJ REFERENCE 52	Community	N = 92 n = 44 (exercise plus calcium - intervention) n = 48 (calcium only-control) Women, mean age 64.5 (range 60-73) 2 year follow up	RCT	Risk factors: Bone mineral content and density Medications Alcohol intake Dietary calcium intake Outcomes: Change in bone mineral content and density Falls Fractures	Both groups: Bone mineral content of non-dominant distal forearm and lumbar vertebral bone mineral density measured at baseline and at two years Exercise (intervention) group, took 1000 mg calcium daily and did weight bearing exercise 3 x week for 3 10-week terms/year Control group, took 1000 mg calcium daily	Falls = 31 calcium group (control) 15 exercise and calcium (intervention) (Overall not significant, but significant between 12 and 18 months) 2 fractures, both in control group There was a modest additional effect of exercise on the bone density of the ultra-distal forearm among women taking regular weight bearing exercise and dietary calcium supplementation for two years.	<i>In young elderly community dwelling women, frequent low impact weight bearing exercises and calcium supplementation over a two year period showed trends toward fall reduction.</i> Cochrane 1998: (Lord 1995; McMurdo 1997; Reinsch 1992; Mulrow 1994) No study specific comments; general conclusions: individually these studies lacked the power to confirm any benefit of the exercise interven- tion; there was no evidence for any protection against sustaining two or more falls

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Falls prevention over 2 years: a randomized controlled trial in women 80 years and older

<i>EXERCISE</i>							
Campbell AJ, et al 1999 Age Ageing REFERENCE 53	Community	N = 213 n = 103 exercise group n – 110 control group Women aged 80 years and older; mean age: 83.4, SD 2.7 exercise group; 84.3, SD 3.3 control group 2 year follow up	RCT	Risk factors Falls history Injuries rel to falls Time between falls Muscle strength Balance Medical history Demographic data Social support Current medications Health related behaviors Weight Height Visual acuity Blood pressure Heart rate IADLs Fear of falling Outcomes Falls Fall injuries	Exercises individually prescribed during 4 home visits by a physiotherapist in the first 2 months of the study Exercise components: --Muscle strengthening --Balance retraining --Walking Subjects instructed to exercise as prescribed 3 x week and to walk 3 x week Telephone contact with physiotherapist on regular basis Controls: no exercise prescription or physiotherapist contacts. Falls monitoring in both groups by monthly mailed postcards	Falls Year 2: 50 = Exercise group 68 = Control group Falls Years 1 & 2: 138 = Exercise group 220 = Control group There was a significant reduction in falls in the exercise group Those complying with the exercise program at 2 years: -- had a higher level of physical activity at baseline --were more likely to have reported falling in the year before the study --had remained more confident in the first year about not falling compared with the rest of the exercise group. Relative hazard for fall injuries: 0.63 – exercise group 1.00 – control group Falls and injuries can be reduced by an individually tailored exercise program in the home.	<i>Falls and injuries are reduced by individually tailored exercise programs in the home incorporating strength and balance retraining; for those who continue exercising the benefit continues during a two year period.</i>

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors and Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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The effects of exercise on falls in elderly patients: a pre-planned meta-analysis of the FICSIT trials. Frailty and Injuries: Cooperative Studies of Intervention Techniques

<i>EXERCISE</i>							
Province, MA et al 1995 JAMA REFERENCE 54	7 sites Community = 5 (3 HMO) LTC = 2	N ranged from 100 to 1323 per study Minimum ages 60 to 75 years	Meta Analysis All = RCT	Subjects were mostly ambulatory and cognitively intact; some studies required additional deficits, such as functionally depen- dent in 2 or more ADLs, balance deficits or lower extremity weakness, or high risk of falling The primary outcomes for these studies are some of the intermediate risk factors for and/or markers of frailty and injuries such as falls, functional status, muscle strength, balance and ADLs.	Each study prospectively assessed falls and injurious falls from randomization to the end of the intervention period and beyond. Exercise compo- nents varied across studies in character, duration, frequency and intensity. Training was per- formed in one area or more of -- endurance -- flexibility -- balance platform (static balance) -- Tai Chi (dynamic balance) -- resistance Several treatment arms included additional non- exercise components such as behavioral, medication changes, education, functional activity or nutritional supplements	Conclusions: No exercise component was significant for injurious falls but power was low to detect this outcome. Different components or training domains of exercise might have different effects on the falls or injurious falls outcomes. Treatments including exercise for elderly adults reduce the risk of falls (incidence ratio = 0.87). Interventions that include balance training significantly reduced falls (incidence ratio = 0.76). All incidence ratio estimates for different training domains are on the side of reducing falls; only balance training and overall exercise is significant None of the pooled effects are significant None of the studies individually or collectively had an effect on injurious falls, although point estimates indicate a slight nonsignificant increase in risk	FICSIT meta- analysis (7 studies) Cochrane 1998 noted inability to con-firm Province conclusion that “treatments including exercise for elderly adults reduce the risk of falls” FISCIT sites: Portland OR New Haven CT Seattle WA San Antonio TX Atlanta GA Boston MA Farmington CT

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Effects of a group exercise program on strength, mobility and falls among fall-prone elderly men

<i>EXERCISE</i>							
Rubenstein LZ et al 2000 J Gerontol A Biol Sci Med Sci REFERENCE 55	Community	N = 59 n = 31 (exercise) n = 28 (control) Men age 70 and older (mean = 74) with specific fall risk factors 3 month intervention	RCT	Risk factors Leg weakness Impaired gait or Impaired balance Previous falls Outcomes: Strength Endurance Gait Balance Falls <i>Other data:</i> Physical functioning Role limitations General health perceptions Physical activity	Three 90 minute sessions/week for 12 weeks) Controls = usual activities Falls and injurious falls monitored by interviewing participants every 2 weeks by telephone (controls) or at exercise class --	Falls during intervention: 38.7% exercisers (13 falls) 32.1% controls (14 falls) (no fall injuries) Fall rate/1000 hours activity 6.0 falls – exercise group 16.2 falls – control group -- Exercise participants significantly increased their physical activity yet experienced fewer falls per unit of activity (new finding) -- A simple program of progressive resistance exercises, walking and balance training can improve muscle endurance and functional mobility in elderly men with chronic impairments and risk factors for falls -- Exercise did not reduce <i>unadjusted</i> 3 month fall rates; -- Increased activity may result in a greater risk of falling due to increased exposure to environmental hazards	Author comment: Looking at unadjusted fall rates may under- estimate positive effects of exercise for all prone individuals

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Reducing frailty and falls in older persons: an investigation of Tai Chi and computerized balance training AND
The effect of Tai Chi Quan and computerized balance training on postural stability in older subjects

<i>EXERCISE</i>							
<p>Wolf SL et al 1996 J Am Geriatr Soc</p> <p>REFERENCE 56</p> <p>AND</p> <p>Wolf SL et al 1997 Phys Ther</p>	<p>Community</p>	<p>N = 200 n = 72 Tai Chi (TC) n = 64 balance training (BT) n = 64 education (ED - control)</p> <p>162 women and 38 men; mean age 76.2</p> <p>Intervention = 15 weeks Follow up after subsequent 4 months</p>	<p>RCT</p>	<p>Risk factors: (FICSIT common database): Psychosocial (depression, fear of falling, self-care of health; mastery index, intrusiveness) Demographic Physical health Fall related variables Also: Medical history Medication usage Present complaints Vital signs Neurological status Cardiovascular status Strength Coordination Sensation Proprioception Outcomes: Strength Flexibility Cardiovascular endurance Body composition IADL Psychosocial well being / indicators of frailty Falls Fall injuries</p>	<p>TC: Tai Chi classes – 1 hour/week (plus unsupervised home practice, recommended twice a day, 15 minutes)</p> <p>BT: Balance training using a mechanical system and weekly 1 hour meetings with nurse to discuss health topics of interest to older people (pharmaco-logical manage-ment; sleep disorders, cognitive deficits, etc)</p> <p>ED (control): The education group was instructed not to change their exercise level throughout the study and follow up period. They met weekly with a nurse to discuss topics of interest (same as balance training group)</p>	<p>1996: Significant risk factors identified were fall occurrence in the past year, fear of fall and trouble falling asleep. -- The rate of falls was substantially reduced by 47.5% for TC subjects, but was elevated if subjects had experienced falls within the past year before entering the study or had a relatively higher score on the fear of falling questionnaire. -- TC was associated with less risk for one or more falls in the presence of identified risk factors; BT did not reduce the rate of falls.</p> <p>1997 used a subset of 24 subjects in each group to study postural stability and found that computerized balance training improves postural stability, but Tai Chi does not. Reduced falling events seen in TC practitioners may be associated with training to increase rather than decrease postural instability</p>	<p>Atlanta FICSIT</p> <p><i>1996-In community dwelling elderly, predominantly women, at low to moderate risk of falls, Tai Chi Quan reduces the risk of falls during a short follow-up period of four months</i></p> <p><i>1997-In the same population, a computerized training program did not signifi- cantly reduce falls.</i></p> <p>Qualify: <i>query re generalizability, Tai Chi master and short follow up</i></p> <p>Cochrane 1998: Wolf reported that participants exposed to the Tai Chi intervention had a lower rate of falling than controls but using a narrower defini- tion of falling, the reported unadju- sted risk ratio was not significant</p>

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A randomized controlled trial of fall prevention strategies in old peoples' homes

<i>EXERCISE</i>							
McMurdo ME, et al 2000 Gerontology REFERENCE 57	LTC	N = 133 n = 77 intervention n = 56 control Men and women mean age 85 (SD 6.8); range 70-97 6 month intervention; 7-12 month falls monitoring	RCT	Targeted risk factors: Postural hypotension Polypharmacy Visual acuity Ambient lighting levels Risk factor assessments also included: Functional reach Reaction time Timed up and go Grip strength Spinal flexibility Cognitive status Depression Outcomes: Falls Dynamic postural control Functional mobility Grip strength Spinal flexion Quality of life	Intervention: -- Risk factor assessment and modification --Seated balance exercise training for 6 months Exercises designed to improve balance, strengthen major muscle groups and improve joint flexibility Control: 6 months of reminiscence therapy = twice weekly 30 minute reminiscence group designed to promote social interaction, including use of quizzes, music, and archive material Falls recorded by staff daily on a falls calendar during follow up period	Falls: 68 – intervention 67 – control There was no significant difference between the groups in the number of falls sustained or in the risk of recurrent falling. There were no significant differences between the groups with regard to change in other outcome measures. There was a high drop out rate that reduced the power to detect any effect of the interventions. It is possible that the exercises were not sufficiently vigorous or that to improve balance, exercises must be performed standing.	<i>Intervention for multiple risk factors and seated exercise programs did not reduce the number of falls or the risk of falling in the long term care setting.</i>

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Rehabilitation of elderly fallers: pilot study of a low to moderate intensity exercise program

<i>EXERCISE</i>							
Means, KM et al 1996 Arch Phys Med Rehabil REFERENCE 58	Community	N = 65 n = 31 (obstacle course practice) n = 34 (no practice) Male (93%) and female volunteers, age 65 and older, (average age 75) with 1 or more falls in the prior year 6 week intervention with 6 month follow up	Pretest- Posttest	Risk factors Age BMI Medications Medical conditions Medications Blood pressure change (lying to standing) Functional status (self report) Activity level (self report) Number of falls in past year Balance dysfunction Neurological abnor- malities Muscle strength Joint range of motion Outcomes Functional performance on obstacle course Falls Fall injuries	All subjects: 6 week structured rehabilitation training program (stretching, postural control, endurance walking, repetitive muscle coordination exercises) 3 sessions per week for 60 minutes each The practice group was allowed to practice before testing on the obstacle course. The group that did not practice functioned as the control group Cognitive interven- tion sessions (home and general safety, health factors related to falls, body mechanics during movement, importance of exercise) Self report of falls and fall injuries at weekly sessions or monthly postcard return (follow up)	Mean number of falls (SD) (baseline): 2.5 (2.9) – practice 2.7 (3.3) – no practice Mean number of falls (SD) (follow up) 1.5 (1.9) – practice 1.9 (3.0) – no practice (One practice group participant had 0 falls at baseline and 138 during follow up; mean number of falls during follow up do not include this participant) There was a non- significant reduction in falls in the practice group. Practicing (i.e., familiarity) did not add significantly to performance. Author comment: The obstacle course, as a predictor of future falls, is not superior to the question of whether or not an individual has fallen in the previous year and is not recommended to predict future falls. The obstacle course may be better as a short-term indicator of response to a rehabilitation program for balance and mobility.	<i>Generic exercise program in elderly men shows no effect of exercise.</i> Cochrane 1998: Means 1996 reported the mean number of falls in 6 months following exercise training, but this was an inappro- priate summary statistic as the data was skewed

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A randomized trial of physical rehabilitation for very frail nursing home residents

<i>EXERCISE</i>							
Mulrow CD et al 1994 JAMA REFERENCE 59	LTC	N = 194 n = 97 intervention n = 97 control Men and women aged 60 and older in residence in LTC for at least 3 months and dependent in 2 or more ADLs 1 academic and 8 community nursing homes 4 month interven- tion; bimonthly follow up assessments for 1 year	RCT	Risk factors Age Gender Race Length of stay Visual impairment Hearing impairment Chronic conditions Medications Physical disability index (PDI) Sickness impact profile (SIP) ADL scale Depression scale MMSE Outcomes: Performance-based physical function Self-perceived health status ADLs (observer reported) Falls	Randomization after baseline assessment (blocked in groups of 4 and stratified by nursing home site) Intervention (PT): 1:1 <i>physical therapy</i> 3 x week (30-45 min each session) by physical therapists trained in a standardized trial assessment and treatment protocol Physical therapy was tailored to individual needs Control (FV) group subjects received 1:1 <i>friendly visits</i> 3 x week FV program used a standardized protocol designed to avoid physical exercise and cognitive and psychosocial interventions	Falls 79 in 44 intervention (PT) subjects 60 in 38 control (FV) subjects Subjects in PT and FV groups were similar demo- graphically and clinically; 81% of subjects were dependent in 3 or more ADLS. The greatest physical function deficits were in strength and mobility; range of motion deficits were least common. No statistically significant improvements were seen for any of the outcomes in the PT group compared with the FV group except for the mobility subscale of the PDI, where a positive improvement of 15.5% was seen. Subjects who experienced worsening mental status during the trial had the greatest deteriorations in PDI scores, regardless of group assignment.	<i>An exercise program in the nursing home population who are not severely demented, which is individually tailored does not reduce falls and may in fact increase fall rates.</i> Cochrane 1998: (Lord 1995; McMurdo 1997; Reinsch 1992; Mulrow 1994) No study specific comments; general conclusions: individually these studies lacked the power to confirm any benefit of the exercise interven- tion; there was no evidence for any protection against sustaining two or more falls

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Home visits by an occupational therapist for assessment and modification of environmental hazards: a randomized trial of falls prevention

<i>ENVIRONMENTAL MODIFICATION</i>							
Cumming RG et al 1999 J Am Geriatr Soc REFERENCE 60	Community	N = 530 n = 264 intervention n = 266 control Recruited before discharge from hospital wards or outpatient clinics and day care centers 115 = geriatric ward 131 = respiratory ward 77 = gastroenterol- ogy ward 61 = general medical ward 60 = eye ward 26 = outpatient clinics 60 = day care centers Men and women, mean age 76.4, SD 7.1 (intervention) and 77.2, SD 7.4 (control) 12 month follow up	RCT	Risk factors Mats/rugs Footwear Non-slip bathmats Behavioral Light use at night External stair rail Electrical cords Falls history Afraid of falling History of stroke History of fractured hip Poor vision Use of psychotropic medications Use of walking aid Need help in ADLs Outcomes: Falls	All: -- baseline data collected at the time of recruitment; -- given follow up falls calendars and asked to return by mail monthly -- randomization after first falls calendar returned --12 month follow up interview Occupational Therapy intervention (OT) (after discharge, for previously hospitalized subjects): Assessment of home for environmental hazards by an experienced occupa- tional therapist; facilitation of home modifications Controls: no OT intervention	Falls History: No falls past year Intervention = 161 Control = 163 1 fall prior year intervention = 103 control = 103 Falls during follow up : Intervention = 96 (36%) Controls = 119 (45%) The home visit effect was significant only in the subgroup that had a history of falling; the effect may not be caused by home modifications alone. Home visits by occupational therapists can prevent falls among older people who are at increased risk of falling. Home visits by occupational therapists may also lead to changes in behavior than enable older people to live more safely in both the home and external environment.	<i>Assessment of the home for environmental hazards in a home visit with facilitated home modifications is recommended in patients with a history of falling</i>

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Home hazards and falls in the elderly: the role of health and functional status

<i>ENVIRONMENTAL MODIFICATION</i>							
Northridge ME, et al 1995 Am J Public Health REFERENCE 61	Community	N = 325 Men and women aged 60-93, who had at least 1 fall during the previous year 1 year prospective study	Cohort	Risk factors Demographic data Fall history Health/physical functioning ADLs Medication use Physical exam data (cardiovascular, neurological, mus- culoskeletal) Gait Balance Visual impairment Mental status Environmental hazards Outcomes: Falls Environmental contribution to fall Frailty factor contribution to fall	3-part baseline assessment --Questionnaire (trained interviewer) --Physical examin- ation (internist) --Neuromuscular performance, visual function and mental status (trained examiner) Completion of home environmental checklist of fall risk factors Weekly postcards to record fall events (with telephone follow up) Telephone inter- views by nurse practitioner after fall event	Total falls = 252 Environmental component: 46.8% - first falls 44.6% - second falls 34.6% - third falls 35.3% - fourth falls 18.2% - fifth -20 th falls Frail older persons experience more falls overall than do vigorous older persons The presence of certain home hazards is more important in predicting falls at home among vigorous than among frail older persons --Storage problems --Clutter --Hall rug problems	

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Home environmental hazards and the risk of fall injury events among community-dwelling older persons

<i>ENVIRONMENTAL MODIFICATION</i>							
Sattin, RW et al 1998 J Am Geriatr Soc REFERENCE 63	Community	N = 961 n = 270 cases n = 691 controls Men and women age 65 and older who sought treatment for a newly diagnosed injury due to a fall in their home or its environs	Case control	Risk factors: Home environment, including: Throw rug(s) Clutter Cords or wires Poorly placed light switch Low cabinets High cabinets No grab bars Standard toilet seat Slip resistant tub/shower floor Demographic data Fall history Reproductive history Medical history Chronic conditions Medication use Alcohol use Smoking Diet Mental status Functional status ADLs Exercise Circumstances of the fall Outcomes: Environmental risk factors for falls Characteristics of fallers	Subjects interviewed within 6 months of fall (index date) or selection as control subject using a standardized questionnaire Interviews conducted in person with the subject or surrogate if the subject was cognitively impaired. Controls (no falls) matched for sex and age by random selection from HCFA files	Characteristics of cases: Older More ADL limitations More cognitively impaired Higher prevalence of anemia, Parkinson's, stroke Hazards were common in the dwelling units of both groups Most postulated home environmental hazards are not associated with an increased risk of injurious falls; few hazards are specific enough to be juxtaposed to a specific activity that leads to a fall	Study to Assess Falls among the Elderly (SAFE) <i>From observa- tional studies there is no evidence that environmental hazard modifica- tions are linked to falls</i>

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Preventing falls in the elderly at home: a community based program

<i>ENVIRONMENTAL MODIFICATION</i>							
Thompson PG et al 1996 Med J Aust REFERENCE 64	Community	N = 305 Men and women (mean age 74) 1 year follow up	Pretest posttest	Risk factors Falls history (past 12 months) Floor hazards (loose rugs, worn carpet) Grab rails Illumination Furniture arrangement Exposed electrical cords Slip resistant surfaces Outcomes: Falls	Pretest: -- interview -- home safety inspection -- installation of recommended modifications Follow up: Telephone follow up to ascertain falls	Fallers before modifications: 69 (22.6%) fell Fallers after modifications 29 (9.5%) fell Risk of falls reduced by 58% Number of falls decreased (121 before to 45 after = 63% reduction) Author comments: Behavioral change probably played a significant role in lowering the rate of falls (e.g., the grab rail was a reminder to be more careful)	Make It Safe Program <i>The risk of falling can be lowered by more than half by simple modifica- tions to the home</i>

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Safety at home: a practical home injury control program for independent seniors

<i>ENVIRONMENTAL MODIFICATION</i>							
Weber J, et al 1996 Caring REFERENCE 65	Community	N = 201 n = 105 (fell in year prior to study) Men and women, mean age 80.7 Follow up 12 months	Pretest Posttest	Risk factors: Fall history Visual impairment Neurological weakness Ambulatory dys- function Medical history Surgical history Medication use Medical diagnoses Vital signs Nutrition Functional status Environmental hazards Outcomes: Falls Environmental hazard awareness	In home environ- mental hazard assessment Individualized education and prevention program Top 6 care plan interventions: --Install grab bars (53.7%) --Install personal emergency response system (41.3%) --Remove throw rugs and clutter (33.3%) --Ambulate with assistance (including cane walker) (24%) --Daily contact with friend-family (23.4%) --One-floor set-up (bed-commode) (20.4%) Telephone follow up at 6 months after intervention	99 of 105 previous year fallers fell in their home Fallers after intervention = 46 (22.3%) 35 of 105 previous fallers fell again after the intervention 85 = no falls before or after intervention 133 (66%) implemented one or more of the recommended interventions Program goals were achieved: --reduction in the incidence of falls --increased awareness of potential personal and environmental hazards	

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Relationships among cane fitting, function, and falls

<i>ASSISTIVE DEVICES</i>							
Dean, E et al 1993 Phys Ther REFERENCE 66	Community	N = 144 Men and women age range 61 – 80 1 year reference range	Descriptive survey	Risk factors Age Gender General physical status Footwear Length of time for cane use Primary indication for cane use Qualifications of cane fitter Hand used for cane Cane length Functional ability with cane Falls history/ frequency Outcomes: Falls Functional capacity	Interview regarding demographic and general physical status Interview regarding cane use Measurement of cane	Prior year falls: Less than 1 fall = 123 One or more falls = 19 There was no relationship between cane fitter and frequency of falling. The relationships between appropriate cane length and functional ability with a cane, correct cane length and falling frequency and cane use and falling frequency were all non- significant. Neither cane length nor holding the cane in the correct hand is associated with greater confidence, improved functional ability or reduced falling.	<i>There is a dearth of evidence regarding assistive device use and falls</i>

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Falls prevention: the efficacy of a bed alarm system in an acute care setting

ASSISTIVE DEVICES							
Tideiksaar R et al 1993 Mt Sinai M Med REFERENCE 67	Hospital	N = 70 n = 35 intervention n = 35 control Men and women, mean age 84 (range = 67-97) 9 month prospective study	RCT	Risk factors: Admission dx Admission meds Use of restraints Use of bed rails Neuromuscular conditions Outcomes: Falls *Environmental mobility screen: --Bed transfer --Sitting balance --Arm support for sitting balance --Feet on ground when sitting --Lie down and rise in one movement --Feet do not slide away when seated --Ability to operate nurse call system --Bed does not slide away when seated	All patients evaluated by performance- oriented environmental mobility screen* Intervention: Patients with poor bed mobility randomly assigned to receive a bed alarm system Controls: no bed alarm Both groups received equal nursing attention to prevent falls (hourly visual checks and restraints as clinically indicated)	Study group = 17 falls Intervention = 5 falls (1 bed fall; 4 elsewhere) Control = 12 falls (4 bed falls; 8 elsewhere) No significant difference in the number of bed falls between the two groups 143 alarms occurred 120 true 23 false The alarm system was not associated with any bodily harm to patients and did not interfere with medical or nursing care The system was well accepted by patients, families and nurses.	<i>Among hospital patients there is insufficient evidence for or against bed alarms</i> Cochrane 98: Two small trials examining strategies to prevent falls in hospital patients showed evidence of benefit of the intervention used. Tideiksaar gave only the total number of falls in control and treated groups and reported that there was no significant difference in the number of bed falls between groups.

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Prevention of hip fracture in elderly people with use of a hip protector

<i>ASSISTIVE DEVICES</i>							
Kannus P, et al 2000 N Engl J Med REFERENCE 68	LTC	N = 1801 n = 653 intervention n = 1148 control Ambulatory but frail elderly men and women, 70 and older (mean age 82 years) from 22 community-based health care centers Study length: After randomization, fractures were recorded until the end of the first full month after 62 hip fractures had occurred in the control group	RCT	Risk factors Previous fall Impaired balance Impaired mobility Use of walking aid Cognitive impairment Impaired vision Poor nutrition Disease known to predispose to falls Medication use known to predispose to falls Outcomes: Fracture of hip or proximal femur Other fractures Falls	Randomization by health center (i.e., all eligible subjects at health center randomized to intervention received hip protectors) Intervention subjects advised by research coordinator about use of the device; subjects were to wear device whenever they were on their feet Caregivers recorded hip protector use in a research diary Falls recorded by caregivers Controls: no hip protectors	Falls: 1404 falls – intervention (hip protector used in 74% of falls recorded) Control group total falls not reported Compliance with hip protector use = 48 +/- 29 percent (range, <1 to 100) Hip fracture : 13 – intervention 67 – control Rates of hip fracture per 1000 person years: 21.3 – intervention 46.0 – control The risk of fracture can be reduced by 60% by the use of an anatomically designed external hip protector. The risk of fracture can be decreased by 80% if the protector is worn at the time of a fall.	

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A randomized controlled trial of a group intervention to reduce fear of falling and associated activity restriction in older adults

<i>BEHAVIORAL & EDUCATIONAL</i>							
Tennstedt S, et al 1998 J Gerontol B Psychol Sci Soc Sci REFERENCE 71	Community	N = 434 N=216 intervention N = 216 control Men and women, mean age 77.8 (SD 7.71) living at senior housing sites (40 sites; pair matched then randomized to intervention or control) Follow up 12 months	RCT	Risk factors Fear of falling Physical activities Social activities Functional activities Socio-demographic characteristics Falls history Outcomes Fear of falling Participation in physical, social, and functional activities affected by fear of falling	Intervention: Structured group program of 8 two- hour sessions 2 per week for 4 weeks. Techniques included videotape, lecture, group discussion, mutual problem solving, role-playing exercise training, assertiveness training, home assignments and behavioral contracting. Control: a single 2 hour group session Didactic presen- tation on incidence and risk factors for falls and risk reduction strategies, AARP video on home hazards Monthly falls monitoring by mailed calendars	9.4% reported 2 or more falls in the previous 3 months 75.1% reported no falls There was no significant difference between intervention and control groups in the number of falls for up to 12 months (actual number of falls not reported) Short term changes can be achieved in maladaptive attitudes and beliefs about falling and in activity levels and in functioning The results indicate a need for a booster session a few months after the intervention to maintain the changes in attitude and self-efficacy	<i>A structured group program including video tapes, group activities and lectures had a modest effect on social activity and mobility range but did not reduce the number of falls at twelve months</i>

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors And Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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Effect of a practice guideline on the process of emergency department care of falls in elder patients

<i>BEHAVIORAL & EDUCATIONAL</i>							
Baraff LJ, et al 1999 Acad Emerg Med REFERENCE 72	Hospital Emergency Departments (ED) 3-sites part of HMO	N = 58,254 patients 65 and older n = 3681 records abstracted for patients with falls N = 1899 eligible for study n = 1140 pre-inter- vention n = 759 post-inter- vention Men and women age 65 and older 1 year pre -interven- tion 1 year post- intervention	Pretest posttest	Data collected: ED site Date of visit Patient name DoB Gender Cause of fall Patient disposition Eligibility for entry into study Risk factors (if eligible) Rx medications used Calcium/Vit D use Prior (12 months) pneumococcal and influenza vaccina- tion Location/cause of fall Ability to get up Length of lie after fall Falls history (12 months) Mental status Visual acuity Mobility Gait Outcome: Staff compliance with guideline	2 – week education- al intervention: Presentation of practice guideline to physicians, nurses who worked in the ED for three shifts at each site Also presented to internal/family medicine primary care physicians at each site early in post-intervention phase ED clerical staff attached a preprinted reminder to chart when patient presented with a fall Fall-related aftercare instructions provided to each ED for distribution to patients	Documentation on cause of fall: substantial variation by site; sites 1 and 2 generally improved, site 3 showed no improvement in documenting any of the items emphasized in the guideline. History items documented: Significant improvement in 6 of ten items in the medical history (cause, location, ability to get up, long lie, rx meds, Pneumovax immunization status) Physical exam item documentation: Significant improvement in 2 of 4 items (visual acuity, gait) Documentation of ED interventions: significant improvement of two of 6 proposed interventions (rx calcium, rx Vitamin D)	Author comments: Effect of the guideline was minimal at 2 sites and there was no apparent effect at 1 site There were no quality manage- ment activities to reinforce the implementation of the guideline (in- tended study design to determine the effect of an educa- tional intervention on actual practice) It was too time consuming to follow guideline in the busy ED; need concurrent reminder system or continuous peer review feedback

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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Effect of a practice guideline for emergency department care of falls in elder patients on subsequent falls and hospitalizations for injuries

<i>BEHAVIORAL & EDUCATIONAL</i>							
Baraff LJ et al 1999 Acad Emerg Med REFERENCE 73	Hospital Emergency Departments (ED) 3-sites part of HMO	N = 58,254 patients 65 and older n = 3717 records abstracted for patients with falls N = 1899 eligible for study n = 1140 pre-inter- vention n = 759 post-inter- vention N = 1504 interviewed n = 907 pre-inter- vention n = 597 post-inter- vention Men and women age 65 and older mean age 76.8 (SD 6.4) 1 year pre-interven- tion 1 year post-educa- tional intervention	Pretest posttest	Outcomes: Number of falls in the year following the initial ED visit Receipt of falls aftercare instructions from ED personnel at ED visit Health care utilization	Telephone interview by research assistant 1 year after visit to ED for fall Healthcare utilization obtained from HMO database	77.5% post-intervention subjects received aftercare instructions Significant improvement in 3 of 6 preventive health measures (Pneumovax immunization, taking calcium, taking Vitamin D) Total falls/100 patient years did not differ between pre and post-intervention groups (36.2) There was no difference in hospitalization rates (3%) or hip fracture rates (1%) in the year following the fall between the two groups	<i>In a pre- post-test study of education guidelines for doctors and nurses in the ED and of health promotion for adults who attended because of a fall, the number of falls was not reduced.at one year.</i>

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors and Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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Permanent cardiac pacing in elderly patients with recurrent falls, dizziness and syncope, and a hypersensitive cardioinhibitory reflex

<i>CARDIOVASCULAR</i>							
Crilley JG et al 1997 Postgrad Med J REFERENCE 75	Community	N = 42 Men and women, average age 79 (range 58-91) 34 months; average follow up 10 months (range 1.5-30)	Cohort	Risk factors Falls history Dizziness Syncope Cardioinhibitory carotid sinus hypersensitivity Outcomes: Falls Dizziness Syncope	Assessment by geriatrician including carotid sinus massage (CSM) Presence of a positive cardio- inhibitory response received pacemakers Follow up question- naires sent to patients and to their general practitioner regarding presence or absence of post- implantation falls, dizzy spells and blackouts	Carotid sinus syndrome patients: Pre-implant = 81% falls; 76% dizziness; 65% syncope Post-implant = 30% falls; 43% dizziness; 16% syncope Permanent dual-chamber pacing is an effective treatment for elderly patients with recurrent falls, dizziness and syncope in whom a hypersensitive cardioinhibitory reflex is found	<i>Retrospective study</i>

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Cardiovascular syncope is the most common cause of drop attacks in the elderly

<i>CARDIOVASCULAR</i>							
Dey AB, et al 1997 Pacing Clin Electrophysiol REFERENCE 76	Community and Hospital	N = 35 Men and women, mean age 75 (range 50-95) Evaluation of consecutive cases at inner city hospital outpatient facility specializing in falls and syncope	Cohort	Risk factors Drop attack Visual impairment Balance/gait impairment Medical history Cognitive impairment Cardiovascular disease Environmental hazards Outcomes Diagnostic information	Standard evaluation protocol of drop attack: Complete history Witness account Cognitive function assessment Physical examination Vision testing Hematological and biochemical inves- tigations Surface ECG Morning orthostatic blood pressures Bilateral carotid sinus massage Prolonged head up tilt testing Additional clinical testing as indicated Quantified balance and gait assessment by physiotherapist Home-based environmental hazard assessment by occupational therapist	Diagnosis: 24 = Carotid sinus syndrome 10 = Orthostatic hypotension 4 = Vasovagal syncope 1 = Gait and visual defect 3 = unexplained drop attacks Underlying cardiovascular diseases are the commonest cause of drop attacks in older patients. Absence of a history of syncope is unreliable in elderly patients and these individuals should be routinely investigated for hemodynamic changes and symptom reproduction during carotid massage and standing.	<i>Carotid sinus syndrome is the commonest cause of drop attacks in older adults referred to a syncope and falls facility.</i>

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An evaluation of falls, syncope and dizziness by prolonged ambulatory cardiographic monitoring in a geriatric institutional setting

<i>CARDIOVASCULAR</i>							
Gordon M et al 1982 J Am Geriatr Soc REFERENCE 77	LTC	N = 59 n = 37 fallers n = 22 nonfallers Men, average age 85 and women, average age 82	Cohort	Risk factors Ischemic heart disease Hypertensive heart disease Valvular heart disease Other heart disease Dizziness Palpitations Syncope Chest pain Dyspnea Unexplained falls Outcomes: Diagnostic information	Ambulatory Holter monitoring (AHM)	Cardiac arrhythmias that might have contributed to the fall discovered in 12 fallers (32%) 8 of 12 ceased falling after appropriate treatment was given The AHM was diagnostic but standard ECG-12 was unrevealing in evaluating fallers AHM monitoring is valuable in elderly patients whose cardiac complaints may be vague and especially in managing those who have sustained falls	<i>Small numbers</i>

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Outcome of an integrated approach to the investigation of dizziness, falls and syncope in elderly patients referred to a 'syncope' clinic

<i>CARDIOVASCULAR</i>							
McIntosh S et al 1993 Age Ageing REFERENCE 78	Community and Hospital	N = 65 Men and women, mean age 78 (range 67-92) Prospective study of consecutive patients referred to an outpatient "syncope and falls" clinic; 75% evaluated as outpatients; 25% as inpatients 6 months	Cohort	Risk factors Dizziness Falls Syncope Outcomes Diagnostic criteria for 8 possible diagnoses	Baseline evaluation: Complete history Cognitive evaluation Physical exam Neurological exam Witness account Morning orthostatic blood pressures Laboratory evaluation 12-lead ECG 24 hour ambulatory monitoring Supine and upright Carotid sinus massage (CSM) Prolonged head-up tilt test (HUTT) Abnormal historical or physical findings evaluated by more specific tests	Presenting symptoms: 12% dizziness only 11% falls only 20% syncope only 57% combination of symptoms (40% recurrent unexplained falls and dizziness) Mean of 13 syncopal episodes or falls (range 1- 240; median, 3) Duration of symptoms on average 4 years Diagnoses: 45% carotid sinus syndrome 32% orthostatic hypotension 21% arrhythmia Other diagnoses included vasodepressor syndrome, epilepsy, cerebrovascular, cough syncope, benign positional vertigo, drop attack, conversion reaction, unexplained Follow up at 7 +/- 2 months re symptoms (54 of 65; 3 died) Completely resolved = 20 Improved = 21 Unchanged = 11 Increase = 2	Author comments: Retrograde amnesia for loss of consciousness can result in confusion between syncope and falls Comprehensive cardiovascular assessment in addition to traditional assessment and investigation is required to achieve attributable cause of symptoms. Assessment required an average of 3-4 hours per patient

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Prospective evaluation of unexplained syncope, dizziness, and falls among community dwelling elderly adults

<i>CARDIOVASCULAR</i>							
O'Mahony D et al 1998 J Gerontol A Biol Sci Med Sci REFERENCE 79	Community	N = 54 Men and women, mean age 76.4 (SD 8.0; range 61-91) Prospective study of consecutive patients 12 months	Cohort	Risk factors Syncope Dizziness Unexplained falls Outcome Diagnostic criteria established for 5 possible diagnoses	Diagnostic schedule: Medical history Drug history Witness account of episodes Injuries sustained Physical exam EKG Selective investiga- tions for dysrhyth- mia, vasovagal syncope, carotid sinus syncope, struc- tural cardiac abnor- malities, epilepsy, other conditions associated with falls and syncope	Primary presenting symptoms and primary diagnoses: 61.1% (n=33) = syncope Vasovagal syncope = 12 Arrhythmias =5 Hypotensive drugs = 3 Orthostatic hypotension = 2 Major anxiety = 1 Unknown = 10 18.5% (n = 10) = falls without loss of consciousness Drop attacks = 3 Orthostatic hypotension = 2 Otologic vertigo = 1 Cerebellar ataxia = 1 Parkinsonism = 1 VBI = 1 Unknown = 1 20.4% (n = 11) = nonsyncopal dizziness Vasovagal syncope = 4 Orthostatic hypotension = 2 Carotid sinus syndrome = 1 Otological disease = 2 Unknown = 2 Mean episodes/month = 4.6 Median duration of symptoms = 13 months (range 1-180 months)	A targeted problem oriented algorithm including a comprehensive cardiovascular evaluation indicates the diagnosis in 75% of the elderly patients with unexplained syncope, falls, and dizziness. Note: Algorithm, page M437

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Prevalence of cardioinhibitory carotid sinus hypersensitivity in patients 50 years or over presenting in the accident and emergency department with “unexplained” or “recurrent” falls

<i>CARDIOVASCULAR</i>							
Richardson, DA et al 1997 Pacing Clin Electrophysiol REFERENCE 80	Hospital	N = 598 (total unexplained/ recurrent fallers) n = 279 assessed suitable for CSM Men and women over age 50 7 month study	Cohort	Risk factors Unexplained fall Recurrent falls (3 or more within past 12 months) Outcomes: Diagnostic information	Supine and upright carotid sinus massage (CSM)	65 (23%) had CI or mixed CSH 31 (11%) had vasodepressor CSH 10 patients were on culprit medications known to cause enhanced vagal activity (digoxin, amiodarone, beta- blockers, verapamil) The prevalence of Cardioinhibitory Carotid Sinus Hypersensitivity (CICSH), is a potentially treatable condition, in “unexplained” or “recurrent” fallers who present to the accident and emergency department.	<i>High prevalence of cardioinhibitory carotid sinus hypersensitivity in patients with unexplained falls attending the accident and emergency department.</i>

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Carotid sinus syndrome – clinical characteristics in elderly patients

<i>CARDIOVASCULAR</i>							
Kenny RA et al 1991 Age Ageing REFERENCE 81	Hospital	N = 130 Consecutive patients men and women, mean age 78 (range 67-89) 18 months	Cohort	Risk factors Dizziness Syncope Unexplained falls Outcomes: Diagnostic information	Supine and upright bilateral carotid sinus massage (CSM)	33 of 130 (25%) diagnosed with carotid sinus syndrome (CSS) Presenting symptoms for 33: Dizzy + syncope = 12 (36%) Dizzy + falls = 5 (15%) Dizzy/syncope/falls = 1 (3%) Dizzy = 4 (12%) Syncope = 3 (9%) Falls = 7 (21%) Carotid sinus massage should be performed on all patients who have symptoms of unexplained dizziness, falls or syncope	

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Diagnosis of carotid sinus hypersensitivity in older adults: carotid sinus massage in the upright position is essential

<i>CARDIOVASCULAR</i>							
Parry, SW et al 2000 Heart REFERENCE 82	Hospital 3 inner city emergency departments	N = 1375 n = 1149 CSM n = 226 excluded n = 25 controls Consecutive patients men and women, age 55 and older Mean age 78 years	Cohort – prospec- tive controlled	Risk factors: Drop attacks Syncope Outcomes: Diagnostic information Clinical characteris- tics of supine vs upright positive groups	Bilateral supine carotid sinus massage (CSM) CSM repeated in 70 degree head up tilt position if the initial test was not diagnostic of cardioinhibitory and mixed carotid sinus hypersensitivity	223 (19%) diagnosed with cardioinhibitory or mixed carotid sinus hypersensitivity Of 223, 70 (31%) had a positive response to CSM in head up tilt position following negative supine massage None of the healthy controls showed carotid sinus hypersensitivity in either position The diagnosis of carotid sinus hypersensitivity amenable to pacing may be missed in one-third of cases if only supine massage is performed. Massage should be done routinely in the head up tilt position if the initial supine test is negative	Author comment: In patients with unexplained syncope or drop attacks, upright CSM should be performed if initial supine CSM is not diagnostic.

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Prevalence of low vision in elderly patients admitted to an acute geriatric unit in Liverpool: elderly people who fall are more likely to have low vision

<i>VISION</i>							
Jack CI et al 1995 Gerontology REFERENCE 83	Hospital (acute geriatric medical unit)	N = 200 Men and women age 65 and older, mean age 80.4 (SD 6.9, range 65-98)	Cohort	<p>Risk factors Presenting illness Home situation (living alone, with relatives, LTC) Current ocular problems</p> <p>Outcomes: Diagnosis of vision impairment Relation of vision impairment to falls</p>	<p>Administration of short questionnaire</p> <p>Visual screening examination approx. 48 hours after admission</p> <p>-- Visual acuity -- Visual fields -- Applanation tonometry -- Slit lamp biomicroscopy -- Fundal exam</p>	<p>There was a significant increase in the number of elderly people admitted with and without impaired vision who presented with falls</p> <p>There was a significant difference in visual impair- ment between patients admitted with falls (76%) and those with other medical problems (45%)</p> <p>The number of fallers with reversible impaired vision was 27 of 45 (60%) and the number of these patients previously unknown to ophthalmologists was 22 of 27 (81%)</p> <p>If this visual impairment was detected and appropriately treated, these elderly at risk fallers may be able to remain more safely in the community.</p> <p>All fallers admitted to hospital should be screened for visual impairment Approximately 50% of patients had ocular morbidity; this was significantly higher in the over 85 group with 66% having impaired vision</p>	<i>Visual problems are a risk factor for falls</i>

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors and Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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Falls in elderly patients with glaucoma

<i>VISION</i>							
Glynn RJ et al 1991 Arch Ophthalmol REFERENCE 84	Community	N = 487 Patients with glaucoma (70%) or suspected to have glaucoma, aged 65 and older (range 65-93; mean age, 74) Patients recruited for 1 year; structured interview elicited falls history for year prior to the interview	Cohort	Risk factors Medications (ocular and other) Visual impairment Fall history Fall injury history Cognitive status Alcohol use Cigarette smoking Age Gender Outcomes: Fall risk factors	Standard assessment at routine glaucoma examinations, including assessment of a measure of percentage impairment in central vision.. Structured interview by telephone to assess risk factors not evaluated during the eye exam	Use of topical eye medications, not including miotics, was associated with a greater than fivefold increase in the odds for a fall A greater effect of non-miotics compared with miotics on falls suggests that these systemic effects of ocular medications may contribute more than the ocular effects such as constriction of the pupil (miosis) to factors that lead to falling. Medications appear to pose a greater risk for falls than major visual impairment. The use of certain ocular and systemic medications emerged as the strongest risk factors for falls. Systemic side effects from topical glaucoma medications include hypotension, bradycardia and even syncope.	Other results: Use of cardiac medications, female gender and use of sedatives had statistically significant associations with falls.

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Visual impairment and falls in older adults: the Blue Mountains Eye Study

<i>VISION</i>							
Ivers RQ et al 1998 J Am Geriatr Soc REFERENCE 85	Community	N = 3654 Men and women 49 years and older (74% over age 60)	Cross- sectional, retrospec- tive	Risk factors Demographic characteristics Medications (current and past) Visual function Family history Past medical history of systemic disorders (stroke, arthritis) Overall health self- rating Self reported falls history for prior 12 months Outcomes Fall risk factors	Study information sheet given (door- to-door) or mailed to residents in selected postal code areas Eye examination at clinic for volunteers -- Subjective refraction -- Screening visual field test -- Applanation tonometry --Stereo-optic disc photography Questionnaire administered at clinic visit	1 fall = 532 (16.1%) 2 falls = 143 (4.3%) 3 or more falls = 146 (4.4%) age 65 and older 29.6% reported 1 or more falls Mean age of fallers = 66.1 (SD 9.8) General risk factors signifi- cantly associated with 2 or more falls: Age Sex Psychotropic drug use History of stroke History of arthritis Self reported poor health status Measures of decreased visual function significantly associated with 2 or more falls: Poor visual acuity Reduced contrast sensitivity (strongest risk factor) Decreased visual field Presence of any posterior subcapsular cataract Use of nonmiotic glaucoma medication	Blue Mountains Eye Study Conclusion: Visual impairment is strongly associated with 2 or more falls in older adults. In addition to poor visual acuity, visual factors such as reduced visual field, impaired contrast sensitivity and the presence of cataract may explain this association.

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Effects of footwear on measurements of balance and gait in women between the ages of 65 and 93 years

<i>FOOTWEAR</i>							
Arnadottir SA 2000 Phys Ther REFERENCE 86	Community	N = 35 Women aged 65-93 (mean = 80, SD = 6.48)	Descrip- tive	Risk factors Age Height Weight Medical diagnoses Medications (Rx) Foot abnormalities Ankle dorsiflexion Ankle plantar flexion Shoe characteristics --Heel height (walking shoes) --Heel height (dress shoes) --Area under heel (dress shoes) --Sole flare --Sole firmness Outcomes Effect of footwear on clinical tests	Subjects performed tests barefoot, in walking shoes and in dress shoes. Subjects performed: Functional reach test (FRT) Timed Up and Go Test (TUG) 10-Meter Walk test (TMW)	Clinicians and researchers should view type of footwear as an important factor when using these common clinical tests Subjects performed better on the FRT when barefooted or wearing walking shoes compared with when they wore dress shoes. Differences were found among all footwear condi- tions for the TUG and the TMW. The women moved fastest in walking shoes, slower bare- footed and slowest wearing dress shoes Footwear should be docu- mented and should remain constant from one test occasion to another when the FRT, TUG and TMW are used in the clinic and in research. Footwear intervention may improve performance of balance and gait tasks in older women	<i>Intermediate outcomes such as functional reach test and timed up and go test are better with walking shoes than barefoot.</i>

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Shoe characteristics and balance in older women

<i>FOOTWEAR</i>							
Lord SR et al 1996 J Am Geriatr Soc REFERENCE 87	Community	N = 30 Women aged 60-89 (mean 78.7, SD 8.5)	Random- ized order cross-over controlled compari- son	Risk factors Difficulty shopping (33%) Difficulty with clothes washing or room cleaning (43%) Difficulty cooking (50%) Poor vision (60%) Stroke (16.7%) Heart disease (36.7%) High blood pressure (60%) Diabetes (13.3%) Arthritis (60%) 1 medication (20%) 2 or 3 meds (36.6%) 4 or more meds (26.7%) Cardiovascular meds (56.7%) Psychoactive meds (20%) NSAIDS (16.7%) Planned walking (56.7%) Able to walk 15 minutes or more (63.3%) Walking aid use (26.6%) Foot abnormalities (50%) Falls (prior 12 months (33.3%)	Assessment of static balance (body sway) and dynamic balance (maximal balance range and coordinated stability) in four shoe conditions: 1 Barefoot 2 Standard low- heeled walking shoes 3 Standard high- heeled shoes 4 Their own shoes Testing equipment was portable, and testing was done in the subject's own environment Outcomes: Postural sway Maximal balance range Coordinated stability	No significant interactions were found between shoe condition and --fall history --psychoactive med use --presence of foot abnormalities --walking aid use In sway and coordinated stability tests, subjects performed Best = barefoot Intermediate = low heeled shoes and their own shoes Worst = high heeled shoes In the dynamic range test subjects performed Best = low heeled shoes Intermediate = barefoot Worst = their own and high heeled shoes Subjects performed signifi- cantly better in the maximal balance range test in the standard low-heeled shoes than they did in their own shoes, (indicates subjects' shoes were not optimal) Bare feet and walking shoes maximize balance whereas high heeled shoes constitute a needless balance hazard for older women	<i>Subjects' performance was better in low heeled shoes than high heeled shoes.</i>

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Foot position awareness in younger and older men: the influence of footwear sole properties

<i>FOOTWEAR NEW</i>							
Robbins, S et al 1997 J AM GERIATR SOC REFERENCE 88	Community	N = 26 n = 13 older subjects n = 13 younger subjects Men in older group = mean age 72.6, SD 4.5 with no falls history in prior 12 months Men in younger group = mean age 28.1, SD 3.9	Random- ized cross over controlled compari- son	Risk factors Age Footwear Health history Outcomes: Balance failure frequency Rear foot angle Foot position error Perceived maximum supination when walking	6 pairs of custom made experimental footwear that incorporated midsoles approxi- mating the ranges of thickness and hardness found in currently available footwear. (three midsole hardnesses and 2 midsole thicknesses were tested); subjects also were tested barefoot Balance beam testing of stability; free walking, and optical position measurement of frontal plane movement and psychophysical measurement of perceived maximum supination Health history obtained by question naire	Foot position awareness (the reciprocal of foot position error) was approx. 200% poorer in the older sample The ability of male humans to detect position of plantar surface declines in relation to support surface under dynamic conditions, the condition under which falls occur. Position error and balance failure frequency showed identical patterns in relation to footwear independent variables in both age groups and were negatively related to midsole hardness and positively related to midsole thickness. Shoes with hard soles provide better propriocep- tion and improve stability The barefoot condition resulted in lowest foot position error and amplitude of maximum supination. Ability to balance barefoot appears to decline with advancing years; stability when barefoot was average in the young and dismal in	EVIDENCE (continued) the old. Soft materials placed underfoot destabilize mainly through high amplitude plantar surface movements affecting proprio- ception via muscle receptors. The amplitude of sole material properties on stability was so large that it seems unlikely that it has no effect on falls. Foot position awareness declines with advancing years and is influenced by footwear sole composition; men benefit in terms of stability and foot position awareness when footwear has high midsole hard- ness and low midsole thickness.

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Improving balance

<i>FOOTWEAR</i>							
Robbins, S et al 1998 J Am Geriatr Soc REFERENCE 89	Community	N = 60 n = 30 older men n = 30 younger men Men in older group, mean age 65 (SD 6.0, range 54-80) Men in younger group, mean age 33 (SD 3.0, range 25- 43) Laboratory testing	Random- ized cross over controlled compari- son	Risk factors Age Resiliency index Stability Sway velocity Outcomes Stability Comfort	Sole resiliency testing method to produce a resiliency index (= % return to preload thickness measured 1 second after removal of main load) Unique force- movement platform used, with barefoot subjects completing a one-legged balance protocol on 9 different surfaces presented in random order: --Bare platform --Platform covered with 4 different surface interface materials (each surface material presented twice)	Stability rises with low resilience interfaces and declines with high resiliency interfaces. Sway velocity in older people wearing hard soled footwear incorporating low resiliency technology would be 20% lower than in younger people wearing most current athletic and walking shoes. When wearing shoes containing soft, highly resilient interfaces, both young and old employ muscle receptors for foot position judgments which results in less precise postural adjustments and instability	<i>Stability is improved by hard soled shoes in young and old.</i>

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Physical restraint use and falls in nursing home residents

<i>RESTRAINTS</i>							
Capezuti E et al 1996 J Am Geriatr Soc REFERENCE 90	LTC	N = 322 n = 119 restrained n = 203 never restrained Secondary data analysis from a longitudinal clinical trial – 9.5 data collection period preceded intervention phase	2 group compari- son	Risk factors Restraint status Falls Cognitive status Psychoactive drug use Visual deficits Hearing deficits Stroke history Musculoskeletal disease Neurological disease Behavioral problems Functional status Ambulation status Outcomes Restraint status Falls Fall injuries	Restraint status was determined by direct observation at 3 points (approx. every 3 months) Fall incident reports were reviewed during the data collection period	1 fall = 46%, 149 subjects 2 or more falls = 26.4%, 85 subjects Injurious falls = Minor injuries 21.1% (68) Serious injuries 5.6% (18) 52.5% of ambulatory subjects fell 34.8% of nonambulatory residents fell More falls occurred in the confused ambulatory subgroup and restraint use was significantly associated with recurrent falls There was an independent effect on falls for subjects who received daily psycho- active drugs Most subjects were moderately to severely cognitively impaired and were functionally dependent. Restrained subjects were significantly more confused, more likely to be non- ambulatory, more functionally impaired, and displayed more behavioral symptoms.	<i>Restraint use is associated with a higher risk of falls in confused ambulatory patients. In non ambulatory patients, restraints did not influence the incidence of falls - either by increasing or reducing numbers.</i>

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors and Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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The relationship between physical restraint removal and falls and injuries among nursing home residents

<i>RESTRAINTS</i>							
Capezuti et al 1998 J Gerontol A Biol Sci Med Sci REFERENCE 91	LTC	N = 633 (all residents regardless of restraint status in- cluded in analysis) n = 463 (survived the 1 year data collection period) n = 302 (never restrained) n = 38 (restrained preintervention, but not at 3 postinter- vention data collec- tion points) n = 88 (restrained at pre intervention and at all 3 data collection points) n = 35 (restraint status varied; excluded from analysis) 3 nursing home sites (Control, RE and REC) Men and women, mean age 83.6, SD 7.5 1 year follow up	Quasi-ex- perimental design	Risk factors Restraint status (vest wrist/ankle, belt, pelvic, geriatric/ recliner chairs, wheelchairs with fixed tray tables) Cognitive status (MMSE) Mobility status (PGDRS*) Behavioral symp- toms (PGDRS) Psychoactive drug use Outcomes: Falls Fall related minor injury Fall related serious injury *Psychogeriatric Dependency Rating Scale	Intervention I: Restraint Education (RE) consisted of 10 classes implemented over a six month period designed to educate the nursing home staff regarding intervention tech- niques for under- standing and respon- ding to specific resi- dent behaviors that result in physical restraint application. Intervention II: Restraint Education with Consultation (REC) consisted of the same 6 month program supple- mented by 12 h x week direct resident centered consulta- tion to staff Data collection at 6, 9, and 12 months after baseline (falls data from incident reports)	-- Impaired cognition was associated with a signifi- cantly increased risk of falling (in addition to being an independent predictor of falling it was a significant confounding factor in the evaluation of restraint use and risk of falls) -- Restraint removal was associated with - a significantly lower fall rate - a reduced risk of all- related minor injury both before and after adjustment for other variables -- The fall rates in the two intervention nursing homes were 50% less than in the control nursing home -- The control nursing home had a restraint prevalence 2-3 times that of the intervention homes -- Only the REC site had a significant reduction in restraint use over time -- Cognitive function mean scores were signif higher for residents who had restraints removed -- Residents who remained in restraints were signi- ficantly more functionally impaired and were twice as likely to be chair-fast	<i>-Restraint removal increases falls.</i> <i>-Restraint removal decreases injuries</i> <i>-We need more available restraint studies</i> Author comments: Continued restraint use (vs restraint removal) was the only characteristic to increase signifi- cantly the risk of fall related minor injury Most falls occurred while a resident was transferring Because incident reports did not document restraint status immediately before or during reported falls, it was not possible to conclude any direct cause-effect relationship between restraint use and falls/ injuries

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors and Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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A clinical trial to reduce restraints in nursing homes

<i>RESTRAINTS - NEW</i>							
Evans LK et al 1997 J Am Geriatr Soc REFERENCE 92	LTC	N = 463 (from 643 at baseline) RE n = 152 REC n = 127 Control n = 184 Men and women mean age (SD) RE = 83.6 (7.1) REC = 83.8 (8.2) Control = 83 (7.7) Three nursing homes, random selection of intervention status 90 day retrospective audit and 12 months follow up	RCT	Risk factors Restraint use Restraint type Restraint prevalence Restraint intensity Number of residents Staffing level Injurious falls Psychoactive drug use/prevalence Outcomes Restraint status Staff levels Psychoactive drug use Falls Fall injuries	RE = compre- hensive Restraint Education program (10 45-minute sessions) taught by geriatric nurse specialist (GNS) REC = RE program plus 12 hrs/wk of concurrent, unit based consultation by GNS Control (C) = no education or consultation -- Direct observation of restraint status on 18 separate occa- sions (random time of visits) during 72 hour period (observers blinded to study design, interventions, nursing home's group assignment) -- Injurious falls data abstracted from 90-day retrospective audit -- Psychoactive drug use abstracted from 90-day retrospective audit & at baseline, 6 & 12 months	Fall rates (3 & 6 mo after intervention): RE: 41.5% and 32.2% REC: 42.5% and 37.8% C: 64.7% and 53.3% Total serious fall-related injuries = small both pre/post intervention. No serious injuries in REC home; RE = 8 (5.3%) C = 4 (2.2%) Compared with baseline, REC home had a significant reduction in restraint prevalence and intensity; Absolute decline in percent restrained (3 & 6 mo after intervention): RE = 7% and 4% REC = 20% and 18% C = 7% and 6% Average reduction in restraint use (from baseline): RE = 23% REC = 56% C = 11% REC residents between 25% and 40% more likely than RE or C residents to experience decreased restraint use.	EVIDENCE (continued) Conclusions: Results were achieved without increased staff, psychoactive drugs or serious fall- related injuries The proportions of residents taking psychoactive drugs was unchanged over time; also did not increase in the RE and REC homes where the greatest reductions in physical restraint use occurred. Although education is useful, far greater effects are achieved with the addition of consultation to provide individualized care for clinically challenging residents

Author Year Journal Reference #	Setting	Characteristics	Type of Study	Risk Factors and Outcome Measures	Interventions	Evidence & Nature of Benefit	Comments (Work Group Statement)
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Mechanical restraint use and fall related injuries among residents of skilled nursing facilities

<i>RESTRAINTS</i>							
Tinetti ME et al 1992 Ann Int Med REFERENCE 93	LTC	N = 397 n = 251 (subgroup at high risk of falls) Men and women, mean age 83.6 (+/- 8.2, range 62-105) Independently mobile and not restrained at baseline 12 skilled nursing facilities 1 year prospective observational study	Cohort	Risk factors Demographic data Medical diagnoses Medication use Falls history Vision deficits Hearing deficits Orientation level Depression Wandering ADLs Social activity participation Mobility Subgroup risk factors: Fall in prior 6 months or 3 of other risk factors, including: Disorientation Depression Unsteadiness Decreased vision Decreased hearing Psychoactive medication use Outcomes Restraint status Falls Fall injuries	Abstraction of medical chart Interview of designated staff nurse on unit Mobility assessment Data on type, location and frequency of mechanical restraint use from daily forms required by state Data on falls and injuries from medical charts and incident reports that occurred after first day of restraint use	-- 607 falls by 215 subjects 1 fall = 79 subjects 2 or more falls = 136 (range 2-12) -- Falls and injuries increased in frequency as restraint use increased. --64% of high risk subjects fell (161); 32% of remaining cohort fell -- Restraint use significantly associated with serious fall related injuries --122 (31%) were restrained during the follow up year --Unsteadiness, concern about falling or maintenance of position was cited as a reason in approx. 90% of cases of restraint use -- Disorientation and number of falls were significant predictors of injury in the entire cohort and high risk subgroup -- Female gender and poor hearing were significant predictors in entire cohort -- Poor vision associated with injury in the high risk subgroup -- Mechanical restraints associated with continued and perhaps increased occurrence of serious fall related injuries.	<i>There is an adverse association between mechanical restraint use and fall related injuries among residents of skilled nursing facilities</i> Author comments: Restraint use was initiated throughout the year and most often intermittent. Deconditioning, and loss of muscle strength, coordination and balance that may have occurred during periods of restraint in residents who were only marginally stable and functional at the initiation of restraint use could explain an increased occurrence of falls and injuries following restraint use.