PREVENTING FALLS IN OLDER PEOPLE: NEW ADVANCES AND THE DEVELOPMENT OF CLINICAL PRACTICE GUIDELINES

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Falls are one of the most common and devastating problems facing older adults, and their prevention has been a perplexing challenge. Fortunately, recent years have witnessed the development of several promising intervention strategies for reducing falls and fall-related injuries, and recent clinical trials have borne out the clear effectiveness of a number of them.

The most dramatically effective of these strategies include:

1. comprehensive assessment of fall-prone individuals tied to recommendations for reducing risk and follow-up;
2. targeted exercise programmes;
3. environmental inspection and modification programmes; and
4. hip-protective devices for reducing fractures among fallers.

A joint UK–US clinical practice guideline has recently been developed by an interdisciplinary panel (co-sponsored by three professional societies with peer review by 12 additional professional practice organisations) to assist clinicians in reducing falls among their older patients.[1] This article will summarise some of the new advances as well as describe the development and content of the new guideline.

EPIDEMIOLOGY OF FALLS IN OLDER PEOPLE

Falls rank among the major serious problems facing older people and cause considerable mortality, morbidity, reduced functioning and premature nursing home admissions.[2–6] Falls usually result from an interaction of multiple and diverse intrinsic risk factors – related to both age and disease – as well as environmental hazards and situations, many of which can be corrected.[6, 7] Frequently, older people do not appreciate their risks of falling nor do they discuss these issues with their physicians. Consequently opportunities for prevention of falling are often overlooked, with risks becoming evident only after injury and disability have already occurred.[8–10]

Both the incidence of falls and the severity of fall-related complications rise steadily after age 65. About 35–40% of the population over 65 living in the community fall annually, and after age 75, the rates are considerably higher.[11, 12] A key concern goes beyond the high incidence of falls in older people (indeed, young children and athletes have an even higher incidence of falls): it is rather the combination of high incidence and a high susceptibility to injury that is of major importance. This propensity for fall-related injury in older people stems from a high prevalence of co-morbidity diseases (e.g. osteoporosis) and age-related physiological decline (e.g. slower reflexes) that make even a relatively mild fall potentially dangerous. Approximately 5% of older people who fall require hospitalisation.

Incidence rates of falls in nursing homes and hospitals are almost three times the rates for people dwelling in the community aged ≥65 (averaging 1·5 falls per bed annually). Injury rates are also considerably higher with 10–25% of institutional falls resulting in fracture, laceration, or the need for acute medical care.[13] Fall-related injuries recently accounted for 6% of all medical expenditures in the US for people aged ≥65.[13, 14]

Unintentional injuries are the fifth leading cause of death in older adults (after cardiovascular, neoplastic, cerebrovascular and pulmonary causes), and falls are responsible for two-thirds of the deaths resulting from unintentional injuries. More strikingly from the geriatric perspective is that about 75% of deaths due to falls in the US occur in the 13% of the population aged ≥65.[15] In addition to physical injury, falls can have major psychological and social consequences. Fear of falling and the post-fall anxiety syndrome are well-recognised negative consequences of falls. The loss of self-confidence in the ability to ambulate safely can lead to self-imposed functional limitations.[2, 16] Recurrent falls and fear of falling commonly result in admission of previously independent older people to long-term care institutions[17, 18] – one study found that falls were a major reason for 40% of nursing home admissions.[19]

RISK FACTORS FOR FALLING

Many risk factors for falling have been identified in well-designed studies. These can be classified as either intrinsic (e.g. lower extremity weakness, poor grip

strength, balance disorders, functional and cognitive impairment, visual deficits) or extrinsic (e.g. medication side-effects, environmental hazards). A recent review of fall/risk factor studies ranked the risk factors and summarised the average relative risk of falls for people with each risk factor (Table 1).[12] The most important of these included muscle weakness (odds ratio (OR) = 4·4), history of falls (OR = 3·0), gait and balance deficits (OR = 2·9), and visual deficit, arthritis, impaired function or depression (OR = 2·2–2·5). In addition, a meta-analysis that studied the relationship of falls and medication found a significantly increased risk from psychotropic medication (OR = 1·7), Class 1a anti-arrhythmic medications (OR = 1·6), digoxin (OR = 1·2), and diuretics (OR = 1·1).[33]

Perhaps as important as identifying risk factors is appreciating the interaction and frequent synergism between multiple risk factors. Several studies, in both community and institutional settings, have shown that the risk of falling increases dramatically as the number of risk factors increases.[4, 6, 28, 31] For example, Tinetti *et al.* surveyed community-dwelling older people and reported that the percentage of individual falling increased from 27% for those with no or one risk factor to 78% for those with four or more risk factors.[31]

GUIDELINE DEVELOPMENT PROCESS AND METHODS

The Panel on Falls Prevention was convened as a joint task force by the American Geriatrics Society, the British Geriatrics Society and the American Academy of Orthopedic Surgeons. Members of the societies with research and clinical interests in falls prevention stimulated the selection of this guideline topic and assisted the societies in gathering unrestricted support to facilitate the bi-national process. The Panel members are listed in the Acknowledgements. They were nominated by the co-chairs in conjunction with the appropriate clinical practice committees of the specialty societies. The panel was supported by a guideline specialist.

The purpose of producing this evidence-based guideline was to create a practical and useful document to assist healthcare professionals in their assessment of fall risk and in their management of older patients who are at risk of falling and those who have fallen. Despite the definitive nature of parts of the guideline, the Panel maintains the assumption that healthcare professionals will use their clinical knowledge and judgement in applying the recommendations to the assessment and management of individual patients.

In preparing for the evidence-based guideline, an iterative literature search was initiated. It began with attempts to locate systematic reviews and meta-analyses, randomised trials, controlled before and after studies, and cohort studies using a combination of subject heading and free text searches. The Panel made extensive use of high-quality recent review articles and bibliographies, as well as contact with subject area experts. A literature search conducted at the RAND Corporation (Santa Monica, California) for the purpose of identifying quality of care indicators for falls and mobility problems for two ongoing national projects provided the initial set of articles reviewed for the guideline. New searches were concentrated in areas of importance to the guideline development process, for which existing systematic reviews were unable to provide valid or up-to-date answers.

The expert knowledge and experience of Panel members also reinforced the search strategy. 'Included' articles were meta-analyses and systematic literature reviews, randomised controlled trials, non-randomised clinical trials, case-control studies and cohort studies in

TABLE 1.

Univariate summary of most common risk factors for falls identified in 16 studies* that examined multiple risk factors.

Risk factor	Significant/Total†	Mean RR-OR‡	Range
Muscle weakness	10/11	4·4	1·5–10·3
History of falls	12/13	3·0	1·7–7·0
Gait deficit	10/12	2·9	1·3–5·6
Balance deficit	8/11	2·9	1·6–5·4
Use assistive device	8/8	2·6	1·2–4·6
Visual deficit	6/12	2·5	1·6–3·5
Arthritis	3/7	2·4	1·9–2·9
Impaired ADL	8/9	2·3	1·5–3·1
Depression	3/6	2·2	1·7–2·5
Cognitive impairment	4/11	1·8	1·0–2·3
Age >80 years	5/8	1·7	1·1–2·5

* References: 4, 6, 20–32

† Number of studies with significant odds ratio or relative risk ratio in univariate analysis/total number of studies that included each factor.

‡ Relative risk ratios (RR) calculated for prospective studies. Odds ratios (OR) calculated for retrospective studies.

which outcomes involved data related to fall risk or fall prevention as well as articles that provided epidemiological or other background information. For each article included, data were extracted. Reference lists of included articles were scanned for additional relevant studies. In all, over 5,000 titles were screened, 754 articles were assessed, and 180 studies were abstracted for evidence tables by the research assistant, with input from the Panel co-chairs. It is important to note that the literature on which the guideline is based includes only those articles that were published by September 2000.

The Panel identified and synthesised relevant published evidence to allow recommendations to be evidence-based, whenever possible, using the grading criteria shown in Table 2. The grading criteria distinguish between category of evidence (Classes I–IV) and strength of the associated recommendation (Grades A–D). It was possible to have methodologically sound (Class I) evidence about an area of practice that had such a small effect that it was of little practical importance and would therefore warrant a lower strength of recommendation.[34] More commonly, a statement of evidence would only cover one part of an area in which a recommendation had to be made, or would cover it in a way that conflicted with other evidence. Therefore, to produce comprehensive recommendations, the Panel sometimes had to extrapolate from the available evidence. It was accepted that there would be areas without evidence where recommendations should be made and that consensus would be required to address such areas. For a number of the interventions, there was insufficient evidence to make recommendations and 'Comment' sections were written. Throughout the guideline development process, the Panel identified important unanswered research questions that were listed in the 'Research Agenda' section at the end of the guideline.

TABLE 2
Categories of evidence and strength of recommendation.

Categories of evidence	
Class I:	Evidence from at least one randomised controlled trial or a meta-analysis of randomised controlled trials.
Class II:	Evidence from at least one controlled study without randomisation or evidence from at least one other type of quasi-experimental study.
Class III:	Evidence from non-experimental studies, such as comparative studies, correlation studies and case-control studies.
Class IV:	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities.
Strength of recommendation	
A:	Directly based on Class I evidence.
B:	Directly based on Class II evidence or extrapolated recommendation from Class I evidence.
C:	Directly based on Class III evidence or extrapolated recommendation from Class I or II evidence.
D:	Directly based on Class IV evidence or extrapolated recommendation from Class I, II, or III evidence.

The guideline was divided into two parts:
1. assessment of people who have fallen or who may be at risk for falling; and
2. management interventions for individuals at increased fall risk.

The following summarises the essential aspects of the clinical guideline. An algorithm summarising the assessment and management of falls is shown in Figure 1.

Although development of this guideline was a joint project of the American Geriatrics Society, the American Academy of Orthopedic Surgeons and the British Geriatrics Society, the epidemiology of falls was based largely on North American data, and thus there are only indirect data to inform the appropriate configuration of services within the UK National Health Service. In particular, the balance between the benefits of assessment and intervention, set against the workload and cost implications of a potential increase in referral for specialist assessment, is unclear and would need to be planned carefully when implementing this guideline within any local setting, as part of the implementation of the National Service framework.

ASSESSMENT OF INDIVIDUALS WHO HAVE FALLEN OR WHO ARE AT RISK FOR FALLING

General principles

The recommendations for assessment came from epidemiological studies demonstrating an association between risk factors and falls and from experimental studies in which assessment followed by intervention demonstrated benefit (see Interventions to Prevent Falls, below). In these studies, the assessment processes contained many common components but were by no means uniform. Thus, the suggested assessment in this guideline is intended to describe what needs to be done to understand an individual's risk factors and apply effective intervention, based on the preponderance of study data as well as clinical experience of the experts.

The intensity of assessment varies by target population. For example, fall risk assessment as part of routine primary healthcare visits with relatively low-risk senior populations would involve a brief screening assessment. In contrast, high-risk groups – such as people with recurrent falls, those living in a nursing home, those prone to injurious falls, or those presenting after a fall –

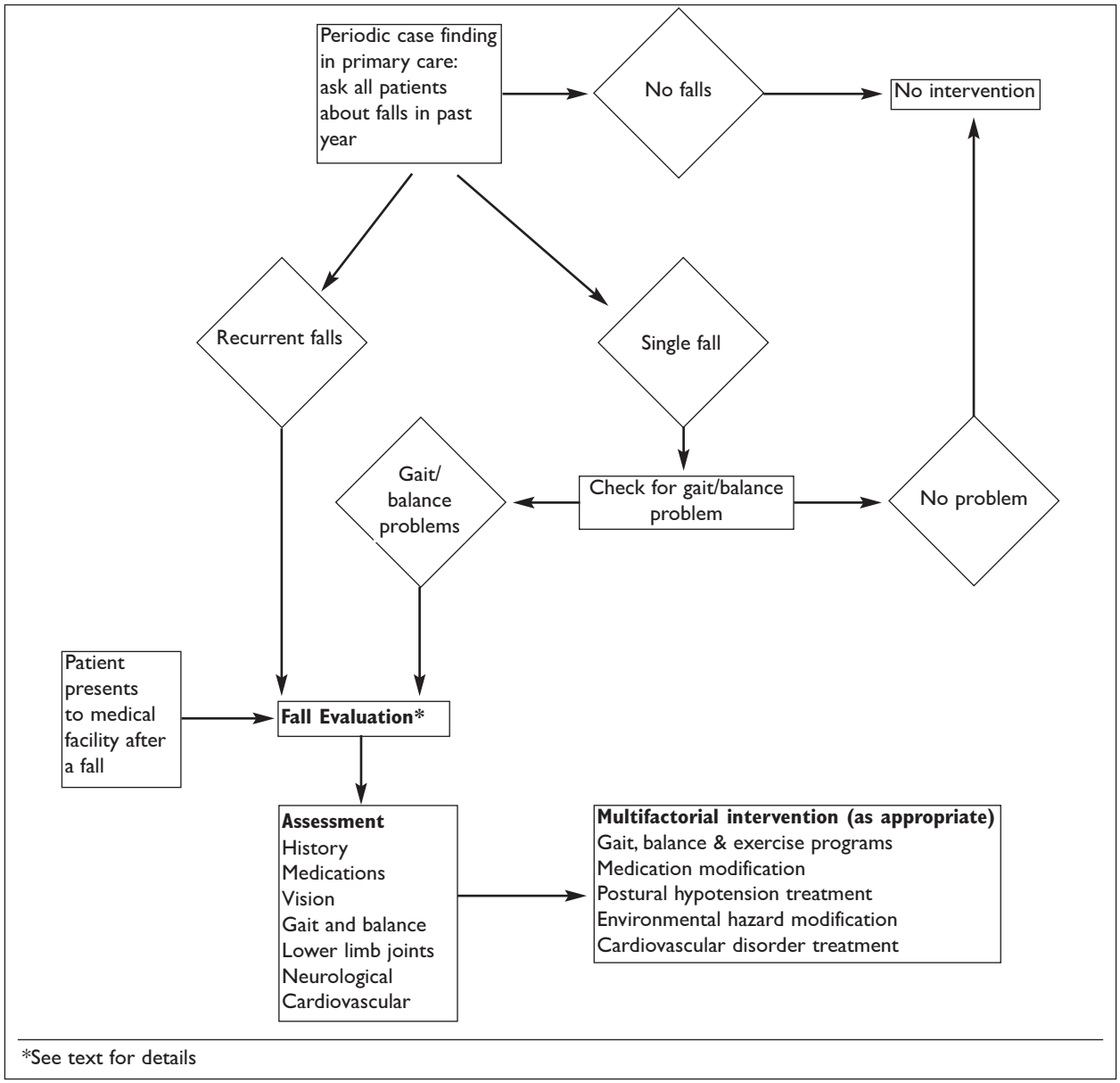

FIGURE 1
Assessment and management of falls

would require a more comprehensive and detailed assessment. The essential elements of any fall-related assessment include details about the circumstances of the fall (including a witness account), identification of the subject's risk factors for falls, any medical co-morbidity, functional status and environmental risks. A comprehensive assessment may necessitate referral to a specialist (e.g. geriatrician).

The risk factors identified in the assessment may be modifiable (i.e. muscle weakness, medication side-effect, or hypotension) or non-modifiable (i.e. hemiplegia or blindness). However, knowledge of all risk factors is important for treatment planning. Essential components of the fall-related patient assessment were identified whenever possible from successful controlled trials of fall-prevention interventions. The justification for assessment to identify a specific risk factor is strongest when successful treatment or other risk-reduction strategies have been explicitly based on this specific risk factor. In some cases, the link between identified risk factors and the content of interventions is not clear. When conclusive data on the importance of specific aspects of the assessment (either to prediction of falls or to responsiveness of these risk factors to the intervention) were not available, consensus from the Panel was sought. Because of the dependence of the assessment on subsequent intervention for effectiveness, it was more difficult to ascribe strength of recommendation to assessment recommendations alone. Therefore, specific recommendations for assessment have been left ungraded.

Specific recommendations: assessment

Approach to older people as part of routine care (not presenting after a fall)

- All older patients who are under the care of a health professional or their caregivers should be asked at least once a year about falls.

- All older patients who report a single fall should be observed as they stand up from a chair without using their arms, walk several paces, and return (i.e. the 'get up and go' test).[35, 36] Those demonstrating no difficulty or unsteadiness need no further assessment.

- Patients who have difficulty or demonstrate unsteadiness performing this test require further assessment.

Approach to older people presenting with one or more falls, or who have abnormalities of gait and/or balance, or who report recurrent falls

- Older patients who present for medical attention because of a fall, report recurrent falls in the past year, or demonstrate abnormalities of gait and/or balance should have a fall evaluation performed. This evaluation should be performed by a clinician with appropriate skills and experience, which may necessitate referral to a specialist (e.g. geriatrician).

- A fall evaluation is defined as an assessment that includes the following: a history of fall circumstances, medication, acute or chronic medical problems, and mobility levels; an examination of vision, gait and balance, and lower-extremity joint function; an examination of basic neurological function, including mental status, muscle strength, lower-extremity peripheral nerves, proprioception, reflexes, tests of cortical, extra-pyramidal, and cerebellar function; and assessment of basic cardiovascular status including heart rate and rhythm, postural pulse and blood pressure and, if appropriate, heart-rate and blood-pressure responses to carotid sinus stimulation.

INTERVENTIONS TO PREVENT FALLS

General principles

The study data identified for this part of the guideline were heterogeneous across most dimensions. This heterogeneity precluded the use of meta-analytic techniques and dictated the use of narrative summary. Again, the Panel identified and synthesised relevant published evidence according to the standard grading criteria mentioned above.

The populations included in the studies varied from fit older people who had not fallen, to those at risk for falls, to those experiencing single or frequent falls. The cognitive status of the study population was not reported consistently. Study environments included community settings (the majority), long-term care facilities and acute hospital units. The method of reporting the effect of interventions on falls also varied across studies. The system used most commonly reported the total number of falls during a given interval following randomisation. Other methods included reporting the number of fallers or the time to the first fall event. Evidence for compliance with the intervention(s) was not always reported. Methods for documenting fall outcomes also varied. The most frequently used method was calendar/diary cards. Other methods included telephone or personal interviews.

Most studies evaluating multifactorial interventions were conducted in community settings. The individual elements of the interventions were described inconsistently and, as a consequence of the study designs, it was not possible to determine which components were most effective. However, by examining the components of studies with and without an overall positive effect, it was possible to identify specific interventions that were used more commonly in positive studies. The multifactorial intervention studies were considered for the different settings in which participants resided: community-based, long-term care, and in-hospital studies.

The intervention strategies that were evaluated for their effectiveness in preventing falls were classified as single or multifactorial strategies and as generic or individually tailored. The recommendations are presented for multifactorial interventions followed by single interventions because this sequence reflects the underlying evidence.

Specific recommendations: multifactorial interventions

- Among community-dwelling older people (i.e. those living in their own homes), multifactorial interventions should include: gait training and advice on the appropriate use of assistive devices (B); review and modification of medication, especially psychotropic medication (B); exercise programmes, with balance training as one of the components (B); treatment of postural hypotension (B); modification of environmental hazards (C); and treatment of cardiovascular disorders, including cardiac arrhythmias (D).

- In long-term care and assisted-living settings, multifactorial interventions should include: staff education programmes (B); gait training and advice on the appropriate use of assistive devices (B); and review and modification of medications, especially psychotropic medications (B).

- The evidence is insufficient to make recom-

mendations for or against multifactorial interventions in acute hospital settings.

Community-based studies

There were 11 randomised controlled studies of community-dwelling older adults.[37–47] The elements of the multifactorial interventions included medical assessment, education programmes, self-management programmes, home environment modifications, advice about medication use (with or without subsequent modification of medication), exercise and management of cardiovascular disorders (such as postural hypotension and carotid sinus syndrome).

Reductions in the number and dosages of prescribed medications were associated with benefit in all three studies that included this intervention (Class I).[37, 38, 44] Medication review without subsequent direct efforts to modify medication was of no benefit in three[39, 40, 46] of four[47] studies (Class I).

Exercise programmes were associated with benefit in all the three studies that included this intervention (Class I).[37,42,44]

Medical assessment followed by specific interventions for any medical problems that were identified (including cardiovascular disorders and visual problems) was beneficial in one study (Class I).[38] Referral for medical assessment was of benefit in two[38, 47] of three[46] studies (Class I). In addition, the management of postural hypotension was part of the effective intervention in two studies (Class I).[38, 45]

Evidence of benefit from modification of home environmental hazards was equivocal in one study[44] and of no benefit in a second (Class I).[46]

Staff education programmes were not effective in reducing falls (Class I).[39] Self-management programmes were not beneficial in the five studies in which they were reported (Class I).[39–42, 46]

Advice alone about fall risk factor modification (without measures to implement recommended changes) was of equivocal benefit in three[38, 42, 47] and of no benefit in two[40, 41] studies (Class I).

Long-term care-based studies

There were two randomised controlled studies in long-term care settings.[48, 49] Both showed overall significant and important benefits from multifactorial interventions, although only one study[48] documented significant reductions in subsequent falls (Class I). The effective components appeared to be comprehensive assessment, staff education (in contrast to community settings), assistive devices, and reduction of medication.

In-hospital-based studies

Although the strategy is widely implemented, there are no adequate randomised controlled trials of multifactorial intervention studies to reduce falls among hospital inpatients.[50]

Specific recommendations: single intervention

Exercise

- Although exercise has many proven benefits, including prevention of falls, the optimal type, duration and intensity of exercise for falls prevention remain unclear (B).

- Older people who have had recurrent falls should be offered long-term exercise and balance training (B).

- Taijiquan is a promising type of balance exercise, although it requires further evaluation before it can be recommended as the preferred balance training (C).

The Panel made a number of general observations about exercise. There is good evidence of benefit from exercise in falls prevention. However, the Panel was unable to determine which configuration of exercise programme to recommend. The Panel identified a number of key findings: the evidence is strongest for balance training; there is less evidence for resistance and aerobic training; there are few comparative data regarding the intensity or type of exercise. Successful programmes have consistently been over ten weeks' duration. Exercise needs to be routine for sustained benefit. There is preliminary evidence to support the particular value of Taijiquan. There is a dearth of studies involving men. In long-term care settings, there is no evidence of benefit for exercise alone.

Among relatively healthy, community-dwelling older people, a programme of very intensive strength and endurance training reduced the risk of subsequent falls and the proportion of fallers (Class I).[51] In another study involving community-dwelling women, there was no evidence that a generic exercise programme reduced falls (Class I).[52] In young elderly (i.e. people aged 65–74), community-dwelling women, frequent low-impact weight-bearing exercises and calcium supplementation over a two-year period did not significantly reduce falls (Class I).[53] In community-dwelling older women, individually designed exercise programmes in the home that incorporated strength and balance training reduced both falls and injuries; for those who continued to exercise, the benefits were evident after a two-year period (Class I).[54] In the FICSIT meta-analysis of seven studies that featured exercise as a prominent part of multifactorial interventions, there was an overall significant reduction in falls among intervention subjects, although only three of the seven individual trials showed significant reductions (Class I).[55] In a randomised trial of a group exercise programme held thrice weekly for fall-

prone older men, there was improvement in strength, endurance, gait and function as well as reduced fall rates adjusted for increased levels of activity (Class I).[56]

In community-dwelling women at moderate risk of falls, Taijiquan reduced the rate of falls during a short follow-up period of four months (Class I).[57] In the same population, a computerised balance training programme did not reduce falls (Class I).[57]

Among older women who had recurrent falls, a course of physical therapy targeting strength and balance was effective in reducing falls,[58] while a community-based generic exercise programme in older men was of no benefit in falls reduction (Class I).[56, 59] An individually designed exercise programme for nursing-home patients with moderate dementia did not reduce falls (Class I).[60]

Environmental modification

- When older patients at increased risk of falls are discharged from the hospital, a facilitated environmental home assessment should be considered (B).

In a subgroup of older patients, a facilitated home modification programme after hospital discharge was effective in reducing falls (Class I).[61] However, while environmental assessment and modification was a component of several successful multifactorial interventions, as noted earlier, modification of home environment without other components of multifactorial intervention was not found to be beneficial in several other studies (Class I).[62–6]

Medication

- Patients who have fallen should have their medication reviewed and altered or stopped as appropriate in light of their risk of future falls. Particular attention to medication reduction should be given to older patients taking four or more medications and to those taking psychotropic medication. (C)

For all settings (i.e. community, long-term care, hospital and rehabilitation), there is a consistent association between psychotropic medication use (i.e. neuroleptics, benzodiazepines and antidepressants) and falls. Although there are no randomised controlled studies of manipulation of medication as a sole intervention, reduction of medications was a prominent component of effective fall-reducing interventions in community-based and long-term care multifactorial intervention studies (Class I).[37, 38, 44, 47, 48] Multifactorial studies suggest that a reduction in the number of medications in patients who are taking more than four preparations is beneficial. However, since prescribing practice has changed considerably in the past decade, particularly for long-term management of cardiovascular disease, it is unlikely that the detailed polypharmacy patterns associated with taking four or more medications remain the same as when these findings were made. This emphasises the need for interpretation of these guidelines in the context of patients' overall health management. There is no clear difference in the risk for falls between long and short-acting benzodiazepines (Class II).[33] Compliance with intervention needs to be sustained to be effective.

Assistive devices (including bed alarms, canes, walkers (Zimmer frames) and hip protectors)

- Studies of multifactorial interventions that have included assistive devices have demonstrated benefit. There is, however, no direct evidence that the use of assistive devices alone will prevent falls. Therefore, while assistive devices may be effective elements of a multifactorial intervention programme, their isolated use without attention to other risk factors cannot be recommended (C).

Few studies have evaluated the effect of assistive devices (such as canes and walkers) as an intervention for preventing falls (Class IV).[67] Among hospitalised patients, there is insufficient evidence for or against the use of bed alarms (Class I).[68]

Hip protectors do not appear to affect the risk of falling (Class I).[69] However, there are a number of studies, including three randomised trials, that strongly support the use of hip protectors for prevention of hip fractures in high-risk individuals. The Panel refers the reader to the published guidelines on the treatment and prevention of osteoporosis.[70, 71]

Behavioural and educational programmes

- Although studies of multifactorial interventions that have included behavioural and educational programmes have demonstrated benefit, when used as an isolated intervention, health or behavioural education does not reduce falls and should not be done in isolation (B).

A structured group educational programme among community-dwelling older people did not reduce the number of falls but did achieve short-term benefits in attitudes and self-efficacy (Class I).[72] The presence of posted practice guidelines in the emergency department, introduced with brief educational training, did not alter documentation of falls-risk factors, causes of falls, consequences of falls, or the implementation of practice guidelines (Class I).[73, 74]

COMMENTS ON OTHER POTENTIAL INTERVENTIONS

Bone strengthening medication

A number of medication used widely to prevent or treat osteoporosis (e.g. hormone replacement therapy (HRT), calcium, vitamin D, antiresorptive agents) reduce

fracture rates. However, these agents have not been shown to reduce rates of falls *per se*. Given the wealth of information concerning HRT and vitamin D in osteoporotic fractures, including ample prior analyses and practice guidelines, the Panel refers the reader to published guidelines on HRT for osteoporosis.[70, 71, 75]

Cardiovascular intervention

There is emerging evidence that some falls have a cardiovascular cause that may be amenable to intervention strategies often directed to syncope, such as medication change or cardiac pacing. The role of these cardiac investigations and treatments is not yet clear.

Case series report an overlap of symptoms of falls and syncope and a causal association between some cardiovascular disorders and falls, particularly orthostatic hypotension, carotid sinus syndrome, and vasovagal syndrome.[76–81] In particular, up to 30% of older patients with carotid sinus syndrome present with falls and have amnesia for loss of consciousness when bradyarrhythmia is induced experimentally.[82, 83] Preliminary studies suggest that patients with recurrent unexplained falls and a bradycardiac response to carotid sinus stimulation experience fewer falls after implantation of a permanent cardiac pacemaker. However, pending the results of an ongoing randomised trial, pacemaker therapy for the treatment of recurrent falls cannot be recommended at this time.

Visual intervention

Patients should be asked about their vision and if they report problems, their vision should be assessed formally and any remediable visual abnormalities should be treated.

There are no randomised controlled studies of interventions for individual visual problems despite a significant relationship between falls, fractures and visual acuity.[84] Fall-related hip fractures were higher in patients with visual impairment.[85] Visual factors associated with two or more falls included poor visual acuity, reduced contrast sensitivity, decreased visual field, posterior subcapsular cataract and non-mitotic glaucoma medication.[84–6]

Footwear interventions

Because there are no experimental studies of footwear examining falls as an outcome, the Panel is not able to recommend specific footwear changes to reduce falls. However, some trials report improvement in intermediate outcomes, such as balance and sway from specific footwear interventions. In women, results of functional reach and timed mobility tests were better when subjects wore walking shoes than when they were barefoot.[87] Static and dynamic balance were better in low-heeled rather than high-heeled shoes or than the patient's own footwear.[88] In men, foot-position awareness and stability were best with high mid-sole hardness and low mid-sole thickness.[89] Static balance was best in hard-soled (low resistance) shoes.[90]

Restraints

The Panel found no evidence to support restraint use for falls prevention. Restraints have been used traditionally as a falls prevention approach. However, they have major drawbacks and can contribute to serious injuries. There is no experimental evidence that widespread use of restraints or, conversely, the removal of restraints, will reduce falls.[91–4]

RESEARCH AGENDA

In the process of developing these guidelines, the Panel identified a number of issues related to falls prevention that it believes should be given high priority for future research and analysis. The Panel believes that further research will be necessary to gather sufficient evidence that will lead to meaningful conclusions about the following concerns:

1. What is the cost-effectiveness of recommended strategies?
2. Can fall-prone individuals be risk-stratified in terms of who will most benefit from assessment and interventions?
3. What are the effective elements for falls prevention among hospital in-patients?
4. How can falls best be prevented in patients with cognitive impairment and dementia?
5. What are the effective elements of exercise programmes (such as type, duration, intensity and frequency)?
6. What are the effective elements of cardiovascular programmes for fall prevention?
7. For whom and when is home assessment by an occupational therapist or other home-care specialist effective?
8. What is the effectiveness of assistive devices (e.g. canes and walkers/Zimmer frames) used alone as a strategy for preventing falls?
9. What is the effect of restraint removal, coupled with other specific interventions, on falls and serious injuries?
10. Does treatment of visual problems prevent falls?
11. What is the safest footwear for people who have fallen or are at risk of falling?
12. What is the role of hip protectors in people who have fallen or are at risk of falling, and what are the most effective designs?

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