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Implementation of multifactorial interventions for fall and fracture prevention

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Abstract

Over 60% of falls experienced by older people result from multiple aetiological factors. Preventing falls in individual patients requires the identification and treatment of these interacting factors. Multifactorial interventions have been successful in some, but not all, fall prevention trials. Preventing falls in populations requires selection of the population most likely to benefit, and selection of the particular interventions shown to have been effective in this group. The implementation of preventive measures has been low despite strong evidence that fall and fractures can be reduced. Misconceptions about the potential for prevention in old age, the time to effect improvement, resource issues and the nature of the interventions contribute to the low uptake. An improved system of delivery of proven preventive measures is needed.

Keywords: *fall prevention, older people, multifactorial*

Introduction

Active people fall with reasonable regularity throughout their lives. It is in old age, when the precipitants can be minimal and the consequences catastrophic, that the prevention of falls becomes particularly important. Falls become a marker of frailty rather than vitality and one of the major problems of old people and aged care services.

Fall prevention trials have been based on information gained from retrospective and then prospective epidemiological studies. These studies have documented the frequency and circumstances of falls amongst different populations and have identified fall risk factors. The initial fall prevention trials demonstrated that falls could be prevented. The Yale-based Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT) trial of Tinetti and colleagues is a seminal study in geriatric medicine, not only because it demonstrated that falls can be prevented but also because this was the first trial to demonstrate effective community prevention of any of the major conditions of old age [1]. Subsequent fall prevention trials have determined more specifically which interventions work and in which populations [2].

Fall prevention now requires not only the identification of those at risk of falling but also the prescription of the most effective programme to those most likely to benefit. Not all falls cause concern, and not all people benefit from all interventions. Prescribing the right treatment requires an understanding of the processes which lead to falls, and knowledge of the modifiable risk factors.

Fall risk factors

The individual fall risk factors identified in epidemiological studies [3, 4] are summarized in Table 1.

Environmental factors do contribute to falls, both within the home and in public places [5]. Falls are more frequent during the winter months and when temperatures are low, especially amongst women [6].

Women are more at risk of falling than men. Factors contributing to this increased risk are women's greater use of psychotropic medication, probable higher weight-to-strength ratio, especially at the ankle and a greater proportion of women living alone [7].

Types of fall

A prospective study of a community population 70 years and older demonstrated that about 15% of falls result from a major external event, the sort of event that would cause most people to fall [8]. People experiencing this type of fall tend to be younger, more active and intellectually able. No further action is needed.

A similar number of falls results from a single identifiable cause such as syncope or established neurological disease.

The remainder of falls result from multiple interacting factors. The ways in which these factors might interact are shown in Figures 1 and 2. Falls result from interactive aetiological factors not simply from the additive effects of multiple pathologies [9].

Table 1. Fall risk factors identified in epidemiological studies[a]

Risk factor
Muscle weakness
History of falls
Gait deficit
Balance deficit
Use assistive device
Visual deficit
Arthritis
Impaired activities of daily living
Depression
Cognitive impairment
Psychotropic medication use
Age > 80 years

[a]Adapted from [3,4].

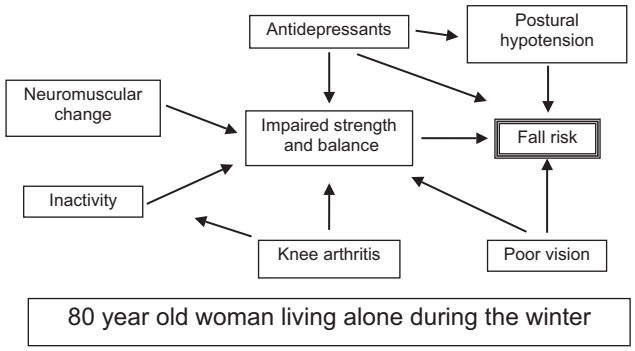

Figure 1. Interaction of risk factors predisposing to falls.

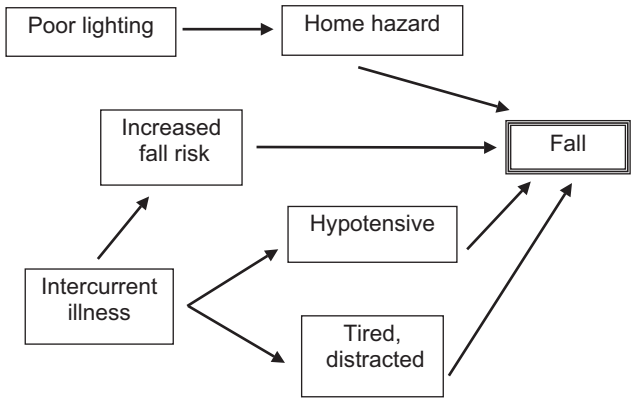

Figure 2. Interaction of risk factors precipitating falls.

A variety of strategies is therefore needed to prevent falls, and these strategies have been investigated through different types of trial.

Types of fall prevention trial

There are four types of successful, published fall prevention trials.

Single factor, single intervention

In this type of trial, falls that result from a single factor are treated with a single intervention. An example is the treatment of syncopal falls with cardiac pacing [10].

Multiple factor, systems intervention

A population group falling from multiple causes is assessed and treated in an established health system. In the Prevention of Falls in the Elderly Trial (PROFET), older people who presented to the accident and emergency department were individually assessed through a fall assessment system and appropriate treatments using established hospital and community resources significantly decreased risk of further falls [11].

Multiple factor, specific interventions

The FICSIT trials used a variety of clearly defined interventions, mostly in combination [12]. The Yale study, for example, used strength and balance retraining, total and psychotropic drug reduction, transfer skill teaching and grab bars, reduction of environmental hazards and correction of postural hypotension to decrease fall risk by about one third [1]. There have now been successful multifactorial intervention trials in residential homes and retirement villages [13, 14].

Multiple factor, single interventions

Although multiple aetiological factors contribute to most falls, addressing a single major risk factor can still be very effective. Successful single interventions include strength and balance retraining [15–17] and psychotropic drug reduction [18]. Single intervention trials can also identify effective components for multifactorial public health programmes for fall prevention.

Public health and personal health interventions

There are important differences between fall prevention programmes developed for individuals and programmes developed for populations.

Personal health programmes are individually tailored to achieve maximum benefit, are based on diagnosis, may require many health professionals (physician, occupational therapist, physiotherapist and nurse), but can reach only a small proportion of people. In fall prevention programmes for individual patients, it makes good sense to identify all the contributing factors to the person's fall and modify those amenable to intervention.

Public health programmes on the contrary identify target populations, tend to use a multi-skilled professional, are protocol based and reach larger numbers at lower individual cost. In the implementation of a public health fall prevention strategy, cost, the population most likely to benefit and public acceptability need to be considered in determining the interventions.

Strengths and weaknesses of population-based multifactorial interventions

Multifactorial interventions are consistent with the multifactorial causation of most falls. In theory, but interestingly not in practice, the benefit to a population should be greater

than with single interventions. Secondary benefit from fall prevention programmes, such as decreased hospital admission rates, has been demonstrated [19], and this should be greatest with multiple interventions. Multiple fall prevention interventions can be coupled with fracture prevention strategies.

However, the cost in both time and other resources is most likely to be greater than with single interventions. Uptake, adherence and long-term participation in the programme may be less when more is required of the participants. More interventions mean more potential adverse effects. In multifactorial trials, it is also difficult to determine the effective components.

Identifying those most likely to benefit from fall prevention programmes

The individuals or groups that trial evidence indicates are most likely to benefit from identification and intervention are given below:

(i) Older people who present to an emergency department undergoing individual assessment and appropriate interventions [11].
(ii) Frail but cognitively intact people living in their own homes, particularly if ≥80 years [15]. There is sound evidence that if those at most risk of falling can participate in a programme to improve strength and balance, then their risk of falling is decreased to a clinically important extent [20, 21]. The overall effect for those ≥80 years in four controlled trials of a home-based strength and balance retraining programme (the Otago Exercise Programme) was to reduce both falls and injuries by 40% [20]. This group may also benefit from modification of other risk factors.
(iii) Those whose falls result from syncope, and selected individuals who have no clear recall of the fall events. These should benefit from cardiac pacing if cardioinhibitory carotid sinus hypersensitivity is shown [10].
(iv) Those on psychotropic drugs whose drugs are gradually withdrawn [18].
(v) Those in rest homes or retirement villages who can participate in a multifactorial fall prevention programme [13, 14].
(vi) At-risk older people living in the community or retirement villages who take part in group exercise programmes [22, 23].
(vii) Elderly women post hip fracture who take vitamin D supplementation [24].

Some whose fall results in injury, a long lie or loss of confidence may need interventions to restore confidence and prevent further injury. Such interventions may include a mobility programme, home modification, an alarm system, vitamin D replacement and hip protector pads.

Implementation

Despite sound trial evidence of the effectiveness of fall and fracture prevention strategies, implementation of treatment is low.

After presentation with fragility, low trauma fracture, only 20–25% of people receive treatment to prevent a further fracture. Paradoxically, it is those at greatest risk of further fracture and most likely to benefit who are least likely to receive treatment. The attributable risk for hip fracture from reduced bone mineral density increases with age. The cost-effectiveness of bisphosphonates in fracture prevention increases with age. Yet, in a follow-up of treatment after a fracture, the use of secondary preventive strategies decreased with age [25].

Participation in fall prevention trials is low. We have found about one-third to a half of older people considered by their general practitioners to potentially benefit from the intervention being tested have been enrolled in the study. In the first successful fall prevention trial, the 301 participants were drawn from 2,229 invited subjects [1]. Acceptance is even lower with interventions some find unacceptable, such as psychotropic drug withdrawal [1, 18]. However, participation in actual programmes, as opposed to trials, may be greater. In one study where group allocation was not randomised, more participants were available than resources allowed our research team to recruit into the trial [17].

Reasons for low implementation rates

There are many different reasons why research findings are not readily disseminated to those who will benefit. These may include difficulty for both health professionals and older people themselves in accessing information, a culture where evidence is not valued, financial and organisational issues, weak incentives for change, the lack of demand and time pressures, especially for health professionals.

Factors that may be contributing to the low prescribing and uptake of fall and fracture treatments are summarised below.

Age and frailty of the population

There is a common misconception that old people are too frail to participate in, or benefit from, preventive measures. In our trials of strength and balance retraining, those who were ≥80 years and had had a previous fall benefited most from the programme [20]. The participation of very old people in preventive activities is often high, because the consequences of a fall and fracture are very evident and real.

Time to fracture prevention

Because of the short life expectancy of the very old and the severity of the underlying problems, the time for improvement may be considered too short. Yet, some interventions such as hip protector pads [26] and environmental changes [27, 28] have immediate effect and could benefit this frail population. Fall reduction from multifactorial fall prevention programmes and strength and balance retraining occurs well within the year. Similarly, fracture reduction from bisphosphonate therapy [29] and from calcium and vitamin D therapy in residential homes [30] is evident within the year.

Resource issues

Because life expectancy is short, expenditure on preventive measures in old age may not be considered good use of

scarce resources. Yet, the cost of fall and hip fracture is considerable and is reduced most effectively in the old and frail group who are most at risk. Good information on cost-effectiveness is seldom available and rarely considered.

Nature of the intervention

Most interventions used in fall prevention programmes require either active and ongoing participation or agreement to changes, which may not be acceptable. Exercise programmes have to extend the person to be effective. Lifestyle changes, such as decreasing psychotropic drug use or environmental modification, are often refused. It is interesting that Tai Chi, which seems trendy and fun, has support which is certainly not justified given the lack of consistent benefit shown in trials so far [31, 32].

System of delivery

One of the important barriers to the implementation of proven fall prevention programmes is the lack of a delivery system. There are no trials that have investigated the most effective way to deliver fall and fracture prevention strategies. We are exploring the development of a primary care, multifactorial fall and fracture prevention programme. The programme would be delivered by a 'fall and fracture' nurse who would be responsible to several general practices. The nurse would assess and manage individuals at risk according to an established protocol for fall and fracture prevention. The general practice base for the nurse enables open communication about assessment of medical conditions, referrals for further investigation and drug addition and modification. The nurse would be responsible for the implementation and teaching of proven preventive strategies to both prevent falls and maintain bone health. This study will need to be an international multicentre trial.

Summary

There is now strong trial evidence that a clinically significant proportion of falls experienced by older people can be prevented. There is no justification for using untested programmes.

Not all falls require assessment, and not all older people will benefit from interventions.

Those who may benefit can be identified by individual assessment and by the characteristics of the previous falls. Similarly, there are certain population groups who will benefit most from public health interventions.

Despite this evidence of benefit, preventive measures are underused. We need more effective means of delivering proven treatments.

Key points

- Over 60% of falls result from multiple interacting aetiological factors.
- Some trials using multifactorial interventions have shown a reduction in falls.
- A multifactorial prevention programme is not necessarily the intervention of choice with all population groups.
- The use of fall and fracture preventive measures is well short of optimal level.
- A system of delivery of proven preventive measures is needed.

Conflicts of interests

None.

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