Second Edition

# Falls in Older People

## Risk Factors and Strategies for Prevention

Stephen Lord
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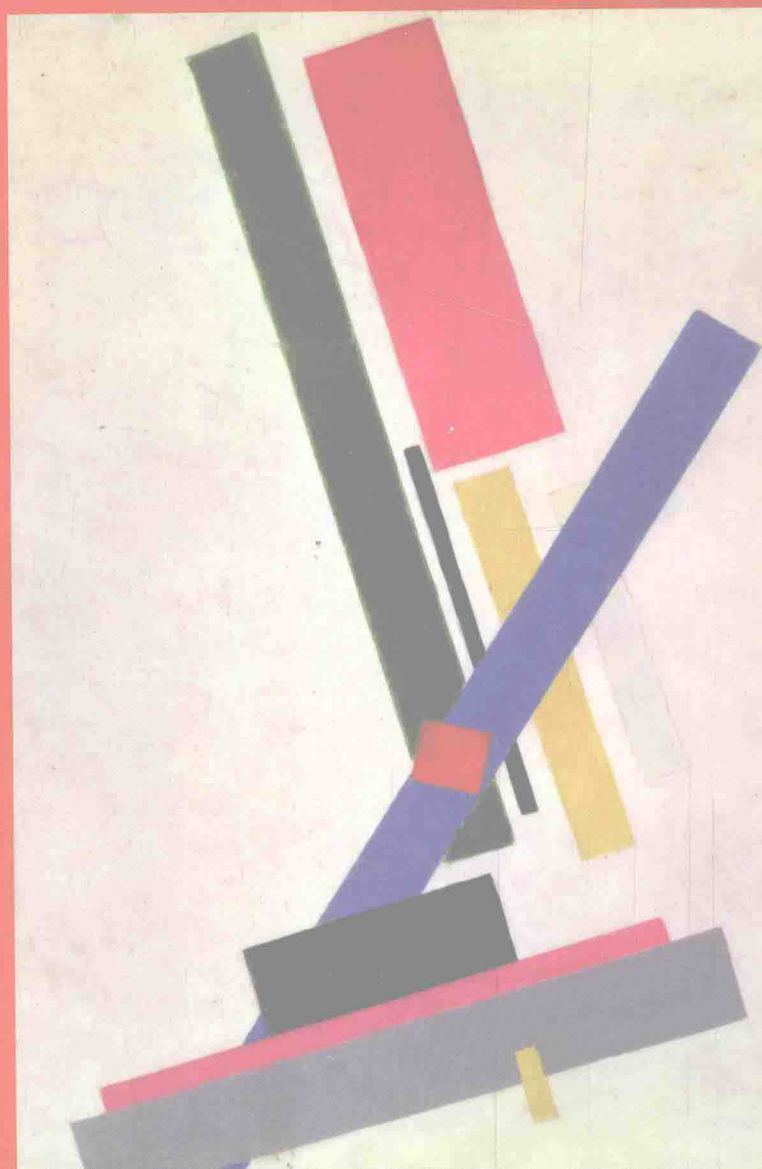

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## Risk factors and strategies for prevention

## Second Edition

Stephen R. Lord
Prince of Wales Medical Research Institute, Australia, Sydney

Catherine Sherrington
Prince of Wales Medical Research Institute, Sydney, Australia and University of Sydney, Australia

Hylton B. Menz
Prince of Wales Medical Research Institute, Sydney, Australia and La Trobe University, Melbourne

Jacqueline C. T. Close
Prince of Wales Medical Research Institute, Sydney, Australia and Prince of Wales Hospital, Sydney

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# Preface

In the preface to the first edition of this book published in 2001, we remarked on the enormous amount of work on risk factors for falling in older people and falls prevention strategies published in the last two decades of the twentieth century. As shown in Figure 1.0, an even larger body of research has been published in the international literature in the subsequent five years. Much has happened in this time and there have been many substantial gains in the evidence base that has increased our understanding of falls risk factors and prevention strategies. Listed below are some highlights of progress and encouraging findings.

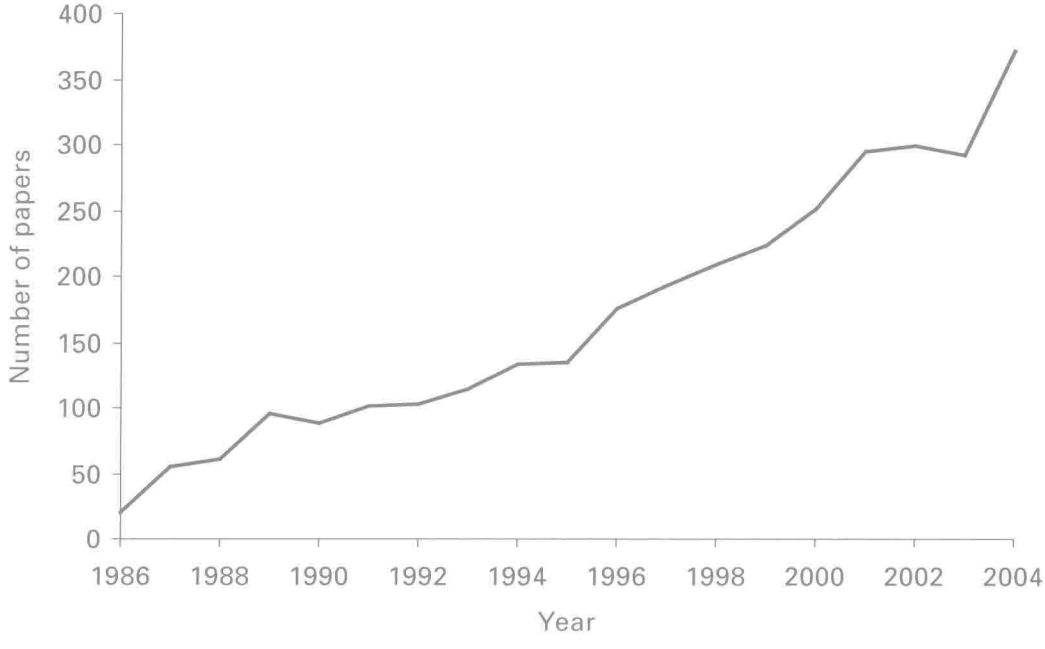


Fig. 1.0 Research publications pertaining to falls in older people between 1986 and 2004 (Source: Medline).

- Studies aimed at understanding balance have evolved more to using paradigms such as tripping, slipping and stepping that more accurately reflect situations in which people fall.
- Several studies have found that contrast sensitivity and depth perception are the most important visual risk factors for falls. It has also been shown that multifocal glasses may add to this risk because near-vision lenses impair distance contrast sensitivity and depth perception in the lower visual field.
- A large body of neuropsychological research has shown that balance activities that were generally considered to be reflex or automatic require attention, and that older people who have difficulties undertaking dual tasks are at increased risk of falls.
- There is increased evidence of the role that syncope plays in unexplained falls.
- The rationale for vitamin D supplementation as a falls prevention strategy for older people has been strengthened by cohort and intervention studies.
- A well designed randomized controlled trial has found that maximizing vision through cataract surgery is an effective falls prevention strategy.
- The role of environmental assessment/modification and safety education undertaken by trained professionals has been strengthened.
- Two randomized controlled trials have shown that falls can be prevented in hospital patients.
- Finally, and most strikingly, a raft of randomized controlled trials has examined the effects of a range of contrasting exercise interventions in preventing falls. From this large body of evidence it is now possible to conclude that effective exercise programmes comprise challenging and progressive, weight-bearing balance exercises.

Two areas of investigation have been less encouraging and will require further research and consideration.

- Intervention studies aimed at the prevention of falls in older people with dementia have not been successful, despite well planned and executed studies.
- Despite initial encouraging findings, well conducted randomized controlled trials have found that hip protectors are not an effective strategy for preventing fractures, with much of the lack of efficacy due to poor compliance.

The aim of this second edition is to review and incorporate the new material that has been published in journal articles, to provide healthcare workers with a means for gaining access to current thinking and best clinical practice. As suggested in the title, the book has two major themes: falls risk factors and falls prevention strategies.

Part I includes an initial chapter on the epidemiology of falls and fall-related injuries in older people. Chapters 2 to 8 present critical appraisals of the many posited falls risk factors, addressed under the headings of postural stability, gait,

sensory and neuromuscular, psychological, medical, medication and environmental risk factors. In Chapter 9, the importance of the risk factors in each of the above domains is weighted as weak, moderate or strong, using evidence from published studies.

Part II addresses falls prevention strategies. An initial overview provides an outline of falls prevention strategies which address the multitude of falls risk factors. The first two chapters (Chapters 10 and 11) summarize the very large body of published findings on the role exercise can play in preventing falls and improving physical function in older people. Chapter 12 presents guidance for a systematic approach to the medical management of older persons at risk of falling, including management of medication use. Chapters 13 and 14 examine the role of specific intervention strategies such as the use of safe footwear, aids and appliances, and environmental modifications for preventing falls and fall injury. In Chapter 15, suggested strategies for preventing falls in institutions are summarized and discussed. Chapter 16 describes a novel profile system for quantifying an individual's risk of falling and targeting intervention strategies. The final chapter (Chapter 17) synthesizes the evidence on successful falls prevention strategies and collates the information in a format that can be used to facilitate the translation of research findings into routine clinical practice.

Part III contains a single chapter which reviews the research issues that still need to be addressed in this field.

In each chapter we have attempted to be analytical in nature. Thus, we have not simply presented lists of the many and varied factors that have been suggested as possible (but unproven) risk factors for falls and the suggested (but untested) falls prevention strategies. Instead, we have attempted to evaluate the evidence for each factor implicated with falls to determine whether they constitute important areas for consideration and intervention. For example, we present arguments that challenge some traditional approaches to the management of older persons at risk of falls. We question the utility of falls risk assessment based solely on diagnoses of disease processes and the value of standard clinical tests of vision, sensation, strength and balance. We also discuss the role of particular medications in predisposing older people to falls and why factors such as alcohol use, vestibular disorders and postural hypotension (which are considered important risk factors in clinical practice) have not been demonstrated to be significant risk factors for falls in well planned epidemiological studies. With regard to interventions, we examine the effectiveness of suggested strategies for preventing falls and question the value of certain exercise interventions and prevention strategies that do not take participant compliance issues into account.

As neurophysiological factors have been found to be key factors in the prediction and prevention of falls, this book places a major emphasis on these. Findings from our own studies have highlighted tests that have great utility in that they are reliable and highly predictive of falls. As outlined in Chapter 16, these tests can be used in a 'profile' based approach to falls risk which is aimed at identifying specific impairments in the major sensorimotor systems that contribute to balance, i.e. vision, peripheral sensation, strength and reaction time as well as measures of sway and stability. This enables intervention strategies to be tailored to address an individual's specific deficits.

The length of the chapters in this book varies considerably. The longer chapters are in areas in which there is a greater amount of available evidence on which to base falls risk factor assessment and the development of prevention strategies.

We hope this book will be of interest to medical and allied health care undergraduate and postgraduate students, medical practitioners, nurses, physiotherapists, occupational therapists, podiatrists, research workers in the fields of gerontology and geriatrics, health service managers, and scientists and health care workers in the disciplines of public health, injury and occupational health. We feel that this book is of relevance to those working in community, hospital and residential aged care settings.

# Acknowledgements

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Finally we would like to thank our partners and families for their support and tolerance throughout the writing process.

# Contents

Part I

# Epidemiology and risk factors for falls

1

# Epidemiology of falls and fall-related injuries

In this chapter, we examine the epidemiology of falls in older people. We review the major studies that have described the incidence of falls, the locations where falls occur and falls sequelae. We also examine the costs and services required to treat and manage falls and fall-related injuries. Before addressing these issues, however, it is helpful to briefly discuss four important methodological considerations that are pertinent to all research studies of falls in older people: how falls are defined, how falls are counted, how injurious falls are defined and what constitutes an older person.

## The definition of a fall

In 1987, the Kellogg International Working Group on the Prevention of Falls in the Elderly defined a fall as 'unintentionally coming to the ground or some lower level and other than as a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis as in stroke or an epileptic seizure' [1]. Since then, many researchers have used this or very similar definitions of a fall. The Kellogg definition is appropriate for studies aimed at identifying factors that impair sensorimotor function and balance control, whereas broader definitions that include dizziness and loss of consciousness are appropriate for studies that also address cardiovascular and neurological causes of falls such as syncope, postural hypotension and transient ischaemic attacks. More recently, the Prevention of Falls Network Europe (ProFaNE) collaborators, in conjunction with international experts in the field and using consensus methodology, have adopted a simpler definition to include falls that occur from all causes, i.e. 'an unexpected event in which the participant comes to rest on the ground, floor or lower level' [2]. A comparable definition has also been adopted by the World Health Organization.[1] This simple definition is appropriate for

[1] www.who.int/violence_injury_prevention/unintentional_injuries/falls/falls1/en/

multi-centre studies requiring a core data set or for situations where details of falls are unrecorded (routine surveillance data/accident records), or where a high proportion of subjects cannot provide reliable information about their falls (i.e. those with delirium or cognitive impairment).

Although falls are often referred to as accidents, it has been shown statistically that falls incidence differs significantly from a Poisson distribution [3]. This implies that causal processes are involved in falls and that they are not merely random events.

## Falls ascertainment

The earliest published studies on falls were retrospective in design, in that they asked subjects whether and/or how many times they had fallen over in a defined period of time – usually 12 months. This approach has limitations in that subjects have limited accuracy in remembering falls over a prolonged period [4]. More recent studies have used prospective designs, in which subjects are followed up for a period, again usually 12 months, to more accurately determine the incidence of falling. Not surprisingly, these studies have usually reported higher rates of falling. In community studies, the only feasible method of ascertaining falls is by self report and a number of methods have been used to record falls in prospective follow-up periods. These include monthly or bi-monthly mail-out questionnaires [5, 6], weekly [7] or monthly falls calendars [8] and monthly telephone interviews [9].

The ProFaNE collaborators recommend that falls should be recorded using prospective daily recording and a notification system with a minimum of monthly reporting [2]. Telephone or face to face interview should be used to chase missing data and to ascertain further details of falls and injuries. Specific information about the circumstances of any falls can also be ascertained with additional questions on the falls diary forms. An example of a monthly falls calendar is shown in Figure 1.1a, with additional questions in Figure 1.1b. Telephone interviews gain the same information as mail-out questionnaires and falls diaries, but may require many calls to contact active older people. In research studies, fall data should be summarized as: number of falls; number of fallers/non-fallers/frequent fallers; and fall rate per person years [2].

However, even with the most rigorous reporting methodology, it is quite likely that falls are under-reported and that data regarding circumstances surrounding falls are sometimes incomplete or inaccurate. After a fall, older people are often shocked and distressed and may not remember the predisposing factors that led to the fall. Denial is also a factor in under-reporting, as it

| SUN | MON | TUES | WED | THURS | FRI | SAT |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

Fig. 1.1a Example of a monthly falls diary.

is common for older people to lay the blame on external factors for their fall, and not count it as a 'true' one. Simply forgetting falls leads to further under-reporting, especially in those with cognitive impairment.

In residential aged care settings, the use of falls record books maintained by nursing staff can provide an ancillary method for improving the accuracy of recording falls. In a study of intermediate care (hostel) residents in Sydney, we found that systematic recording of falls by nurses increased the number of falls reported by 32% [5]. In hospitals, falls incident forms are now commonly used.

## The definition of a fall-related injury

The definitions of injurious falls have differed considerably in the literature, due primarily to whether or not minor injuries such as bruises, cuts and abrasions have been classified as fall-related injuries. The ProFaNE collaborators recommend that due to difficulties in standardizing definitions and classifications of fall injury type, the most rigorous definition of a serious fall-related injury is radiologically confirmed peripheral fracture, i.e. fractures of the limbs and limb girdles [2].

## The definition of the older person

There is no consistency among studies as to what demographic group constitutes older people. The term is used for age-groups starting from as low as 50 years. However, the most frequently used definition is people aged 65 years and over. Within this age-band, commonly accepted subgroups are those aged 65–74 years, 75–84 years and 85 years and older.

**If you have had no falls please stop here, otherwise please continue**

**1. WHERE HAVE YOU FALLEN?**

**Inside:**

| | | | | |
|---|---|---|---|---|
| On the one level | Yes | [ ] | No | [ ] |
| Getting out of bed | Yes | [ ] | No | [ ] |
| Getting out of a chair | Yes | [ ] | No | [ ] |
| Using the shower/bath | Yes | [ ] | No | [ ] |
| Using the toilet | Yes | [ ] | No | [ ] |
| Walking up or down stairs | Yes | [ ] | No | [ ] |

**Home entrances or in the garden:**

| | | | | |
|---|---|---|---|---|
| Walking up or down a step/stairs | Yes | [ ] | No | [ ] |
| On the one level (e.g. pathway) | Yes | [ ] | No | [ ] |
| In the garden | Yes | [ ] | No | [ ] |

**Away from home:**

| | | | | |
|---|---|---|---|---|
| On the footpath | Yes | [ ] | No | [ ] |
| On a kerb/gutter | Yes | [ ] | No | [ ] |
| In a public building | Yes | [ ] | No | [ ] |
| Getting out of a vehicle | Yes | [ ] | No | [ ] |
| In another person's home | Yes | [ ] | No | [ ] |

Falls not described above (please specify)

**2. HOW DID YOU FALL?**

(Tick more than one if necessary)

| | |
|---|---|
| I tripped | [ ] |
| I slipped | [ ] |
| I lost my balance | [ ] |
| My legs gave way | [ ] |

Fig. 1.1b (Cont.)

I felt faint [ ]

I felt giddy/dizzy [ ]

I am not sure [ ]

**3. AS A RESULT OF THIS FALL OR FALLS DID YOU SUFFER ANY INJURIES?** Yes [ ] No [ ]

**4. IF YES WHAT TYPE OF INJURIES DID YOU SUFFER?**

Bruises [ ]

Cuts/grazes [ ]

Broken wrist [ ]

Broken hip [ ]

Broken ribs [ ]

Back pain [ ]

**Thank you very much for your co-operation. Please return it to us by using the enclosed envelope**

Fig. 1.1b Example of additional questions seeking specific information about the circumstances of falls.

## The incidence of falls in older people

### Community-dwelling older people

In 1977, Exton-Smith examined the incidence of falls in 963 people over the age of 65 years living in England [10]. He found that in women, the proportion that fell increased with age from 30% in the 65–9 year age group to over 50% in those over the age of 85. In men, the proportion that fell increased from 13% in the 65–9 year age group to levels of approximately 30% in those aged 80 years and over.

Retrospective community studies in primarily White populations undertaken since Exton-Smith's work have reported similar findings – that approximately 30% of older persons experience one or more falls per year [11–13]. Campbell *et al.* [11] analysed a stratified population sample of 533 subjects aged 65 years and over, and found that 33% experienced one or more falls in the previous year. Blake *et al.* [13] reported a similar incidence (35%) in a study of 1042 subjects aged 65 years and over. In a large study of 2793 subjects aged 65 years and over, Prudham and Grimley-Evans [12] estimated an annual incidence for accidental falls of 28%, a figure identical to that found in

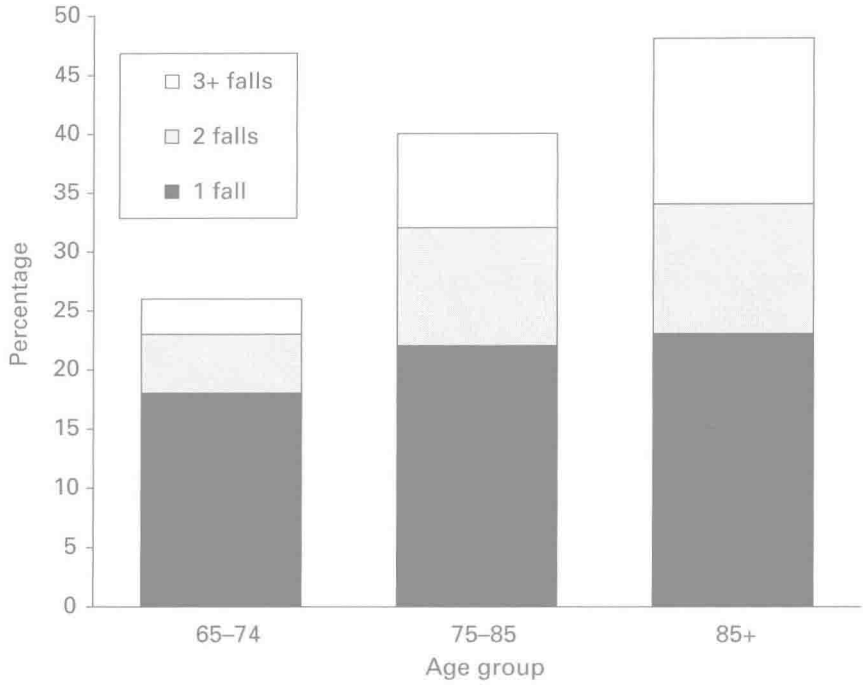


Fig. 1.2 Proportion of older women who took part in the Randwick Falls and Fractures Study who reported falling once, twice, or three or more times in a 12 month period. Diagram adapted from Lord *et al.* [15].

the Australian Dubbo Osteoporosis Epidemiology Study of 1762 older people aged 60 years and over [14].

More recent prospective studies undertaken in community settings have found higher falls incidence rates. In the Randwick Falls and Fractures Study conducted in Australia, we found that 39% of 341 community-dwelling women aged 65 years and over reported one or more falls in a one-year follow-up period [15]. In a large study of 761 subjects aged 70 years and over undertaken in New Zealand, Campbell *et al.* [16] found that 40% of the 465 women and 28% of the 296 men fell at least once in the study period of one year, an overall incidence rate of 35%. In the United States, Tinetti *et al.* [8] found an incidence rate of one or more falls of 32% in 336 subjects aged 75 years and over. Similar rates have been reported in Canada by O'Loughlin *et al.* [9] in a 48-week prospective study of a random sample of 409 community-dwelling people aged 65 years and over (29%), and in Finland community-dwelling people aged 70 years and over by Luukinen *et al.* in 833 from five rural districts (30%) [17].