A guide for implementers of interventions to prevent falls in community-dwelling older people.

[Materials on strategic resources for parties involved]

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SUMMARY

Purpose of this guide

In 2007 the EUNESE[1] (European Network for Safety among Elderly) project produced a guide entitled "*Learn From The Eunese Pilot Projects Experience: A 7-Step Guide to implement successful interventions for injury prevention among elderly people (65+)*"[2]. The EUNESE guide provides information about the process and the methodology used in the EUNESE pilot projects, as well as general information i on how to design and produce a successful program intervention.

The aim of the present guide is to serve as a companion guide to the EUNESE guide, providing implementers with information specific for falls prevention among older people, in order to carry out the 7 steps described in the EUNESE guide to implement successful interventions. The present guide originates from the work conducted within the Working package 4 of the project APOLLO[3], as well as from a compilation of information from other sources.

It is addressed to all people who are interested in the prevention of falls in older people, such as the health care professionals working with older people in the community.

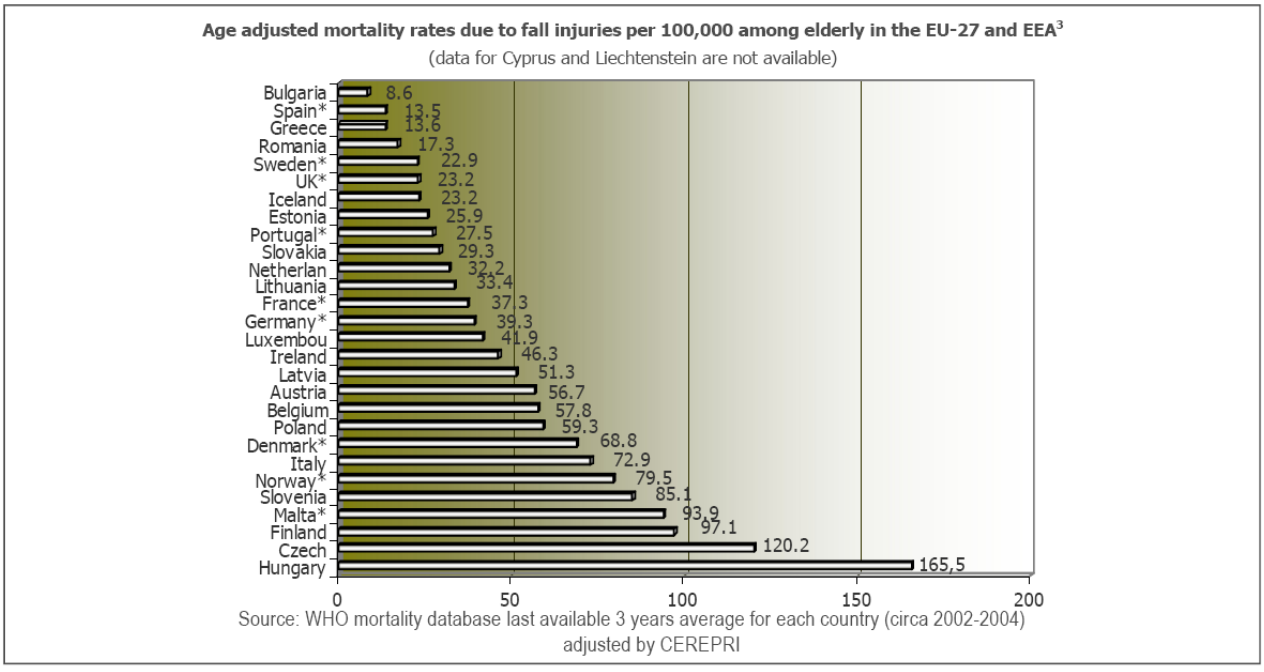
[1]See appendix 3 for a description of WP4 of the Apollo project
[2]See appendix 2 for a description of the Eunese guide for implementers
[3]See appendix 1 for a description of WP4 of the Apollo project

1 The burden of falls

About 30% of persons above age 65 years experience a fall or more each year. Among persons aged 80 year or more, this percentage rises to 50% (O'Loughlin et al., 1993). About 20% of these falls require a medical intervention, and about 5% result in a fracture or require hospitalization (Rubenstein, 2006). The management of hip and other fractures, and of the other consequences of unintentional falls in the elderly is a heavy economic burden for Health services. The total cost to the UK government in the year 2000 from unintentional falls in people ages 60 years or more was estimated to be almost 1 billion pounds (Scuffham et al., 2003). Among community-dwelling older people, falls are a strong predictor of subsequent nursing home admission (Tinetti & Williams, 1997).

Half of the deaths due to injury in the elderly are a consequence of a fall (Petridou et al., 2008), resulting in about 40,000 deaths each year in the EU.
There are large differences in falls mortality within the EU, with a 10-fold variation between the highest rates observed in Hungary and the Czech Republic, and the lowest rates in Bulgaria, Spain and Greece (Figure 1) (EUNESE)

Figure 1.1



Falls mortality rates among the elderly have been declining in most European countries, between the early 1990's and the early 2000's (Petridou et al., 2008), although increases in rates have been noted in a few countries, including Finland (Kannus et al., 2005), Ireland and Latvia (Petridou et al., 2008). However, differences in certification practices between countries must be taken into account when comparing fall mortality rates (Petridou et al., 2008).

Also when the fall does not result in an injury, it can have important psychological consequences. Fear of falling is common among older people, is increased after experiencing a fall, and often leads to a reduction of activities and of the quality of life (Scheffer et al., 2008; Yardley & Smith, 2002; Zijlstra et al., 2007a).

For sources of data on the burden of falls in Europe see appendix 3.

2 The causes of falls

The majority of falls in the elderly are not due to a single well identified cause, but rather to the combination of several interacting factors (Campbell et al., 1989).
The ability to cope with the challenges offered by the environment depends on the physical abilities of the subject. In those with very poor physical abilities a fall can occur even without an identifiable environmental challenge. In subjects with high physical abilities, only extreme environmental challenges generally result in a fall (Lawton MP, 1980; Lord et al., 2007).
The identification of the risk factors for falls is important because 1) it can help identify subjects who are at high risk of falling and 2) by eliminating or acting on the risk factor the risk of falling can, in principle, be decreased.

Many studies with either prospective or retrospective design have suggested hundreds of factors that can influence the risk of falling. These factors have been broadly classified in intrinsic and extrinsic factors (Lord et al., 2007; NICE, 2004; Perell et al., 2001; Skelton & Todd, 2004).

Intrinsic risk factors include

- psychosocial and demographic factors (e.g. history of falls, older age, disability and functional impairment, living alone, inactivity)
- balance and mobility factors (e.g. impaired stability, inadequate response to external perturbation, impaired gait and mobility)
- sensory and neuromuscular factors (e.g. visual impairment, muscle weakness, low reaction time, hearing impairment)
- medical factors (e.g. impaired cognition, depression, cerebrovascular diseases, urinary incontinence, rheumatic disease, leg problems, dizziness and vertigo, blood pressure problems, respiratory diseases, malnutrition, diabetes, cardiac diseases, osteoporosis)
- use of medications (e.g. use of multiple medications, of psychoactive drugs like benzodiazepines, hypnotics, antipsychotic, and antidepressants, and of some antihypertensive drugs).

Extrinsic factors include

- Environmental hazards (poor lightning, slippery floors, uneven surfaces, loose rugs etc.)
- inappropriate footwear or clothes
- inappropriate visual correction
- lacking or inappropriate walking aids

Finally, the risk of falling also depends on how much a person decides to expose him or herself to environmental challenges (Skelton & Todd, 2004).

2.1 Systematic review of risk factors for falls in community dwelling older people

A systematic review of risk factors for falls in older people was conducted within the framework of WP4 of the Apollo project. This review used the methods of meta-analysis in order to investigate the causes of falls in community dwelling older people in a comprehensive, objective and systematic way, and provided an **evidence-based assessment of the strength of the association between each factor and falls**.

2.1.1 Methods

Original studies published up to 2006 were included if they met the following inclusion criteria:

- Prospective design (to ensure that the measurement of the risk factor preceded the event, i.e. the fall)
- Sample size >200 subjects
- At least 80% of the sample aged 65 years or more
- At least 80% of the sample living in the community
- Number of fallers during follow-up as outcome.

Two different outcomes were considered: number of fallers and number of recurrent fallers (i.e. subjects who fell more than once during the follow-up).

A summary estimate was computed only for risk factors that were investigated by at least 5 studies.

Using a random effect model (DerSimonian & Laird, 1986) pooled odds ratios (OR) were computed. Not all studies measured a risk factor in the same way. When a measure was not comparable with the others, the study was not used for the pooled estimate.

The following subgroup analyses were also performed:

- Studies presenting multivariate OR (adjusted for age and sex) vs studies presenting crude ORs
- Mean/median age of the subjects <75 years vs ≥75 years
- Follow-up longer than 1 year vs shorter
- Assessment of falls frequent (at least every 3 months) vs unfrequent

2.1.2 Results

In total 60 studies that met the inclusion criteria were identified.
The main results were as follows:

2.1.2.1 Sociodemographic factors

- For an increase of 5 years in age the risk of falling one or more times increased by 10-15%.
- Women had a 30-40% higher risk of falling than men.
- Subjects living alone had an increased risk of falling of about 20-30%.
- A previous history of falls was a strong indicator of the subsequent risk of falling: the risk of falling again was about 2.7 times higher, and that of falling more than once more than 3 times higher.
- No clear association emerged with physical activity. Some studies found an increased risk of falling for both inactive and very active subjects, as compared to moderately active subjects.
- Subjects with physical disabilities had a higher risk of falling (although the quantification of the OR varied strongly between studies, and in the subgroups considered). For recurrent falls the results were more consistent and indicated that the risk was increased 2.2-2.6 times.
- No clear association emerged for subjects with high body mass, as compared to those with low/intermediate values.
- Education did not appear to be associated with the risk of falling. If anything, subjects with low/intermediate education had a somewhat lower risk (though not statistically significant) of recurrent falls, as compared to more educated subjects. This may be due to a lower occupational physical activity in more educated subjects in the past.
- The use of walking aids was a strong indicator of the risk of falls (OR: 2-2.5) and

2.1.2.2 Medical and psychological factors

Many chronic and acute conditions appear to increase the risk of falling. Besides the ones listed below, there may be several others, which have not been included in this review since they have been investigated by less than 5 studies. For each condition included in the systematic review, an estimate of the combined OR for any faller and for recurrent fallers is given below. Results were statistically significant if not stated otherwise.

- Cognition impairment (OR:1.5-2 for any faller; 1.5-3.5 for recurrent fallers)
- Depression (OR:1.5 for any faller; 1.5-1.8 for recurrent fallers)
- History of stroke (OR:1.5 for any faller; 2-3 for recurrent fallers)
- Urinary incontinence (OR:1.3-1.7 for any faller; 1.7 for recurrent fallers)
- Rheumatic disease (OR:1.5 for any faller; 1.5-2 for recurrent fallers)
- Dizziness and vertigo (OR:1-5-2.3 for any faller, 2.2 for recurrent fallers)
- Hypotension (OR:1.2-1.4 for any faller; not significant; 1.3-1.6 for recurrent fallers, not significant)
- Diabetes (OR:1.2-1.4 for any faller; 1.5 for recurrent fallers)
- Comorbidity (OR for the increase in 1 condition 1.2-1.3 for any faller; 1.3-1.4 for recurrent fallers)
- Poor self perceived health status (1.4 for any faller; 1.5 for recurrent fallers)
- Pain (1.4 for any faller; 1.6-1.8 for recurrent fallers)
- Fear of falling (1.3-1.9 for any faller; 1.7-2.2 for recurrent fallers)

2.1.2.3 Medications

Although many different classes of drugs have been associated to the risk of falling, results were often not comparable between studies, because they used different grouping of drugs. Thus, we computed pooled ORs only for three classes of medications, besides number of medications used. It is likely that other classes, in particular benzodiazepines and other psychoactive drugs, also increase the risk of falling. It is also possible that different drugs of the same class affect the risk of falling differently. Moreover, it must be

considered that it is difficult to separate the effect of the drug to that of the underlying condition.

- Number of medications (for an increase of one medication 1.3-1.9 for any faller; 1.7-2.2 for recurrent fallers)
- Use of sedatives (1.4-1.7 for any faller; 1.5 for recurrent fallers)
- Use of antyhypertensives (1.3-1.4 for any faller; 1.3-1.4 for recurrent fallers)
- Use of antiepilectics (1.5-1.9 for any faller; 2.5-3.2 for recurrent fallers)

2.1.2.4 Balance, mobility, sensory and neuromuscular factors

Many studies investigated balance and mobility factors. However, many different tests have been employed, and it was difficult to combined results from different studies. For this reason it was not possible to obtain a single pooled estimate for impaired balance.

- Gait abnormalities (2 for any faller; 2.2-3.7 for recurrent fallers)
- Vision impairment (1.3-1.6 for any faller; 1.7-1.9 for recurrent fallers)
- Hearing impairment (1.2 for any faller; 1.5 for recurrent fallers)

2.1.3 Conclusions from the systematic review

This systematic review of risk factors for falls yet again underlines that there are a plethora of factors that affect the risk of falling. The point estimates presented here must be considered with caution, taking into account not only the uncertainties in estimation due to random variation alone, but also systematic differences between studies which gave rise, in many instances, to substantial heterogeneity between studies. Nevertheless, some clear indications emerge from this systematic review.

For most of the factors considered, the associated OR is weak or moderate at the most, in general below 2. Many of these factors, however, are common in the older population,

and it is frequent to find older people that present many of these factors. This confirms the multifactorial nature of falls causation.

The estimated ORs were generally higher for the outcome “recurrent fallers” than for “any fallers”, indicating that the group of subjects that experience more than one fall is a more clearly delineated risk group. In fact, albeit one fall can occur also by chance alone, the repetition of the event suggests the existence of an underlying high risk condition.

Some variables which are not per se risk factors, but indicators of such a high baseline risk condition, i.e. history of falls, fear of falling and use of walking aids, are associated with an approximately 3-fold risk of falling, also in studies where multivariate analyses were presented, and thus adjustment for at least some fall risk factors was performed. These variables are not per se a potential target for prevention, but they may help in identifying individuals at high risk of falling, thus selecting the subjects which are likely to benefit the most from preventive interventions.

Key messages:

- *This review provides a systematic, objective, and comprehensive evidence based-assessment of the causes of falls.*
- *A multitude of factors influence the risk of falls, including psychosocial and demographic factors, balance and mobility factors, sensory and neuromuscular factors, medical factors, use of medications and environmental factors.*
- *Although for many - but not all - of these factors the association with falls is weak or moderate, some of these factors are common in the older population, and the proportion of falls they cause is far from negligible.*
- *Some aspecific indicators of high baseline risk can help to identify in a very simple way (e.g. via telephone interview) subjects at high risk of falling.*

2.2 Factors not included in the systematic review

Some factors that may be important risk factors were not included in the systematic meta-analysis because they were considered in less than five studies or because the measures used in different studies were too heterogeneous to be combined. Below the evidence for a few factors which may be important is presented:

Alcohol

Studies investigating the association between alcohol consumption and fall risk have used different measures, including , use versus non use, ounces per day, use at least monthly or weekly, alcohol abuse etc,. and it was not possible to derive any combined summary estimate. No clear indication of an association emerged from the various studies.

Body mass index

No clear significant result emerged in any of the few studies that investigated BMI.

Malnutrition

We found only one study investigating malnutrition as a risk factor for falls, which found an OR around 2. Malnutrition is a potentially relevant factor which has been neglected by researchers so far.

Foot problems

Three studies reported ORs around 1.4 for any faller, and four studies for recurrent fallers, with ORs ranging from 1.2 to 4.1.

Hypertension

No clear results emerged from the studies reporting data on any (4 studies) or recurrent (3 studies) fallers.

Hypovitaminosis D

Two studies investigating any falls did not find a clear association while three studies on recurrent fallers found ORs ranging from 1.0 to 1.8.

Anemia

One study only was retrieved, reporting an OR of 1.9

Osteoporosis

One study only was retrieved, reporting an OR of 2.1

Postural stability

While impaired balance is clearly a risk factor for falls, several different tests have been used to measure postural stability in various studies. The PROFANE project has compiled a list of over 30 balance assessment measures used within the EU, that can be found at the PROFANE website (see appendix 3).

2.3 The attributable fraction

How many falls can be prevented by eliminating a risk factor?

The attributable fraction (AF)

The AF is the proportion of falls in a population that can be attributed to a given risk factor and hence (in principle) preventable by eliminating that factor. It depends on

1) The strength of the association between the factor and the risk of falling
2) The frequency of exposure to the factor in the population

The strength of the association can be measure by the **relative risk**, i.e. the ratio of the incidence of the event in the subjects exposed to the risk factor to the incidence of the event in those not exposed to the factor. A relative risk of 1.5 means that the risk of falling is 1.5 times higher in the subjects exposed to the risk factor, i.e. that the exposed subjects experience 50% more falls that the non exposed ones.
It can be assumed that the relative risk for a factor is (approximately) the same in all populations.
In many studies the relative risk is approximated by the **odds ratio**

The frequency of exposure to the risk factor depends on the population under study. Exposure can vary widely across different populations. Clearly, eliminating a risk factor from a population changes the risk only of subjects who were exposed to the factor in the first place.

Calculation of the attributable fraction
If P is the proportion of subjects exposed and RR is the relative risk

$$AF = \frac{P*(RR-1)}{RR}$$

Justification: The falls that will still occur after elimination of the factor are all those among the non exposed subjects (1-P) and P/RR among the exposed ones. Thus, the falls avoided are 1-(1-P)-P/RR

Example
From our review the relative risk for the use of sedatives is 1.5
Ina population where 50% of older people use sedatives, AF=0.5*0.5/1.5=0.17.
In a population where the use of sedatives is only 10%, AF=0.03.
In the first case 17% of falls could be avoided by eliminating sedatives, in the second only 3%.

Caution on causality
Eliminating the factor gives the expected result only if the observed association is causal. If the increased risk observed in subjects using sedatives is due to the conditions for which the sedatives are taken, rather than to the use of sedatives in itself, eliminating sedatives would not have the expected effect.

3 Definition and measurement of falls and related outcomes

Trials on interventions to prevent falls have used heterogeneous definitions of falls and have measured many different outcomes. This has hindered the comparison of the results of these trials (Gillespie et al., 2003).

3.1 Definition of a fall

The PROFANE project (see appendix 3), generated a set of recommendations in order to develop a common set of outcome definitions and measures for fall injury prevention trials (Lamb et al., 2005). The Consensus process suggested to define a fall as "**an unexpected event in which the participant comes to rest on the ground, floor, or lower level**" This definition is broader than the one previously suggested by the Kellog International Work Group on the Prevention of Falls by the Elderly, that explicitly excluded consequences of violent blows, loss of consciousness, sudden onset of paralysis such as in stroke or an epileptic seizure. (Gibson et al., 1987).

3.2 Outcomes and their measurement

An important part of the design of a trial is to define which are the outcomes of interest, and how to measure them. For each outcome, the expected frequency of events and the minimal difference between groups that the investigator wants to be able to observe must be considered, in order to compute an appropriate sample size.
The question of which outcomes to measure in fall prevention trials has been extensively studied by the PROFANE Consensus group, which has conducted systematic reviews of the instruments used and of their properties, and issued recommendations (Lamb et al., 2005). Following these will not only guarantee the investigators of working with instruments which eminent experts of the field consider the best ones available to date, but will also improve comparability of results of different studies, and is thus advisable, whenever possible.

3.2.1 Falls

Falls have the advantage that are generally frequent in older subjects and thus require comparatively small samples.

It has been shown that older people tend to forget falls, particularly those who did not have consequences, and in order to avoid substantial underestimation of the event it is recommended to investigate the outcome at least once per month. In addition to monthly telephone or face to face interviews, additional instruments have been used in order to improve the recording of the event, like fall calendars/diaries to be filled daily or weekly by the subject, or fall cards to be sent to the investigators when a fall occurs.

The way in which the occurrence of falls is investigated is important. The PROFANE (see appendix 3) consensus suggests to ask:
In the past month, Have you had any fall including a slip or a trip in which you lost your balance and landed on the floor or ground or lower level?
The translation of this question in languages other than English can be problematic, depending also on the features of the language.

The PROFANE consensus suggests to compute the following indicators:

- Number of falls
- Number of fallers
- Number of recurrent fallers (i.e. subject who fall more than once)
- Fall rate per person year
- Time to first fall

3.2.2 Fall-related injuries

If a falls results in some kind of consequence it is reasonable to assume that it is more easily remembered than a fall without notable consequences. Thus, these outcomes are less subject to underreporting than all falls.

It is important to define clearly which injuries are considered. Other methods of ascertainment are often required, bedsides or instead of direct interview of the subject. The family doctor or a surveillance of the emergency department and/or traumatic departments of the hospitals in the area are often needed to determine the outcome.

Among the outcomes recorded in this category there are

- falls that cause minor injuries, like superficial wounds or bruises, or pain
- falls that result in some kind of (temporary) disability
- falls that require medical attention or hospital admission
- falls that result in specific types of injuries such as fractures (of the hip, spine, limbs etc) or traumatic brain injuries
- falls that cause death

3.2.3 Psychological consequences of falls

In 1990 Tinetti and colleagues (Tinetti et al., 1990) developed the **Falls Efficacy Scale (FES)**, a 10-items instrument aiming at measuring the confidence of older people in their ability to perform various activities of daily living. Subsequently other scales to measure fall-related self-efficacy in the elderly have been developed (Jorstad et al., 2005; Scheffer et al., 2008).

A systematic quality assessment of the key measurement properties of fall-related psychological outcome measures (Jorstad et al., 2005) identified 23 different instruments, measuring fall-related self-efficacy (7 instruments), fear of falling (11 instruments) or other measures (5 instrument). Six of these instruments were based on only 1 item (5 of which measuring fear of falling), while many included 10-18 items. The review summarized their measurement properties, but also showed confusion in the use and interpretation of these measures, and lack of evidence on the comparability of their properties.
Another systematic review (Scheffer et al., 2008) concluded that fear of falling in highly prevalent among older persons, but that measurement instruments lacked uniformity. Multi-item instruments that measure fall-related self efficacy showed generally good

reliability, but weak to adequate validity, while the evidence about psychometric qualities of single-item instruments measuring fear of falling was lacking.

Recently the Falls Efficacy Scale-International (FES-I) had been developed within the framework of the PROFANE project from the FES scale, in order to be used in different populations and setting (Yardley et al., 2005). The FES-I includes 16 items and has shown an excellent test-retest reliability. A shortened version (Short FES-I) including 7 items has also been developed and validated (Kempen et al., 2008). The FES-I and Short FES-I in English and a few other languages can be found on the PROFANE website (http://www.profane.eu.org/fesi.php)

3.2.4 Health related quality of life

In their review of the measurement and practical properties of multi-item, generic patient or self-assessed measures of health, applied in published evaluations of older people Haywood and colleagues identified 15 different instruments (Haywood et al., 2005).
The PROFANE Consensus recommends two of these instruments, i.e. the Short Form 12 (SF12) version 2, based on 12 items, and the European Quality of Life Instrument (EuroQoL EQ-5D) , based on 5 items, because they have good psychometric properties in spite of their conciseness. Other longer instruments were considered to place too much burden on the respondents (Lamb et al., 2005).

3.2.5 Changes in targeted risk factors

Clearly these outcomes depend on the type of intervention implemented. They can be measured at baseline and at different points in time during and after the delivering of the intervention to evaluate short and long term changes in the risk factors addressed by the intervention.
As shown in the chapter on risk factors, the use of different measures to assess the same factor renders the comparison of results from different sources difficult.

A list of assessment measures used within the EU for several risk factors for falls has been developed by Workpackage 2 of the PROFANE project (see appendix 3)

3.2.6 Outcomes not related to falls

In studies evaluating the effectiveness of interventions to prevent falls in the elderly the investigation of outcomes not related to falls is generally lacking.
However, some types of interventions proposed were may affect the risk of other important health problems in the elderly.
Physical exercise, for example, has been studied also in the context of primary or secondary prevention of obesity, diabetes, hypertension, cardiovascular disease and depression (Batty, 2002; Boule et al., 2001), and to study the effect of the proposed exercise regimen on endpoints related to these disorders too should be considered.
Similarly, vitamin D supplementation has been postulated to prevent a number of different conditions, including muscle weakness, osteoporosis, cancer, cardiovascular disease and infections (Holick, 2007) .

3.2.7 Process evaluation

In the design of an intervention, outcomes for process, formative and impact evaluation can also be included.
These outcomes depend in part on the type of intervention implemented.

Process evaluation assesses the process of program delivery (Rychetnik et al., 2004).
The components of process evaluation may include the following (Baranowski & Stables, 2000; Rychetnik et al., 2004):

- *Recruitment* of participants but also of professionals, agencies and other stakeholders)
- *Maintenance* of participation
- *Context* in which the program is conducted

- *Resources* needed for implementation
- *Implementation* as compared to the protocol design
- *Barriers* and problems encountered
- *Exposure* of the participants to the materials and activities
- *Initial use* i.e. initial engagement in the project's activities
- *Continued use* of activities over time
- *Quality standard* attained

Formative evaluation is the spin-off of early process evaluation data for implementers, triggering subsequent project's adjustments if necessary (Rychetnik et al., 2004).

Impact evaluation examines the initial effect of the programme on proximal tagets of change, such as attitudes and behaviors (Rychetnik et al., 2004). In a programme to reduce falls, changes in risk factor exposure can be part of impact evaluation.

4 *Effectiveness of interventions for preventing falls in community dwelling older people*

4.1 The Review of the Cochrane collaboration

In 2003 the Cochrane collaboration published a systematic review aiming “to present the best evidence for effectiveness of programmes designed to reduce the incidence of falls in both community dwelling and institutionalized older people” (Gillespie et al., 2003). That review included 62 studies (47 of which in community dwelling subjects) involving a total of 21,668 people.

The authors found several interventions which were “likely to be beneficial”, i.e. for which the relative risk of falling in the intervention group compared to the control group, obtained pooling the results of all the studies together, was significantly below one. For several interventions, however, effectiveness could not be determined, and the authors concluded that further research was indicated.

An update of the review has been planned, split into two separate reviews, namely one for community dwelling older people and the other for older people in residential care facilities and hospitals. A protocol of the first one has appeared on the Cochrane library website, and the full review was originally announced for 2007 and subsequently for 2008. By mid November 2008, however, the review has not yet been published.

Since many studies have been published since the publication of the Cochrane review in 2003, an update of the evaluation on effectiveness of selected intervention types is presented in the following sections, together with other considerations, e.g. on resources needed to implement the intervention, type of population selected etc.

4.2 Individually targeted exercise programs

4.2.1 Results from the Cochrane review

4.2.1.1 Individually targeted therapy for muscle strength and balance training delivered by trained health professionals

Studies:

Three studies all conducted in New Zealand used the same program of muscle strengthening and balance retraining (called OTAGO) including in total 566 participants (Campbell AJ et al., 1999; Campbell AJ et al., 1997; Robertson Mc et al., 2001)

Results:

The pooled RR of falling was 0.80 (95% CI 0.66-0.98),

Fall related injuries were also significantly lower in the intervention group (RR=0.67, 95% CI 0.51-0.89).

In a subsample of one of the studies the intervention was continued for another year and a reduced RR in the intervention group was reported also in the second year.

Conclusion :

Intervention likely to be beneficial

4.2.1.2 Individual lower limb strengthening

Studies:

One study on 222 frail older people evaluated a program of progressive resistance training of the quadriceps muscle (Latham et al., 2003).

Results:

The pooled RR of falling was 0.92 (95% CI 0.73-1.16)

Conclusion :

Intervention of unknown effectiveness

4.2.2 Update

4.2.2.1 New studies

Studies

One additional study (Skelton et al., 2005) on 100 participants who fell at least three times in the previous year evaluated an intervention based on the OTAGO exercises finding a RR of 0.23 (0.04-0.99)

Another study (Campbell et al., 2005; La Grow et al., 2006) adapted the OTAGO exercise program for older people with severe visual impairment, alone and in combination with a home hazard assessment program. In the 291 participants to the study, there was no evidence of an effectiveness of the exercise program (IRR=1.15 ; 95% CI 0.2-1.61)

A pragmatic individually targeted exercise-oriented program consisting of home exercise, walking exercise, group activities or self-care exercise was conducted among 486 home-dwelling Finnish persons aged 85 years or older (Luukinen et al., 2006). The time to first 4 falls was not significantly different between the intervention and the control group (hazard ratio to first 4 falls=0.88, 95% CI 0.-74-1.04)

4.2.2.2 Updated evaluation

Individually targeted therapy for muscle strength and balance training delivered by trained health professionals (4 studies, 666 partcipants)

Intervention likely to be beneficial

Skelton et al confirmed the effectiveness of an Individually targeted therapy for muscle strength and balance training delivered by trained health professionals in a European population at high risk of falls.

Individually targeted therapy for muscle strength and balance training delivered by trained health professionals for people with severe visual impairment (1 study, 291 participants)

Intervention of unknown effectiveness

No evidence of effectiveness was shown for an adaptation of the program in older people with severe visual impairment.

A pragmatic intervention consisting of home exercise, walking exercise, group activities or self-care exercise -(1 study, 486 participants) – **Intervention of unknown effectiveness**

4.3 Group delivered exercise not individually prescribed

4.3.1 Results from the Cochrane review

Studies:

Nine studies conducted in the UK (Ebrahim S et al., 1997; McMurdo Me et al., 1997), France (Cornillon E et al., 2002), the USA (Buchner DM et al., 1997; Cerny K et al., 1998; Pereira et al., 1998; Rubenstein LZ et al., 2000), Australia (Day L et al., 2002; Lord SR et al., 1995) incluiding in total 1387 participants.

Results:

The pooled RR of falling was 0.89 (0.79-1.01**)**

Conclusion :

Intervention of unknown effectiveness

4.3.2 Update

4.3.2.1 New studies

Studies

Five additional studies provided data that could be added to the evaluation.:

Two studies were conducted in the USA and included 40 (Ballard et al., 2004) and 210 (Means et al., 2005) participants respectively, one in Canada ((Liu-Ambrose et al., 2004; Liu-Ambrose et al., 2005), 104 participants), one in Australia ((Barnett et al., 2003), 163 participants) and one in Japan ((Suzuki et al., 2004), 52 participants).

Two additional studies could not be added to the overall evaluation:
Korpelainen 2006 (Korpelainen et al., 2006) was based on 160 Finnish women, provided data on number of falls but not on number of fallers.
Lord 2003 (Lord et al., 2003) was a cluster randomized study including 551 people living in self- and intermediate-care retirement villages in Australia.

Results

Figure 4.1 gives the results of the 9 individual studies included in the Cochrane review evaluation and of the 5 new included studies
The RR in the five new studies ranged from 0.16 to 1.00, although a statistically significant reduction was observed only in one study (Suzuki et al., 2004) and the combined RR of the new studies was 0.72 (95% CI 0.57-0.93)

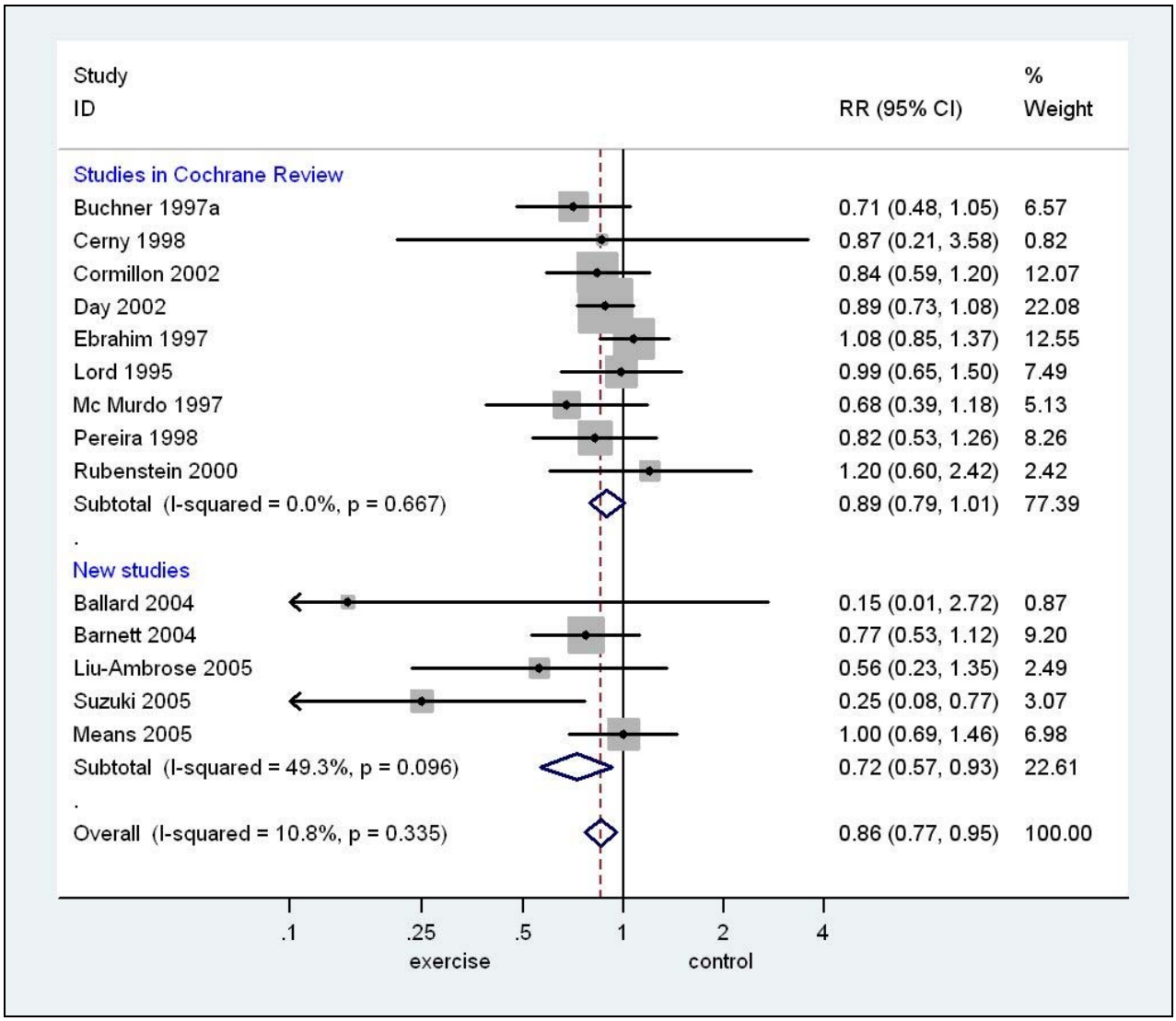


Figure 4.1: Meta-analysis of number of fallers during follow-up for group-delivered exercise

The pooled RR of all 14 studies together was 0.86 (95% CI 0.77-0.95)

The Finnish study (Korpelainen et al., 2006) found a lower incidence of falls in the exercise group (88 falls among 84 participants) than in the control group (101 falls in 76 participants). Lord 2003 (Lord et al., 2003) also found fewer falls in the intervention group (174 falls in 259 participants) than in the control group (211 falls in 249 participants), and the incidence rate ratio was 078 (95% CI 0.62-0.99)

Updated evaluation

Intervention likely to be beneficial

Comments:

The fact that more recent studies tended to be more effective than previous ones suggests that newer programs have benefited from the knowledge that has accumulated over time on how to structure an exercise group to prevent falls.

4.4 Class delivered Tai Chi exercise

4.4.1 Results from the Cochrane review

Studies: Only one study (Wolf SL et al., 1996) conducted in the USA on 200 participants was available for evaluation.

Results: The number of fallers by group was not given. The risk ratio of the time to one or more falls was 0.51 (95% 0.36-0.73).

Conclusion : Intervention likely to be beneficial

4.4.2 New studies

Studies

Three studies provided data on number of fallers. Two were conducted in the USA and were based on 291 (Wolf et al., 2003) and 256 (Li et al., 2004) participants, respectively, and one in Australia ((Voukelatos A et al., 2007), 702 participants).

Another study based on 180 participants from Hong Kong allocated either to Tai Chi (N=60) , resistance exercise (N=60) or control (N=60) reported data only on number of falls (Woo J et al., 2007).

Results

Figure 4.2 gives the results of the 3 studies reporting data on number of fallers. The RR ranged from 0.61 to 0.85, and was statistically in two studies (Li et al., 2004; Wolf et al., 2003) and the combined RR was 0.78 (95% CI 0.66-0.91)

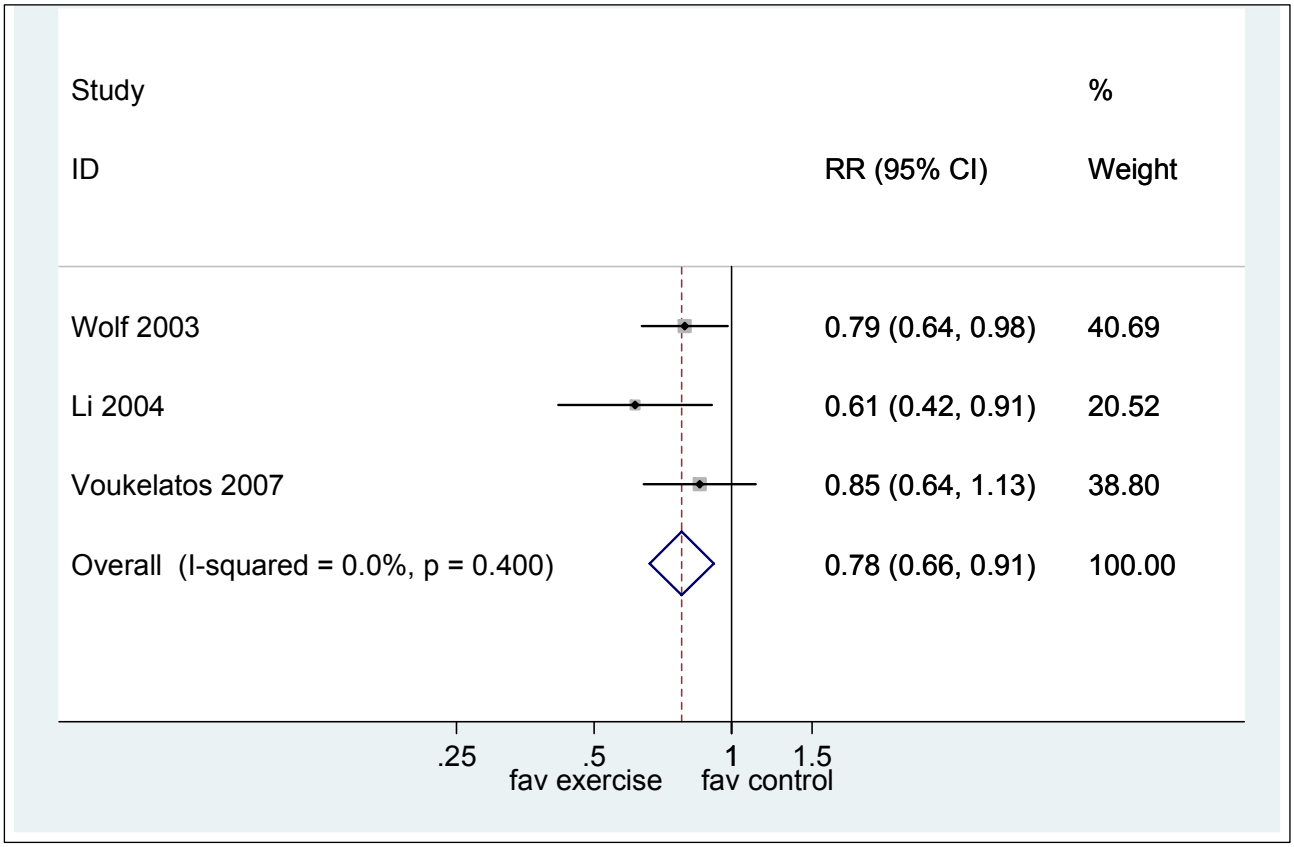


Figure 4.2: Meta-analysis of number of fallers during follow-up for Tai Chi

In the study from Hong Kong (Woo J et al., 2007) there were 15 falls in the 60 participants allocated to Tai Chi, 24 in the 60 allocated to resistance exercise and 30 in the 60 controls.

A review revising the effectiveness of Tai Chi on fall reduction in older people, without however computing a pooled estimate concluded that “Tai Chi has the potential to reduce falls or risk of falls among the elderly, provided that they are relatively young and non-frail” (Low et al., 2008).

Updated evaluation

Intervention likely to be beneficial

Comments

The intervention is still classified as likely beneficial, although the effect appears to be smaller than the one from the Cochrane review, which was based on one study only.

4.4.3 Resources needed for interventions based on exercise

A baseline assessment of the eligibility of potential participants was performed either by the general practitioner, a physiatrist, a “doctor” not otherwise specified, or, in the Finnish study, by an experienced nurse (Korpelainen et al., 2006).

The design of the intervention was in some instances performed by a physical therapist, although this information was not always reported. In some cases it was mentioned that one instructor trained the trainers so that the classes were delivered in a homogeneous way. The number of subjects per class when reported was generally between 5 and 10.

4.5 Home safety interventions

4.5.1 Results from the Cochrane review

Studies

Four studies provided raw data on number of participants falling: two form Australia, including 530 (Cumming RG et al., 1999) and 273 (Day L et al., 2002) participants, one from Germany including 360 participants (Nikolaus T & Bach M, 2003) and one from France based on 60 participants (Pardessus V et al., 2002).
A cluster-randomized study of individual households in Australia including 1737 participants provided data on falls rate (Stevens M et al., 2001).

Results

The pooled estimates based on four studies and including 1223 participants was 0.85 (0.74-0.96). When only participants with a history of falling in the year prior to randomization were considered, the pooled RR of sustaining two or more falls during the study period was 0.66 (95% 0.54-0.81). In the only study (Cumming RG et al., 1999) which presented data separately for the 324 participants without a history of falls in the previous year the RR was 1.03 (95% CI 0.75-1.41)

Conclusion

Home hazard assessment and modification that is professionally prescribed for older people with a history of falls:
Intervention likely to be beneficial

Home hazard modification for older people without a history of falls:
Intervention of unknown effectiveness

4.5.2 New studies

The results presented are based on a recent meta-analysis which updated the literature search up to July 2007 (Clemson et al., 2008).

Studies

A study from New Zealand evaluated home hazard modification also in combination with an individually targeted exercise program on 196 subjects with severe visual impairment (Campbell et al., 2005).

Results

Campbell 2005 (Campbell et al., 2005) found an incidence rate ratio of falls of 0.39 (95% 0.24-0.63).

In their analysis Clemson et al (Clemson et al., 2008) pooled together two different outcomes, i.e. incidence rate ratios for number of falls or cumulative incidence ratios for proportions of fallers, choosing for each study the outcome that was reported as the measure outcome in published articles. They also included the cluster-randomized study from Australia (Stevens M et al., 2001).

The pooled odds of the 6 studies was 0.79 (95% CI 0.65-0.97), based on 3298 participants.

When the analysis was restricted to the high risk older people (i.e. those with known risk factors at baseline) the RR became 0.61 (95% 0.47-0.79) based on 570 subjects.

Updated evaluation

Home hazard assessment and modification that is professionally prescribed for older people at high risk of falls:

Intervention likely to be beneficial

Home hazard modification for older people without known risk factors for falls

Intervention of unknown effectiveness

4.6 Visual correction

4.6.1 Results from the Cochrane review

Studies:

One study from Australia (Day L et al., 2002) based on 276 participants evaluated vision testing and referral to the usual eye care provider, general practitioner or local optometrist

Results:

The RR was 0.95 (95% CI 0.79-1.14)

Conclusion :

Referral for correction of visual deficiency

Intervention of unknown effectiveness

4.6.2 New studies

Studies

A study from Australia evaluated an intervention based on a comprehensive vision and eye assessment, with appropriate treatment on 616 participants (Cumming RG et al., 2007).

Expedition of first eye cataract surgery was tested on 306 women with cataract from the UK (Harwood et al., 2005). Expedition of second eye cataract was also tested by the same group on 239 women (Foss et al., 2006).

Results

The falls rate ratio for a comprehensive vision and eye assessment and treatment (Cumming RG et al., 2007) was 1.57 (95% CI 1.20-2.05) .

The hazard ratio for any falls in the expedited first eye cataract surgery study (Harwood et al., 2005) was 0.95 (95% CI 0.69-1.35).
The rate ratio of falling was 0.66 (95% 0.45-0.96)

The hazard ratio for first falls in the expedited second eye cataract study (Foss et al., 2006) was 1.06 (95% CI 0.69-1.61). The rate ratio of falling was 0.68 (95% 0.39-1.19)

Updated evaluation

Expedition of first eye or of second eye surgery
Intervention of unknown effectiveness

Comprehensive vision and eye assessment, with appropriate treatment
Intervention unlikely to be beneficial

Comments
The possible reasons that the authors gave for the higher falls rate ratio in the intervention group in Cummings 2007 (Cumming RG et al., 2007) were

- Differential report of falls (unlikely because also fractures were higher in the intervention group, although not significantly)
- Frail people may need a considerable period of time to adjust to new eyeglasses and be at greater risk of falling during this period
- Improving vision may lead to behavioral changes and increased exposure to fall-prone situations.

4.7 Multifactorial Interventions

4.7.1 Results from the Cochrane review

In the Cochrane review these interventions were called “multidisciplinary, multifactorial health/environmental risk factor screening and intervention”, and were evaluated separately intervention conducted in an unselected population and interventions conducted in a high risk population.

4.7.1.1 Multifactorial interventions in an unselected population

Studies

Four studies were used to compute the pooled relative risk: two from the USA, based on 254 (Fabacher et al., 1994) and 1559 (Wagner EH et al., 1994) participants, respectively, one from Thailand based on 160 participants (Jitapunkul, 1998), and one from Australia and including 100 subjects (Newbury J & Marley J, 2000; Newbury et al., 2001).
Four additional studies were not used to compute the pooled RR:
Carpenter 1990 (Carpenter & Demopoulos, 1990), UK, 539 women, cluster randomized
Steinberg 2000 (Steinberg M et al., 2000), Australia, 252 participants, cluster randomized
van Rossum 1993 (van Rossum et al., 1993), Netherland, 580 participants, not enough data provided
Vetter 1992 (Vetter et al., 1992), UK, 674 participants, cluster randomized

Results:

The combined RR of four studies was 0.73 (95% CI 0.63-0.85), based on 1651 participants.
Of the four studies not included, only one reported significantly fewer falls in the intervention group (Carpenter & Demopoulos, 1990), while in the other three no significant advantage was found (Steinberg M et al., 2000; van Rossum et al., 1993; Vetter et al., 1992).

Conclusion

Intervention likely to be beneficial

4.7.1.2 Multifactorial interventions in high risk populations

Studies

Subjects were defined as high risk either because they were known fallers or had identified risk factors prior to enrolment

Five studies were used to compute the pooled relative risk: three from the UK, based on 397 (Close J et al., 1999), 109 (Kingston P et al., 2001a; Kingston P et al., 2001b) and 348 (Lightbody E et al., 2002) participants, respectively, one from Canada based on 163 participants (Hogan DB et al., 2001), and one from the Netherland and including 316 subjects (van Haastregt JC et al., 2000).

Two additional studies were not used to compute the pooled RR, because the unit of analysis differed from the unit of randomization (cluster randomized)..

Coleman 1999 (Coleman et al., 1999), USA, 169 participants

Tinetti 1994 (Tinetti ME et al., 1994), 301 participants

Results

The combined RR of five studies was 0.86 (95% CI 0.76-0.98), based on 1176 participants.

Of the two studies not included, one reported significantly fewer falls in the intervention group (Tinetti ME et al., 1994), while in the other did not find a a difference in the incidence of falls (Coleman et al., 1999).

Conclusion

Intervention likely to be beneficial

4.7.2 New studies

Gates and colleagues (Gates et al., 2008) re-evaluated effectiveness of multifactorial assessment and targeted interventions for preventing falls, including studies published up to March 2007. They included studies with the following characteristics: ”it carried out an assessment of multiple risk factors for falling, to identify those that were potentially modifiable; it provided treatments delivered by healthcare professionals, either directly or

by onward referral, to reduce risk of falling, on the basis of the result of the assessment; it was delivered to individuals, not a community or population level; and it was a service based in an emenrgency department, primary care, or the community (Gates et al., 2008).

Studies

Gates and colleagues (Gates et al., 2008) included 19 studies, either individually randomized or cluster randomize,. for a total of 6397 participants.

Comparison of the 19 studies included by Gates 2008 (Gates et al., 2008) with those included in the Cochrane review:

- Four were included in the Cochrane review in the analysis in the unselected population (Fabacher et al., 1994; Jitapunkul, 1998; Newbury et al., 2001; Wagner EH et al., 1994)
- Four were included in the analysis in the high risk population (Close J et al., 1999; Hogan DB et al., 2001; Lightbody E et al., 2002; van Haastregt JC et al., 2000). Kingston 2001 (Kingston P et al., 2001a; Kingston P et al., 2001b) was excluded by Gates because it did not report data on falls.
- Two were not included in the analysis because they were cluster-randomized, but mentioned among the studies in high risk group (Coleman et al., 1999; Tinetti ME et al., 1994).
- One was considered separately because participants had cognitive impairment (Shaw et al., 2003).
- One was included among the cognitive/behavioural interventions (Gallagher EM & Brunt H, 1996), because after the risk assessment the intervention was based on a 1-hour counseling.
- One was included among the home hazard assessment interventions (Pardessus V et al., 2002).
- One is not mentioned (Gill et al., 2002)
- Five were published afterwards (Davison et al., 2005; Huang & Acton, 2004; Lord et al., 2005; Rubenstein et al., 2007; Whitehead et al., 2003).

Of the five studies not described in the Cochrane review:

Davison 2005 (Davison et al., 2005) was conducted in the UK on 313 participants and the intervention incuded exercise, drug modification, surgery, environmental modification and assistive devices.

Gill 2002 (Gill et al., 2002) was conducted in the USA on 188 participants provided exercise, environment modification, assisitive devices and education/counseling.
Huang 2004 (Huang & Acton, 2004) was conducted in Taiwan on 120 participants and provided education/counseling.
Lord 2005 (Lord et al., 2005) was conducted in Australia on 414 participants and provided exercise, surgery, education/counseling and referral.
Rubenstein 2007 (Rubenstein et al., 2007) as conducted in the USA on 792 participants (97% males) and provided referral.
Whitehead 2003 (Whitehead et al., 2003) was conducted in Australia and provided referral.

Results

For the outcome number of fallers 18 studies were included for a total of 5154 participants. The pooled RR was 0.91 (95% CI 0.82-1.02). There was a great heterogeneity between studies (p=0.0006).
For fall related injuries the pooled RR was 0.90 (95% CI 0.68-1.20), based on 8 studies, 3220 participants.
When interventions that provided an active intervention were considered separately from those who provided only counseling or referral the pooled RR was 0.73 (95% 0.63—0.85) for the more intense interventions, and 0.82 (95% 0.72-0.94) for the less intense ones.
No difference was found for studies in unselected or high risk populations.

Updated evaluation

Multifactorial risk assessment followed by active management of risk factors
intervention likely to be beneficial

Multifactorial risk assessment followed by education/counseling or referral to usual healthcare providers
Intervention of unknown effectiveness

5 Barriers and facilitators to the implementation of interventions to the prevention of falls in older people

5.1 Attitudes of older people towards participation

Investigating the attitude of older people towards falls and fall prevention is necessary to design interventions that are better accepted by the target population, in order to increase participation and consequently effectiveness.

5.1.1 Participation and drop out in trials evaluating the effectiveness of interventions

In the guidelines for the prevention of falls issued by the UK National Institute of Clinical Excellence (NICE 2004), a review of randomized controlled trials (RCT) on fall prevention in elderly people showed that i) few of the studies reported the proportion of subjects that refused to participate or dropped out during the intervention, and ii) when these proportions were given they were often high, thus limiting the potential for effectiveness at a population level.

Apollo WP4 has updated the review with the aims of investigating i) the amount of information on refusal and dropout rates that can be obtained from studies investigating the effectiveness of selected interventions to prevent falls in community-dwelling older people, ii)the level of participation and compliance and iii) the reasons for refusal or dropout, when given. Since the awareness of health problems and prevention and of the benefits of physical activity and other factors is likely to have changed over time, we included only studies published since 1997, in order to have an updated picture of the issue.

A dropout was defined as a subject who left the study between randomization (or recruitment for non randomized studies) and the end of the intervention, and a refusal a subject who refused to participate to the study at recruitment or left before randomization. When the information was unclear, not consistent, or incomplete, we classified the refusal/dropout rate as not given.

Of the 33 studies identified, 17 implemented an intervention based on an exercise program, 5 an exercise program in combination with some countermeasure and 11 other types of interventions.

The following table presents data on refusal and drop out rates.

Table 5.1 Refusal and drop out rates in RCT of interventions to prevent falls in older people published between 1997 and 2006.

Type of rate	No of studies
Refusal rate	
<25%	4
25-50%	10
>50%	5
Not given	14
Drop out rate	
<10%	9
10%-20%	8
>20%	6
Not given	10
Refusal+drop out combined	
<30%	6
30-50%	2
>50%	6
Not given	19

The percentage of reporting was higher in studies published after 2002, and interventions implementing exercise programs appeared to have slightly higher refusal and drop out rates, while no difference emerged between RCT and non-RCT. These results were based on small numbers and are thus difficult to interpret.

Reasons for not participating were usually not given. Among the few studies that reported reasons for drop out, the more frequent were health problems (including death) and organization problems, like time schedule conflicts or inadequate transportation availability.

In order to choose whether to implement an intervention that has proved effective in another setting, the provider needs additional information, which is essential to assess the generalization of the results from a given study. In this respect, the extent to which the intervention reaches the target population is a key issue. Thus, information on the proportion of subjects who refused to take part or did not complete the intervention, together with the reasons for refusal/drop out is should be always collected and reported.. However, only 14 (42%) out of 33 studies reported this information. There was a tendency to report this information more frequently in more recent studies, in accordance with a general tendency of improved reporting, following the issuing and spreading of recommendation on the reporting of clinical trials.

In some instances participation rates are difficult to define, for example when the study sample consisted of volunteers recruited by means of advertisement on various media. In this case, however, the sample is extremely selected and the results are far from applicable to a population setting.

In many of the studies, more than 50% of the intended target population entered and completed the intervention. These results are encouraging, compared to the considerable difficulties observed for interventions aiming at modifying lifestyle, like smoking cessation, alcohol abuse or weight loss. In evaluating these findings, the modalities of recruitment and the inclusion and exclusion criteria used in each study must be considered.

Key messages:

- *Reporting of information on participation and drop out has improved over time*
- *Over 50% of the intended target population entered and completed the intervention in several studies.*

5.1.2 Overview of studies investigating attitudes of older people towards falls prevention

5.1.2.1 The NICE review

In 2004 a review of **patient's views and experiences of falls prevention strategies for falls in elderly people** was conducted within the NICE (National Institute for Clinical Excellence, UK) guidelines on fall prevention (NICE, 2004)
24 qualitative and quantitative studies published between 1990 and 2003 were included. The barriers and facilitators to falls prevention identified in these studies were summarized in the following table:

Table 5.2 Barriers and Facilitators for the participation of community dwelling older people to fall prevention interventions:

Facilitators	Barriers
Information from a variety of sources (GP, mass media,community nurse, and published in different languages).	Lack of non-English speaking information.
Information that falls can be preventable rather than unpredictable.	The term 'fall prevention' is unfamiliar and the perceived relevance of falls prevention low until fall experienced.
Information that communicates life-enhancing aspects of falls prevention, such as maintaining independence, control.	Inaccessible and unappealing information.
Emphasis on social aspects of falls prevention programmes.	Social stigma attached to programmes targeting 'older people'.
Partnering with a peer who has successfully undertaken a falls prevention programme.	Low health expectations and low confidence in physical abilities.
Finding out which characteristics the person is willing to modify.	Differing agendas between older people and health professionals.
Countering the belief that nothing can be done for falls.	Pain, effort and age (in relation to exercise programmes).
Programmes with exercise which is of moderate intensity only. Addressing the following issues prior to participation in intervention strategies: activity avoidance, fear of falling, fear of injury, lack of perceived ability, fear of exertion.	Programmes with an emphasis on balance and strengthening.
Assistive/mobility aids and home modification most readily accepted interventions.	Lack of transport to venues.
People may be more receptive to messages around prevention when they have actually had a fall or near fall.	No support from family.

The review conducted for the NICE guidelines was also published as an article (McInnes & Askie, 2004) where the following **key implications** were given :

Key implications from the NICE review (McInnes 2004):

- Practitioners who are involved in developing falls prevention programs should ensure that such programs: (1) are flexible enough to accommodate participants' different needs and interests and (2) promote the social value of such programs.
- Prior to recommending a falls prevention program for an individual, practitioners should consult with people about the changes that are realistic for them, as individuals, to make.
- Assistance or referral to the appropriate service should be provided to address modifiable individual factors that may be barriers to participation, such as fear of falling, denial of risk of falling, and lack of motivation to participate in a program with a physical activity element.
- To engender and maintain interest in falls prevention programs, potential participants should be given written and verbal information on:
  - the preventable nature of some falls
  - how to stay motivated, and
  - the physical and psychological benefits of physical activity and of modifying falls risk.

Among the studies included in the NICE review, a review of 29 randomized controlled trials or quasi-experimental design trials, with interventions aimed at increasing physical activity in older people (King et al., 1998) found that:

- 19 studies reported participation rates, which ranged from 36% to 98% (median 80%).
- 13 (45%) studies explicitly described or mentioned the use of specific behavioral, educational, social, cognitive, or program-based (e.g. exercise type, intensity, format) strategies aimed at promoting physical activity participation.
- 6 studies explicitly manipulated one or more of these strategies as part of the study design with the aim of influencing participation rates
- The most frequently included methods to promote participation were behavioral strategies based on social learning theory or derivatives (10 studies) and strategies

focused on exercise type (e.g. less vigorous) or form (e.g. self-paced, class or home based) (10 studies).

- A supervised home-based format or a combination group- and home-based formats typically reported comparable or better adherence relative to programs using class or group format only.
- Ongoing telephone supervision (7 studies) was an effective alternative to face-to-face on-site instruction
- 11 studies also provided some form of follow-up after the intervention ended (3 month to 11 years). With some exceptions, physical activity of fitness level was higher than at baseline, and better than in the comparison group.

Many of the retrieved papers were about willingness of older people to undertake some sort of physical activity, not always in the context of falls prevention (e.g. general health or cardiovascular prevention).

Thus, not all types of activities investigated have proven effectiveness against falls.

5.1.2.2 The PROFANE recommendations

Wokpackage 4 of the PROFANE project (see appendix 3) also provided the following recommendations for promoting the engagement of older people in preventive health care (see appendix 3)

Recommendations for promoting the engagement of older people in preventive health care
(PROFANE project, WP4)

Raise awareness in the general population that undertaking specific physical activities has the potential to improve balance and prevent falls.
Uptake may be encouraged by promoting greater awareness among older people, their families and carers, and health professionals of how undertaking specific physical activities (e.g. exercises to improve strength and balance) may contribute to improving balance and reducing falls risk.

When offering or publicising interventions, promote immediate benefits that fit with a positive self-identity.
Uptake of falls prevention interventions may be enhanced by emphasizing the positive benefits which are likely to accord with desirable self images for older people, in addition to those which reduce falls risk. Examples of benefits include increased independence, and greater confidence.

Utilise a variety of forms of social encouragement to engage older people in interventions.
Uptake may be encouraged by the use of personal invitations to participate (preferably from a health professional) and positive media images and peer role models to illustrate the social acceptability, safety and multiple benefits of taking part. Uptake and adherence may be encouraged by ongoing support from family, peers, and professionals.)

Ensure that the intervention is designed to meet the needs, preferences and capabilities of the individual.
A tailored personal approach – even in a group approach context – can greatly improve the chance of older people engaging with and maintaining an intervention programme. There is a need to consider the individual's lifestyle, values, and ethnicity, as well as environmental factors such as place of residence and access to services.

Encourage self-management rather than dependence on professionals, by giving older people an active role.
Participation in, and adherence to, an intervention will be maximized if the older person can choose or modify the intervention. While some form of supervision will be necessary to ensure safety, the older person should be enabled wherever possible to select from between different interventions, different formats of the same intervention, or from among a range of intervention goals.)

Draw on validated methods for promoting and assessing the processes that maintain adherence, especially in the longer term.
These could include encouraging realistic positive beliefs, assisting with planning and implementation of new behaviours, building self-confidence, and providing practical support.

The authors noted that these recommendations represent a consensus based on current knowledge and evidence, but the evidence base from which these recommendations were developed was limited, and not always specific to falls prevention (Yardley et al., 2007a).

5.1.2.3 Some recent studies

A Prospective cohort study on 1725 subjects aged 50 years or more, involving 10 different types of exercise programs, was conducted in the Netherlands and investigated predictors of exercise maintenance (Stiggelbout et al., 2006).
They found that **predictors of intention to continue participating** were female sex, younger age, being married, non-smoker, and in paid employment, having positive attitude towards exercise, high self-efficacy at baseline.
Predictors of actual maintenance of exercise participation, however, different from those of intention to continue and were short or no lapses during intervention, high

intention at baseline, high perceived quality of programme, positive attitude at baseline, and few risk situations at baseline.

A survey investigated **intention to undertake strength and balance training** (SBT) among 558 subjects aged 60 to 95 years recruited using a variety of methods in the UK (Yardley et al., 2007b).
Threat appraisal (concern about falling, perceived risk, and consequences of falling) and coping appraisal (perceived benefits, and appropriateness for them of undertaking SBT) were also investigated.
Intention to undertake SBT was much more closely related to all elements of coping appraisal than to threat appraisal.
Elements of coping appraisal included belief that SBT has multiple benefits, belief that SBT is associated with a positive social identity, feeling that family, friends and doctors would approve.

A systematic review of **interventions to reduce fear of falling**. Included 19 RCT that assessed fear of falling in community-dwelling older people (Zijlstra et al., 2007b).
In 11 trials fear of falling was lower in the intervention group than in the control group.
Effectiveness was found for fall-related multifactorial programs (5 studies), tai chi interventions (3 studies), and hip protector intervention (1 study).
Some interventions not specifically aimed at it resulted in a reduction in fear of falling

A computer-assisted telephone surveys was conducted in 2002 with Australians 60 years and older in Northern Rivers, New South Wales (site of a previous fall-prevention program; n=1601), and Wide Bay, Queensland (comparison community; n=1601) **to examine older people's attitudes about falls and implications for the design of fall-prevention awareness campaigns**. (Hughes et al., 2008). Participants from the previous intervention site were less likely than were comparison participants to agree that falls are not preventable (OR=0.76; 95% CI=0.65, 0.90) and more likely to rate the prevention of falls a high priority (OR=1.31; 95% CI=1.09, 1.57). There was no difference between the groups for self-perceived risk of falls; more than 60% rated their risk as low. Those with a low perceived risk were more likely to be men, younger, partnered, and privately insured, and to report better health and no history of falls.

Focus groups with older people were also conducted to compare 3 key messages:

1. **If you are more active, you will stay independent for longer.**
2. **If you are more active, you will stay healthy for longer.**
3. **If you are more active, you will be less likely to fall.**

Focus group data indicated that older people preferred messages that emphasized health and independence rather than falls.

5.1.3 Apollo WP4 study on attitudes of older people towards fall prevention

In Europe, the few studies that investigated these aspects have been conducted mostly in the UK and in the Nordic countries, and there was a lack of information from Central, Eastern and Southern Europe. There was therefore the need to conduct studies in these areas of Europe.
Apollo WP4 investigated the attitude of senior citizens towards two evidence-based measures to prevent falls using a validated questionnaire in five European countries for which no or only scant data were available.

The two evidence-based measures investigated were i) participation to a social activity like an exercise class or a dancing group aimed at improving muscle strength and balance (briefly “exercise class”) and ii) home safety assessment and modification (briefly “home assessment”) .

The sample included 1497 subjects (633 men and 864 women) aged 65 to 89 years in Italy (n=312), Poland (n=300), Greece (n=408), Hungary (n=200) and Slovenia (n=277). In Italy, Poland and Greece the sample was representative of the general elderly population, in Hungary of the population living outside the Budapest area, and in Slovenia it was an opportunistic sample. The questionnaire included a few socio-demographic variables, physical activity and history of falls. The attitude towards the two fall prevention measures was investigated by means of the Attitudes to Falls-Related Interventions Scale (AFRIS), a

questionnaire developed for this purpose within the European project PROFANE (see appendix 3).

Figure 5.1 – You intend to participate if you are offered the opportunity (social activity to improve balance and/or muscle strength)

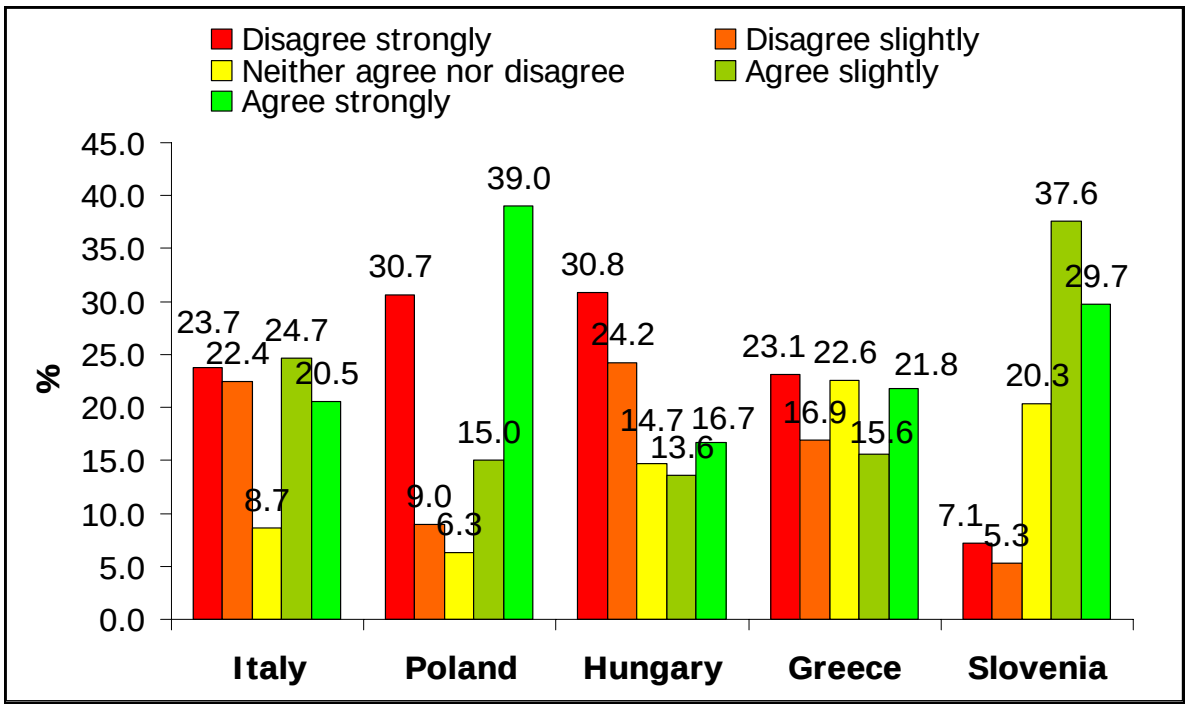
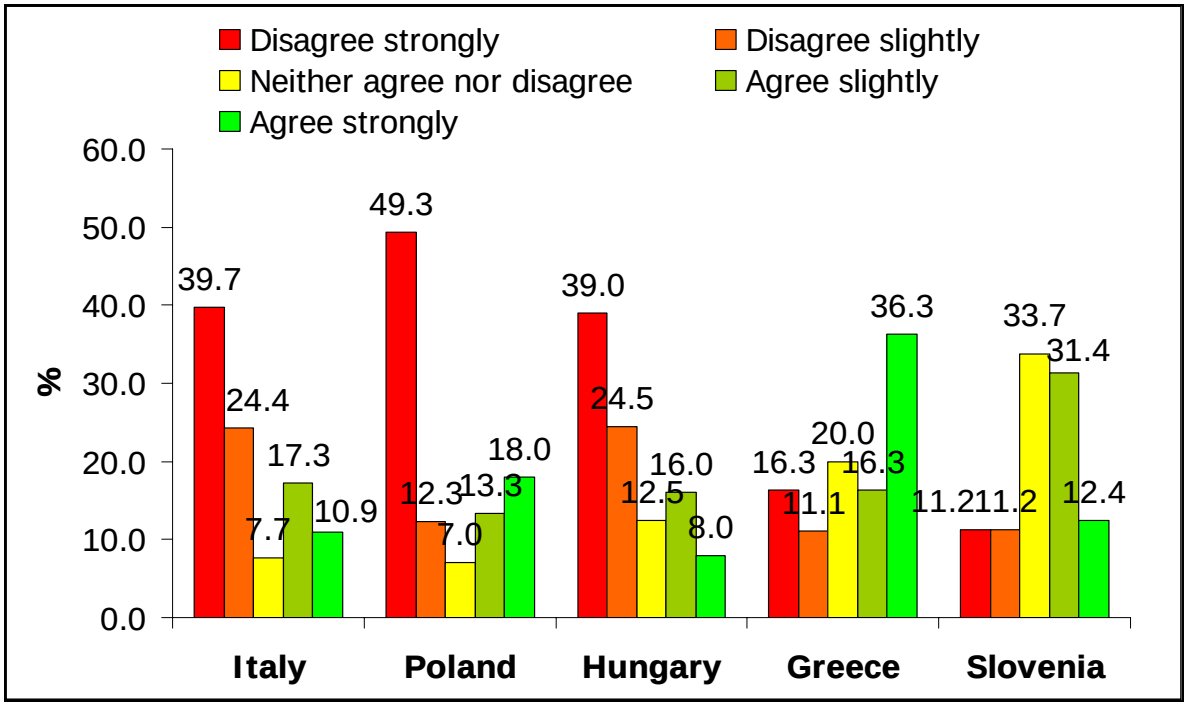


Figure 5.2 – You intend to have your home safety assessed if you are offered the opportunity



There were marked differences between countries in the acceptability of the two proposed measures. A strongly or moderately positive intention to do the exercise program, if offered, was expressed by 55% of the sample in Italy, 54% in Poland, 30% in Hungary, 37% in Greece and 68% in Slovenia. The corresponding figures for the home assessment were 28% in Italy, 31% in Poland, 24% in Hungary, 53% in Greece and 44% in Slovenia.

These marked differences in the intention to participate between countries were observed also in multivariate analyses, after taking into account differences in the sex and age distribution and in the prevalence of other risk factors for falls.

Willingness to participate to the exercise program was higher for

- Subjects aged <75 years as compared to ≥75 years (strong difference)
- Subjects who had fallen in the last 6 months (modest difference)
- More educated subjects (modest difference)
- Subjects with higher levels of physical activity (strong difference)
- Subjects considering their health status better than their peers (strong difference)

Willingness to have the home safety assessed was higher for

- Subjects aged <75 years as compared to ≥75 years (moderate difference)
- Men (modest difference)
- Subjects who had fallen in the last 6 months (strong difference)
- Subjects with higher levels of physical activity (moderate difference)
- Subjects considering their health status worse than their peers (strong difference)

This study shows that there are marked differences in the acceptability of the proposed interventions in different countries. This confirms that the customization of the intervention to meet the needs of the target population as well as raising awareness to the problem of falls is important to achieve good results.

The marked differences between subjects aged 65-74 years and the older ones, show that the latter need a greater effort in order to convince them to participate to fall prevention programs.

This study investigated intention to participate, if offered the opportunity. Clearly, the actual participation may differ from the reported "theoretical" willingness, since it will be influenced by many other factors, besides general attitudes. It is nonetheless encouraging that, in most countries, the majority of the elderly population reported to be willing to participate to at least one of the proposed measures to prevent falls.

Key messages:

- *Information on the attitudes of older people in Greece, Hungary, Italy, Poland and Slovenia is now available for implementers*
- *The marked differences in the acceptability of interventions in different countries show that it is important to customize the intervention to meet the needs and inclinations of the target population*
- *Different strategies may be considered for healthy and frail older people: physical exercise was more acceptable to less frail respondents, while the opposite was true for home hazard assessment*

5.2 Barriers and facilitators: the experience of those who have done it

The experience of those who already have implemented interventions for the prevention of falls in older people is an invaluable source of information for those who want to work in this field. Using a mailed questionnaire, WP4 has asked them to share their experience on which were the main barriers and facilitating factors.

We received answers from 15 (40%) implementers.
In general, experiences appeared varied and heterogeneous, and depended heavily on the local context.
The main barriers and facilitators reported are listed below.

Political factors

Several of the implementers gave a neutral judgment to the political climate, judging it neither a facilitator nor a barrier.

Facilitators

- A commitment at the national level (national action plan, national guidelines, political prioritization of injury prevention) or at the local level (hospital guidelines for the prevention of falls, hospital quality improvement policy, interest of local politicians towards the intervention)

Barriers

- Lack of interest from politicians
- Attempt to exploit intervention by local politicians during election time.

***F*inancial factors**

Facilitators

- Governmental economic support
- Donation of equipment needed for the intervention
- No fees requested for participation
- NHS providing refunds for needed aids and assistive devices

Barriers

- Lack of funding for occupational therapists and other paramedics
- Lack of healthcare reimbursement for injury prevention
- Possible distrust when the intervention funding comes from private companies (e.g. pharmaceutical companies)

Attitudes of the target population

Facilitators

- Influence of peers and relatives
- Higher socioeconomic status
- Good relationship with family doctor

Barriers

- Low participation rate
- Belief that falls are due to chance and cannot be prevented

Attitudes of involved operators

Facilitators

- Strong commitment of PI
- Strong commitment of nurses, occupational therapists, trainers
- Good leadership of trainers
- Volunteers good in motivating participants
- Involvement of the team in projects management

Barriers

- Lack of commitment of doctors
- Lack of knowledge of doctors about existing fall prevention facilities

Other miscellaneous factors

Facilitators

- Research and community partnership
- Adaptation of programme to educational background
- Preventive involvement of specific groups/advocacy organizations
- Monitoring of implementation
- Interest of local press and television
-

Barriers

- Lack of transportation
- Lack of evidence supporting fall prevention strategies
- Regulations about privacy
- Restrictive regulatory climate for clinical research
- Other priorities for the use of facilities needed for the conduction of the intervention

Appendix 1 - Description of Workpackage 4 of the Apollo project

Apollo: Strategies and best practices for the reduction of injuries

Initiated by CEREPRI and run under the auspices of DG SANCO, the “Strategies And Best Practices For The Reduction Of Injuries” (APOLLO) Project began on December 2005 and ended on November 2008.
The project aims to provide: (a) the evidence on the health and financial burden of injuries and easily measurable indicators and (b) recommendations on how to overcome the barriers in applying existing best practices and efficient policies to decrease the most common injuries in the EU member states with specification of success and failure factors for implementation of injury prevention programs in all age groups and all types of injuries. n addition, implementation activities will focus on two high injury burden areas: (a) falls among elderly and (b) injuries among vulnerable road users. Dissemination activities include the creation of a scientific platform with input from practitioners in the field, injury victims and policy makers as well as the dissemination of results of all the work packages. Activities under the projects heading are divided amongst six Work Packages. Similar to the structure followed in other successful endeavours, the project will approach the prevention of injuries at the overall policy level, apply the priorities and strategies at the operational level and devote substantial resources to communicate the results.
More information can be found at: http://www.euroipn.org/apollo/

Workpackage 4 – Development and assessment of strategic materials for implementation of recommendations for preventing falls among elderly people in the EU

Objectives

- To extend implementation of policy recommendations for overcoming barriers in order to reduce the most common type of injuries in elderly, namely falls, building on the experience of other EC co-sponsored projects for prevention of injuries among the elderly, namely the EUNESE and related projects such as PROFANE (see appendix 3)

- To develop materials on strategic resources that can be used by member states in order to increase awareness among EU citizens, scientific community and policy makers of fall related injuries and effective practices for their prevention

Main investigation lines developed by WP4

1. Systematic review and meta-analysis of risk factors for falls

In order to plan a strategy for the prevention of falls, it is fundamental to assess not only what are the causes of falls, but also how important these causes are in the target population, i.e. how many falls they cause.
To perform this assessment one needs information: on i) the strength of the association of each factor with the risk of falls, and ii) the prevalence of the factor in the target population
The review conducted by WP4 used the methods of meta-analysis in order to investigate the causes of falls in community dwelling older people in a comprehensive, objective and systematic way, and provided an evidence-based assessment of the strength of the association between each factor and falls.

2. Periodic updates on information about what works in the prevention of falls

In 2003 an extensive review on interventions for the prevention of falls in older people was issued by the Cochrane Collaboration. From 2003 onwards, over 30 new studies have been published. WP4 has conducted a periodic systematic search and evaluation of new studies, in order to be abreast with the literature in the field and provide an up-to-date picture of what works in the prevention of falls.
Besides effectiveness, these studies have been evaluated under other aspects too, e.g. resources needed for their implementation and degree of success in recruiting the target population.

3. Barriers and facilitators: the experience of those who have done it

The experience of those who already have implemented interventions for the prevention of falls in older people is an invaluable source of information for those who want to work in this field. Using a mailed questionnaire WP4 has asked them to share their experience on which were the main barriers and facilitating factors.

4. Investigation of the attitudes of older people towards two evidence based fall prevention interventions

Lack of willingness of older people to participate to fall prevention programs has often been reported as a barrier. WP4 investigated the attitude of senior citizens towards two evidence-based measures to prevent falls using a validated questionnaire developed in the framework of the European project PROFANE in a representative sample of about 1,500 subjects from five European countries (Greece, Hungary, Italy, Poland and Slovenia) for which no, or only scant data was available.

5. Additional activities

A comprehensive survey of the literature concerning several aspects of falls and fall prevention, as well as health promotion in older people in general, has also been conducted throughout the project, with particular attention to review articles, in order to integrate different aspects of health promotion in the evaluation of fall prevention, and to provide a more comprehensive picture on the issue in the deliverables.

For information contact Dr Eva Negri at evanegri@marionegri.it

Appendix 2 - Description of the EUNESE guide for implementers

The EUNESE pilot projects

The aim of the EUNESE Working Group “Pilot Projects” was to plan and implement specific operational pilot projects that would create measurable injury prevention efforts targeting the two main sub-segments of the elderly population (those that support themselves and those living within communities that support them), as well as health care professionals working with the elderly. The main objective of the pilot projects implemented in three European countries was to test the applicability and enforceability of specific injury prevention measures, to evaluate their effectiveness and to disseminate the projects’ results and experience.

The projects have been selected in such a manner to address all three “Es” that work in injury prevention focusing on both institutionalized and community-dwelling elderly:

- Engineering: an illustrative example could be to define the structural modifications that can contribute to a safer environment for the elderly –specifications for a safer domestic environment, nursing homes and rehabilitation centres and safer transportation, referring to both public and private means
- Education: training materials for community-dwelling (living independently) seniors, nursing home residents and their caregivers, self-performed evaluation of the safety of the domestic, nursing home and rehabilitation centre settings.
- Enforcement: the degree to which the elderly environment adheres to the minimum safety norms required by international standards and regulations and whether the best practices advocated by the experts are being used

After the implementation and evaluation of the pilot projects, the partners of each country drafted a report in which all steps, methodology and results were described and communicated to the WG Coordinator.

The EUNESE implementer’s guide

Based on these reports, a final paper that included Model methodologies to design, develop, implement, and evaluate pilot projects for injury prevention among the elderly

was designed by the WG3 Coordinator in a format of an “Implementer’s Guide”. This material was developed for the dissemination of the pilot projects planned and implemented within the EUNESE project context.

This guide provides implementers with all the necessary information about the process and the methodology used in the present pilot projects as well as with the available materials.

The Guide consists of three distinct sections, one for each pilot project. Each section includes an outline of the pilot project, a brief introduction, a template providing all the basic information on the intervention at one glance and the 7 steps for each project implementation.

Finally, this guide provides an additional section with the name “Notes for implementers”, where a more general and detailed guideline for successful programme implementation is provided with an extra focus on the facilitating factors and ways to overcome possible impediments during project development/implementation.

The seven step of a project implementation:

Step 1: Problem identification-Needs Assessment
Step 2: Goals and Objectives
Step 3: Organize the intervention: Project Strategies
Step 4: Recruitment of participants
Step 5: Implementation
Step 6: Evaluation
Step 7: Reporting

How to Use The EUNESE Guide for implementers

Each of the three projects' development are firstly defined and subsequently broken down into seven steps. Examples from the EUNESE pilot projects are included in order to illustrate the way in which evaluation can be used throughout the process of program development.

Additional resources for each program development and evaluation are provided in the Section 5 "Notes for the Implementers".

All material used for the realisation of the pilot projects presented below can be accessed at http://www.euroipn.org/eunese.

Appendix 3 – Where to find resources on falls in older people

Comprehensive lists of resources on falls

Two other European projects, the EUNESE and the PROFANE project have compiled extensive lists of resources on falls in the elderly.

The European Network for Safety among Elderly (EUNESE) Project

Initiated by CEREPRI and run under the auspices of DG SANCO within the framework of the Public Health Program of the European Union, the European Network for Safety among Elderly (EUNESE) Project began on July 1st, 2004 and will run for 36 months. This project involves over 30 partners representing 23 different EU countries and aims to reduce injuries among senior citizens. Specifically, acquired knowledge and policy prevention strategies will be built upon to establish an EU-wide network of safety promotion among both those who live independently and nursing home/institutionalized residents. Further, a best practices policy manual and commonly acceptable information materials will be developed as well as the implementation of pilot projects to enhance safety, reduce injuries and promote health among senior citizens in the EU. We feel confident that this project will succeed in making a significant difference in this area of health. Indeed, EUNESE is a project of paramount importance, as there is no other such initiative for the harmonization of policies and the development of a concise strategy on injury prevention among the elderly.

Contact person Sakis Ntinapogias at eunese@med.uoa.gr

Project's Web Site**:** http://www.cc.uoa.gr/socmed/hygien/eunese/

The Prevention of Falls Network Europe (PROFANE)

PROFANE focuses and co-ordinates ongoing European clinical, research and technology developments related to prevention of falls amongst elderly people. Scientists, clinicians and SME from diverse fields work in 4 work-packages: Co-ordination and consultation of future fall prevention intervention trials, Clinical assessment and management,

Assessment of balance function and prediction of falls, Psychological aspects of falling. The 4 work-packages are linked horizontally to permit synergy and achieve major progress in understanding. The collaboration will: bring together trialists, co-ordinate a taxonomy, identify a core data set, build capacity, develop practical clinical protocols, collaborate to agree and share measures, and facilitate centres to valid balance assessments, develop a shared understanding of psychological sequellae of falling and psychological mechanisms which facilitate prevention interventions. Co-ordinate developments in Quality of Life measurement and distribution of self test measures for older people. PROFANE will disseminate knowledge and skills widely.

Project's Web Site: http://www.profane.eu.org/

Data on burden of falls in Europe

The Injury database IDB

The European Injury Database (IDB) is based on a systematic injury surveillance system that collects accident and injury data from selected emergency departments of Member State hospitals, providing a complement to and integrating existing data sources, such as routine causes of death statistics, hospital discharge registers and data sources specific to injury areas, including road accidents and accidents at work.

IDB is hosted by the European Commission, and was set up by DG SANCO under the Injury Prevention Programme in 1999, in order to provide central access to the data collected in the Member States under the EHLASS Programme (European Home and Leisure Accident Surveillance System).

The European Injury Database is the only data source in the EU that contains standardised cross-national data for developing preventive action against the rising tide of home and leisure accidents in Europe. The purpose of the database is to facilitate targeted injury prevention and improve consumer safety in the Member States and at EU level by contributing to a comprehensive overview of the injury spectrum within the Community,

and to facilitate comparisons among Member States, through trans-national aggregation and harmonization of data, and through reporting and identification of best practice (benchmarking). This is well in line with the Community aim of a common information system on accidents and injuries to provide all stakeholders with the best available information about the magnitude of the European burden of injuries, including high-risk population groups as well as major health determinants and risks linked to certain consumer products and services.

Website: https://webgate.ec.europa.eu/idb

Workpackage 2 of the Apollo project . "The burden of injuries in the EU: indicators and recommendations for prevention and control"

This is a project to gather data on the burden that injuries impose on the European population. WP2 concentrates on the measurement of the burden. Its goal is, in addition, to create the necessary infrastructure for researchers in participating countries to continue to measure this burden in years to come. Researchers from more than 20 European countries have agreed to participate in the project.

WP2 is coordinated by researchers and staff at the University of Navarra. WP2 consists of six 6 projects. The central or "core" project, led by Dr. Segui-Gomez consists on the actual development of a ·burden of (non-fatal) injuries in EU· report.. There are 5 other projects on additional work on severity indicators, costs of injuries, exposure measures, efficient preventive interventions to reduce the burden and a policy document. These additional pieces of work are led, respectively by Drs. Pitidis, Mulder, Frangakis, McDaid and Skalkidis and the interested reader is encouraged to contact them directly for further information.

The aim of Apollo WP2 is to produce relevant evidence for European policy makers on the burden of injuries, together with information on the efficiency of relevant injury prevention interventions

The web-based query passive surveillance system based on patient-level hospital discharge data from voluntary participating countries (20 countries at November 2008) developed by WP2 is accesible at http://www.unav.es/preventiva/apollo/asistente/

Description of Apollo WP2 is available at: http://www.unav.es/ecip/english/

Appendix 4- The European Code against Injuries (ECAI)

In total ECAI comprises 60 messages which are divided into 8 prioritised unintentional injury types plus a category on cross-cutting risk factors. Further, as practices only relevant to certain Member States or to a specific population group may not apply elsewhere, the messages were developed for broad application across the across Europe.

The key message of ECAI is:

Accidental injury is a major risk to your health and well- being in everyday life, regardless of your age, whether working, traveling, going out or at home. Most injuries are preventable; they are not caused by bad luck or chance events that are outside of your control. There is a lot you can do to make your life safer. You can promote safety for yourself and those you care for by knowing more about how injuries happen, learning how to manage risks, and adopting safe behaviour in everyday life.

One section of the code concerns falls in older people.

The Code is available in at least 10 languages as from 10 October at:
http://www.euroipn.org/apollo/WP4.htm
and
http://www.eurosafe.eu.com/csi/eurosafe2006.nsf/wwwVwContent/l2apollo.htm

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