

**Literatuuronderzoek naar preventie
van spoedzorggebruik**

Deelstudie 2: Valpreventie bij ouderen

Drs. Jennifer Speirs
Drs. Sylvie Sodoyer
Dr. Leontien Sturms
Prof. dr. Guus Schrijvers

Mei 2011

In opdracht van: AGIS Zorgverzekeringen

UMC Utrecht, divisie Julius Centrum voor Gezondheidswetenschappen en Eerstelijns
Geneeskunde, Unit zorginnovatie
Huispost Str. 6.131, postbus 85500, 3508 GA Utrecht

Voorwoord

Jaarlijks groeit de behoefte aan spoedzorg met 6,8%. Dat stond in het boek *Atlas en Scenario's van spoedzorg* dat in 2008 uitkwam bij het Julius Centrum. Ook na 2008 gaat de groei van het spoedzorggebruik bij huisartsenposten en spoedeisende hulpafdelingen van ziekenhuizen door. Natuurlijk is het prima dat thans vele initiatieven plaatsvinden om de spoedzorg doelmatiger in te richten. Te noemen zijn goede voorbeelden met 1. spoedposten, 2. het inzetten van spoedeisende hulpartsen, 3. taakherschikking naar Nurse practitioners, 4. het Nederlands Triage Systeem en concentratie van SEH's en van huisartsenposten gedurende de nachten. Toch blijft er desondanks een aspect onderbelicht, wordt er een vraag nauwelijks beantwoord: is het gebruik van spoedzorg af te remmen? Of anders geformuleerd: is preventie van spoedzorggebruik mogelijk? Het beantwoorden van deze vragen is gevaarlijk. Toen ik deze vraag stelde aan een Engelse, universitaire collega kreeg ik het antwoord: we commit suicide if we deminish the access for the population to the emergency services. Toch is het een taak voor een academisch instituut als het Julius Centrum om bij de bevolking niet-populaire ideeën aan de orde te stellen. Ik krijg mijn collega's in ons centrum daarin mee onder het motto: de beste wetenschappers eindigden in de historie op de brandstapel.

In 2010 kregen wij steun van AGIS Zorgverzekeringen in de persoon van de hoofd ziekenhuisinkoop voor de gemeente Amsterdam, spoedzorgexpert en arts Herman Flens. Ook hij wilde zijn nek uitsteken en de vraag *Is preventie van spoedzorg mogelijk?* op beleids- en wetenschappelijke agenda's zetten. In onderling overleg besloten wij deze vraag in vier literatuurstudies te beantwoorden. Deze hebben kort geformuleerd de volgende onderzoeksvragen:

1. Leidt het terugdringen van alcoholgebruik door interventies op de SEH tot minder spoedzorggebruik?
2. Leidt valpreventie bij ouderen tot minder spoedzorggebruik?
3. Leidt het hebben van een EHBO-diploma tot minder spoedzorggebruik bij diploma-bezitters en hun omgeving?
4. Leidt het betalen van financiële eigen bijdragen aan de poort tot minder spoedzorggebruik?

In elk van de vier studies verantwoordten wij de wijze waarop wij –volgens de regelen der kunst- de publicaties hebben opgezocht en samengevat. Ook geven wij conclusies. Achter onze eigen tekst vindt u, lezer, de oorspronkelijke wetenschappelijke artikelen. In onze tekst doen wij geen beleidsaanbevelingen. Wel doen wij suggesties voor vervolgonderzoek. Want zoals u zult lezen, vinden ook in het buitenland boeiende experimenten plaats die navolging verdienen in de Nederlandse setting.

Hierachter treft u het antwoord op literatuurstudie 2: *'leidt valpreventie bij ouderen tot minder spoedzorggebruik'*? De andere deelstudies treft u aan op website www.unitzorginnovatie.nl doorklikken op "publicaties". Als u met ons over dit stuk in discussie wil, graag.

Ik wens u veel leesplezier en inspiratie toe.

Prof.dr. Guus Schrijvers
A.J.P.Schrijvers@umcutrecht.nl
Hoofd Unit zorginnovatie, Julius Centrum UMC Utrecht

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1. Introduction

In the Netherlands the estimated number of medically treated injuries is 3,1 million/year. Each year 870.000 cases present to the emergency department as a result of accidents, violence or self harm (NKV¹). One of the most common and expensive injury types is the hip fracture due to predominantly falling in the elderly. The risk and rate of hip fractures drastically increases with increasing age, as well as the risk of death or immobility as a result of a hip fracture (NKV¹). In the Netherlands 17.000 hospital admissions per year are due to hip fractures in people older than 55 years of age. Only 40% of these patients recover fully and 25% die within a year after fracture due to health deterioration.

The prevention of injuries and specifically hip fractures seems favourable, not only for the patients themselves, but also to reduce costs of emergency and health care. With this context in mind the aim of this paper is to investigate to what degree measures have been found effective in reducing falling, injuries (i.e. hip fractures) and the use of emergency services in the elderly.

2. Methods

Instead of setting up a systematic literature review with the use of Pubmed and Embase we studied the website of Eurosafe. Eurosafe has already done a lot of investigation into the effectiveness of injury prevention measures.

Eurosafe is a non- governmental organization (NGO) that works to prevent injury and promote safety. It is supported by a network of other NGO's from European countries and it collaborates with the European Commission and the World Health Organization. Eurosafe offers a platform of resources and data in the form of a website (www.eurosafe.eu.com) about Effective Measures in Injury Prevention (EMIP) (Appendix 2). With this they aim to offer a consistent and clear view of policies, programmes and infrastructure which may be implemented in order to achieve the highest possible safety measures in Europe. This includes measures to promote child safety, sport safety, vulnerable road users and safety for seniors.

Within the category "safety for seniors" Eurosafe makes use of the concept that fall prevention in elderly people will prevent fall-related injury. Eurosafe has evaluated the scientific evidence on the effectiveness of fall prevention measures in the elderly primarily in terms of the number of prevented falls. Logically less falls would lead to less injuries and less fractures. This latter, however, has not been the main focus of Eurosafe. So the question remained whether there is a measured effect in reducing the rate of *injury* if preventative measures for falling are used in the elderly. In order to answer this we have reviewed the scientific literature on the Eurosafe website about fall prevention interventions in terms of the effectiveness for reduction of falls as well as the reduction of fall-related injuries (www.eurosafe.eu.com - Knowledge Base - Effective measures - Senior Safety). This concerned the review of the following seven interventions:

1. Multifactorial interventions
2. Home environment modification
3. Exercise
4. Population based interventions
5. Medication adjustment
6. Poor vision
7. Hip protectors

¹ Nationaal Kompas Volksgezondheid (NKV): <http://www.nationaalkompas.nl/>. April 2011

3. Results

3.1 Multifactorial interventions

Multifactorial intervention programs are made up of different combinations of interventions which are formed on the basis of individual needs. All five studies reviewed by Eurosafe on this matter use the term multifactorial intervention meaning that several elements were included into each program. For example combinations of exercise and training programs, home hazard assessment and modification, medication review, multidisciplinary risk factor screening and intervention, vitamin D supplementation with or without calcium, vision modification and home visits. The indications for effectiveness of multifactorial interventions according to Eurosafe are based on a summary of the five studies published in the time span of 2004-2009, and consisted two systematic reviews, two meta-analysis papers and one randomized controlled trial. The study populations concerned elderly people who were 60 years or older and who lived either in the community, in institutions, care homes or who were hospital inpatients.

Fall reduction

All five studies conclude that the multifactorial interventions reduce the rate of falling. In the community population this can be up to a 25% reduction although in nursing-care homes this is less clear. The overall conclusion drawn by Eurosafe is that after a fall, older people should be offered multidisciplinary assessment and intervention to prevent future falls. However, single interventions seem sufficient for people of the community because in this case multifactorial interventions do not seem to add to effectiveness and may be more acceptable and cost-effective.

Injury reduction

Two studies specify also report on the effect of the intervention on fall-related injury and concerned firstly, a meta-analysis (10) and secondly a systematic review (4). The first study regards residents in care homes and hospital inpatients and looked at two factors: a multifactorial approach and solely the use of hip protectors. Based on 13 studies, they report a rate ratio of 0.82 (95% CI = 0.68- 0.997) for falling after multifaceted interventions in hospital (which included risk assessment, care planning, medical/diagnostic approaches, changes in the physical environment, education programs, medication review, hip protectors, removal of physical restraints, and exercise). However, no significant effect was found on the number of fallers or fractures. For the use of only hip protectors in care homes (based on 11 studies) a rate ratio of 0.67 (95% CI = 0.46-0.98) for hip fractures was found. For many other interventions (multifaceted interventions in care homes, removal of physical restraints in both, use of alarm devices in both, exercise in care homes, calcium and/or vitamin D in care homes, environment changes in both, medication review in hospitals) the meta-analysis found insufficient evidence that regards fractures.

The second review (5) evaluates multifaceted programs among a population (aged 60+) living in residential care facilities and is based on five studies. They report that three of the five studies found a reduction in the number of recurrent fallers, two reported significant reductions in the number of falls, and one reported significant reductions in the number of fallers. Only one reported a reduction in the number of injurious falls but this study was considered inconclusive due to the study design. Their conclusion regarding injuries is that future studies with larger sample sizes and longer follow-up periods are needed to make conclusions about the effects of programs on the incidence of injurious falls.

3.2 Home environment modification

The concept of home environment modification is actually also a multifactorial approach. It consists of home visits to assess hazards, providing information about possible improvements, facilitating the necessary modifications as well as training how to use technical and mobility aids. For this intervention five studies were consulted by Eurosafe. The studies were published between 1999-2009 and consist of two systematic reviews, two randomized controlled trials and one meta-analysis. The interventions used and study populations among all five studies were very heterogeneous. Some studies did not specify their study population further than members of the community. One uses subjects aged 75+ with bad eyesight, another includes older people in the community, in nursing homes, children under five and the general public found in emergency departments.

Fall reduction

Reduced falling was found to be an effect in all five studies. The meta-analysis reports on an overall effect on falling for home safety programs of 0.59 (95% CI = 0.42-0.83). A reduction in falling due to home environment modification was found to be specifically related to high risk groups (frail older people with a history of falling and/or bad eyesight) in which the reduction of falling can be as much as 39%.

Injury reduction

Only two of the studies on the effects of home environment modification evaluated whether the number of injuries reduced. Remarkably, in these studies a reduction in falling was reported but no significant reduction in injuries in the intervention groups was found (2; 8).

3.3 Exercise

The effect of exercise (for example balance and strength training or Tai Chi) on fall and injury prevention was determined by Eurosafe by reviewing seven studies from between 2002-2009. These studies looked at elderly populations living at home, above 60 years of age, some of which were considered healthy and others who had a history of falls. Among these studies were two meta-analyses, two systematic reviews and three randomized controlled trials.

Fall reduction

Eurosafe found that overall, the interventions based especially on balance and strength training in the community can have an effect of 15-50% in fall and fall risk reduction. Also, training seemed able to reduce risk the hazard ratio of time to first fall (0.67, 95% CI = 0.49-0.93) but not in the percentage of people who fell. Eurosafe states that exercise may be less effective when there are other risk factors for falls present that are not influenced by the intervention. This might be the reason for the limited effectiveness of exercise in frail, institutionalised elderly. It is important that exercise and training be carried out in a specific, professional manor because non-supervised training is likely to increase the risk of falling.

Injury reduction

In one study exercise was found to be specifically useful in the reduction of fall-related injuries in subjects who are 80 years and older (rate ratio 0.65, 95% CI= 0.53-0.81) and in those who had a previous fall but *not* in those with a recent fall (13).

3.4. Population based interventions

Only one systematic review from 2005 was found on the effectiveness of population based interventions. This review looked at the effect of population based interventions on specifically fall-related injuries in older people. Population based interventions were defined as multiple, coordinated, community-wide initiatives to implement measures against falling in an entire community. For example, implementation of regulations and education. The study population is therefore community members of 65 years and older.

Injury reduction

Despite the lack of strong methodological studies (no randomized controlled trials were found) the conclusion of this review, which included five studies, points out a relative reduction in fall-related injuries with a range of 6-33% (9). Measuring the effect of large population based interventions is difficult. The authors state the following: 'despite methodological limitations of the evaluation studies reviewed, the consistency of reported reductions in fall-related injuries across all programmes support the preliminary claim that the population-based approach to the prevention of fall-related injury is effective and can form the basis of public health practice'. It remains unclear which exact factors facilitate or limit the effectiveness of this broad approach and if it is cost effective. Furthermore, consensus is needed on the exact nature of the population-based intervention.

3.5 Medication adjustment

The effect of medication may influence falling because some types of medication may have side-effects that will influence balance and the central nervous system. There were six studies which looked at the effect of medication on falling. These concerned two systematic reviews, two non-experimental studies and two meta-analyses. All were published between 1999-2009. The population studied was defined as people aged 55 years and above who were known to be using several different types of prescription medications.

Fall reduction

All six studies indicate that discontinuing certain types of medication (psychotropic medication such as benzodiazepines, antidepressants and neuroleptics or in some cases also cardiovascular drugs) can reduce falling. Discontinuation of psychotropic medication as a single intervention resulted in 66% decrease in falls, which was more than in a multifactorial intervention. One study reports that people using cardiovascular medication such as digoxin and diuretics have a higher risk to fall than people who are not using these drugs but it is unclear if fall reduction was achieved by stopping medication. In another study, the hazard ratio for falling was 0.48 (95% CI = 0.23 -0.99) after stopping all medication; 0.35 (95% CI = 0.15-0.82) after stopping cardiovascular medication and 0.56 (95% CI = 0.23 – 1.38) after stopping psychotropic medication. The risk of falling is known to be increased with polypharmacy, but after correction for other factors and after further investigation it seems that the use of one 'risk drug' (CNS drugs and diuretics) is responsible for this effect.

Although the use of certain medications is an important factor in falling risk assessment, it remains unclear if the effect of fall reduction can be weighed against the indication for using the medication. It does however mean that critical examination and decisions about medication use

is important for elderly people, especially those who are at a higher risk for falling (increased age, women, disability, use of a walking aid and fracture history).

Injury reduction

None of the six studies reported on the potential effect of preventing injuries due to withdrawing medication.

3.6 Poor vision

Eye sight might have an effect on the rate of falling. Vision modification (for example, new glasses or cataract surgery) as an intervention was therefore studied for its effectiveness on prevention of falling. Eurosafe found four studies: three randomized controlled trials and one systematic review all from between 2005-2009.

Fall and injury reduction

It quickly becomes clear that the effectiveness of interventions targeted at poor vision requires a careful approach. As a single measure, vision assessment and treatment do not always reduce the risk of falling or fractures. Three of the four studies report on a reduction in falling. One of these also found a decrease in injuries, one did not and one did not look at the effect on injuries. However, one study even found an increase in the risk of falling and fractures. Because of this discrepancy a closer look at these studies is required.

1. The systematic review reports a reduction of falling. It did not look at vision as a single measure but examined the effect of cataract surgery as part of a multifactorial program and found that first time cataract surgery in elderly people leads to a rate ratio of 0.66 (95% CI= 0.45-0.95) for less falling.
2. One of the randomized controlled trials also reports on a decrease in falls. This study looked at severely visually impaired people in the community older than 75 years. The results showed that a reduction in falls could be achieved by the implementation of a home safety assessment and modification program (rate ratio 0.59 95% CI = 0.42-0.83), but that exercise and vitamin D supplementation were not successful. This may have to do with low adherence but also could simply indicate that for people with severe visual impairment home modification is more suitable. Neither intervention resulted in a reduction in injuries from falls (1). The absence of reduction in injuries was already mentioned for the home environment modification.
3. For injury reduction, a randomized controlled trial reports that cataract surgery in women, over the age of 70 years, resulted in a 34% decrease in falling (rate ratio 0.66 95% CI = 0.45-0.96) and a difference of 5% in the number of fractures that occurred (3% in intervention group and 8% in control group) (6). Other reported factors such as anxiety, activity and depression also all improved in this intervention group.
4. In contrast, the fourth study (randomized trial) found that vision examination and modification (new glasses, glaucoma treatment, occupational therapy, or cataract surgery) lead to an increase in the fall and fracture rate with rate ratios of 1.57 (95% CI = 1.20 - 2.05) and 1.74 (95% CI = 0.97-3.11) respectively (3). The study population was outpatients of 70 years and older visiting old age care services, with a mean age of 81 years. The most prescribed intervention was new glasses. The authors therefore note that although providing new eyeglasses may have a positive effect on many aspects of the lives of older people, the current study suggests that new eyeglasses could have the adverse effect of causing falls and fractures.

Clearly, it is important to carefully find out who will benefit from which type of intervention and who will not.

3.7 Hip Protectors

Hip protectors are garments that can be worn around the waist or as underwear, that are intended to lower the impact received by the hip bone during a fall and hereby prevent fractures. Seven articles regarding hip protector use were reviewed by Eurosafe, three randomized controlled trials, three meta-analyses, and two non-experimental studies from between 2003 and 2007. Two of these studies did not look at the effect of hip protectors but at the compliance and determinants of compliance. The use of hip protectors is interesting because it is the only measure used here that aims directly at injury prevention and not indirectly via fall prevention. For this reason fall prevention is not addressed here.

Injury reduction

There is no convincing evidence that hip protectors are effective in preventing hip fractures. The studies that looked at the effect in elderly living in the community or in institutional care mention no effect (16), little evidence (15) or doubt of evidence (12). The adherence of using hip protectors is very low and may be a factor affecting its effectiveness. However, even despite good compliance hip protectors worn by nursing home residents, the protectors have not found effective in a RCT (7). Only one meta-analysis published in 2007 concludes that hip protectors decrease the risk of hip fracture in elderly nursing home residents (14). Also, in a multifactorial approach reviewed earlier in this report by Oliver *et. al.* (11) hip protectors were found to be effective in injury reduction for people living in care homes.

The great draw back rendering hip protectors ineffective in injury prevention is that the adherence is very low and this cancels out the positive effect.

4. Discussion and Conclusion

The Eurosafe website provides an overview of literature regarding the effectiveness of measures to prevent injuries. We have used Eurosafe's collection of literature regarding senior safety to look at how often injury, specifically hip fractures, in the elderly can be reduced due to preventative measures for falling. A summary of our findings regarding the effectiveness of different interventions on a reduction of falls as well as injuries are presented in the Appendix. In conclusion we found that hip protectors are not to be recommended because they don't prevent the incident of falling and there is poor evidence regarding the effectiveness for fracture prevention. The other six reviewed interventions showed (strong) indications for effectiveness to reduce falls in elderly. These interventions concerned multifactorial interventions, home environment modification, exercise, population based interventions, medication withdrawal and vision improvement among visually impaired elderly. Regarding the prevention of fall-related injuries there is only evidence of effectiveness for exercise, cataract surgery, and population-based interventions. However, not all studies examining fall preventions also measured whether a reduction of fall-related injuries was effectuated.

In general we would like to make the following remarks about our findings:

- We found that Eurosafe's conclusions and literature reviews are focused on fall prevention more than on reduction of injuries.
- There is not a simple linear relation between less falls or fallers and a reduction of injuries. For example there are strong indications for evidence that multifactorial interventions are effective in reduction of numbers of falls or fallers but this did not simply lead to a reduction of fractures.
- It became clear, for example in the case of exercise and vision modification, that an increased risk of falling can be the result if measures are not implemented in a correct and careful manner.
- Studies are very difficult to compare because of different study populations, i.e. different ages and elderly living independently or institutionalized as well as not well defined interventions. With respect to multifactorial interventions it is often not clear which interventions are included. Moreover, to what degree population based interventions are different from multifactorial interventions is also not clear.
- The Eurosafe website does not specifically look at the effect of supplemented diet with vitamin C and D.
- The literature reviews on the Eurosafe website were from between 2007 and 2009. Possibly more recent studies give new insights.
- Finally, we conclude that in the future we better focus on one intervention and perform a systematic search on this topic to be able to draw conclusions and recommendations in detail instead of evaluating a knowledge base in general such as we did in this study. We found it difficult to draw conclusions on the basis of the literature presented on Eurosafes website because our research question seems not fully comparable to the content of the website.

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Appendix 1: Overview of effectiveness of all interventions

Intervention	Conclusion regarding effectiveness of preventive measures to reduce falling based on the literature and conclusions presented on the Eurosafe website. + Positive point - Negative point	Conclusion regarding effectiveness of preventive measures to reduce injuries based on the literature presented on the Eurosafe website. + Positive point - Negative point
Multifactorial	++ Strong indications for effectiveness to reduce falls - For people in the community single measures may be sufficient - The evidence in nursing homes is not so clear - Unclear effect of individual measures within the multifactorial design and cost-effectiveness	- Insufficient evidence for reduction of fall-related injuries (including fractures)
Home environment modification	++ Strong indications for effectiveness to reduce falls, especially in frail, high risk groups	- Insufficient evidence for reduction of fall-related injuries (including fractures)
Exercise	++ Strong indications for effectiveness to reduce falls (especially balance and strength training) in especially elderly in the community (60+) - Non-supervised training is likely to increase the risk of falling.	+ Positive effect on reduction of fall-related injuries in elderly (80+) but less in elderly with a recent fall
Population based	+ Indications for effectiveness to reduce falls in elderly in the community (65+) - The exact nature of the population-based interventions has not been well defined - Low level of evidence (no RCTs) - Unclear effect of individual measures and which factors relate to success	+ Positive effect on the reduction of fall-related injuries in elderly in the community (65+)
Withdrawal of medication	+ Indications for effectiveness to reduce falls especially with respect to withdrawal of CNS drugs and diuretics in elderly (55+) - Use of medication often cannot simply be stopped	- None of the studies looked at a potential decrease in fall-related injuries
Vision improvement	+ Indications for effectiveness to reduce falls for home environment modifications among severely visually impaired elderly in the community (75+) + Cataract surgery has a positive effect on fall reduction - Application of new glasses may have the adverse effect of increasing falls in elderly with poor sight (70+)	- Home environment modifications have not shown to have a positive effect on reduction of injuries from falls among severely visually impaired elderly (75+) + Cataract surgery has a positive effect on fracture reduction - Application of new glasses may have the adverse effect of increasing fractures in elderly with poor sight (70+)
Hip protectors	- Not aimed at reducing falls	- Not convincing evidence on a reduction of fractures. Possibly it is effective in nursing home residents - Low adherence



EMIP

Effective Measures in Injury Prevention (EMIP)

The EMIP database is an attempt to make it easier for decision makers (e.g. policy-makers and health professionals) to assess the level of evidence available for a particular measure or strategy. By browsing the database, users have access to statements that provide evidence on prevention measures in injury prevention (e.g. legislation, education), background documents upon which these evidence statements are based and an indication on whether experts have judged the measure or strategy to have adequate evidence to be recommended as a good practice.

Definition of good practice

In the context of EMIP a good practice is defined as a measure or strategy that has been evaluated by experts as part of the EMIP assessment process and found to meet the following criteria:

- A preventive measure/intervention strategy that has been evaluated and found to be effective in reducing injuries (either through a systematic review or at least one rigorous evaluation) OR
- A preventive measure/intervention strategy where rigorous evaluation is difficult but expert opinion supports the practice and data suggest it is an effective strategy (e.g., use of personal floatation devices to prevent drowning) OR
- A preventive measure/intervention strategy where rigorous evaluation is difficult but expert opinion supports the practice and there is a clear link between the measure/strategy and reduced risk but a less clear link between the measure/strategy and reduced injuries (e.g., secure storage of poisonings) AND

- The preventive measure/intervention strategy in question has been implemented in a real world setting so that the practicality of the intervention has also been examined.

Scope

The scope of EMIP is all injuries (intentional and unintentional) and all ages. Information in the database is primarily based on existing reviews with a focus on systematic reviews. If high quality reviews are not available, other literature including original articles have been reviewed. Evidence statements are developed and reviewed by experts from the appropriate area of the injury field prior to being added to the database.

Launch

While EMIP is officially launched at the end of 2008, building and filling the database is a continuous process as new topics and new research becomes available. The topics covered in the initial launch include child safety, sport safety, vulnerable road users, and safety for seniors.

Available at

The EMIP database is available via the EuroSafe website at the address listed below:

Contact/Feedback

We are very keen to receive your feedback so if you have any questions or suggestions for existing or new effective measures please don't hesitate to contact us at emip@eurosafe.eu.com

<http://www.eurosafe.eu.com/effectiveness>

EuroSafe

European Association for
Injury Prevention and Safety Promotion

EuroSafe, in partnership with the Dutch Consumer Safety Institute has developed the database on Effective Measures in Injury Prevention (EMIP) as part of the European Commission funded and EuroSafe led initiative SafeStrat.

PO Box 75169 1070 AD Amsterdam The Netherlands Tel +31 20 511 45 13 Fax +31 20 511 45 10
secretariat@eurosafe.eu.com http://www.eurosafe.eu.com

Appendix 3: Full text papers on effectiveness of interventions on fall-related injuries