

## REVIEW ΑΝΑΣΚΟΠΗΣΗ

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### Message 3: “Prevent falls”

Older people as well as young children below the age of four are the two most vulnerable age groups for falls, particularly inside and around the house. The consequences of an accidental fall injury range from a single fracture to death, but even a single fracture, may cause lifetime disability and require lengthy and costly rehabilitation. This paper aims: (a) to describe the magnitude and the socio-economic burden of falls related injuries in the countries of European Union (EU), (b) to outline underlying risk factors and (c) to present evidence-based preventive practices that reduce the likelihood of falls occurrence. Some of these measures are therefore included in the European Code Against Injuries (ECAI) aiming to raise public awareness regarding injury prevention. The major focus of the respective ECAI section is dedicated to older people and children’s safety given that these two groups are the most vulnerable for falls injuries.

#### 1. DEFINITION

The Prevention of Falls Network Europe Consensus defined a fall as “an unexpected event in which the participant comes to rest on the ground, floor, or lower level”.<sup>1</sup> This definition is broader than the one previously suggested by the Kellogg 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.<sup>2</sup>

#### PREVENTING FALLS AMONG OLDER PEOPLE

#### 2. MAGNITUDE OF THE PROBLEM

Approximately 30% of persons 65 years of age and above experience one or more falls every year while for persons aged 80 years or more, this percentage rises to 50%. About 20% of these falls require medical intervention, and 5% of them result in a fracture or require hospitalization.<sup>3</sup> Treatment of hip or other fractures as well as of the remaining potential consequences of unintentional falls in older people has a heavy economic impact on health services.<sup>4</sup> Among community-dwelling older people, falls are a strong predictor of subsequent nursing home admission.<sup>5</sup> Half of deaths due to injury in older people are a consequence of a fall,<sup>6</sup> resulting in about 40,000 fatalities each year in

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Μήνυμα 3: «Προλάβετε  
τις πτώσεις»

*Περίληψη στο τέλος του άρθρου*

#### Key words:

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the EU. Moreover, even if a fall does not result in injury, it can have important psychological consequences, inducing fear of falling and further reduction of daily activities and quality of life in older people.

There are large differences in falls mortality within EU countries, 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.<sup>7</sup>

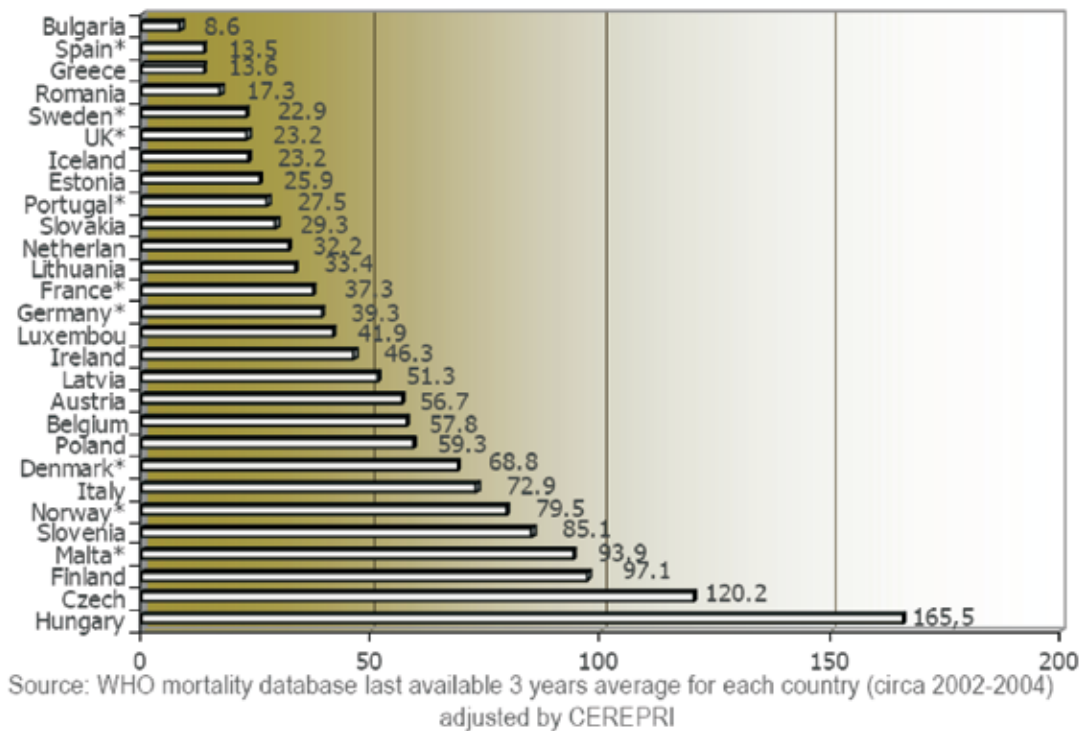
#### 3. RISK FACTORS

The majority of falls in older people are not due to a single well-identified cause, but rather to the combination of several interacting factors.<sup>8</sup> The ability to cope with the challenges posed by the environment depends on the subject’s physical abilities. In those individuals with particularly poor physical abilities, a fall can occur even in absence of a clearly identifiable environmental challenge. On the contrary, in subjects with good physical abilities, only extreme environmental challenges generally result in a fall.<sup>9,10</sup> Several risk factors for falls have been identified and they have been broadly classified in intrinsic and extrinsic.<sup>11–14</sup>

(a) Intrinsic risk factors include:

- Psycho-social and demographic factors (e.g. history of

**Age adjusted mortality rates due to fall injuries per 100,000 among elderly in the EU-27 and EEA<sup>3</sup>**  
(data for Cyprus and Liechtenstein are not available)



**Figure 1.** Falls mortality rates among elderly have been declining between the early 1990's and the early 2000's (Petridou et al, 2008).<sup>6</sup>

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, osteoporosis, dizziness and vertigo, blood pressure problems, respiratory diseases, malnutrition, diabetes, cardiac diseases)
- Use of medications (e.g. use of multiple medications, psychoactive drugs such as benzodiazepines, hypnotics, antipsychotic, and antidepressants, antihypertensive drugs).

(b) Extrinsic risk factors include:

- Environmental hazards (poor lighting, slippery floors, uneven surfaces, loose rugs etc.)

- Inappropriate footwear or clothes
- Inappropriate visual correction
- Lack or inappropriate walking aids.

The risk of falling depends also on how much a person decides to be exposed to environmental challenges, e.g choice to practice certain types of physical activity or not.<sup>14</sup>

#### 4. EFFECTIVE PREVENTIVE PRACTICES

Several randomized controlled trials on the prevention of falls have been conducted testing the efficacy of many different countermeasures. In 2003 a review conducted by the Cochrane Collaboration systematically evaluated the evidence of effectiveness of these interventions.<sup>15</sup> Given the multifaceted etiology of falls, it is not surprising that the most effective interventions are multi-factorial interventions aimed at eliminating or reducing exposure to several risk factors simultaneously.<sup>12,15-19</sup>

A history of falls is a strong predictor of future falls.<sup>12,13</sup> An older person - particularly if he/she experiences a fall or is a recurrent faller - should undergo a comprehensive

evaluation in order to identify, and, where possible, to eliminate existing risk factors.

#### - Modification of the home environment

Many falls among older people occur within the home. Several home hazards have been identified that may increase the risk of falling. Modification of the home environment can render the home a safer place. Changes may include improvement of indoor lighting, removal of doormats and loose rugs, correction of slippery floors, installation of handrails on stairs and in the bathroom, changes to the furniture disposition, changes to the kitchen workplace etc. Intervention programs aiming at eliminating hazards in the home environment have shown to be effective in high-risk groups, e.g. subjects with a history of falls, with limited mobility or visual impairment or as a component of multi factorial interventions.<sup>10,15,20</sup>

#### - Footwear characteristics

Studies have shown that going barefoot, wearing socks or slippers are all directly associated with the risk of falling, as well as wearing shoes with high heels, small contact area or no fixation.<sup>21-24</sup>

#### - Exercise

Regular exercise and improvement in cardiopulmonary fitness is recommended for all age groups to prevent overweight, obesity and cardiovascular diseases. In older people, programs aimed at improving muscle strength and balance retraining and Tai Chi exercises have been shown to reduce falls.<sup>15,25</sup> An exercise component has been recommended as part of a multi-factorial intervention to reduce falls.<sup>12</sup> Although untargeted exercise may have other health benefits, for the prevention of falls individually targeted strength and balance training appears to be the most effective type of exercise.<sup>15</sup> Yet, there seems to be some indication that single exercise programs have also some beneficial effect.

#### - Medication review

It has been shown that older people who receive multiple medications are at higher risk of falls with the risk increasing with an increasing number of medication used.<sup>11,13</sup> On one hand, intake of several drugs by itself is an indicator of poorer health, which is *per se* a risk factor for falls.<sup>26</sup> On the other hand, side effects or interactions of these drugs may also increase the risk of falling.<sup>11</sup> Psy-

choactive drugs (sedative/hypnotics, antidepressant, antipsychotics) were associated with risk of falling in several studies,<sup>27</sup> as well as certain cardiovascular medications.<sup>28</sup> Frequently the benefits of these medications outweigh the risks. However, it is not uncommon for older people to take unnecessary medications, often without informing their health provider. Periodical review of medications used by the health provider is strongly recommended as a means to reduce fall risk.

#### - Visual correction

Impaired vision is an independent risk factor for falls and fractures.<sup>29</sup> Wearing inappropriate or multifocal glasses has been associated with an increase in fall risk.<sup>30</sup> This is the reason why, an eye examination and visual correction has been included in several multi-factorial interventions for falls prevention.<sup>15</sup> It has also been shown that eye cataract surgery improves visual disability and reduces the rate of falling.<sup>31</sup>

## PREVENTING FALLS AMONG CHILDREN

### 2. MAGNITUDE OF THE PROBLEM

Within the Global Burden of Disease Project, it was estimated that in 2002 approximately 37,000 children died in the world as a consequence of a fall.<sup>32</sup> Falls were among the 24 diseases with the largest environmental fraction, estimated around 26% in developed countries.<sup>33</sup> Although in developed countries falls comparatively do not cause a high number of fatalities, they are the leading cause of hospital visits and admissions among children.<sup>34</sup>

### 3. RISK FACTORS

A variety of factors that interact dynamically contribute to the occurrence of fall-related injuries in children, which are generally classified into the following major categories:

#### - Falls from heights (beds, windows, roof, balconies)

The majority of fall-related deaths are associated with falls from heights, mostly from three stories or higher, while falls from one or two stories are generally non fatal, but may cause serious injuries. Smaller children tend to fall from windows, while older ones from dangerous playground areas, such as rooftops and fire escapes.

Falls from beds represent a non-negligible source of injuries. A high proportion of injuries derived from a fall

from bed occur in children below the age of 6 years. For this reason it has been recommended to avoid placing younger children in the upper bunk. Injuries may occur during sleep or leisure activities. Falls from bunk beds have more serious consequences than falls from conventional beds. Use of side rails and removal of bed ladder from bunk beds when not in use may reduce the risk of falls.<sup>35-37</sup>

Narrowly spaced railings on balconies, installation of window guards (preferably operable ones that can be removed in case of fire), avoidance of placing furniture near windows and discouraging children from playing in dangerous areas can prevent falls from heights.<sup>38</sup> An intervention aimed to reduce falls from windows, including mass media and individualized counseling and free distribution of window guards in high risk areas of the US, reported a 35% decrease in mortality due to falls and a 31% decrease in reported falls compared to the period before the intervention.<sup>39</sup>

#### - Falls associated with baby walkers

Baby walkers are widely used in Europe<sup>40</sup> although there is evidence that they increase the risk of injuries, including falls, poisoning and burns.<sup>41-44</sup> Falls from heights, and stairs in particular, are the most frequent cause of baby walker-related injuries.<sup>42</sup> Baby walkers do not provide developmental benefits. If anything, some studies reported a delay in the onset of walking in children using baby walkers.<sup>45</sup> For these reasons, a ban on baby walkers' manufacture and sale has been recommended.<sup>44,46</sup> In many cases, care takers of injured children were not aware of the dangers of baby walkers. A cluster randomized controlled trial conducted in the UK showed that an educational package delivered by midwives and health visitors was effective in reducing baby walkers' possession and use.<sup>47</sup>

#### - Falls from nursery furniture

Another important cause of fall-related injuries in infants are falls from nursery furniture such as high chairs, bouncy chairs, cribs and cradles, push chairs and changing tables.<sup>48-54</sup> Lack of availability or use of child restraints are frequent causes of falls. High chairs, bouncy chairs, push chairs and changing tables should have pre-installed appropriate child restraints. These should always be used and correctly fastened in all products providing them.<sup>48,49</sup> For bouncy chairs (or car seats used in the same way), most injuries are caused by fall of the chair from elevated surfaces (e.g. tables, kitchen worktops or other furniture). For this reason, bouncy chairs should not be placed on

raised surfaces.<sup>52</sup>

#### - Falls from playground equipment

Falls and other injuries from public and private playground equipment frequently result in injuries among children.<sup>53,55</sup> Climbing equipments, trampolines, swings and slides for younger children, have been identified as particularly dangerous.<sup>56,57</sup> Height of the equipment and inappropriate (non impact-absorbing) surfaces are the major identified risk factors<sup>58-61</sup> along with suboptimal supervision.<sup>55</sup>

A study from Greece estimated that 50% of playground injuries could be avoided by structural and equipment changes, and further reduction could be achieved by closer supervision and the adoption of a few other simple measures.<sup>55</sup> In Cardiff, a partnership between health services and local authority led to environmental changes in playgrounds, including improvement of surfaces and substitution of monkey bars with other climbing equipments. The injury rate decreased from 0.72 in the period before the changes to 0.30 after the changes were adopted.<sup>62</sup> Similarly, an intervention aimed at replacing unsafe playground equipment from elementary schools in Toronto<sup>63</sup> led to a 30% (95% CI: 22%–38%) reduction in children's injury rates.

In New Zealand an intervention to encourage implementation of playground safety standards through engineer visits and support in implementing changes led to a reduction of observed hazards in playgrounds, while no general reduction was observed in control schools where only a baseline check and information were provided.<sup>64</sup> Educational interventions aimed at parents, teachers or children led to improvements in safety standards,<sup>65</sup> children supervision,<sup>66</sup> or decreases in children's risk taking behaviors.<sup>67,68</sup>

## 4. EFFECTIVE PREVENTIVE PRACTICES

Preventing falls in children requires the use of a variety of strategies. Numerous interventions aimed to improve home safety or reduce childhood injuries in general included measures directed to the prevention of falls-related injuries. A systematic review evaluating the effectiveness of interventions on home safety education and provision of safety equipment in increasing home safety practices or reducing child injury rates<sup>69</sup> found that home safety education was effective in increasing the proportion of families with fitted stair gates, and there was some evidence of effectiveness in reducing use or possession of baby walkers.

Supervision is one of the strongest protective factors for many injuries within the home environments and outdoors. Dedoukou et al<sup>54</sup> pointed out that young children need to be supervised carefully by adults, who can choose the appropriate/safe pieces of equipment and realize all necessary changes for the safety of infants. Considerable success has been reported with modification of the physical environment<sup>70</sup> according to recommendations for prevention of injuries associated with falls from tables, benches, and counters and include the following: (a) installation of corner protectors on sharp edges on tables, benches, and counters, (b) check of glass topped tables to ensure that they are made of safety glass of sufficient strength to resist a fall by an adult, (c) placing of furniture in appropriate locations considering traffic flow within rooms, (d) avoidance of placing youth on benches in bouncers in particular and (e) discouragement of climbing onto tables and benches.

Moreover, because most of the severest and fatal fall-related injuries among children are falls from heights, in particular falls out of windows, window locks are shown to be an effective preventive strategy.<sup>41</sup> For example Barlow et al<sup>71</sup> reported a 96% reduction in fall admissions after the regulation in 1979 that required window bars. Child safety stair gates at the top and bottom of stairs are a useful intervention against stair falls for infants and toddlers.<sup>72</sup> Gates can also be used to prevent children from entering particularly hazardous areas, such as the kitchen area.

## 5. CONCLUSION

Reducing fall injuries among older people and children living in the European Union to the incidence rate of the member state with the lowest rate could prevent thousands of deaths. As most of the accidental injuries due to falls occur in predictable ways, they can be easily prevented, especially if the practices address specific risk factors such as age, gender, social characteristics and geography. Effective practices for older people include a combination of practices. More specifically the following practices are

strongly recommended:

- Reduce your risk of falls at home, e.g. by having good lighting; handrails on both sides of the stairs and in the bathroom; non-slip bath mats, and rugs that don't slip on the floor. Move obstacles away from walking areas and store things within easy reach.
- Have a home safety assessment from a safety specialist and make the recommended changes to improve your home safety.
- Wear shoes with firm non-slip soles and avoid loose-fitting footwear that could cause you to trip.
- Exercise regularly to keep yourself fit and help you to reduce the risk of falling. Consider taking formal strength and balance exercises to maintain muscle and bone strength and to improve your balance and flexibility; bear in mind that these exercises can be tailored to your specific needs.
- Have periodic reviews of your medication and follow your health care provider's instructions; remember that some medications can increase your risk of falls.
- Have regular eye tests and correct your vision if needed.

For children the most important preventive measure is parental education which includes recommendations for attentive child supervision and several home modification practices such as window locks, safety straps and stairs' barriers etc. More specifically parents should:

- Reduce hazards in the home by using window locks and safety gates or other barriers at the top and bottom of stairs. Keep chairs, cribs and other furniture away from windows. Remember baby walkers can be dangerous and are not recommended. Use safety straps on high chairs, changing tables and all products when supplied.
- Always supervise children when using playground equipment; Make sure they play on appropriate surfaces and with the age-appropriate equipment.

## ΠΕΡΙΛΗΨΗ

### Μήνυμα 3: «Προλάβετε τις πτώσεις»

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Οι ηλικιωμένοι καθώς επίσης και τα παιδιά κάτω των τεσσάρων ετών είναι οι δύο πιο ευπαθείς ομάδες στους τραυματισμούς από πτώσεις κυρίως μέσα ή γύρω από το σπίτι. Οι συνέπειες των ακούσιων τραυματισμών από πτώσεις μπορεί να κυμανθούν από ένα κάταγμα μέχρι και τον θάνατο. Αλλά ακόμα και ένα κάταγμα μπορεί να προκαλέσει δια βίου αναπηρία ή να χρειαστεί εκτενή και ακριβή αποκατάσταση. Αυτή η εργασία στοχεύει: (α) να περιγράψει την έκταση του προβλήματος και τις κοινωνικο-οικονομικές επιπτώσεις των ατυχημάτων που προκαλούνται από πτώση στις χώρες της Ευρωπαϊκής Ένωσης, (β) να επισημάνει τους υποκείμενους παράγοντες κινδύνου, και (γ) να παρουσιάσει τις επιστημονικά αποδεδειγμένες πρακτικές που μειώνουν την πιθανότητα πτώσεων. Μερικές από αυτές τις πρακτικές έχουν συμπεριληφθεί στον Ευρωπαϊκό Κώδικα Κατά των Ατυχημάτων, προκειμένου το κοινό να ενημερωθεί σχετικά με την πρόληψη των ακούσιων τραυματισμών. Κύρια έμφαση του σχετικού πεδίου του Ευρωπαϊκού Κώδικα Κατά των Ατυχημάτων έχει δοθεί στους ηλικιωμένους και στα παιδιά δεδομένου ότι οι δύο αυτές κατηγορίες είναι οι πιο ευπαθείς για ατυχήματα που οφείλονται σε πτώση.

**Λέξεις ευρητηρίου:** Ακούσιες πτώσεις, Ευρωπαϊκός Κώδικας Κατά των Ατυχημάτων, Ευπαθείς ηλικιωμένοι, Παιδιά, Πρόληψη ατυχημάτων

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