

# **Falls Prevention for Older Persons**

**Eastern Mediterranean Regional Review**

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## Summary

Older people frequently fall. This is a serious public health problem, with a substantial impact on health and healthcare costs. The situation in the Eastern Mediterranean Region (EMR) including the size of the problem, and the procedures for prevention and control of falls and subsequent morbidity and mortality in old age is still in need to be addressed due to the shortcomings in studies, information, and health system procedures. The available data from some countries of the EMR may be used as an indicator for a potential high health impact of the problem within this region.

A fall can be defined as a sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, or the ground, other than as a consequence of sudden onset of paralysis, epileptic seizure, or overwhelming external force (9).

Most falls' cases result from a complex interplay of predisposing and precipitating factors in a person's environment. One half to two thirds of falls occur in or around the patient's home (4).

Injurious fall events coming to acute medical attention in Iran in 2003 are 143.1, 336.7, 848.3 per 100.000 person-years among males, and 190.2, 416.8, and 854.7 per 100.000 person-years among females of the age groups 60-69, 70-79, and 80+ respectively (5).

Incidence rates of fall-related hip fracture are 38.0, 135.8, and 501.9 per 100.000 person-years among males, and 67.3, 214.7, and 564.6 per 100.000 person-years among females of the age groups 60-69, 70-79, and 80+ respectively (5).

Place of fall was home in 63.5% of the male hip-fracture cases, and in 80.6% of the female hip-fracture cases (5).

Because approximately 95% of hip fractures result from falls, minimizing fall risk is a practical approach to reducing these serious injuries. Primary prevention of fall-related injuries involves reducing the occurrence of falls; secondary prevention of fall-related injuries involves preventing injuries when falls occur (3).

The U.S. Preventive Services Task Force (USPSTF) recommends counseling older patients on measures to reduce the risk of falling. These measures include exercise (particularly training to improve balance), safety-related skills and behaviors, environmental hazard reduction, and monitoring and adjusting medications. This recommendation is based on fair evidence that these measures

reduce the likelihood of falling. The USPSTF also recommends an intensive individualized home-based multi-factorial intervention for high-risk older patients in settings where adequate resources are available to deliver such services. Several studies have examined single risk-factor modification and multi-factorial interventions, and have found that both can prevent falls in older patients (1).

## **Background**

Older people frequently fall. This is a serious public health problem, with a substantial impact on health and healthcare costs. Falls are one of the most common geriatric syndromes threatening the independence of older persons (1). They are the leading cause of injury deaths and disabilities among persons aged  $\geq 65$  years (3). Unintentional falls are one of the most costly and complex health issues facing older persons in the world (1).

Fall-related injuries are more common among older persons and are a major cause of pain, disability, loss of independence and premature death. Injuries are the sixth leading cause of death in adults of 65 years of age or more and falls are the leading cause of such injuries (2).

In the United States, one in every three older adults falls each year. In 1997, nearly 9,000 persons aged  $\geq 65$  years died from falls. Of those who fall, 20%-30% sustain moderate to severe injuries that reduce mobility and independence and increase the risk for premature death. Older adults are hospitalized for fall-related injuries five times more often than they are for injuries from other causes, and women are nearly three times more likely than men to be hospitalized for a fall-related injury. The most prevalent fall-related injuries among older adults are fractures of the hip; spine; upper arm; forearm; and bones of the pelvis, hand, and ankle. Of these, the most serious injury is hip fracture, a leading cause of morbidity and excess mortality among older adults. During 1988-1996, the estimated number of hospital admissions for hip fracture increased from 230,000 to 340,000. In 1996, 80% of the admissions for hip fracture occurred among women (3). From 1988 to 1996, hip fracture hospitalization rates for women aged  $\geq 65$  years increased 23% (3).

Older persons' falls also have serious repercussions on the lives of family and friends and on health care service utilization and costs. The magnitude of the problem of falls in developed countries is reflected in the 300% increase in global publications on the issue between 1985 and 2005.

Falls result from a complex and interactive mix of biological or medical, behavioral and environmental factors, many of which are amenable to intervention. There is a growing body of international evidence of best-practices for the prevention of falls and fall-related injuries among older persons. An ever-growing number of falls prevention interventions are being implemented. These initiatives are concentrated in developed countries, including Canada, Australia, United States, and European nations.

The personal, family and societal impact of fall-related injuries for older persons, their families and society, and the possibility of effective intervention make this an important global health issue for the World Health Organization. The most significant growth of the older adult population is occurring in developing nations: of the 1 million people in the world each month who turn 60, 80% live in developing countries (United Nations estimate). The key to targeting resources for the prevention of falls and related injuries is enhanced knowledge of their scope and nature and of the best-practice evidence. Thus, it is critical to support decision-makers, health service providers, the research community, older persons and stakeholders in all countries, and especially in the developing world, to increase the production, dissemination and use of knowledge on older adult falls.

## **Objectives**

The goal of the project is to produce a WHO Global Report on fall among Older Persons which will serve to increase awareness and knowledge of the importance of older adult falls and encourage action to prevent falls and fall-related injuries in all regions of the world. This background paper will present the available falls and falls-injury data, research knowledge and practice evidence from a national, regional, and international perspectives. Relevant data of the Eastern Mediterranean Region will be presented when they are available.

## **Methods**

Medline was electronically searched for all types of the available research works that were conducted in the Eastern Mediterranean Region (EMR) by using the following key words: fall(s), accidental falls, injuries, fracture, elderly, aged, older, and senior. Individual name of the EMR countries was included in the search inquiry. Iran and Lebanon have specific studies about the falls subject, while some other countries (Egypt, Saudi Arabia, and Syria) have injuries' studies. Some available regional injuries' studies, like those that were conducted in Egypt and Saudi Arabia, didn't contain older persons' information.

Web pages of the CDC and WHO, and medical journals as Bulletin of the WHO, and Eastern Mediterranean Health Journal were also electronically Searched.

All available research works of the EMR are recent studies, so the 10-years Limit for the search was automatically applied.

The most important regional study was the Iranian one (5). Another important Lebanese paper was found. This paper aspires to delineate some of the frequent etiological factors connected to falls and a realistic strategy to the diagnosis and management (15).

The regional research works were supplemented by some international works when the regional data were missing or not available. International reviews were consulted for missed regional data, especially in the fields of intervention and prevention programs. Relevant references in papers were followed up, and researchers in the fields of ageing were contacted for information about other unpublished research works and about studies from journals not catalogued by the Medline.

All available regional studies on the subject of falls and injuries, in addition to the key international works were included. These studies were reviewed, summarized and presented in the following section.

## **Results**

### **Epidemiology of falls in older persons**

#### **Definition of a fall**

The actual definition of a fall in older people has been open to some debate. A frequently used definition is "unintentionally coming to the ground or some lower level and other than as a consequence of sustaining violent blow, loss of consciousness, sudden onset of paralysis as in stroke or an epileptic seizure. This definition excludes overwhelming external disturbances that result in an older person being knocked over, and major internal disturbances that cause an older person to collapse instead of fall. Some researchers use a broader definition of falls to include those that occur because of dizziness and syncope (4).

A fall is also defined as a sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, or the ground, as a consequence of sudden onset of paralysis, epileptic seizure, or overwhelming external force (9)

#### **Incidence and Consequences**

Older people frequently fall. From 30 to 40 percent of community-dwelling adults older than 65 years fall each year. Rates are higher in nursing home residents and hospitalized patients. The incidence of falls rises steadily from middle age and peaks in persons older than 80 years. Between 20 and 30 percent of older adults who fall suffer serious injuries such as hip fractures and head trauma. Recovery from falls often is complicated by poor quality of life caused by restricted mobility, functional decline, and increased risk for nursing home

placement. Self-imposed functional limitations due to the fear of falling can cause post-fall anxiety syndrome. This can lead to depression, feelings of helplessness, and social isolation (1).

At least one in three adults age 65 and older will fall one or more times each year. For example in the Randwick falls and fractures study conducted in Australia, Lord et al. 1993 found that 39% of 341 community-dwelling women reported one or more falls in a one-year follow-up period. Similarly, a New Zealand study by Campbell et al, 1929 of 761 subjects age 70 and over found that 40% of the women and 28% of the men fell at least once in the study period of one year, an overall incidence rate of 35%. Falling rates in residential aged care facilities are even higher, with 50-60% of residents falling at least once each year (4).

### **Incidence within EMR**

The available information from the Eastern Mediterranean Region refers to the following incidence rates:

The most comprehensive study from the region was the Iranian multi-center study on accidental injuries, 2003. The older person sex-specific rates (per 100.000 person-years) of injurious fall coming to acute medical attention in the 60-69, 70-79, and 80+ age groups were 143.1, 336.7, and 848.3 among males, and 190.2, 416.8, and 854.7 among females respectively (Table 1). The incidence rates increased with increasing age. and were higher in females than in males within the first and second age groups (5).

Table 1: Older person sex-specific incidence rates (per 100.000 person-years) of injurious fall events coming to acute medical attention, Iranian multi-center study on accidental injuries, 2003

Age	Male				Female				F:M ratio
	No.	Population	Rate	95% CI	No.	Population	Rate	95% CI	
60-69	128	241465	143.1 53.0*	133.9- 152.3	147	208653	190.2 70.5*	178.8- 201.6	1.3
70-79	181	145143	336.7 124.7*	318.51- 354.9	200	129559	416.8 154.4*	395.4- 438.2	1.2
80+	120	38192	848.3 314.2*	792.2- 904.5	109	34432	854.7 316.6*	795.4- 914.1	1.0
Total	429	424800	100.9*		456	372644	122.4*		1.2

\* per 100000 of the population

The Older person sex-specific incidence rates (per 100.000 person-years) of fall-related hip fracture, in this study in the 60-69, 70-79, and 80+ age groups were 38.0, 135.8, and 501.9 among males, and 67.3, 214.7, and 564.6 among females respectively (Table 2) showing an increased fracture rate by age, and among females than males (5).

Table 2: Older person sex-specific incidence rates (per 100.000 person-years) of fall-related hip fracture, Iranian multi-center study on accidental injuries, 2003

Age	Male			Female			F:M ratio
	No.	Rate	95% CI	No.	Rate	95% CI	
60-69	34	38.0 14.1*	33.3-42.8	52	67.3 24.9*	60.5-74.1	1.8
70-79	73	135.8 50.3*	124.3-147.3	103	214.7 79.5*	199.3-230.0	1.6
80+	71	501.9 185.9*	458.7-545.1	72	564.6 209.1*	516.3-612.8	1.1
Total	178	41.9*		227	60.9*		1.5

\* per 100000 of the population

The place of fall was home in 63.5% of the male and in 80.6% of female hip fracture cases (table 3) (5).

Table 3: Circumstances around falls leading to hip fractures and composition with other injurious falls among older persons of 50+ years of age

	Men		female	
	Hip fracture (%)	Other injuries	Hip fracture	Other injuries
<b>Place of fall</b>				
• Home	132 (63.5)	168 (45.9)	195(80.6)	168 (52.8)
• Work-place/ office	26 (12.5)	118 (32.3)	11 (4.5)	118 (36.4)
• Passage (street/alleyways)	29 (13.9)	43 (11.7)	29 (12.0)	43 (13.4)
• Recreative places (parks/ sport clubs/ mountains)	17 (8.2)	32 (8.7)	3 (1.2)	33 (9.9)
• unknown	4 (1.9)	5 (1.4)	4 (1.7)	5 (1.5)
<b>Height of fall</b>				
> Standing	91 (43.8)	249 (68)	73 (30.2)	176 (54.3)
Standing	109(52.4)	107 (29.2)	154 63.6)	141 (43.5)
< Standing	4 (1.9)	5 (1.4)	11 (4.5)	2 (0.7)
Unknown	4 (1.9)	5 (1.4)	4 (1.7)	5 (1.5)
<b>Activity during fall</b>				
Walking	142 (68.3)	149 (40.7)	196 (81.0)	245 (75.6)
Sitting/lying down	6 (2.9)	14 (3.8)	11 (4.5)	5 (1.5)
Working activity	59 (28.4)	199 (54.4)	35 (14.5)	71 (22)
Recreation (sport/entertainment)	1 (0.5)	4 (1.1)	0 (0)	3 (0.9)
On stairs/steps	38 (18.2)	51 (13.9)	54 (22.3)	84 (25.9)
From ladder/scaffolding	36 (17.3)	147 (40.2)	12 (4.9)	38 (11.7)

The odds ratio of hip fractures occurrence for different risk factors in older persons (50+ years of age) based on multivariate logistic regression analysis were 0.78 for male gender (vs. female), 1.07 for urban residence (vs. rural), 0.61 for married (vs. single or widowed), 1.70 for falling at home (vs. other places), 1.14 for indoor falling (vs. outdoor), 2.67 for standing or less height of fall (vs. over? standing), 1.71 for walking during fall (vs. other activities), 1.73

for falling on stairs (vs. none), and 0.47 for falling from ladder (vs. none) (Table 4) (5).

Table 4: Odds ratio of hip fractures occurrence for different risk factors in older persons (50+ years of age) based on multivariate logistic regression analysis

	Odds ratio	95% CI
Male gender (vs. female)	0.78	0.59-1.05
Urban residence (vs. rural)	1.07	0.82-1.39
Married (vs. single or widowed)	0.61	0.45-0.83
Falling at home (vs. other places)	1.70	1.06-2.74
Indoor falling (vs. outdoor)	1.14	0.71-1.81
Standing or less height of fall (vs. over standing)	2.67	1.03-6.90
Walking during fall (vs. other activities)	1.71	1.23-2.38
Falling on stairs (vs. none)	1.73	1.25-2.37
Falling from ladder (vs. none)	0.47	0.30-0.71

The available study from Syria was about injuries "**Injuries in Aleppo, Syria; first population-based estimates and characterization of predominant types**". There is some information about injuries of the adults in general within this study. Information of the older persons couldn't be separated alone from the adult's numbers and rates. It reported the following incidence results (8): **236 injuries** among household members (all Ages) were reported (21.0 per 1000), 94 of which were among adults age  $\geq 18$  (19.7‰). Adults were more likely to experience injuries outside of the home, and males were more likely than females to experience injuries (Table 5). Fall injuries ranked third among all causes of injury following traffic and poisoning injuries. Falls seem to have caused most morbidity for the injured household members (8).

**Table 5:** Prevalence and characteristics of past year proxy-reported injuries among household members (adults) of study participants (n = 4692)

	Adults (>18 years) /n = 4692	Overall
<b>Total number of injuries and rate (per 1000)</b>	94 (19.7)	236 (21)
<b>Gender:</b>		
Male	64 (26)	158 (28)
Female	30 (13)	78 (14)
<b>SES:</b>		
Lower class	38 (24)	99 (25)
Middle class	31 (18)	84 (20)
High class	25 (18)	53 (17)

<b>Place of injury (% of all injuries):</b>		
Home	35 (37.2)	109 (46.2)
Outside	59 (62.8)	127 (53.8)
<b>Outcome of the injurious fall (total number and rate per 1000):</b>		
Recovery	8 (61.5)	32 (72.7)
Disability (temporary)	4 (30.8)	10 (22.7)
Disability (prolonged)	1 (7.7)	2 (4.5)
Death	0 (0)	0 (0)

### Other Consequences

A ten-year follow-up study in Beirut, Lebanon, during Wartime, 1983 – 93 on "non-communicable disease mortality rates using the verbal autopsy in a cohort of middle aged and older populations showed a ten year cause specific mortality rate (falls and fractures) among people aged 50 years and above of 0.68 per 1000 person years (0.71 for men and 1.27 for women) (6).

A Lebanon study (EMR) examining the cost of injuries showed that": The mean medical cost per injury was higher for women than men, but compensation cost was higher for men. The medical cost per injury was almost twice as high among older workers (those aged  $\geq 50$  years) (US\$ 348.70 per injury) than for the younger age groups, and the cost of compensation gradually increased with age (7). Cost per injury was highest among older workers and for injuries that involved falls and vehicle incidents.

Internationally, a report from Australia in 2003 (13) projected an increase in costs of fall related injury in older persons due to demographic change. The projections were as follows:

- the total health cost attributable to fall related injury will increase almost three fold to \$1,375 million per annum;
- there will be 886,000 additional hospital bed days required per annum or the equivalent of 2,500 additional beds permanently allocated to falls injury treatment;
- there will be 3,320 additional nursing home places required; and
- to maintain cost parity over this period, prevention strategies will need to deliver approximately a 66% reduction in falls incidence.

## Causes and risk factors

Most falls result from a complex interplay of predisposing and precipitating factors in a person's environment. One half to two thirds of falls occur in or around the patient's home (4, 5, and 8).

### Causes

Environmental hazards are the leading cause of falls, accounting for about 25 to 45 percent in most studies. Gait disturbance and muscle weakness also are common causes. Dizziness, vertigo, drop attacks, postural hypotension, visual impairment, and syncope also are known to cause falls (Table 6) (4).

Table 6: Causes of fall in older persons

Cause	Mean* (%)	Range**
Accident and environment-related causes	31	1 to 53
Gait and balance disorders or weakness	17	4 to 39
Dizziness and vertigo	13	0 to 30
Drop attack	9	0 to 52
Confusion	5	0 to 14
Postural hypotension	3	0 to 24
Visual disorder	2	0 to 5
Syncope	0.3	0 to 3
Other specified causes***	15	2 to 39
Unknown	5	0 to 21

\* Mean calculated from the 3,628 reported falls.

\*\* Range of percentages reported in the 12 studies.

\*\*\* This category includes: arthritis, acute illness, drugs, alcohol, pain, epilepsy, and falling from bed. SOURCE: AMERICAN PHAMILY PHYSICIAN, VOL. 72/NO. 1 (JULY 1, 2005)

### Risk Factors

Lower extremity muscle weakness is a significant risk factor for falls, increasing the odds of falling fourfold. A history of fall and gait or balance deficits increases the risk threefold. Other high-risk situations that can cause or contribute to falls are use of an assistive device, visual deficit, arthritis, impaired activities of daily living, depression, cognitive impairment, and age older than 80 years (4).

Use of four or more medications has been strongly associated with an increased risk of falls. In particular, the usage of psychotropic medications, cardiac drugs including class 1A antiarrhythmic agents, digoxin, diuretics, and anticonvulsants have been implicated in increasing the risk of falls. In a recent study of nursing

home residents followed for one year, starting a new benzodiazepine or antipsychotic medication was associated with a very high risk (odds ratio = 11) for falls. Careful selection in prescribing, continual review, and withdrawal of unnecessary medications may reduce the risk of falls (4).

There is a positive correlation between increased risk of falling and the number of risk factors. Among a cohort of community-dwelling older adults, during one year of follow-up, the risk of falling increased from 8 percent for persons with no risk factor to 78 percent for persons with four or more risk factors (1).

## **Interventions and Prevention Programs**

Interventions and prevention programs in developing countries including EMR, if implemented, will depend largely and almost always on evidence from developed countries. The best international reviews contain the following intervention and prevention data:

### **Counseling and Health Education**

Counseling older patients on measures to reduce the risk of falling is recommended (1). This recommendation is based on fair evidence that these measures reduce the likelihood of falling. These measures include:

- Exercise (particularly training to improve balance),
- Safety-related skills and behaviors,
- Environmental hazard reduction, and
- Monitoring and adjusting medications (1).

Fall prevention programs frequently include health education and health promotion materials about reducing fall hazards. However, educational materials alone might not promote behavioral changes (3).

Many health education programs employ home-hazard checklists that can be used by the caregiver or health agency personnel (e.g., a visiting nurse or home health aide) to help persons identify fall hazards and to suggest corrective action (e.g., eliminating potential tripping hazards such as clutter and throw rugs, adding stair railings, improving lighting, adding nonslip floor surfaces, and installing grab bars in bathrooms). Checklists are also given to residents to help them assess personal and environmental risks and take preventive action, including behavioral changes (3).

Interventions can be divided into single and multi-factorial. Several studies have examined single risk-factor modification and multi-factorial interventions, and have found that both can prevent falls and fall-related injuries in older patients.

## **SINGLE INTERVENTIONS**

Approximately 95% of hip fractures result from falls, minimizing fall risk is therefore a practical approach to reducing these serious injuries (3). Primary prevention of fall-related injuries involves reducing the occurrence of falls; secondary prevention of fall-related injuries involves preventing injuries when falls occur.

### **PRIMARY PREVENTION**

**Exercise and physical activity:** Increasing physical activity can be an effective component of fall prevention programs (10). Activities that improve strength, balance, and coordination can reduce the risk for falls. Although fall prevention programs have focused on several techniques to improve strength, balance, coordination, mobility, and flexibility, Tai Chi is probably the most frequently studied type of exercise. Tai Chi C'uan is a promising type of balance exercise, although it requires further evaluation before it can be recommended as the preferred balance training (12).

Effective programs have been employed with persons of different ages and with varied physical abilities; however, persons with functional limitations might require more individualized physical activity programs (3).

The Cochrane Collaboration conducted a systematic review of fall prevention studies incorporating exercise programs such as progressive muscle strengthening, balance training, and a walking plan, individually tailored for each participant by a trained health professional. Pooled data from these studies indicate that such programs significantly decreased the number of individuals experiencing a fall over one year when compared with a control group that received no intervention (1).

**Environmental modifications:** Approximately 50%-60% of all falls among older adults occur at home, fall prevention programs should address home hazards that can contribute to falls. Home-visiting programs (e.g., those using visiting nurses) provide opportunities to identify potential fall hazards and take corrective action (3).

In a study of older patients discharged from an acute care hospital, home assessment and modification by an occupational therapist reduced the risk of falls by 20 percent compared with a group who did not receive the intervention. The intervention was particularly effective in those with a history of falling. A recent systematic review also found that in patients with a history of falling, home hazard modification by a trained health professional reduced falls (1).

**Medication withdrawal:** In one study, withdrawal of psychotropic medications such as benzodiazepines, other sedatives or hypnotics, neuroleptic agents, or antidepressants over 14 weeks resulted in a 66 percent reduction in risk of falling. However, one month after completion of the study, 47 percent of the patients in the intervention group had restarted their psychotropic medication. Further studies are needed to find effective ways to support patients tapering off these medications (1).

**Cardiac pacemaker:** In one study, patients with unexplained or recurrent falls who had cardio-inhibitory carotid sinus hypersensitivity were randomized to dual-chamber pacemaker implantation or the standard treatment. The total number of falls at one year was reduced by two thirds in the pacemaker group compared with the control group (1).

### **Secondary prevention**

Secondary prevention strategies are being developed to reduce the incidence of hip fracture among older persons.

#### *Hip Protectors*

Most hip fractures are caused by falling directly on the hip, and biomechanical studies have demonstrated that a pad that shunts the energy away from the point of impact is highly effective in reducing the force of a fall on the proximal femur (3). Hip Protectors are plastic shields or foam pads fitted in pockets within specially designed underwear that reduce the impact of a fall. They do not reduce the risk of falling, but aim to reduce the impact of a fall. The pads are recommended for prevention of hip fractures for persons at high risk of falls or those living in an institution (1). A 1993 clinical study in a Copenhagen nursing home demonstrated that hip protectors reduced the risk for hip fracture by approximately 50%.

#### Safe floor

A promising technologic innovation for preventing fall-related injuries is a recently developed safety floor. Under laboratory conditions, this flooring material provides a firm walking surface and, if a fall occurs, reduces the force of impact through the use of special energy-absorbing flooring material. Field trials are under way in nursing homes to evaluate the effectiveness of this material in preventing fall-related hip fractures among nursing-home residents.

### **Multi-factorial interventions**

Studies that explain the evidence for multi-factorial interventions came from the developed world. Multi-factorial falls risk assessment and intervention is a way to achieve better effectiveness in the prevention programs. A multi-factorial falls risk assessment and management program was the most effective component in a meta-analysis review that compared evidence from sixty-one randomized controlled trials (10). Practice guideline also stress the role of risk assessment and multi-factorial intervention (14).

### **Multi-factorial community and institutional prevention programs**

Prevention of fall-related injuries among older adults can be targeted to persons living independently in the community or residents of nursing homes.

#### **Community intervention**

The majority of older persons live in the community and many fall prevention programs in developed countries target these persons. Developing countries i need to develop such programs.

During 1990-1992, a prospective, multi-factorial, fall prevention study was conducted among 301 community-dwelling men and women aged  $\geq 70$  years who had at least one fall risk factor (e.g., sedative use or some limitation in arm or leg strength). A total of 153 persons participated in an intervention that consisted of behavioral instructions and training to reduce specific risk factors (e.g., persons with gait or balance impairments received specialized training in these areas), exercise programs to increase strength, and medication adjustments. After 1 year, the intervention had 30% fewer falls than the control group. Further research is needed to evaluate the effectiveness of such a program among all persons aged  $\geq 65$  years living independently in the community (3).

A systematic review of multidisciplinary, multi-factorial health and environmental screening and intervention programs in community-dwelling older adults found a significant reduction in falls when compared with a control group in unselected, community-dwelling older adults and in older patients with a history of falling or with known risk factors.

Research has established that effective multi-factorial falls intervention programs have incorporated both behavioral and environmental elements: exercises to improve strength and balance, environmental modifications, education about fall prevention, medication review and assessment to minimize side effects, and risk factor reduction (3).

Another report also explained the components of a successful multi-factorial intervention to include: exercise programs incorporating gait and balance training;

advice on appropriate use of assistive devices by an occupational therapist; review and modification of medications; evaluation and treatment of postural hypotension; removal or modification of environmental hazards; and targeted medical and cardiovascular assessment and treatments.

### **Nursing-home intervention**

Nursing-home residency is not preferred practice in EMR countries, where members of the community prefer to keep the older person within the community. However, these communities are in the transition period where they begin to accept the idea of leaving fathers and mothers in nursing-home.

Falls are more common among those in residential care facilities. Those living in a nursing-home are at particularly high risk for fall-related injuries. Approximately one half of the estimated 1.7 million nursing-home residents in the United States fall at least once each year, and 11 per cent sustain a serious fall-related injury.

Multi-factorial interventions have also been successful in preventing falls in these settings. Adequate resources are available to deliver services of such programs in these settings (1).

Successful multi-factorial interventions include: comprehensive individual assessment with specific safety recommendations targeting environmental and personal safety (e.g., improvement in room lighting, flooring, and footwear); wheelchair use; psychotropic drug use; exercises for strength, balance, transfer, and ambulation; provision and repair of aids; providing hip protectors; facility-wide educational programs; and post-fall problem-solving conferences.

A randomized trial of seven pairs of nursing homes that included 500 residents evaluated an intensive, multifaceted intervention of extensive environmental modifications (e.g., obtaining wheel locks for beds, changing lighting, modifying floor plans, and purchasing raised toilet seats), medication review, and increased attention to individual resident needs. Repeat falls declined 19% among nursing-home residents who had fallen at least once during the previous year. However, approximately one third of the safety recommendations implemented in the study group were discontinued within 3 months of the completion of the study. Strategies are needed to institutionalize fall prevention interventions in the nursing-home setting, and additional programs designed for high-risk nursing-home residents need to be implemented and evaluated (3).

A more systematic approach for suggesting the components of multi-factorial interventions according to the setting may be recommended as follows (12), (The evidence on the components of the different programs and their items is from classes other than class I):

1. Among community-dwelling older persons (i.e., those living in their own homes), multi-factorial interventions should include:
  - gait training and advice on the appropriate use of assistive devices
  - review and modification of medication, especially psychotropic medication
  - exercise programs, with balance training as one of the components
  - treatment of postural hypotension
  - modification of environmental hazards
  - treatment of cardiovascular disorders, including cardiac arrhythmias
2. In long-term care and assisted living settings, multi-factorial interventions should include:
  - staff education programs
  - gait training and advice on the appropriate use of assistive devices
  - review and modification of medications, especially psychotropic medications
3. The evidence is insufficient to make recommendations for or against multi-factorial interventions in acute hospital settings.

### **Interventions of Unknown Effectiveness**

The effectiveness of a number of interventions is unknown. Examples include home hazard modification in older persons without history of falling in association with advice on optimizing medication, or in association with education on exercise and reducing falls. Other interventions of unknown effectiveness in preventing falls include group exercise programs, nutritional supplements, vitamin D with or without calcium, cognitive behavior approaches, pharmacologic therapy with raubasine-dihydroergocristine, and hormone therapy (1).

### **Conclusions**

It seems that the problem of falls in older persons in the EMR is at a community level. Falls policy and management does not exist in the region. The accurate size of the problem and its economic impact is not completely clear.

The size of the problem, and the procedures for prevention and control of falls and subsequent morbidity and mortality in old age in the EMR still need to be addressed due to a lack of studies, information, and health system procedures.

Scarcity of studies about falls and injuries in the older persons within the region made it difficult to present all data from regional sources. In addition, all available studies in the EMR were chosen regardless of the study design. The lack of uniformity in study designs made data consolidation a problem.

There is a lack of elderly health programs in general, and specially in those aiming at dealing with the falls problem. It appeared from the available research that the focus was upon the problem but not about the solutions. The solutions in this paper came from developed countries' papers, so the intervention and prevention items depended largely on studies from outside the region.

A fall can be defined as a sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, or the ground, other than as a consequence of sudden onset of paralysis, epileptic seizure, or overwhelming external force.

Most falls resulted from a complex interplay of predisposing and precipitating factors in a person's environment. One half to two thirds of falls occur in or around the patient's home. Special consideration should be given to the factors in the home and environment, and health education is of high importance.

Injurious fall events coming to acute medical attention in Iran in 2003 showed a higher incident rate in females than males and an increase in incident rate with age. It is expected that other countries of EMR would have similar outcomes as Iran because of the great similarities in community circumstances of most countries within the region.

Incidence rates of fall-related hip fracture in Iran are 38.0, 135.8, and 501.9 per 100.000 person-years among males, and 67.3, 214.7, and 564.6 per 100.000 person-years among females of the age groups 60-69, 70-79, and 80+ respectively (5).

Falls and hip fracture commonly occur at home.

Approximately 95% of hip fractures result from falls, minimizing fall risk is a practical approach to reducing these serious injuries. Primary prevention of fall-related injuries involves reducing the occurrence of falls; secondary prevention of fall-related injuries involves preventing injuries when falls occur.

The U.S. Preventive Services Task Force (USPSTF) recommends counseling older patients on measures to reduce the risk of falling. These measures include exercise (particularly training to improve balance), safety-related skills and behaviors, environmental hazard reduction, and monitoring and adjusting medications. This recommendation is based on fair evidence that these measures

reduce the likelihood of falling. The USPSTF also recommends an intensive individualized home-based multi-factorial intervention for high-risk older patients in settings where adequate resources are available to deliver such services. Several studies have examined single risk-factor modification and multi-factorial interventions, and have found that both can prevent falls in older patients.

### **Limitations**

- Scarcity of the research in EMR countries on the subject of falls in older persons in general.
- A lack of interventional studies.
- A lack of economic evaluation studies within EMR countries.

### **Recommendations**

- Further Research work within the eastern Mediterranean region is needed on the size of the problem of falls in older persons. Research is also needed on the interventions that may contribute to the prevention of falls in older persons.

### **Areas needing research are:**

- Epidemiology of falls in old age
  - Evaluation of different components of multifaceted intervention programs
  - Trials of implementation of programs for prevention of falls by several agencies
  - Economic evaluations of intervention programs for falls
  - Validation of risk assessment as a guide to intervention
  - Evaluation and assessment of the effectiveness of health educational materials and home-hazard checklists to promote fall-risk reduction activities and behaviors
  - Use of hip protectors in different care settings
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- Well-designed intervention programs are needed in the Eastern Mediterranean Regional to diagnose and manage this problem.
  - International evidence-based practices for prevention and control can be applied and studied within the region towards discovering locally relevant procedures.

## **Annex**

### **Falls Injury Prevention Policies**

Many procedures that have a potential to reduce the overall burden of falls injury among older persons should be supported, and adapted and modified for use in developing countries.

Physicians can become **advocates** in petitioning Governments (11) to make injury prevention policy a priority on the agenda of health issues. Existing resources to keep well informed of policy issues and other initiatives could be used. Increase in funding for injury prevention projects can be targeted.

Physicians can **lead** the medical community in promoting prevention of and/or reducing falls related injury in older persons. To do this, there is a need for inter-sectoral cooperation between the medical and allied health professions.

Health care providers should work together to reduce falls injury. The first point of contact is usually general practitioners. Physicians should support the coordination and continuity of care in all settings. Risk indicators should be included in a patient's medical records.

It's believed that both formal and informal **communication** between injury prevention groups is necessary. Stakeholders should be involved in program development, implementation and evaluation.

**Evidence-based strategies** that improve the effectiveness and efficiency of treatment and rehabilitation of falls injury, and allow for monitoring risk factors and implementation of interventions to prevent or lessen fall injury need to be supported.

A **systematic assessment** of individual risk is desirable and a **pro-active, multi-factorial approach** to injury prevention is essential.

Physicians should be encouraged to make their own decisions about the appropriateness of fall screening tools and other assessment procedures.

Commitment to exercise should be maintained throughout a person's life. However it is critical for people to have an exercise regimen in place by middle age. Older persons need to be **educated** to increase their awareness of the beneficial effects of targeted exercise. Older people should be encouraged to take up **physical interventions** if it is safe to do so. A resistance to exercising warrants investigation.

Inclusion of **injury prevention in core medical curricula, and information on falls injury prevention dissemination should be encouraged.**

A **long-term fall injury prevention strategy** that incorporates risk assessments, intervention strategies, health promotion, funding issues and continuity of care is needed.

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