A Global Report on Falls Prevention
Epidemiology of Falls

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1. Definition

A *fall* is one of the external causes of unintentional injury. It is coded as E880-E888 in International Classification of Disease-9 (ICD-9), and as W00-W19 in ICD-10. These codes include a wide range of falls including falls on the same level, upper level, and other unspecified fall. A *fall* is often defined as "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects"

It is important to note that there is no universal consensus on the definition of a fall. A recent Cochrane review reported that most studies fail to specify the operational definition of falls, leaving the interpretation to study participants. This leaves room for many different interpretations of a *fall*, and consequently brings into question the validity of the studies. Older people tend to describe a fall as a loss of balance whereas health care professionals generally refer to the consequence of falling, including injury and reduced quality of life [1]. Even a small change in definition may have significant consequences on the results of a study [2]. Thus providing an operational definition of a *fall*, with explicit inclusion and exclusion criteria, is recommended when conducting research [1].

2. Incidence

2.1. Frequency of falls

Table 1 presents a summary of six falls studies and their study designs. Most used a retrospective design and focused on older people living in the community. Findings show that, among community-dwelling older people over 64 years of age, 28-35% fall each year. Of those who are 70 years and older, approximately 32%-42% fall each year. The frequency of falls increases with age and frailty level. Older people who are living in nursing homes fall more often than those who are living in the community. Approximately 30-50% of people living in long term care institutions fall each year, and 40% of them experienced recurrent falls [3].

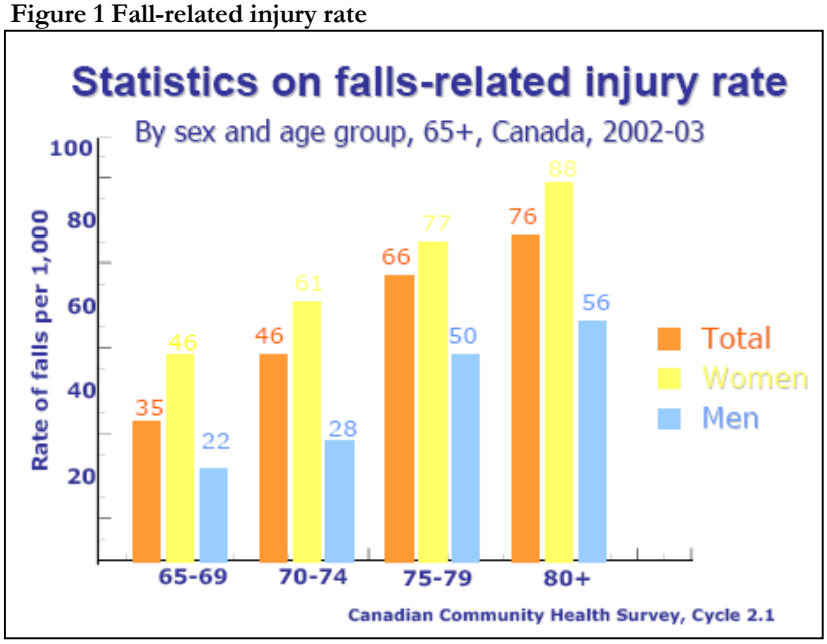
Table 1 Percentage of falls among participants in six studies

Study	Country	Target group	Study design	Percentage
Prudham, D (1981) [4]	UK	N=2793 65+	Retrospective study (1 year)	28%
Campbell, AJ (1981) [5]	New Zealand	N=553 65+	Retrospective study (1 year)	33%
Tinetti, ME (1988) [6]	USA	N=326 70+	Telephone interview	32%
Blake, AJ (1988) [7]	UK	N=1042 65+	Retrospective study (1 year)	35%
Downton,JH (1991) [8]	UK	N=203 75+	Retrospective study (1 year)	42%
Stalenhoef, PA (2002) [9]	The Netherlands	N=311 70+	Telephone interview (1 year)	33%

2.2. Fall-related injuries: The Canadian survey

Figure 1 shows the incidence rate of fall injuries for men and women by 5-year age group. The injury rate increases with age from 35 per 1000 population for people age 65-69 to 76 per 1000 population for people age 80 and over. For ages 65 and older, the rate of fall injuries (serious enough to limit normal activities) was 47.7 per 1000 population [10]. Rates among women exceed those of men for all age groups. These gender differences are statistically significant except for ages 75-79. The authors suggest that these gender differences may be related to women's lower income and greater social isolation.

Figure 1 Fall-related injury rate



Source: [10]

2.3. Distribution

Time

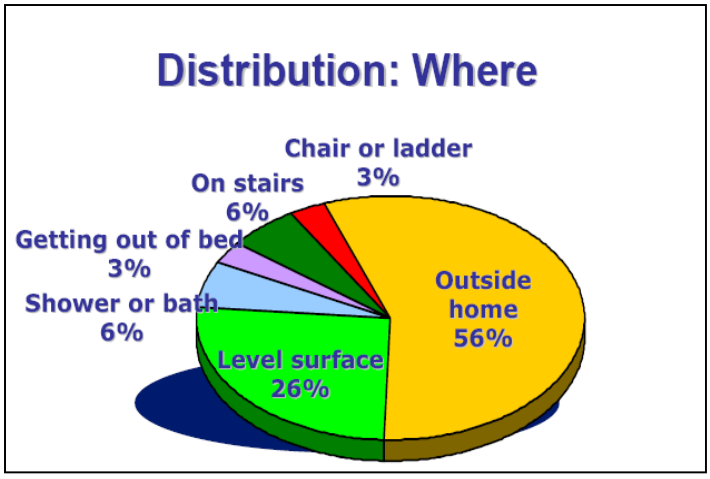
Most falls occur during the day; only 20% of falls occur at night [11]. Of those at night, most occur between 9 pm and 7 am, perhaps when older people wake up to use the bathroom. In countries that experience pronounced changes in seasonal temperatures, colder temperatures during the winter appear to increase the risk of falls especially among older women [12]. This may be due to a mild hypothermia triggered by cold temperatures, which slows reaction time,

as well as to icy or slippery conditions. Moreover, colder weather may increase the time spent in bed or of sedentary behavior, which can cause deconditioning and increase the risk of falling [13]. In a nursing home setting, older people are more likely to fall on the first day after moving into a new room or new ward.

Location

Figure 2 shows the major location of falls. Fifty-six percent of falls occur outside the home such as in the yard, on the street, or in a public place. Falls that occur inside the home happen most frequently in bedrooms, kitchens and dining rooms. Relatively few falls occur in the bathroom, on the stairs, or from ladders and step stools [11].

Figure 2 Location of falls



Adopted from [14].

Location of fall by age and sex group

The location of falls differs by age, sex, race, and level of frailty. Outdoor falls are more likely to occur among people younger than 75 years, which suggests that they are more active and mobile, whereas indoor falls occur more frequently among those who are more frail, generally those age 75 years and older [15]. Men are more likely to be more active and to fall

outdoors while women tend to fall inside the home. One study reported that Caucasian women were more likely than African American women to fall outside [16]. For nursing home residents, moving to a new environment increases the occurrence of falls by 50% [17].

Location of fall-related fractures

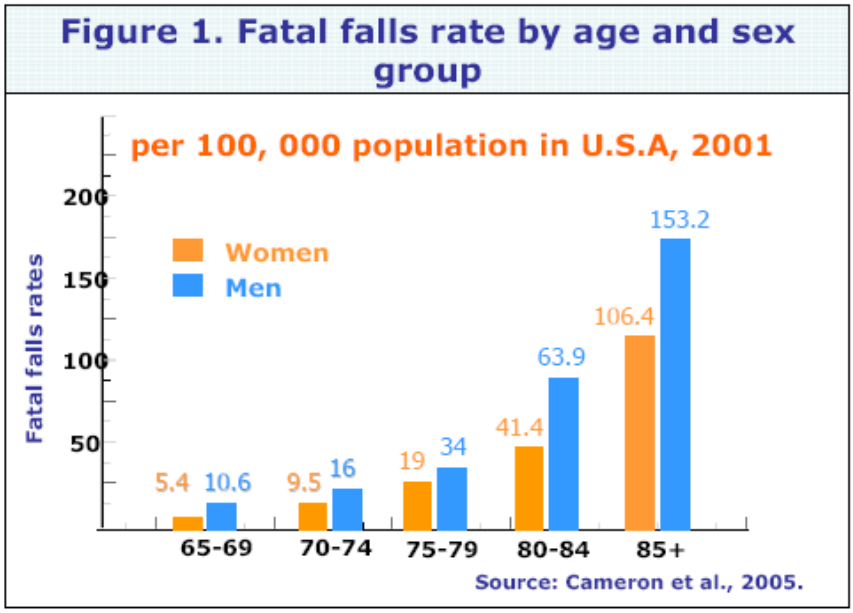
Approximately 10-20% of falls result in fractures [18]. Most fractures occur at home (85%) although only 25% of fractures are caused by environmental hazards in the home [19]. Falls that occur indoors are likely to result in hip fracture, whereas those that occur outdoors are likely to result in distal forearm fracture [20].

3. Sex

Women are more likely than men to experience nonfatal falls [21]. Contributing risk factors include age-related frailty, restricted mobility, more frequent use of multiple medications, and being a widow [13].

Men are more likely than women to experience fatal falls [21]. Figure 3 shows fatal falls by 5-year age group and sex. Fatal fall rates increase exponentially with age for both sexes. Fatality rates for men exceed that for women for all age groups. It may be that men are more physically active or more likely to engage in risky behaviors.

Figure 3. Fatal fall rates by sex and age group per 100,000 population



Source: [22]

4. Secular trends

4.1. Secular trend in fall-related fatality rate: Evidence from U.S

Figure 4 shows age adjusted fall-related fatality rates for people age 65 and older in the U.S.A [23]. Rates for both men and women had an upward trend between 1993 and 2003. Men's rate increased 45% from 31.8 to 46.2 per 100,000 and women's rate increased 59% from 19.5 to 31.1 per 100,000. This increasing trend also has been reported for Finland [24].

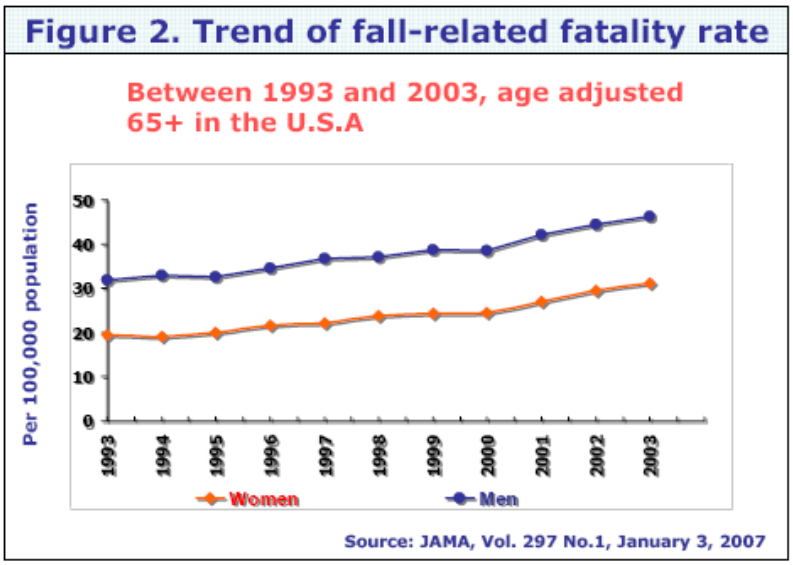
As outlined in section 2.2, men are more likely to die from a fall, possibly because they suffer from more comorbid conditions than women of the same age.[23]. A similar gender difference has been reported for mortality following hip fracture. The incidence of hip fracture is greater among women while hip fracture mortality is higher among men [25]. One study found that men reported poorer health and a greater number of underlying conditions than women, which substantially increased the impact of hip fracture and consequently increased the risk of mortality (26).

Table 2. Falls-related fatality rate by sex per 100, 000 population.

Sex	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Women	19.5	19.1	20	21.6	22.1	23.7	24.2	24.5	26.9	29.5	31.1
Men	31.8	32.9	32.6	34.6	36.7	37.1	38.7	38.5	42.1	44.4	46.2

Source:[23]

Figure 4 Trend of fall-related fatality rates

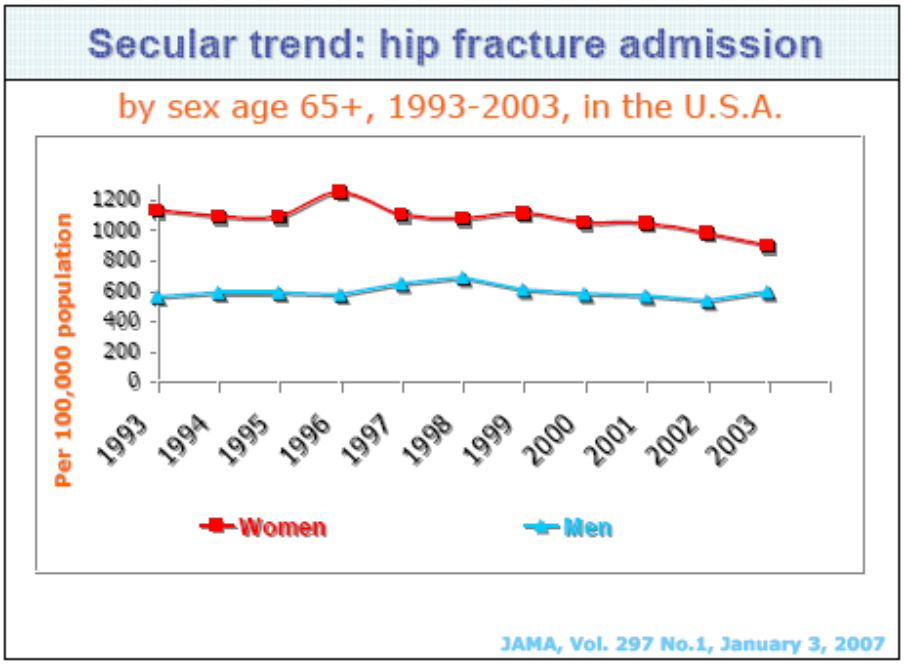


4.2. Secular trend in hip fracture

Hip fractures predominantly occur among people over age 65 and are becoming a major health burden worldwide. An upward trend in hip fracture rates was reported in studies from Spain (27) and South Korea (28). The crude rate of hip fracture increased approximately 50% during last 14 years in the Northern Spanish region of Cantabria [26]. In Gwangju city and Chonnam province in South Korea, from 1991 to 2001, the number of hip fractures increased from 247 to 1152, while the rate increased from 3.3 per 10,000 to 13.3 per 10,000. One study suggests that the increase in the number of hip fractures may be attributed to an increase in osteoporosis (28). The total number of patients with osteoporosis increased 20% from 1991 to 2001.

Figure 5 shows the secular trend of hip fracture admission rates in the U.S.A from 1993 to 2003 [23]. Overall, the rate decreased 15.5%, from 917.6 to 775.7 per 100,000. Notably, the rate among women declined significantly while the rate among men remained unchanged. The author postulates that public health measures including wider osteoporosis screening and effective treatments for women may explain the decrease [23].

Figure 5 secular trend: Hip Fracture hospitalization rates

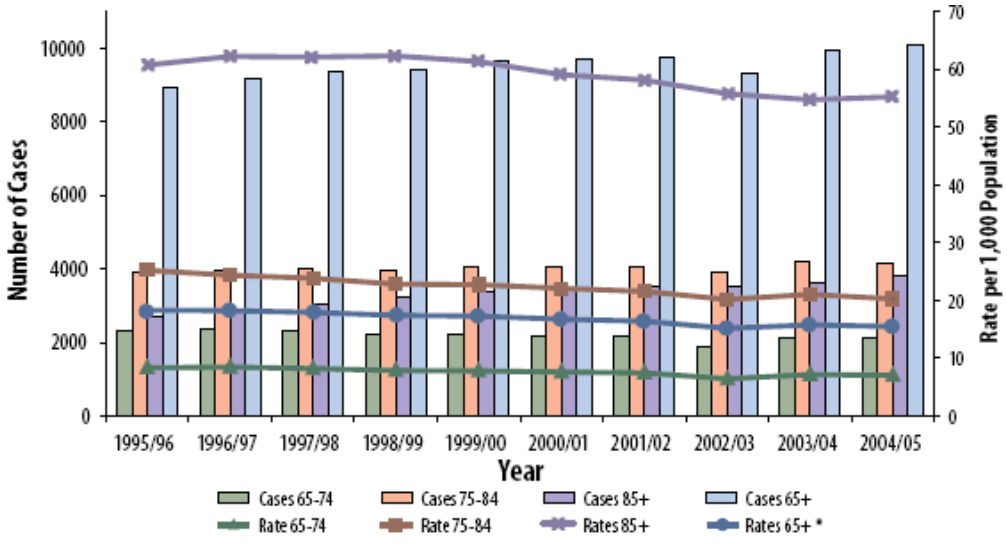


Source: modified from [27]

4.3. Secular trend in hospitalization rates: British Columbia, Canada

Figure 6 shows the number of fall-related hospital cases and hospitalization rates for three 10-year age groups in British Columbia (BC). In contrast to the report from U.S.A, the B.C report shows a small but statistically significant decline in rates over the past decade from 18.3 per 1000 population in 1997 to 15.5 per 1000 population in 2003. This decline is statistically significant for all three age groups. It is unclear whether this decline is due to fewer fall-related injuries or indicates a change in hospital management, such as an increased tendency to treat older adults in emergency departments and to release and support them at home. However, these changes also may reflect the effect of improved fall prevention strategies in B.C.

Figure 6 Falls related hospital cases and rates among older persons in British Columbia, Canada.



Note: Acute and rehabilitation hospital cases only

Source: [28]

5. Geographical variation

5.1. Frequency of falls worldwide

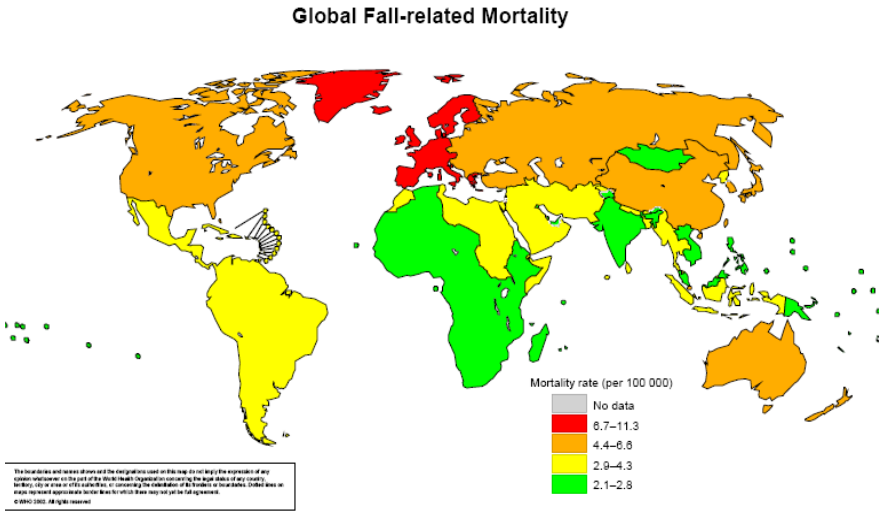
While approximately one in three older people falls each year, this proportion varies depending on the country and the target population studied. For instance, a study of the South East Asia region found that in China, 6%-31% and in Japan 20% of older adults fell each year. A study of Latin America found the proportion of older adult who fell each year was 34% in Santiago, 29% in Sao Paulo, and 24% in Havana.

In the developing world, however, there is a lack of data for many regions. For instance, there is no epidemiological data available for Africa, South Asia and the WHO Eastern Mediterranean region.

5.2. Geographical disparity in mortality rate

Figure 7 shows the world map and illustrates the geographical variation in fall mortality rates. Worldwide, an estimated 391000 people of all ages died of injuries related to falls in 2002. High income counties account for 25% of the total number of fatal falls worldwide. The mortality rate is highest in European regions, accounting for 6.6-11.3 deaths per 100,000 population. Males in the low and middle income countries of Europe have the highest fall-related mortality rates worldwide [29]. If the total number of fatal falls in Europe and in Western Pacific is combined, it accounts for 60% of the fall-related deaths worldwide.

Figure 7 Global Fall-related Mortality



Fall-related mortality rates (per 100 000 population) in WHO regions, 2000

Africa	Americas		South-East Asia		Europe		Eastern Mediterranean		Western Pacific		
LMIC	HIC	LMIC	India	Other LMIC	HIC	LMIC	HIC	LMIC	HIC	China	Other LMIC
2.7	6.5	3.9	2.1	3.4	11.3	6.6	2.7	4.3	5.3	5.7	2.8

HIC, High-income countries; LMIC, Low- and middle-income countries.

Source: [29]

6. Risk factors

Falls occur as a result of complex interactions among demographic, physical and behavioral risk factors. Throughout the past two decades, risk factors have been identified and categorized as intrinsic or extrinsic factors. Intrinsic factors include demographic and biological factors, while extrinsic factors encompass environmental and behavioral factors. This report illuminates some of the demographic, biological, and physiological risk factors that increase fall risk.

6.1. Demographic factors

Race

There are clear racial differences in fatal fall rates. Although the rates increase with age for both genders and among different races, in the U.S.A, white men have highest fatal fall rates followed by white women, black men, and black women [22]. Several studies suggest that the risk of falling is 33%-60% higher among Caucasians in the U.S.A. [30-33].

Racial differences in fall circumstances have been identified in some studies [6, 30] and not in others [31-33]. Caucasian women are 1.6 times more likely to fall outdoors than African American women, and twice as likely to land on surfaces such as ice, snow, or dirt. They are 3.8 times more likely to fall straight down, twice as likely to fall laterally or posteriorly compared to falling forward, but 40% less likely to land on a hand or wrist.

Socioeconomic status

Limited accessibility to health and social services, low income, little education and poor housing environments are associated with higher risk of chronic disease which may be associated with an increased risk of falling. A limited body of research suggests that older women with limited social connections are at high risk of falling after adjusting for several confounding factors [34, 35]. Women who live alone have an increased risk of falling compared to their married counterparts. These studies found that social interaction is inversely associated with falls among older women.

Table 3 shows a summary of demographic risk factors presented above.

Demographic risk factors	
Race	White men have higher fatal fall rates, followed by white women black men, and black women
	In the U.S.A., Caucasians are 33%-60% higher risk of falls than African Americans. Caucasian women are more likely to fall outdoors than African Americans.
Socioeconomic Status	Older women with limited social connections are at a high risk of falls, after adjusting several confounding factors

6.2. Biological factors

Age

As is discussed in section 2.1 and 2.2, fall-related mortality rates increase exponentially with age, with the greatest increase after age 80. This is because most falls are associated with age-related conditions such as physical frailty, immobility and reduced functional capacity.

Sex

As is discussed in section 3, women are more likely than men to fall [36-38] and suffer nonfatal injuries [39]. A study in the U.S examined the gender differences in non-fatal falls. The study reported that women have an injury rate 40-60% higher than men of similar age. Women are 1.8-2.3 times more likely to be hospitalized for a fall injury than are men [10, 21]. Furthermore, women are 2.2 times more likely to sustain fractures [21]. A biological factor contributing to women's increased fracture risk is that their bone mass declines faster than that of men, especially in the five years following menopause. Women are known to be at higher risk for injuries related to falls due to their higher rates of osteoporosis, which makes them more likely to sustain a serious fracture from a fall [40].

Medical conditions

Diabetes

Women with diabetes have an increased risk of falling. Cross-sectional data from the Third National Health and Nutrition Examination Survey indicate that among people age 60 years and older, women with diabetes are 1.6 times more likely to have fallen in the previous year and twice as likely to have fall-related injuries than women without diabetes [41]. A survey of African Americans found a 2.5 -fold increased risk of falls and falls with injuries among those with diabetes compared to individuals without diabetes [42]. People with diabetes are also more likely to have other risk factors for falls. One study of women with low BMI suggests that type II diabetes may be a protective factor by counteracting the risk of osteoporosis [43].

Parkinson's disease (PD)

Approximately 38-68% of PD patients experience falls as a serious complication of gait disturbances. One study showed that advanced patients are more likely to fall [44]. The increased risk of falling among patients with PD was attributed to impaired stride-to-stride variability in PD patients with a history of recurrent falls [45]. Compared to age- and sex-matched non-PD community subjects, PD patients had a 2.2-fold increased risk of fractures and a 3.2-fold greater risk of hip fracture. Adjusting for age, the significant risk factors for fracture included being female (OR=1.6) and having dementia (OR=1.6); chronic depression was associated with reduced fracture risk (OR=0.4) [45].

Depression

Depression is associated with increased risk of falls. Older people with a symptom of depression have an approximately 2.2-fold increased risk of falls [43]. However, depression could be the result of a fall rather than a causal or risk factor. For example, depression could result from fear of falling or from self-imposed functional limitations.

Incontinence

Incontinence is a serious problem in the older population and is frequently reported by those who fall [46, 47]. A recent study found that mixed incontinence, defined as leakage associated with urgency and also with exertion, effort, sneezing or coughing, is associated with an increased risk of falling [51[48]. Women with mixed incontinence are three times more likely to fall than those who do not have this condition, and are likely to fall on the way to the bathroom [49].

Alzheimer Disease

People with Alzheimer disease have twice the risk of falling as those of the same age without this disease [50]. Contributing factors may include defects in attention and visual-spatial abilities. A recent Japanese study reported that neuroperiventricular white matter lesions and the use of neuroleptic drugs disturb postural balance and lead to an increased risk of falls [51].

Physical conditions

Table 4 presents some of the physical risk factors identified in 17 controlled trials [52]. These physical disabilities are linked to aging.

Table 3 Risk factor for falls identified in 17 controlled trials

Risk factor	Significance/ Total[1] A/B	Risk/Odd Ratio (RR-OR)	Range
Muscle weakness	12/12	4.9 (8)	1.9-10.3
Impaired balance	10/10	3.2 (5)	1.6-5.4
Gait deficit	8/9	3.0 (5)	1.7-4.8
Visual deficit	5/9	2.8 (9)	1.1-7.4
Limited mobility	9/9	2.5 (8)	1.0-5.3
Cognitive impairment	4/8	2.4 (5)	2.0-4.7
Impaired ADL	5/6	2.0 (4)	1.0-3.1
Postural hypotension	2/7	1.9 (5)	1.0-3.4

Source: [53]

Muscle weakness

A decline in muscle strength is frequently reported among older people [54] and can interfere with balance. Table 4 shows that people with muscle weakness are almost five times more likely to fall. Furthermore persons with lower extremity weakness, usually measured by knee extension, ankle dorsiflexion, and chair stands, have a 1.8-fold increased risk of falling and three-fold risk for recurrent falls [55].

Visual impairment

A decrease in visual acuity has been shown in some [56, 57] but not all studies [58, 59] to increase the risk of multiple falls. Older people with impaired depth perception have a 3-fold

[1] A/B A: number of papers showing statistically significant differences, B: total number of papers reviewed

increased risk of multiple falls. Slower reaction time and increased body sway on a compliant surface were significantly and independently associated with falls [60]. However, it is not clear which aspect of visual function is most closely associated with increased risk of falling. Further studies with systematic and validated measurements of eye disease and visual function are needed.

Cognitive impairment

Cognitive impairment and confusion, even at relatively modest levels, can increase the risk of falling. Studies have found that five or more errors on a short mental status questionnaire [58], a score <26 [61] or a score <24 [62] on the Mini-Mental State Examination is associated with increased risk [62]. One study in the Netherlands showed short-term memory to be an independent risk factor for falls in those over age 75 years [63]. In the USA, one study found an increased risk of 1.8 for persons with cognitive impairment; other studies have reported increased risks ranging from 2.0 to 4.7 [46].

Foot problems

Foot problems are reported by approximately 30% of older people living in the community [64-67] and are a risk factor for falls [64, 68-70]. One prospective study reported that older people with severe bunion, toe deformity, ulcer and deformed nails have a two-fold increased risk of falling [6]. Another study found that ankle flexibility was an independent predictor of difficulties with postural sway, leaning balance, alternate stepping tests, sit to stand tests, and walking speed [71, 72]. Moreover, hallux valgus deformity [72, 73], impaired tactile sensitivity [72], decreased toe strength [72], and foot pain [72, 74] all impair balance and increase the risk of falls.

BMI

A low body mass index is associated with increased risk of falls [61]. Low body weight and unintentional weight loss due to malnutrition are a particular problem for older people, especially older women. Weight loss and low body mass index are associated with low bone mineral density and increased risk of fall-related fractures [75-78]. One study found that voluntary weight loss among obese older women increases the risk of bone loss at the hip

and is associated with an approximately two-fold increased risk of subsequent hip fracture. [79].

Table 4 Summary of biological risk factors

Biological risk factors	
Age	Fall-related mortality rates increase exponentially with age, with the greatest increase after age 85.
Sex	Women have an injury rate 40-60% higher than men of similar age.
	Women are 2.2 times more likely to suffer fractures as a consequence of falls.
Medical conditions	Diabetic women are 1.6 times more likely to fall and twice as likely to suffer fall-related injuries than women without diabetes.
	Approximately 38-68% of Parkinson's disease patients experience falls due to gait disturbances.
	Depression is associated with a 2.2 fold increased risk of falling but the direction of causality is unknown.
	Women with mixed incontinence are three times more likely to fall as women who do not have this condition..
	Persons with Alzheimer's disease are twice as likely to fall as people of the same age without this disease.
Physical conditions	Muscle weakness is associated with an almost five times greater risk of falling.
	Visual impairment is associated with slowed reaction time, increased body sway, and a 2.3 times increased risk of multiple falls.
	Cognitive impairment from dementia and delirium is associated with increased risks ranging from 2.0 to 4.7.
	Foot problems, such as severe bunion, toe deformity, ulcer and deformed nails, are associated with a two-fold increased risk of falling.
	Low BMI and weight loss are associated with low bone mineral density and an increased risk of fall-related fractures.

6.3. Behavioral factors

Fear of falling is common among older people. It occurs among approximately 30% of those who have never fallen and 60% for those who have fallen previously [6, 80]. Fear of falling is significantly associated with changes in balance [81, 82], mobility [82, 83], and muscle weakness. It is also associated with increased spontaneous sway, decreased one-leg stance time [81], and reduced gait speed [83, 84]. A recent study of women ages 75 and older with low bone mass found that fear of falling, as measured by falls self-efficacy, was independently associated with balance and mobility after adjusting for age, physical activity level, and performance in a number of physiological domains [82]. Furthermore, the study suggests this association was stronger in older adults with a history of injurious falls. Women with greater physical dependency are more likely to report fear of falling [85]. As a consequence, 34% of older women who are physically dependent also become house-bound, socially isolated, and at increased risk of falling.

Sedentary behavior

Muscle function is strongly associated with physical activity. Those who fall tend to be less active which causes muscle atrophy [86]. Those who are inactive fall more often than those who are moderately active or very active [87].

Medication intake

Table 6 presents a summary of medication classes and the mechanisms by which they increase the risk of falls. Some studies have found that taking more than four medications, irrespective of type, increases the risk of falling [59, 88, 89]. Using four or more medications is associated with fear of falling [90] and a nine-fold increased risk of cognitive impairment [90-92]. The most common drugs associated with falls are those that act on the central nervous system, such as sedatives, tranquilizers, and benzodiazepines. The risk comes from adverse effects resulting from physiologic changes associated with aging. These changes, such as decreased lean body mass, increased body fat, decline of kidney and liver function, affect the absorption, distribution, metabolism and elimination of medications.

Table 5 Medications and their mechanisms that increase risk of falls and fractures

Medication class	Mechanism
Benzodiazepines -long and short acting	Sedation, dizziness, decrease in neuromuscular function, cognitive impairment
Antidepressants	Postural hypotension, sedation, blurred vision, confusion, ataxia.
Antipsychotic	Postural hypotension, dizziness, blurred vision, sedation
Antihypertensive	
Centrally acting hypertensive	Postural hypotension, sedation
Beta Blockers	Postural hypotension, sedation
ACE Inhibitors	Postural hypotension
Thiazide Diuretics	Postural hypotension, lethargy
Loop Diuretics	Postural hypotension, decreased alertness, fatigue
Cardiac medications	
Cardiac Glycosides	Lethargy, confusion
Antiarrhythmics	Hypotension, arrhythmias
Calcium Channel Blockers	Postural hypotension
Nitrates	Postural hypotension, syncope
Analgesics	
Non-steroidal anti-inflammatory agents (NSAIDs)	Sedation, dizziness, cognitive dysfunction
Opioid Analgesics	Sedation, confusion, ataxia, blurred vision.
Anticonvulsants	Ataxia, cognitive impairment, sedation
Antihistamines	Hypotension, sedation, confusion
Gastro-intestinal-Histamine Antagonists	Confusion, ataxia. Cimetidine, decreases the clearance of many drugs including diazepam, propranolol and tricycle antidepressants.

Source: [22]

Alcohol misuse

Research has demonstrated a correlation between alcohol consumption and falls. Alcohol consumption is related to postural hypotension [93] which is consequently associated with falls. In some studies, heavy drinking results in recurrent falls [58] but not in other studies [59, 94]. Alcohol-related mortality varies by age, gender and geographical area. Higher rates of accidental mortality caused by alcohol have been found in Northern Europe [95]. When compared with abstainers, persons with a monthly ethanol intake of more than 1000g have a three-fold increased risk of injurious falls that can lead to hospitalization or death [96]. A recent study found that 14 or more alcoholic drinks a week elevates the risk of falling. However, this study did not specify the type or quantity of alcohol [97]. Long-term alcohol use, combined with age-related decline in the portion of the brain that controls posture and balance, can increase age-related postural instability and increase the likelihood of falling. In addition, alcohol use can accelerate the loss of postural control.

Alcohol consumption increases the risk of hip fracture. This may be due to the increased risk of falling while intoxicated, combined with a decrease in bone density associated with alcoholism.

Inappropriate shoes

Foot wear is a potentially modifiable factor that is thought to play a contributing role in some falls [98]. Some studies [99-102], but not others [99], suggest that athletic shoes may be associated with an increased risk of falling because the relatively thick, soft midsoles interfere with positional sense. One study found that high heeled shoes impair balance and are associated with an increased risk of falling [103].

One study found that more than 25% of older people do not wear shoes indoors [104]. Walking barefoot or wearing only socks increases the risk of falling at home [105]
Table 7 shows a summary of the behavioral risk factors described above.

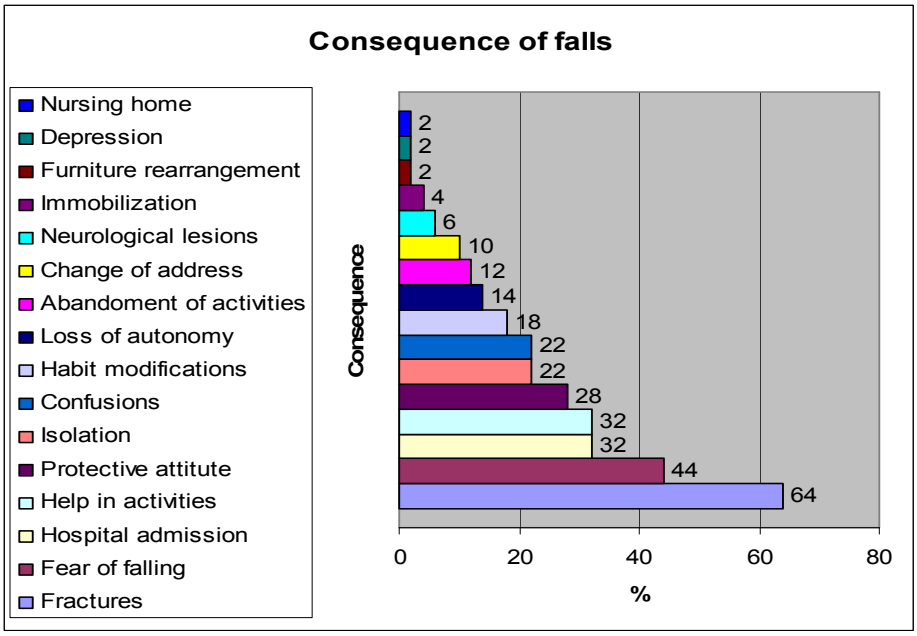
Table 6 Summary of behavioral risk factors

Behavioral risk factors	
Sedentary behavior	Sedentary behavior causes muscle atrophy and declines muscle strength. Those who are inactive fall more often than those who are moderately active or very active. Fear of falling triggers inactive behaviors. Fear of falling occurs in 30% of people age 65 and older, and is significantly associated with changes in balance and mobility, muscle weakness, and an increase in fall risk.
Medication intake	Use of four or more medications is associated with fear of falling and a 9-fold increased risk of cognitive impairment,
Alcohol misuse	Alcohol misuse affects biological decline in the part of brain that controls posture and balance. Ethanol intake of more than 1000g a month, or intake of 14 or more drinks per week increases the risk of injurious falls that can lead to hospitalization or death.
Inappropriate shoes	Athletic shoes may be associated with fall risk because the relatively thick soft midsoles interfere with positional sense. High-heeled shoes may impair older women's balance and increase their risk of falls. In one study, going barefoot or wearing only socks was associated with an increased risk of falling.

7. Consequences

Figure 8 shows consequences of falls. Falls can result in fractures (64%), fear of falling (44%) and hospital admissions (32%), and reduced quality of life. Falls can also result in a "post fall syndrome" that includes dependence (32%), loss of autonomy (14%), confusion (22%), and immobilization (4%), depression (2%), and restrictions in daily activities [106]. Falls are often considered a contributing reason for admission to a nursing home [107, 108].

Figure 8 Consequence of falls



Adopted from [109]

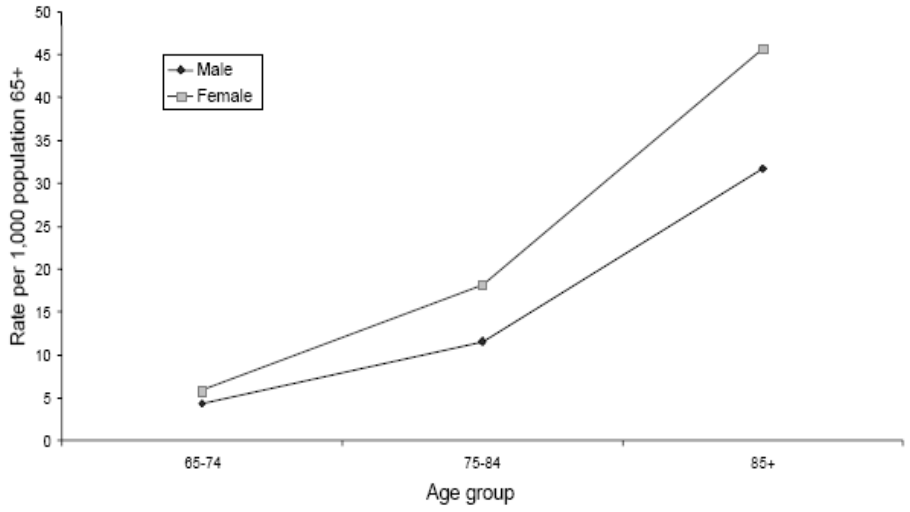
7.1. Hospital admission

Falls are common cause of hospital admissions for traumatic injuries, accounting for 40% of hospitalization. A Canadian survey analyzed fall related hospitalization data between 1998/99 through 2002/03 found that approximately 85,000 Canadians age 65 and older had been admitted to a hospital due to injuries related to falls. The average length of stay was approximately 15-20 days for those 65-74 years of age, 13-15 days for those 75-84 years, and 12-14 days for those 85 years and over. The length of stay for a fall injury was consistently

longer than the average length of stay for all causes combined for seniors age 65 and older. Over the 1998/99 to 2002/03 period, the average length of a hospital stay for fall related injuries among people age 65 and older declined.

Rates of fall-related hospitalizations increased with age for both men and women [28]. The hospitalization rate among women increased from 6 per 1000 population in the 65-74 age group to 46 per 1000 population among those age 85 and older. The rate for men increased from 4 per 1000 in the 65-74 age group to 32 per 1000 in the 85 and older age group (see Figure 9).

Figure 9 Fall-related hospitalization rates, by sex and age group, age 65+



Source [10]

7.2. Immobility

Falls are a major cause of severe non-fatal injuries and are the second leading cause of spinal cord and brain injury among older adults. Approximately 30-50% of falls result in minor soft tissue injuries. Overall, 20-30% of those who fall sustain moderate to severe injuries that limit mobility and independence and may result in death. Nearly 30% of older people experiences injuries to the hip, thigh, knee, lower leg, ankle, or foot; 17% experience injuries

to the wrist and hand, and 14% to the back and spine [10]. Approximately 50% of hip fractures lead to immobility [110].

Falls are the largest single cause of restricted activity among older adults, accounting for 18% of restricted activity days [111], increasing the probability of nursing home admission [112]. Falls also account for 12% of people bed-bound for life among those who fall and are age 65 years and over.

Falls can cause fear of falling and reduce independence and quality of life . Even falls that do not result in physical injuries can result in a "post-fall syndrome" that is associated with a loss of confidence and immobility.

7.3. Mortality

Falls account for 40% of all injury deaths. [111]. Men have a higher mortality rate than women [21]. A Canadian survey found the mortality rate increased from 8.1 per 10,000 population during 1997-99 to 9.4 per 10,000 populations during 2000-02. Falls can be an indirect cause of death if a person is unable to get up from the floor and cannot call for a help. Lying on the floor for more than 12 hours is associated with pressure sores, dehydration, hypothermia, pneumonia, and ultimately with higher mortality [80]. Approximately 20% of hip fractures lead to death within 6 months. The increasing fall death rate during the past decade is, in part, a reflection of the increasing average age of the over-65 population.

7.4. Conclusion

Fall and fall related injuries are major public health challenges that call for global attention. This problem will increase in magnitude as the numbers of older adults increase in many nations throughout the world. This report describes some commonly reported fall risk factors from international studies. These include demographic, biological and behavioral factors that both alone and in interaction with each other, increase the risk of falls. Epidemiological data show gender differences in the rates of fall-related mortality and hip fracture, with considerably higher death rates among men. Depending on the injury, falls can lead to hospital admission, disability and functional limitations that significantly decrease the

quality of life for older people. Preventive measure must be taken to reduce the burden of falls on the individual, family and society. Additionally, there is a lack of epidemiological data for many regions in the developing world. Research is needed to identify prevention strategies that will be effective in different cultural contexts.

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