Falls Prevention in Older Age in Western Pacific Asia Region

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Summary

To understand the epidemiology of falls among older population in the region, a literature review was conducted. The results show that incidence of falls were different in different countries and studies. The incidence of the falls in elderly aged 60 years and over was at least more than 10%, and some reached to 30.6%. Falls of elderly occurred frequently daytime, and among female elderly. The cost of falls in Australia was 500 million Australian Dollars in 2001, and ¥ 2 million ($17,000) per se, and ¥200 billion ($17,000,000) in total in Japan. Falls were the main reason of injury-related death among elderly, and led to many serious consequences. It was found that interventions including regular strength and balance training, vitamin D and calcium supplementation, reduction of psychotropic medication, visual intervention, home hazard assessment and modification can prevent falls happening among elderly.

Background/Introduction

Western Pacific Region comprises of 37 countries and areas with a population of approximately 1746 million. In 2005 the population aged 60 years or above was accounted for 10.7%. The countries with more than 10% of population aged 60 year and over are Japan (23.6%), Australia(16.2%), New Zealand(15.4%), Singapore(11.4%), China [10.1%, Hong Kong (14.7%)], Republic of Korea(11.0%), except of Pitcaim Island (its population is too small to be included in). With the fast population ageing, falls among older people become a big challenge in the region. To understand the current situation and its related risk factors of falls among elderly in this region, a literature review was conducted.

Methods

Falls, falls prevention, unintentional injuries, fractures, older, senior and aged were used as key words to search literature through the literature databases such as ***Pubmed， CBMDisc*** (Chinese Bio-med Database) and other literature sources The literature search was limited in the countries with more than 10% of ageing population aged 60 year and above in this region. 61 papers were selected from more than 200 papers found from 1995 to now. Among them 29 papers were in English, 16 in Chinese, and 16 in Japanese.

Results

1. Epidemiology of Falls in Older Population

1.1 Incidence and its epidemiological characteristics of falls

- **Incidence**

Japan is the oldest country in the region. It sustains 23.6% of the population aged 60 years or above. Annually, approximately 20% of older persons fall in Japan. Table 1 shows a summary of incidence of falls reported from six municipalities in Japan. Findings showed that, annually, 6.8-19.2% of older men and 13.7-22.9% of older women experience falls, except in Okinawa where incidence is significantly lower (Men of 6.8%, women of 13.7%) [1] **(Table 1**). The incidence of falls was higher in women than in men, and that it increased sharply with advancing age [2]. Statistical difference in incidence of falls between men and women was found in three studies from Tokyo and Okinawa area. Niino N et al conducted a survey to understand the incidence and circumstances of falls among community-dwelling elderly people in Tokoname-shi, Aichi Prefecture in 2002. 2,774 elderly people participated in health examinations and history of falls in the past one-year was interviewed. The incidence of falls among 2,774 subjects was 13.7%. It was significantly higher among women (17.2%) than men (8.3%,P < 0.001). Incidence increased as subjects get older. The incidence of falls was extremely high during the daytime and outdoors. Falls occurred most frequently while walking. The majority of falls were due to extrinsic factors. About 10% of all falls caused fracture. [3]

Table 1 Incidence of falls in six different municipalities in Japan

Study	Municipality	Target (Mean age)		Incidence		
		Men	Women	Men	Significance	Women
Yasumura (1991)	Akita/Nangai town	276(71.8)	409 (72.4)	19.2	n.s	20.3
Yasumura (1994)	Tokyo/Koganei city	366 (71.6)	441(72.1)	12.8	*p<.01*	21.5
Yasumura (1996)	Nigata/Nakazato town	532(73.1)	785(74.4)	17.7	n.s.	20.6
Kanou (1997)	Shizuoka/Hamamatsu city	219(65+)	315 (65+)	18.7	n.s.	22.9

Sakihara (1997)	Okinawa/Urazoe city	340 (74 mix)	497 (74 mix)	6.8	*p<.05*	13.7
Hoga (1997)	Hokkaido/Onsai town	396 (72)	481 (72.4)	16.4	n.s.	19.1
Shinya (1997)	Tokyo/Koganei city	285(75.8)	339(76.2)	9.5	*p<.05*	14.8

n.s.: not statistically significant; Source: [1].

China, the largest country in the Region, represents 76% of the regional population and had 10.1% of population aged 60 year or above. Wan Nian Liang [4] et al used a cluster random sampling from the community-dwelling residents aged 60 year and above, and found that the incidence of falls was 10.5% (person). In Fuzhou, however, the incidence was much higher and reached to 30.1%[[5]], which result was similar to that (30.6%) in Chengdu, Sichuan[6]. But another study in Beijing showed that the incidence of falls was only 6.5%.[7] In elderly people of rural areas in Shandong province, the average incidence of falling down was 22.6% in total,15.9% for men and 28·4% for women, respectively[8]. **(Table 2)**

In Australian which had 16.2% of population aged 60 year and over, approximately one in three people aged 65 years and over fall each year, with 10% having multiple falls and over 30% experiencing injuries requiring medical attention. The rate of falls and associated injuries is even higher for older people in residential aged care and acute care settings [9]. One study among older women in Australia found that during 12-month follow-up period, 49% of subjects fell, with 23% falling more than once [10] .

In Singapore which had 11.4% of population aged 60 year and above, a random sample of 3,000 persons aged 60 years and above was chosen from a database based on the 1990 population census. Incidence rate of falls of 17.2% was found. Two-thirds of these had single falls, while one-third had recurrent falls, defined as having more than one fall within the previous one year[11].

In Republic of Korea which had 11.0% of population aged 60 year and above, no data on incidence of elderly falls in whole country was found. But it was reported that 42% of elderly Korean subjects reported at least one episode of falling in the previous 12 months among 351 elderly people aged 65 years or older, and 38% of whom had consequences that required either the attention of a physician or hospitalization [12].

Table 2 The incidence of falls in different studies

Study authors	gender	N	falls	
			Person	%
Wan Nian Liang et al[3]	male	990	81	8.18%
	female	1305	159	12.18%
	total	2295	240	10.46%
Wei Ping Meng et al [5]	male	380	82	21.58
	female	412	156	37.86
	total	792	238	30.50
Su Zhen Liu et al [6]	male	35	12	34.29
	female	89	26	29.21
	total	124	38	30.60
Li Gang et al[7]	male	1245	61	4.9
	female	1738	132	7.6
	total	2983	193	6.5
Lin Tao Li et al[8]	Male	428	68	15.9
	Female	508	114	28.4
	Total	936	212	22.6

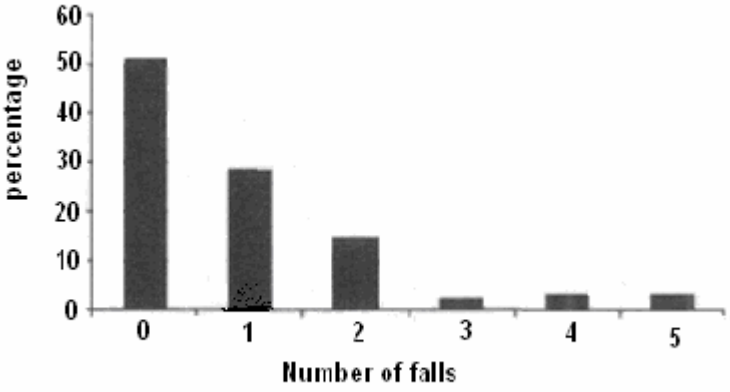


Figure.1 Frequency of falls during 12-month follow-up period

■ Places of falls

In Japan, approximately one in two falls occur inside the home. Most falls occur in bedroom or in the room frequently shared with others; 29% occur in the bedroom, 22% occur in a shared room, 17% on a porch, and 6% in a restroom[13]. In Australia follow-up study [10], however, the incidence of falls occurring outdoors was higher than indoors. More than half of falls occurring outdoors away from home. Frequent locations for falls away from home included streets or parks(25%), steps(not including steps on public transport, 12%), kerbs(6%), and public transport(6%). 26% of falls within the home also included trips on the steps within the home.**(Figure 2)**

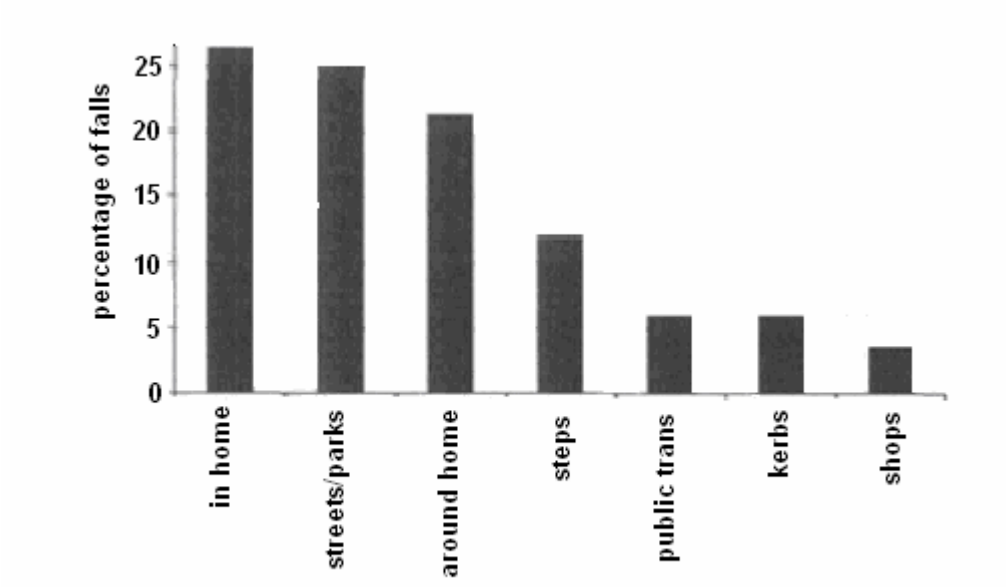


Figure. 2 Location of all falls(n=88)

Similarly, the studies[8,14] in China showed the incidence of falls occurring outdoors was much higher than occurring indoors, the most Frequent locations

for falls outdoors were streets(37.8%, 58.9%), Frequent locations for falls indoors were bedroom, bathroom and stairs.

Table 3 The locations of falls

Studies	Total fallls	locations of Falls	
		Outdoors (%)	Indoors(%)
Lin Tao Li et al[8]	286	185(64.7)	101(35.3)
Lin Tao Li et al[11]	107	73(68.2)	34(31.8)

- **Time**

Falls happened during daytimes more than nights, especially in the mornings, and it was found that during autumns and winters were more than springs and summers [7,8,15] **(Table 4).** Among community dweller, most of the falls occur from 3 am to 6 am, when they wake up to use the bathroom. In a residential setting, older people are likely to fall on the first day of moving into a new room or a new ward in a nursing home [16].

Table 4 Time distribution of falls

Studies	Total falls	Falls time	
		Daytimes(%)	Nights(%)
Lin Tao Li et al[8]	286	278(97.2)	8(2.8)
Shu Fang Chen et al[15]	507	293(57.8)	214(42.2)

- **Person(difference between gender, age group, race)**

Almost all the studies showed that the incidence of falls among females were higher than males', such as shown in the Table 1 and 2. Another study in China showed that the incidence of falls increased with aging, but people over 90 years old had the lowest incidence of falls[5].**(Table 5)**

Table 5 The incidence of falls in different aged people

age	persons	faller	Incidence (%)
60~	124	21	16.96
65~	219	49	22.37
70~	168	73	43.45
75~	176	76	43.18
80~	58	12	20.69
85~	36	6	16.66
90~	11	1	9.09
Total	792	238	30.05

- **Geographical variation and secular trends**

Yang GH[17]et al found that mortality related to general injury in rural areas was higher than in urban areas, and that was higher in western-regions than mid-regions, lowest in eastern-regions as a whole in China. But the mortality related to falls was higher in urban areas than in rural areas **(Figure 3)** . The study also showed that the mortality related to falls increased from 1991 to 2000although the total level of injury was not changed **(Figure 4).** In one district of Shanghai，falls ranked the third death cause among accidental death in 1996, but ranked the first in 1999, ranked second in 1997, 1998 and 2000[18]**(Table 6).**

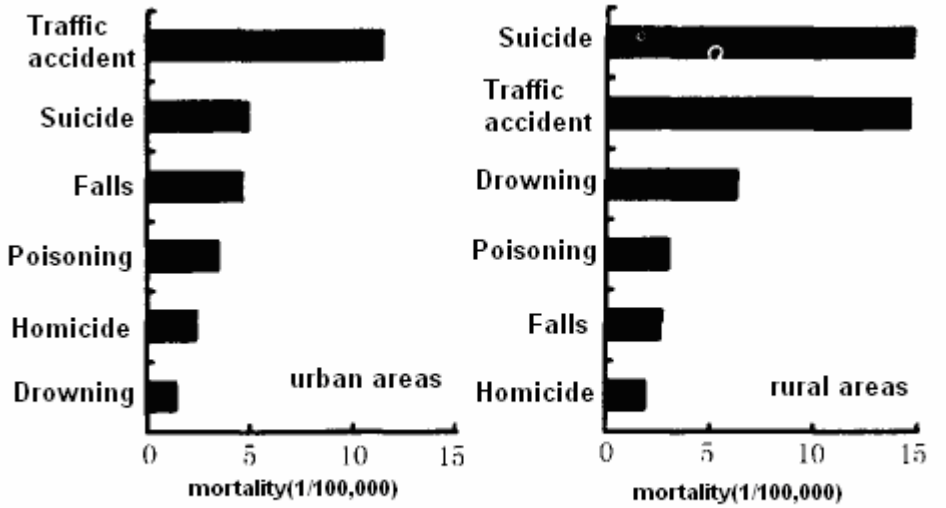


Figure. 3 Mortality related injury among Chineses in urban and rural areas

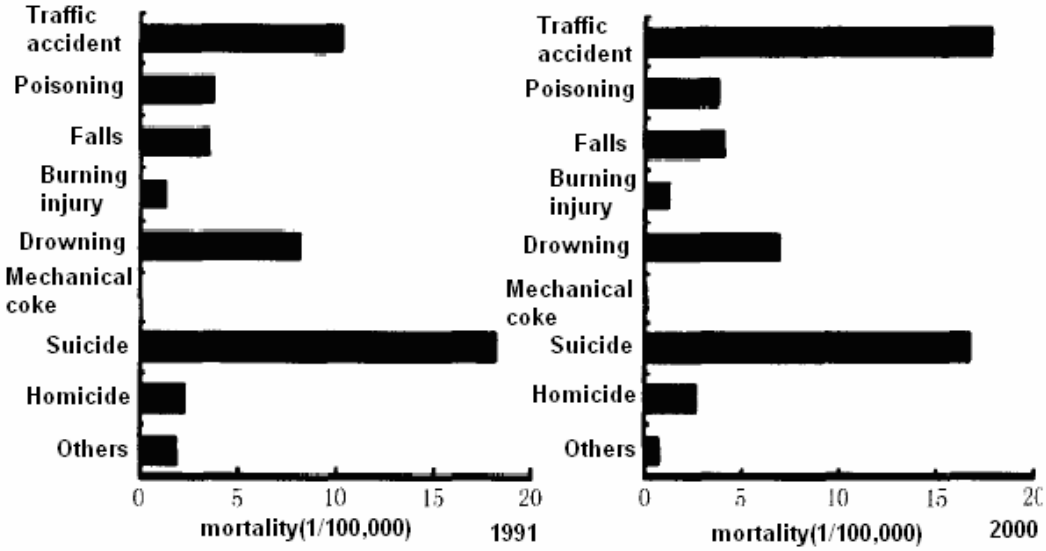


Figure.4 Changes of mortality related injury from 1991 to 2000 in China

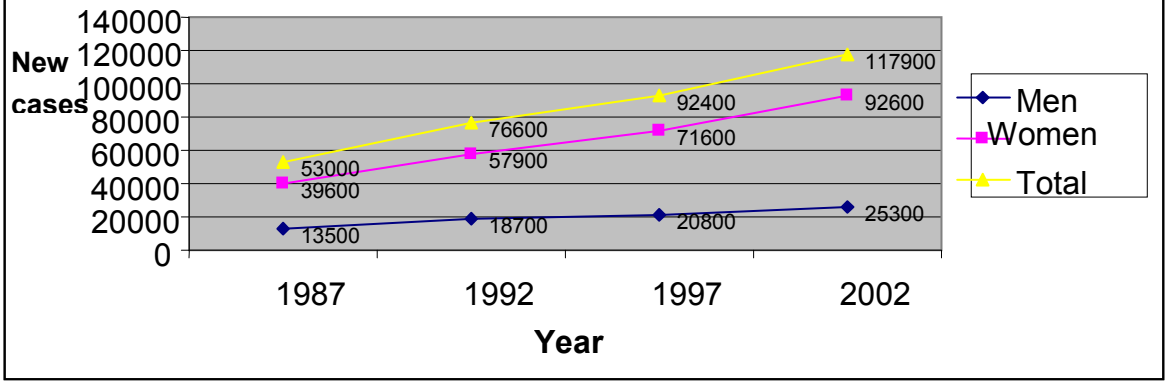
Table 6 The first five death causes related to accidental death from 1996 to 2000

Death cause	1996			1997			1998			1999			2000		
	M	P	R	M	P	R	M	P	R	M	P	R	M	P	R
Traffic accidents	48.60	12.55	1	49.20	13.28	1	59.91	14.64	1	39.15	10.55	2	45.92	14.78	1
Suicide	24.83	6.46	2	22.02	5.86	4	7.26	1.79	5	5.67	1.56	5	7.20	2.17	5
falls	22.00	6.08	3	24.59	7.81	2	44.66	11.43	2	47.57	12.50	1	29.49	11.30	2
HEOC	19.66	5.32	4	7.95	2.34	5	28.50	7.50	3	23.05	6.75	3	15.99	6.52	4
drowning	11.80	3.04	5	22.30	5.86	3	23.03	5.71	4	16.46	4.30	4	29.83	10.43	3

HEOC: Harmful effects of other accidents M: mortality($1/10^5$), P: percentum(%), R: rank

In Japan, the incidence was higher in the Western part of Japan than in Eastern part. Relatively fewer cases were found in the Northeast Japan (e.g., Tohoku), whereas higher cases were reported in the Southern part of Japan (e.g., Shikoku, Kyushu) Furthermore, the number was lower in areas where exposure to sunshine was reduced due to a pronounced colder climate. This may be due to a decreased activity of older people during the cold months. **Figure 5**. presents a secular trend in an incidence of hip fractures reported from national osteoporosis survey, which conduced in every five year 1987, 92, 97 and 2002. It clearly demonstrates that the total number of new cases has been rising in each survey. In 1992, the total number of new cases was approximately 1.4 times higher than the baseline in 1987. In 1997, the total number was about 1.7 times higher than the baseline. In the past 15 years, there has been a consistent increase in the incidence of falls. Especially affected were the women, where the incidence jumped by 50% from 39,600 in 1987 to 92,600 in 2000 [19]. Moreover, the total number of new female cases was about three times higher than that of new male cases.

Figure 5 Estimated number of new cases of hip fractures in 1987, 1992, 1997 and 2002



1.2 Consequences

- **Falls related injury and death**

Falls are the first cause of injury in older age. Over 73% of falls were related to injuries. Majority of the injury was parenchyma injury(67.1%), and 6.7% of them were fractures, including femoral fracture, arms fracture, rib fractures, besides falls could lead to the decline of activities of daily living and stepped ability. 41.8% of falls led fear of falling, limiting the activity range[20]. Another study[21] in Shanghai indicated that the mortality of falls related death increased with aging(Table 5), and the percent of people aged 60-years-old or more died from craniocerebral trauma, femoral fracture, fracture of neck of femur, late effect of lower limb fracture, and other injuries were 18.42%(14/76), 26.32%(20/76), 18.42%(14/76), 23.68%(18/76) and 13.6%(10/76).

In Japan, approximately 62-74% of falls result in injuries. Of those injuries, 50% result in intermediate to severe level of injuries. Over 40% of the injuries result in fractures, bruises (31%), cuts or scratches (16%) [22]. (**Figure 6**)

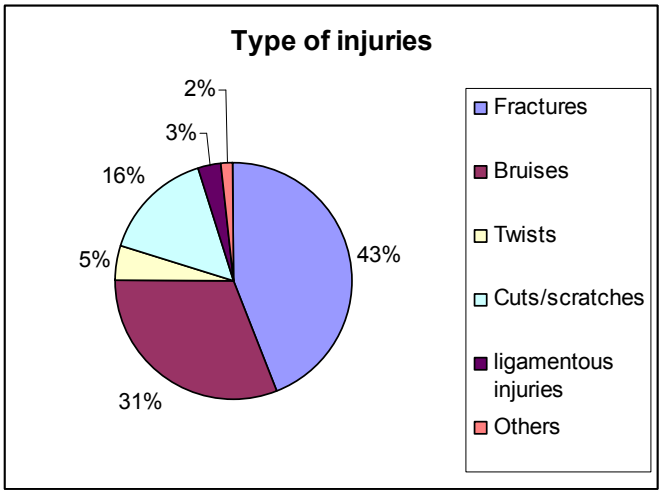


Figure 6 Type of injuries. (Source: [22].)

In New South Wales, Australia, the number of admissions for pelvic fractures among those aged 50 years and over increased by 58.4% in men and 110.8% in women between July 1988 and June 2000. Age-specific rates of admissions per 100,000 population for pelvic fracture also rose significantly, particularly for those aged at least 75 years. The number and proportion of transport related pelvic fractures fell significantly for both men and women, while those resulting from falls increased significantly over the 12-year-period[23].

Falls can affect the quality of life of the elderly, besides leading fractures and injury. Lin ZM et al found that falls reduced the state of function and activities of daily living (ADL) (**Table 7**), leading lose of motor ability, and affecting the healthy state of elderly seriously[24].

Table 7 the effect of falls on life quality of elderly

		N	Percent			*P*
			complete self servicing	Hemi-self servicing	disability	
Male	Pre-falling	94	68.09	30.85	1.06	＜0.005
	Post-falling	94	46.81	30.85	22.14	
Female	Pre-falling	63	60.32	38.68	0.00	＜0.05
	Post-falling	63	41.27	50.79	7.94	
Total	Pre-falling	157	64.97	34.39	0.64	＜0.005
	Post-falling	157	44.59	38.85	16.56	

- **Health service impacts and costs of falls in older peopl**e

In Australia, the number of hospitalized caused by falls was 55,000 in 1999[25]. There were 1,300 older persons aged 65 and over died of falls in 2002[260]. Falls accounted for 40% in all the injury-related death causes in Australia, 1.0% in all the death causes. It's the top one cause for the injury-to-death [27]. In New South Wales (NSW), Australia, the number of hospital separations for wrist fractures between July 1993 and June 2003 increased by 71% in men, an average yearly increase of 6.5%, and by 43% in women, an average yearly increase of 3.9%. A modest, but significant, increase in age-specific and age-standardised hospitalisation rates for wrist fractures was also observed. Whilst the majority of wrist fractures were due to falls[28]**.(Figure 7)**.

In 2001, the cost of falls was 500 million Australian Dollars [29]. It is estimated that the falls will increase to 1,500 million Australian Dollars till 2051 in Australia. In Western-Australia, there were 18706 Emergency Department(ED) presentations and 6222 hospital admissions for fall-related injuries among the people aged 65 years and above. It costed 86.4 million Australia Dollars in 2001 , half of that hospital separation spend, as estimated that, the cost will rise to 181 million Australia Dollars till 2021[30] **(Table 8,9)** .

It was estimated that there were 20,000,000 older people falls 25,000,000 times every year at present at least in China. Each fell person costed￥ 209 RMB every time, and the direct medical fees was￥5 billion[31] and above. The society cost of elderly falls in China every year was estimated as ￥1.6-1.8

billion, and it's 1.5 times higher than adolescent-adult. An epidemiology survey of suddenness falls in Shanghai reported that, as for one person, the average medical fee was ￥3373.63 , nursing costs￥702.89, indirect cost was ￥4846.18[21].

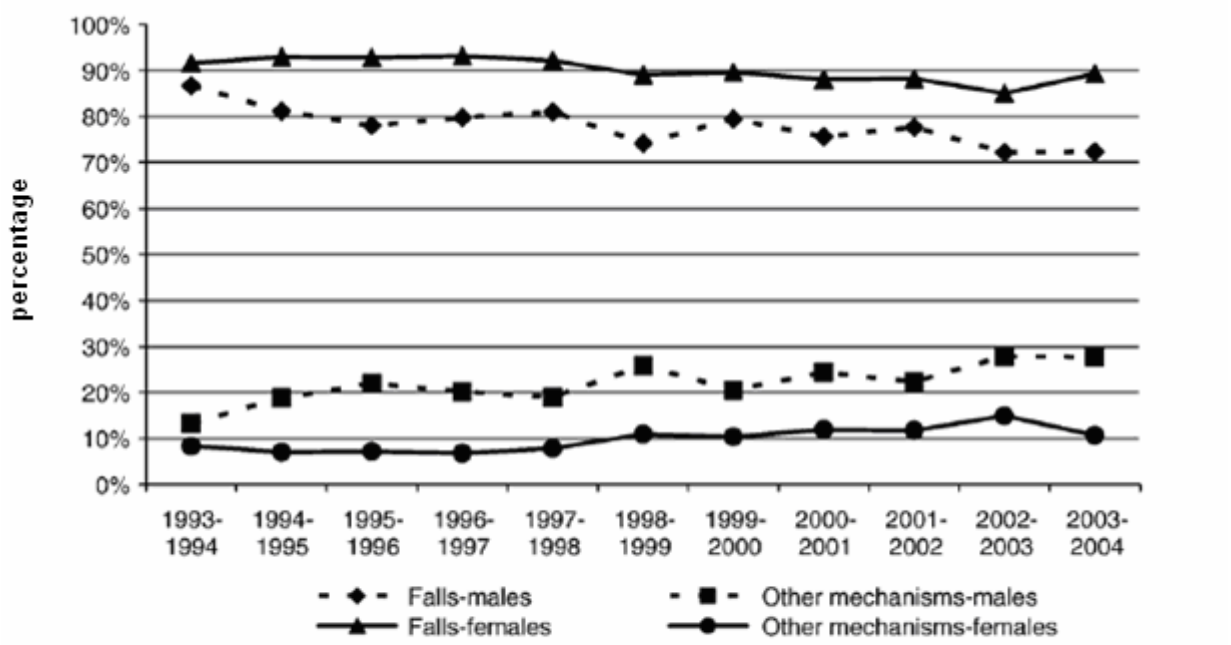


Fig.6. Proportion of falls and other mechanisms leading to admissions for wrist fractures in people aged 50 years and over by sex, NSW, 1988–1989 to 1999–2000.

Table 8 Number and rate of emergency presentations and hospital admissions

		Age groups(years)					
		65-69	70-74	75-79	80-84	85+	total
ED presentations							
Males	Number	820	918	1082	1073	1719	5612
	Rate per 10^5	270	345	559	1034	2427	598
Females	Number	940	1379	2148	2741	5886	13094
	Rate per 10^5	300	486	902	1678	3667	1130
Total	Number	1760	2297	3230	3814	7606	18706

	Rate per 10^5	286	417	749	1428	3287	892
Hospital admissions							
Males	Number	192	246	332	333	512	1615
	Rate per 10^5	63	92	172	321	723	172
Females	Number	276	461	800	1051	2019	4607
	Rate per 10^5	88	162	336	643	1258	398
Total	Number	468	707	1132	1384	2531	6222
	Rate per 10^5	76	128	262	518	1094	297

Table 9 Number and cost of episodes of care for falls in older people 2001-2002 composition of health system costs

	Number			Cost($ 000)	
Item	male	female	Total	Total	%total
In-patient hospital treatment	1615	4067	6222	45400	52.5
High-level residential care beds	60	140	200	7900	9.1
Hospital outpatient services	12300	50500	62800	7500	8.7
ED presentations	5612	13094	18706	5000	5.8
Allied health consultations	44900	68200	113100	4600	5.3
Ambulance trips	2800	6500	9300	4000	4.6
Specialist consultations	6900	23600	30500	3500	4.1
Personal care assistant visits	25500	59600	85100	2200	2.5
General practitioner consultations	20100	56100	76100	2200	2.5
Community nurse visits	9400	21900	31300	1900	2.2
Other domiciliary services	21100	49200	70300	600	0.7
Prescriptions	16200	36900	53100	400	0.5
Other*				1200	1.4
Total				86400	100

*includes equipment and lab costs

In Japan, medical and other expenses due to fall related injuries give a huge burden not only to a national economy but also to a household economy. All fall related costs are estimated to ¥2 million (USD17,000) per person. An annual financial cost due to falls in older people is estimated to ¥2 billion (USD17,000,000). Out of pocket fees due to inpatient hospital treatment for fracture were ¥1,200 per day for cases without surgery and ¥1,500 to ¥ 3,000 per day for cases requiring surgery. Although a large variance was observed, average of total non-medical costs are ¥15,358 (USD 129), transportation

expenses are ¥12,714 (USD 107), and purchases are ¥2,671 (USD 22). Opportunity costs referring to a labour productivity and social activity are mainly on housework [19].

2. Interventions/best Practice of Falls Prevention;

2.1 Single-intervention strategies

2.1.1 Strength and balance training

Several randomized controlled trials and meta-analyses and systematic reviews showed that strength and balance training for elderly adults living in the community could reduce the risk of both non-injurious and injurious falls by 15-50%—even cost-effectively [32] **(Table 10)** . Some randomized studies suggested that not only individually tailored training but also more untargeted group exercise programmes were effective in preventing falls[33,34,], especially if the training programme involves Taichi or other exercises that change balance[35,36] **(Table 11)** . A study[37] in Korea, exercise interventions targeted older adults with high risk of falls, found the preventive effects of the program for strength and balance training, because they can improve many risk factors of falling, such as muscle strength, flexibility, balance, coordination, proprioception, reaction time and gait. The desirable type of exercise intervention was lower limb strength and balance exercise together. Further investigation is needed to establish the effects of program on fall risk in such people, many of them live in care homes or other institutions. Also, the optimum type, frequency, duration, and intensity of exercise need to be examined further, as the ways to improve long-term adherence to physical activity.

Table 10 Falls in the 12 month trial period

	Intervention (n=76)	Control (n=74)	Risk (95%CI)
Falls			
Rate	0.605	0.946	0.60[a](0.36-0.99)
One or more	27(35.5%)	37(50.0%)	0.71[b](0.49-1.04)
Two or more	8(10.8%)	18(24.3%)	0.44 [b] (0.210.96)
Falls injuries			
Rate	0.395	0.541	0.66 [a] (0.38-1.15)

One or more	22(28.9%)	28(37.8%)	0.77 [b] (0.48-1.21)
Two or more	6(7.9%)	10(13.5%)	0.58 [b] (0.22-1.52)

[a] Incident rate ratios calculated for comparing the rate of falls and injurious falls between the groups

[b] Relative risks calculated for comparing the number of intervention and control subjects who suffered falls and falls injuries.

Table 11 Crude rate change for injurious falls per 1000person-years before and after the Tai chi program

	Incidence Rate		Rate change after Tai chi
Group	Before Tai chi	After Tai chi	
Control villages	98.0	73.7	-24.3
Tai chi villages	104.6	58.8	-45.8
Tai chi practitioners	66.7	50	-16.7

2.1.2. Supplement of Vitamin D and calcium

In addition to an essential role in calcium and bone metabolism, vitamin D might have an important role in improving muscle function (ie, alleviation of muscle atrophy) and musculoskeletal performance. Older people in residential care can reduce their incidence of falls if they take a vitamin D supplement for 2 years even if they are not initially classically vitamin D deficient [38]. Although many important issues, such as optimum type and dose of vitamin D and calcium, and the true falls and fracture preventing effects of these supplementations are unresolved. But a low level of serum vitamin D is an independent predictor of incident falls[39], so vitamin D with calcium could reasonable be recommended for almost elderly individuals—at least those known to be at high risk for deficiency of these substances, because the treatment is safe, cheap, and easy to accomplish.

2.1.3. Reduction of psychotropic medication

Medicines have significantly effect on falls' pathologic physiology. Medications that can lead to falls include sedative hypnotic, benzodiazepines, tricyclic antidepressants, antipsychotic, antihypertensive agents, cardiac corticosteroid drugs, non-steroidal anti-inflammatory drugs, antiarrhythmia drugs, antihistamine, antidiabetic drugs, purgatives, monoamine oxidase, muscle relaxant, vasodilators and drugs that effects balance, et al[40]. These medicines, especially psychotropic medication, can slower reaction, impairs cognitive ability, arouse arrhythmia, disorder consciousness and increase hazarder of falls. So reduction of psychotropic medication is of utmost importance in our modern pharmaceutically oriented health care, and further investigation is need.

2.1.4. Visual intervention

Impaired vision is an important and independent risk factor for falls. Adequate depth perception and distant-edge-contrast sensitivity, in particular, appear to be important for maintaining balance and detecting and avoiding hazards in the environment and visual intervention could improve Visual acuity high(MAR), Visual acuity low(MAR), and Edge-contrast sensitivity(dB) [41] **(Table 12)** . One study in Australia showed [42]: visual impairment wais strongly associated with two or more falls in older adults. In addition to poor visual acuity, visual factors such as reduced visual field, impaired contrast sensitivity, and the presence of cataract may explain this association. Since cataract induced visual impairment is common in elderly people, this finding could have major public health implications. Future studies are needed in older men and other target groups.

Table 12 Baseline and retest for visual acuity and edge-contrast sensitivity test for the intervention and control groups

	Intervention (n=64)		Control (n=69)	
Test variable	Baseline mean(SD)	6-month retest mean (SD)	Baseline mean(SD)	6-monthretest mean (SD)
Visual acuity high(MAR)	1.4(0.5)	1.3(0.6)***	1.3(0.5)	1.7(2.0)
Visual acuity low(MAR)	2.7(1.4)	2.7(1.6)**	3.0(3.6)	3.7(4.9)
Edge-contrast sensitivity(dB)	17.8(1.9)	18.5(2.3)*	18.3(2.5)	18.0(2.8)

2.1.5. Home hazard assessment and modification

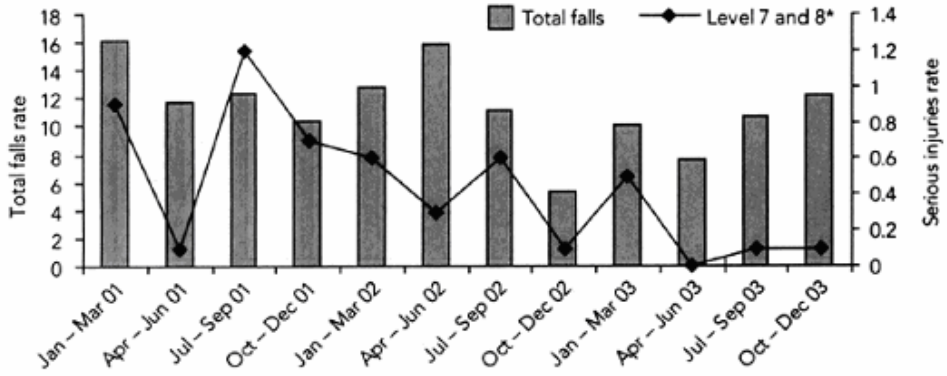
Because one-third of older adults fall happened in room, and environmental hazards were found in the majority of homes (60.4%) where community-dwelling elderly people lived [43], home hazard assessment and modification are very important to prevent falling. Home hazard reduction is effective if targeting at older people with a history of falls and mobility limitations [44]. But other studies showed that a single factor home hazard reduction program is more likely to be most cost-effective amongst older people who have a history of falls[45]

2.2 Multiple-intervention strategies

The content of the multifaceted interventions has varied substantially from study to study, including components such as: strength, balance, and gait training; improving transferring and ambulation with or without the use of aids; footwear improvements; investigation and management of untreated medical problems; medication review and adjustment(especially psychotroic drugs); vision test with referral to an optometrist or ophthalmologist if necessary; hip protectors; patient and staff education about fall prevention; falls risk alert cards; post-fall assessments; and environmental and home risk assessment and management.

One multifaceted study composed with education program and Taichi program in Taiwan showed that multifaceted intervention can prevent the decline in functional balance and gait among older people [46]. Another multifaceted intervention based on education in hospital showed that lower limb muscle force, dynamic balancing ability, and ambulation ability were all improved significantly after 4 months intervention [47]. Another study with multi-strategy prevention approach in Melbourne showed[48]: a multi-strategy falls prevention program in an aged care hospital setting produced a significant reduction in the number of falls and a marked reduction in serious fall-related injuries, and Incorporating a falls prevention program into all levels of an organisation, as part of daily care, is crucial to the success and sustainability of falls prevention.**(Figure 8)** But the reverse result has been reported[49]. So the multiple interventions have limitations. The major limitation of multiple disciplinary fall-prevention interventions is that they cannot distinguish between the independent role of individual modified risk factor, and thus which part of the intervention is effective, and which is not cannot be established. A great deal of time and effort might be put into implementing a complex intervention, when, in truth, the use of one or two of its components is equally effective. Insufficient long-term compliance and adherence to many treatment methods might affect the effects of Multiple-interventions program. Thus, the importance of careful selection of the content and target group of a multifaceted fall prevention program cannot be overemphasized.

	Jan–Dec 2001 (baseline)	Jan–Dec 2002 (Year 1)	Jan–Dec 2003 (Year 2)
Total occupied bed-days (OBDs)	37133	43274	41013
Total number of falls	465	489	413
Falls per 1000 OBDs	12.5	11.3	10.1
Reduction in falls per 1000 OBDs, baseline to Year 2	*19.2% (95% CI, 16.7%–21.7%; P = 0.001)*		
Number of serious injuries*	27	17	7
Serious injuries* per 1000 OBDs	0.73	0.39	0.17
Reduction in serious injuries per 1000 OBDs, baseline to Year 2	*76.8% (95% CI, 74.1%–79.5%; P < 0.001)*		



* Level 7 and 8 injuries, as defined by the Australian Incident Monitoring System of the Australian Patient Safety Foundation.

Figure. 7 Number of falls and serious fall-related injuries in Aged Care Serious wards at Caulfield General Medical Centre,2001--2003.

Falls prevention or fall intervention policies/guidelines

In China, there is an item that “it should be taken account of special needs for the elderly when urban public service, residential area and dwelling house being are built or reconstructed, and building living and activity facilities should be suitable for elderly” in “The Chinese Law for Protecting Rights and Interests of the Elderly “, which was issued by People Congress of People’s Republic of China in 1996. This legal item will assure good physical environment to prevent falls in older age.

In the urban areas of Shanghai, “paths with no barriers for elderly and disable people” were built in the most public places. Special project of safety and healthy communities which strongly emphasize prevention of injury especially for elderly falls has been involved in the government-driven healthy city programme in the next 3-year onward. This programme is expected to generate good results for prevention of elderly falls in Shanghai. In addition, Shanghai also promotes the coverage of an insurance for accidents occurred in the elderly. If old people buy the insurance with 10 Chinese yuan (=US$1.25) for one year, he/she will be paid back 10,000 Chinese yuan when has accidents. Now there are more than 250,000 old people covered by the insurance this year.

In Australia, to provide a strategic framework for collaborative action across jurisdictions, local government and organizations in order to prevent falls and minimise fall related injuries in older people throughout Australia, a NATIONAL FALLS PREVENTION FOR OLDER PEOPLE PLAN: 2004 ONWARDS [9]was issued for a cohesive and comprehensive response to falls among older persons. The Plan provides a framework to assist in making investment decisions by governments to ensure a systematic response to an important issue. It articulates the responsibilities of the Australian, State and Territory governments to take the lead in reducing falls and fall related injuries and in promoting safer and healthier communities. It guides cross-jurisdictional effort and develop partnerships across stakeholder groups at all levels. In addition, the Falls and Balance Clinic is the tertiary falls prevention service for Australian Capital Territory（ACT）and south eastern region of New South Wales, providing a comprehensive multidisciplinary assessment, with nursing, physiotherapy and medical involvement. The recent clinic outcome survey clearly demonstrated a reduction of rates of falls as high as 40 to 60% within a six to 12 month follow-up period, and an even higher reduction of falls in multi fallers [50]. Besides, some multifaceted community-based programs, such as Stepping On[51], and Stay On Your Feet(*SOYF*, from 1992 to 1996)[52], were conducted in Australia. In 2004, L. M. Barnett [53] et al found that SYOF's sustainability was clearly demonstrated among health practitioners.

In Japan, falls prevention is integrated in policies that ultimately target to a disability-postponing. The newly launched policy, called "health frontier", aims at a prolongation of "disability adjusted year" of two years. The policy includes falls prevention as one of the strategies for prevention of fractures. Sustainability of a "health frontier" policy is ensured by three dimensions: a capacity building, a legal reinforcement, and a financial support. First dimension is a capacity building. The capacity building encompasses provisions of support for falls prevention research and relevant academic meeting and seminar, as well as encouragement of prospective research on biotechnology. With the advent of the policy, many municipalities have launched cooperative falls prevention programmes and have provided improved physical and mental outcomes.

Conclusions

Falls among elderly in this region is a big challenge. The incidence of the falls in elderly aged 60 years and over was at least more than 10%, and some reached to 30.6%. Falls of elderly occurred frequently daytime, and among female elderly. The cost of falls in Australia was 500 million Australian Dollars in 2001, and ¥ 2 million ($17,000) per se, and ¥200 billion ($17,000,000) in total in Japan. Falls prevention in elderly people consists of regular strength and balance training, vitamin D and calcium supplementation, reduction of psychotropic medication, visual intervention, home hazard assessment and modification. Multiple-intervention strategies are effective in preventing falls

among elderly population, but have limitations. But much work needs to be done, and many subgroups, such as frail elderly men and people with cognitive impairment or chronic stroke, will need further investigation. Future studies should be large enough to see the effect of the intervention on not only falls but also falls-induced injuries and fractures. Also, before recommendations can be made, any old or new potential intervention for prevention of falls and related injuries, such as bed or chair alarms, movement detectors, canes, walkers, use of restraints, or less resistant floorings, footwear improvements or visual correction with glasses, have to be tested in same rigorous way.

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