Original Article

Study on Age and Education Level and Their Relationship with Fall-Related Injuries in Shanghai, China

LI Yan Hong[1,#], SONG Gui Xiang[2], YU Yan[1], ZHOU De Ding[1], and ZHANG Hong Wei[3,#]

1.Department of Injury Prevention and Control, Shanghai Municipal Center for Disease Control & Prevention, Shanghai 200336, China; 2.Department of Vital Statistics, Shanghai Municipal Center for Disease Control & Prevention, Shanghai 200336, China; 3.Department of Epidemiology, Second Military Medical University, Shanghai 200433, China

Abstract

Objective To study age and educational level and their relationship with fall-related injuries in Shanghai and to analyze the relevant costs.

Methods Multistage cluster sampling was used for the selection of participants and standardized questionnaires were used for the information collection in 2006. Information on cases and deaths caused by fall-related injuries were obtained from 494 hospitals as well as from the mortality registry systems from 2001 till 2010.

Results Of 45 857 participates, 674 suffered from fall-related injuries with the largest proportion among all injuries. The fall-related mortality increased from 10.63 per 100 000 in 2001 to 14.11 per 100 000 in 2010. The under-five mortality rate was the highest among children aged 0-14 years. Mortality increased dramatically among those aged 55 or above for the female and aged 60 or older for the male. Individuals with an educational level under the primary school were more likely to suffer fall-related injuries, accounting for 72.66% of all deaths and 49.24% of nonfatal cases respectively. The annual burden of fall-related injuries equated to 25.90% of the share of GDP for the healthcare, social security and welfare industries in 2006.

Conclusion Fall-related injuries were inversely related to victims' educational level. Children under the age of 5, women over 55 years old and men over 60 years old with an educational level lower than the primary school are the most risky groups of populations for intervention measures.

Key words: Fall; Injury; Education; Costs; Mortality

Biomed Environ Sci, 2013; 26(2):79-86 *doi: 10.3967/0895-3988.2013.02.001* *ISSN:0895-3988*

www.besjournal.com(full text) *CN: 11-2816/Q*

INTRODUCTION

As a public health problem, injuries are under-estimated in China and they cause more than 800 000 deaths and about 200 million person-times injury incidences per year. Also, injuries are the first and fifth cause of hospitalization and death in both urban and rural areas in China[1-2]. The most important causes of injury-related mortality in cities in China are traffic injures, suicide and fall-related injuries and the fall-related mortality rate increased from 4.40 (per 100 000 population) in 2001 to 7.22 (per 100 000 population) in 2009[3-4]. A report from WHO showed that China had the greatest

[#]Correspondence should be addressed to LI Yan Hong. Tel: 86-21-62758710-1422. Fax: 86-21-62758710-1422. E-mail: yhli@scdc.sh.cn; ZHANG Hong Wei. Tel: 86-21-81871061. Fax: 86-21-81871061. E-mail: smmuhongwei@yahoo.com.cn

Biographical note of the first author: LI Yan Hong, female, born in 1963, master, professor, majoring in injury prevention and control.

Received: April 6, 2012; Accepted: June 28, 2012

fall-related injury burden, and the disability adjusted life years (DALYs) lost to this type of injury was almost twice of that of any other countries in the world[5].

In the past two decades, Shanghai's gross domestic product (GDP) per capita increased more than 9 times and the proportion of residents living in the urban area was up to 89.30%[6]. By the end of 2010, the number of the population aged 65 and above in Shanghai increased to 2 264 900, accounting for 16.0% of those in all age groups[7]. Rapid economic growth, increasing aging of the population and urbanization have resulted in substantial changes in housing, transportation and the lifestyle changes, all of which fundamentally changed the pattern of injuries and made the injuries become the fourth leading cause of death in Shanghai. The most common causes of injury deaths are falls, traffic-related injuries and suicides. The overall injury death rate changed slightly from 44.02 per 100 000 in 2001 to 41.84 per 100 000 in 2010[8]. The increasing healthcare cost due to fall-related injuries are becoming big challenges the healthcare system faced.

In the United States and other industrial nations, the epidemiological characteristics of fall-related injuries and the effectiveness of intervention have been documented in population based settings[9-10]. In China, fall-related injuries have not been properly recognized as a public health problem which is predictable and preventable and the nature and extent of such injuries remain largely unknown. Therefore, there is an urgent need to study and identify the characteristics of fall-related deaths and injuries in order to take appropriate actions for healthcare delivery and comprehensive risk management.

The aim of the present study was to identify population groups at high risks on fall-related injuries in which age and education level were emphasized and to provide scientific evidences for fall prevention and management. The costs of these injuries were also estimated in the study.

MATERIALS AND METHODS

Definitions

A fall is an event which results in a person coming to rest inadvertently on the ground or floor or other lower level. A fall-related injury is defined as any physical damage resulting from a fall (including bruising, abrasions, lacerations and fractures)[11]. In our database, fall-related deaths and non-fatal injuries were coded as W00-W19 according to International Classification of Disease-10 (ICD-10), and the cases of assault and intentional self-harm were excluded.

The costs of total fall-related injuries were shown in terms of direct medical treatment costs and costs of productivity loss. The cost of total direct medical treatment refers to the payment provided by patients and insurance companies for treating fall-related injuries, such as the fees of inpatient and outpatient care, primary health care and medications. Costs of total productivity loss are the labor earnings that are forgone as a result of an adverse health outcome. The costs cover the lost earnings and productivity of both patients and the family members who take care of them. For some cases of premature death, the indirect cost is the loss in potential wages and benefits[15].

The underlying cause of fall-related death is defined as the injury which initiates the train of events leading directly to death, or the circumstances where the accident produces a fatal injury. Diagnostic evidence of cause-of-death covers autopsy, pathology, surgery, physical, and chemical tests, clinical diagnosis and verbal autopsy[16].

Data Sources

Information on morbidity rates and their constitutional proportions of fall-related injuries in Shanghai were collected from a retrospective survey about injury disease burden conducted in all 19 districts of Shanghai in 2006 and the data on fall-related injuries were abstracted from the cross-sectional survey for the purpose of this analysis. Information on cases of hospitalization and fatalities due to fall-related injuries was analyzed based on the data from 494 hospitals and mortality registry systems from 2001 to 2010 in Shanghai. Data on local-level economic accounting, demography, and labor force from 2001 to 2010 were collected from Shanghai Municipal Statistics Bureau and were used to complete the economic analysis of the impact of fall-related injuries.

Sampling Technique

A multistage cluster sampling was used for sampling in all 19 districts in Shanghai. In the first step, three sub-districts of each district were sampled randomly and in each sub-district, three communities were randomly selected. Then, in each community, 100 households were selected randomly and each household was considered as a cluster. A total of 17 100 households were involved in this

study. A household was defined as persons living in the same apartment and having dinner together. A total of 45 857 participants were recruited for the survey. All individuals in each household were invited to participate during the survey. Participants were interviewed by trained investigators in accordance with the Declaration of Helsinki 1975. A written informed consent was obtained from each participant interviewed. Standardized questionnaires were designed to collect information on demography, date of injuries, treatment type (in-patient or out-patient), hospitalization and costs.

Instruments

The instruments of the WHO injury survey at the community level were used as the starting point of developing instruments for the survey. All fatalities and injuries were categorized according to the international classification of external causes of morbidity, mortality, injury, poisoning, and certain other consequences of external causes[12-14].

Quality control was conducted identically in the process of investigation. The sample size was determined and standardized questionnaires were developed after the pilot study. Investigators were trained to be eligible for this study and were required to check the finished questionnaires daily during the survey in order to ensure the integrality and accuracy. Five percent of the subjects were selected randomly to be interviewed twice for quality control of the questionnaires completed. Data were checked before being input into database, and 10% of the input data were selected to be checked twice in order to control the quality of the data for analysis.

Statistical Analysis

SPSS (Version 15) was used in this study. Age was categorized into to groups with 5-year interval. Morbidity and mortality rates were calculated for different age groups as well as both genders. Chi-square test was used to examine the difference in categorical variables and variation trend in rates of mortality and morbidity by income, years and age. Fall-related injuries costs of total direct medical treatment and total productivity loss were also calculated and $P<0.05$ was taken to indicate significance.

RESULTS

During the period of 2001 to 2010, a total of 18 407 people died of fall-related injuries in Shanghai and falls accounted for 31.00% of all injury-related deaths, with the highest proportion. Of 45 857 individuals surveyed in 2006, 1556 were injured and 674 of them were due to falls (43.32%). The fall-related morbidity was 14.70 per 1000 populations.

Figure 1 shows the changes of the fall-related mortality rate and per capita disposable annual income from 2001 to 2010. The fall-related mortality rate changed from 10.63 per 100 000 populations in 2001 to 14.11 per 100 000 populations in 2010 while average per capita disposable annual income increased by 147.13%, from 12 883 CNY (US$ 2043) to 31 838 CNY (US$ 5050) during this 10-year period (No statistical significance, Chi-Square is 0.201, $P_{trend}=0.654$).

Figure 2 presents fall-related mortality and morbidity rates stratified by age and gender from 2003 to 2010 in Shanghai. The mortality and morbidity rates increased progressively with age (14 years old and above) in both genders (Chi-Square is 383.91, $P_{trend}<0.001$ for age groups). The mortality rate increased dramatically in the group of aged 55 or above for the female and the group of aged 60 or above for the male. The male-specific mortality exceeded the female's in all age groups except for people aged 80 years or above. The morbidity rates for females over the age of 55 were higher than those for males.

Mortality rates of the age groups of 1-4, 5-9, and 10-14 were 1.21, 0.69, and 0.52 per 100 000 populations respectively. The under-five mortality rate (U5MR) for the male was 1.39 per 100 000 populations, being about 34.95% higher than that for the female. Also, the morbidity rates in the age groups of 1-4, 5-9, and 10-14 years were 3.95, 4.66, and 5.65 per 1000 populations respectively.

Labor force groups with the ages ranging primarily from 15 to 64 years old accounted for 13.29% of the mortality and 42.43% of the nonfatal injuries respectively. Among the age groups of 15-44 and 45-64, the mortality rates were 1.35 and 3.74 per 100 000 populations respectively and the morbidity rates were 5.16 and 12.70 per 1000 populations correspondingly. The mortality rate of the male was 3.70 per 100 000 populations, being about 228.57% higher than that of the female.

Of all fall-related deaths, about 86.23% occurred in the age group of 65 years or above. Mortality rates in the age groups of 65-69, 70-74, 75-79, 80-84, and aged 85 or above were 9.42, 19.21, 50.57,

135.53, and 498.04 per 100 000 populations, respectively. Meanwhile, the morbidity rates were 27.78, 32.93, 44.34, 33.30, and 72.49 per 1000 populations, respectively.

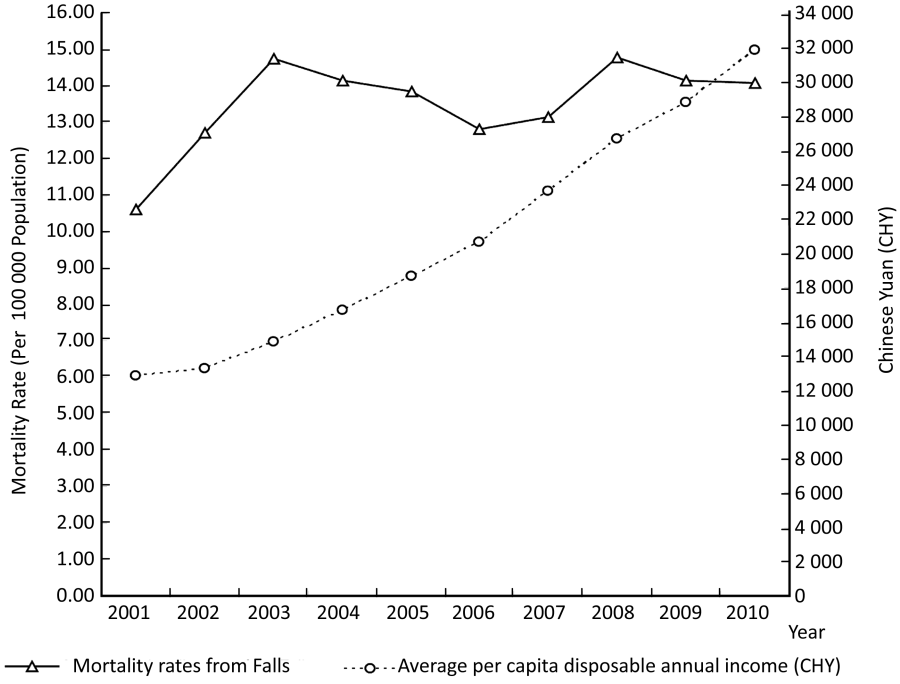

Figure 1. Change in income and fall-related mortality, 2001-2010.

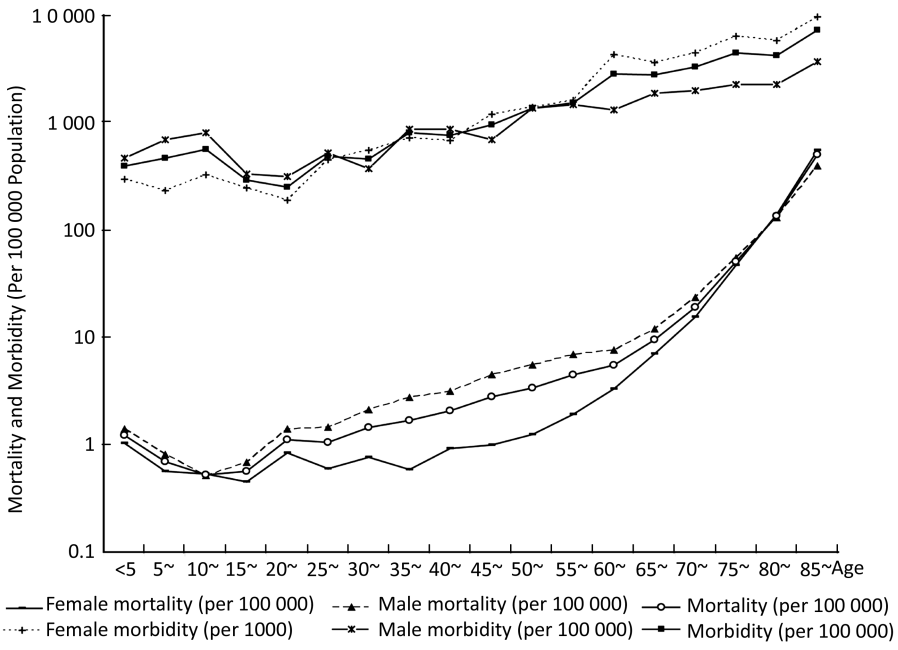

Figure 2. Changes in fall-related injuries and mortalities by age and gender in Shanghai, 2003-2010.

Table 1 presents the distribution of fall-related injuries of people with different educational levels. There was an obvious variation in fall-related injuries among people with different education levels. Fall-related mortality and morbidity were inversely related to victims' educational levels. Those with a lower educational level had higher fall-related injury rates in all settings. Individuals with their educational level under primary school were more likely to suffer from fall-related injuries, accounting for 72.66% of all deaths and 49.24% of the nonfatal cases respectively. This group of people had the highest mortality and morbidity rates (74.47 per 100 000 populations and 33.96 per 1000 populations, respectively) compared with other groups (Chi-Square is 93.58; $P<0.001$ for mortality, Chi-Square is 290.69, $P<0.001$ for morbidity)

Individuals with an educational level of junior middle school or senior high school represented 22.68% of all fatalities and 44.24% of the nonfatal cases respectively. Individuals with a college or higher degree had lower rates of fall-related injuries. This group only had 4.63% of fatalities and 6.52% nonfatal cases respectively.

Table1. Distribution of Fall-related Injuries by Different Educational Level, Shanghai, 2003-2010

Educational Level	Fatalities			Non-fatalities		
	N	Proportion (%)	Mortality (per 100 000)	*N*	Proportion (%)	Morbidity (per 1000)
Under Primary School	11 057	72.66	74.47	325	49.24	33.96
Junior middle school/Senior high school	3 451	22.68	5.48	292	44.24	11.02
College degree or above	709	4.66	2.96	43	6.52	6.20
Total	15 217	100.00	13.98	660	100.00	16.20

Note. (Chi-Square is 93.58; $P<0.001$ for mortality, Chi-Square is 290.69, $P<0.001$ for morbidity).

Table 2 shows the estimated costs of total fall-related injuries in Shanghai in 2006. In general, the total annual cost was approximately 2 622 669 490 CNY (US$ 415 955 382) in 2006. Health care costs, derived from the costs borne directly by victims and/or public agencies/organizations for the medical treatment and events relevant to care, were estimated using information on those composed of the five different conditions of severity. Total direct medical treatment cost was approximately 1 042 600 804 CNY (US$ 165 356 488) in 2006. In addition, the cost related with lost or impaired ability to work due to morbidity or mortality was also estimated. The total productivity loss cost was about 1 580 068 686 CNY (US$ 250 598 894). During this period, the total of GDP on the healthcare system, social security and welfare industries was 10.125 billion CNY (US$ 1 605 825 000) in Shanghai in 2006, 25.90% of which was allocated and spent to ease the burden of total fall-related injuries.

Table2. Estimated Fall-related Injury Costs in 2006, Shanghai

Items	Fees (CHY)
Total direct medical treatment costs	1 042 600 804
Total productivity loss costs	1 580 068 686
From moderate cases who sought medical care but were not admitted in a hospital	663 545 616
Form serious cases-- Hospitalized without permanent disability	476 530 667
From severe cases with permanent disability	141 319 987
Inpatients in fatal end	39 701 534
From fatal and permanent disability cases aged 15-64 years	258 970 882
Total costs	2 622 669 490
The total of GDP of the health, social security and welfare industries	10 125 000 000
Fall-related injury costs/ The total of GDP of the health, social security and welfare industries (%)	25.90

DISCUSSION

Data from this study indicate that the fall-related mortality rate in Shanghai was higher than the national rate of 6.75 deaths per 100 000 people, and also higher than the worldwide average of 6.6 per 100 000[17]. Fall-related injury is the second leading cause of unintentional injury mortality and accounts for 11% of all unintentional injury deaths worldwide[14]. The ranking of the top three leading causes of death in Shanghai is falls, traffic-related injuries and suicides, while in the United States it is traffic-related injury, poison and falls[8,18]. Our findings showed that about 31.00% of deaths caused by injuries were fall-related. And fall-related injuries are therefore a major public health challenges faced in Shanghai. The burden of total fall-related injuries contributes to 25.90% of the GDP on the healthcare system, social security and welfare industries in Shanghai.

Our results suggested that the U5MR was group with the highest risks for fall-related injuries among children aged 0-14 years. Therefore, appropriate prevention programs are needed to be initiated and implemented for this group. Some programs that have effectively reduced falls among children in high-income countries, such as the "Children Can't Fly" program developed by New York health authorities to combat the high mortality and morbidly of children due to falls from windows[19], would be considered as the reference for relevant departmental agencies as well as health authorities at all level in China.

Our findings showed that the frequency of falls was inversely related to victims' educational levels, which may be an important risk factor for fall-related injuries in China. Individuals with an educational level lower than primary school accounted for 72.66% of all fatalities and 49.24% of the injuries. This could be explained by the lack of resources to learn information on how to prevent injuries. The lack of the knowledge therefore leads to the absence of preventive measures and activities. Some Chinese people believe that falls are normal events due to aging, and are not preventable. Although increasingly being recognized and emphasized, there is few research report investigating the relationship between the educational level and falls in low-income settings in China.

Elder adults occupied a disproportionate share of the fall-related injuries. The relationship between age and falls is partly explained by physiologic changes in the process of aging, including impaired vision, osteoporosis, declining strength, worsened cognition, loss of balance and flexibility[20-25]. The percentage of elder population has been increasing in Shanghai in recent years. The proportion of people aged 65 or above increased from 14.51% in 2001 to 16.00% in 2010[7,26]. Among the deaths due to falls, 86.23 percent was the people from this age group. The risk of fall-related injuries or deaths began to increase dramatically from the age of 55 for females and 60 for males. Compared to New York City, the injury death rate of Shanghai is much higher among the age group of 75 or above[8,18]. The demographic transition will therefore surely lead to an increase of the falls among elder adults and will impose a commensurate burden on families and health-care systems in the coming years.

Men are more likely to experience fatal falls than women while women are more likely to experience nonfatal falls[27]. Our data reflected that fall-related mortality rates for the male exceeded those for the female till the age of 79, which may be explained that men are more physically active or more likely to be engaged in risky behaviors or to experience different circumstances of falls compared to women. Moreover, women aged 80 years or above had a higher rate of death from falls than men, primarily because men have shorter life expectancy than women. Female and male life expectancy was 84.44 and 79.82 respectively in 2010 in Shanghai and the proportions of males and females was 45.7% and 54.3% respectively[7]. The morbidity rates for females aged 55 or above were higher than those of males. The above results suggest that people in this age group be target group for the intervention.

Community-based programs focusing on strength and balance training and vision improvement among the elderly, have shown that vitamin D supplementation and home environment modification have demonstrated effective effects in preventing falls. Meanwhile, many programs based on exercises for balance improvement, medication management and home modification have proven to be cost-effective in high-income countries[28-35]. Community-based comprehensive and effective programs for fall prevention and control needed to be initiated and implemented. In China, the current health system reform includes a responsibility system of family doctors, who offer personalized care and whole-process health management by setting up a long-term relationship between general

practitioners and contracted families. This platform can provide better public health services. Comprehensive programs for fall prevention should be therefore integrated into this system to reduce the risk of fall-related injuries.

CONCLUSIONS

Age and education are the major factors related to morbidity and mortality of fall-related injuries in Shanghai. Children under the age of 5, women over 55 and men over 60 with an educational level lower than primary school are recognized as target populations for reducing the fall-related risk. One-fourth of the GDP on the healthcare system, social security and welfare industries is allocated and spent to ease the burden of fall-related injuries in Shanghai. Comprehensive fall prevention programs should be integrated into the service system of family doctors for the risk reduction strategies and intervention activities.

ACKNOWLEDGEMENTS

We are thankful to all the colleagues from 19 administrative districts of Shanghai, China for their effort and contribution for the data collection work.

REFERENCES

1. Wang SY, Li YH, Chi GB, et al. Injury-Related Fatalities in China: An Under-Recognized Public-Health Problem. The Lancet, 2008; 372, 1765-73.
2. Disease Prevention and Control Bureau of Ministry of Public Health. Report on Injury Prevention in China. Beijing: People's Medical Publishing House, 2007; 7-8. (In Chinese)
3. Ministry of Health of the People's Republic of China. China health statistical yearbook(2002)[M]. Beijing: Peking Union Medical College Press, 2002; 7. (In Chinese)
4. Ministry of Health of the People's Republic of China. China health statistical yearbook(2010)[M]. Beijing: Peking Union Medical College Press, 2010; 8. (In Chinese)
5. Doll LS, Bonzo SE, Mercy JA, et al. Handbook of Injury and Violence Prevention. New York: Springe, 2006; 49.
6. Shanghai Municipal Statistics Bureau. Shanghai Statistical Yearbook 2011. Shanghai: China Statistics Press, 2011; 305. (In Chinese)
7. Shanghai Research Center On Aging. A Report of Shanghai Aging population, 2010.Retrieved March 16, 2012, from http://www.shrca.org.cn/4113.html. (In Chinese)
8. Shanghai Municipal Statistics Bureau. Shanghai Heath Yearbook. Shanghai: China Statistics Press, 2002; 541. (In Chinese)
9. McClure R, Turner C, Peel N, et al. Population based interventions for the prevention of fall-related injuries in older people. Cochrane Database Syst Rev, 2005; 1, CD004441.
10. Lyons RA, Sander LV, Weightman AL, et al. Medication of the home environment for the reduction of injuries. Cochrane Database Syst Rev, 2003; 4, CD003600.
11. Yoshida S. A global report on falls prevention: Epidemiology of falls. Geneva: World Health Organization, 2007. Available from: http://www.who.int/ageing/projects/ 1.Epidemiology%20of%20falls%20in%20older%20age.pdf/
12. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, Tenth Revision. Volume 1. Geneva: World Health Organization, 1992; 709-888.
13. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, Tenth Revision. Volume 2: Instruction Manual. Geneva: World Health Organization, 1993; 12-77.
14. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, Tenth Revision. Volume 3: Alphabetical Index. Geneva: World Health Organization, 1993; 21-85.
15. Polinder S, Toet H, Martien M, et al. Methodological approaches for cost-effectiveness and cost-utility analysis of injury prevention measures, Denmark: World Health Organization Regional Office for Europe, 2011. Available from: http://www.euro.who.int/__data/assets/pdf_file/0007/144196/e95096.pdf
16. Lindahl BIB, Glattre E, Lahti R, et al. The WHO principles for registering causes of death: suggestions for improvement. J Clin Epidemiol, 1990; 43(5), 467-74.
17. World Health Organization. The global burden of disease: 2004 update. Geneva: World Health Organization; 2008. Available from: http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf [accessed March 17, 2012]
18. Centers for Disease Control and Prevention. WISQARS fatal injury reports, national and regional, 1999-2009. 2012, Retrieved from http://webappa.cdc.gov/sasweb/ncipc/mortrate10_sy.html
19. Spiegel CN, Lindaman FC. Children can't fly: A program to prevent childhood morbidity and mortality from window falls. 1977. Inj Prev, 1995; 1, 194-8, doi: 10.1136/ip.1.3.194 pmid: 9346026.
20. Campbell AJ, Robertson MC, Gardner MM, et al. Falls prevention over 2 years: a randomized controlled trial in women 80 years and older. Age Ageing, 1999; 28, 513-8.
21. Rossiter-Fornoff JE, Wolf SL, Wolfson LI, et al. A cross-sectional validation study of the FICSIT common data base static balance measures. Frailty and Injuries: Cooperative Studies of Intervention Techniques. J Gerontol A Biol Sci Med Sci, 1995; 50, 291-7.
22. Speechley M, Tinetti M. Falls and injuries in frail and vigorous

community elderly persons. J Am Geriatr Soc, 1991; 39, 46-52.
23. Mills KM, Stewart AL, King AC, et al. Factors associated with enrollment of older adults into a physical activity promotion program. J Aging Health, 1996; 8, 96-113.
24. Peel NM, Kassulke DJ, McClure RJ. Population based study of hospitalized fall related injuries in older people. Inj Prev, 2002; 8, 280-3.
25. Yu PL, Qin ZH, Shi J, et al. Prevalence and related factors of falls among the elderly in an urban community of Beijing. Biomed Environ Sci, 2009; 22, 179-87.
26. Shanghai Research Center On Aging. A Report of Shanghai Aging population, 2001. Retrieved March 167 2012, from http://www.shrca.org.cn/442.html. (In Chinese)
27. Stevens JA, Sogolow ED. Gender differences for non-fatal unintentional fall related injuries among older adults. Inj Prev, 2005; 11, 115-9.
28. Gates S, Fisher JD, Cooke MW, et al. Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: systematic review and meta-analysis. BMJ, 2008; 336, 130-3, doi: 10.1136/bmj.39412.525243.BE pmid: 18089892.
29. Gillespie L. Preventing falls in elderly people. BMJ, 2004; 328, 653-4, doi: 10.1136/bmj.328.7441.653 pmid: 15031213.
30. McClure R, Turner C, Peel N, et al. Population-based interventions for the prevention of fall-related injuries in older people. Cochrane Database Syst Rev, 2005; 1, CD004441- pmid: 15674948.
31. Cumming RG. Intervention strategies and risk-factor modification for falls prevention. A review of recent intervention studies. Clin Geriatr Med, 2002; 18, 175-89, doi: 10.1016/S0749-0690(02)00004-6 pmid: 12180242.
32. Tinetti ME. Clinical practice. Preventing falls in elderly persons. N Engl J Med, 2003; 348, 42-9, doi: 10.1056/NEJMcp020719 pmid: 12510042.
33. Gillespie LD, Robertson MC, Gillespie WJ, et al. Interventions for preventing falls in older people living in the community. Cochrane Database Syst Rev, 2009; 2, CD007146- pmid: 19370674.
34. Robertson MC, Devlin N, Scuffham P, et al. Economic evaluation of a community based exercise program to prevent falls. J Epidemiol Community Health, 2001; 55, 600-6, doi: 10.1136/jech.55.8.600 pmid: 11449021.
35. MacCulloch PA, Gardner T, Bonner A. Comprehensive fall prevention programs across settings: a review of the literature. Geriatr Nurs, 2007; 28, 306-11, doi: 10.1016/j.gerinurse.2007.03.001 pmid: 17923287.