



Risk factors of indoor fall injuries in community-dwelling older women: A prospective cohort study



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ABSTRACT

The aims of the study were to explore the characteristics and the potential risk factors of indoor fall injuries in community-dwelling older women, and to provide evidence for the future intervention strategy. A prospective cohort of 3043 women aged 60 years old and above from 3 selected counties in Shanghai was followed up on the outcomes of indoor fall injuries for up to 1 year. Demographic and health data were collected during admission; the physical function, balance ability and home-living environment were examined by a structured questionnaire when admitted. The outcome of indoor fall injury was investigated by a visit in month 3, month 6 and month 12 after baseline survey. Univariate analysis and Multiple Logistic Regression Model were used to examine the associations between potential risk factors and outcomes of indoor fall injuries. Two hundred and thirty-one of the 3043 women (7.6%) eventually suffered indoor fall injuries at least once during the 1-year follow-up. The injurious falls of women were significantly associated with age, educational level, marital status, health status, balance ability, physical activity and home-living environment in the univariate analyses. Women who worried about falls and restrained activities for it were more likely to suffer fall injury. Younger women, with less chronic disease, with good balance ability and living in good corridor environment, were less likely to receive fall injury in multiple logistic regression analyses. Multidimensional factors were associated with indoor fall injuries for community-dwelling older women. Proper clinical treatment of chronic disease and improvement of women's balance ability, as well as reducing the risk factor of indoor environment, which will play vital roles in preventing indoor fall injuries, should be prioritized for the intervention strategy.

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1. Introduction

Falls are one of the most challenging issues of public health among older women and have serious health and social consequences (Bergland, Jarnlo, & Laake, 2003; Hill, Schwarz, Flicker, & Carroll, 1999; Leslie & Roe, 2003). In Caucasian populations, more than 40% community-dwelling women aged 65 years and older will fall at least once a year, and many of them will result in injuries (Leslie & Roe, 2003). The median fall rate reported for Chinese populations is 18% (Kwan, Close, Wong, & Lord, 2011). Falls are estimated to account for 40% of the lifetime injury costs for women (Moller, 2002). They may result in negative health consequences, such as limitations in everyday activities and severe injuries including hip fracture,

which leads individuals to be bedridden or even to death (Howland et al., 1998; Tinetti, Gordon, Sogolow, Lapin, & Bradley, 2006). Generally, falling is referred to as one of the geriatric syndromes because of its complex occurrence mechanisms resulting not only from one or more discrete diseases but also from accumulated effects of impairments in multiple systems (Flacker, 2003; Tinetti, Williams, & Gill, 2000). So a fall prevention program with interventions to address multiple fall risk factors is intensively required (Filiatrault et al., 2007; Rizzo et al., 1998).

Multiple falls or fall injuries risk factors, such as demographic status, socioeconomic characteristics, and health status, in community-dwelling older adults were identified in previous studies (Harwood, 2001; Krueger, Brazil, & Lohfeld, 2001; Sherrington et al., 2010; Steinman, Pynoos, & Nguyen, 2009; Unsworth & Mode, 2003). However, being affected by the uncertainty associated with diverse study design and subject resource, the findings vary from different studies with regard to some factors. Previous studies showed the associations of gender,

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race, marital status, and education with the falls (Gama & Gomez-Conesa, 2008; Peterson, 1986). It is also reported that medical conditions (e.g., cancer, diabetes, heart disease) and their risk factors (e.g., smoking, alcohol drinking) are known to be associated with fall risk (Gunn, Creanor, Haas, Marsden, & Freeman, 2013; Kannus, Sievanen, Palvanen, Järvinen, & Parkkari, 2005; Pang & Eng, 2008; Stone, Lawlor, Savva, Bennett, & Kenny, 2012). Additionally, functional impairments (e.g., limitations in activities of daily living [ADL]) and physical limitations (e.g., bending knees) generally increase fall risks because these limitations translate into additional burdens on regular everyday activities (Farrell, Rutt, Lusardi, & Williams, 2011; Kwan, Lin, Chen, Close, & Lord, 2011; Smee, Anson, Waddington, & Berry, 2012; Yamashita, Noe, & Bailer, 2012). Environmental hazards also play an important role in the context of falls because some risk factors such as functional limitations may be influenced by individuals' living environments (Clemson, Mackenzie, Ballinger, Close, & Cumming, 2008; Iwarsen, Horstmann, Carlsson, Oswald, & Wahl, 2009). Thus it must be suggested on the need to examine all risk factors in a fall study.

At present most fall studies focused on older Caucasian populations, while falls data from the Chinese population was relatively rare. With the rapid aging of Chinese population, studies on older Chinese are urgent. In previous studies, we find that more than 40% elderly falls occurred indoor, and women have higher incidence than men (Xia Qinghua, 2010). Some studies showed that the risk factors of indoor and outdoor falls are different (Bergland et al., 2003). Older age and being female are significantly associated with the indoor injurious falls (Kelsey et al., 2010). Focusing on the demographic, clinical, psychological, and home-living environmental factors, we purposefully explored the possible links with various determinants predicting indoor falls in a sample of older women in East China.

2. Materials and methods

2.1. Subjects

This is a home-based prospective cohort study. The subjects were community-dwelling women from three random selected counties (1221 were from Huayang County, 1011 from Xinhua County and 860 from Chengqiao County) in Changning District, Shanghai, China. Stratified random sampling was applied to determine the inclusion counties by their size, economical level and location. Families with women aged 60 and above were randomly selected with relatively equal number for every county. Subjects were first administered in 2010 with follow-up in 2011. Women who reported in 2010 of losing the ability to walk independently following a serious fall injury within the previous year were excluded. According to the approved statement of Institutional Review Board (IRB) of Changning Center for Disease Control and Prevention, all subjects were requested to sign the Informed Consent for participation in the study.

For the purpose of this study, a fall is defined as 'sudden, involuntary and unexpected landing on the ground or assumption of the horizontal position with or without loss of consciousness or injury reported either by the faller or witness' (Robbins et al., 1989) (does not include stumbles, trips); women having falls outdoors were excluded in the present study. For women who suffered from indoor fall injury twice or more times, only the most severe injury event was included.

2.2. Data collection

A trained interviewer team was responsible for collecting information including demographic characteristics, such as birth date, marital status (single/divorced/widowed, married),

education level, residential registration (permanent/temporary), and health conditions (with chronic disease, self-assessment of health, visual ability, hearing, somatosensory, language skill) using a structured questionnaire. Data on life style such as sleep habit (regular, irregular) and drinking habit (no, sometimes, often) were also included. The physical function including physical activity and balance ability was examined by an investigator on site. The home-living environment was also observed when interviewed. The outcomes of indoor fall injury (e.g., injury time, injury locus, injury nature and treatment) were ascertained during follow-up by a visit (at month 3, month 6 and month 12 after baseline survey, respectively) by general practitioners. The age was classified into 4 subgroups with roughly equal number of cases in each group. The education level was ranked into 4 levels, i.e., primary school and below, junior middle school, senior middle school, and college and above.

The physical activity was scaled by number of times in a normal week, as none (0), low (1–3 times), moderate (4–6 times), and high (everyday/almost every day). The balance ability including posture and gait was also examined by a structure scale with 12 items. The ability of posture is examined by the time duration in which people can keep the four different postures, which is scored as 0 (≥ 10 s), one (5–9 s) and two (0–4 s). The gait scale includes eight actions. Every item is scored as 0 (can achieve) and one (cannot achieve). The balance ability scale total scored between 12 and 28, representing the best and the worst (Jiang Yu, 2011). The balance ability for all subjects was then graded into 4 levels according to score: (1) good (level 1) – scores = 12; (2) Moderate (level 2) – scores ranged 13–21; (3) Severe (level 3) – scores ranged 22–25; (4) Major (level 4) – scores ≥ 26 . The home-living environment was assessed by a scale regarding as unsafe items in corridor, bedroom, living room, kitchen, lavatory and balcony. Every item is scored as 0 (inexistence) and one (existing), and environment is examined by subgroup scores and total scores.

2.3. Statistical analyses

Fall outcome was defined as binary (suffer/not suffer). The descriptive results were presented by median and mean \pm standard deviation (SD) for the continuous variables or by percentage for the categorical ones. Pearson's Chi-Square was employed to compare the proportions of fall injury outcome among the categories of the independent variables. Likelihood Ratio (LR) Forward stepwise regression was carried out to estimate the odds ratios (OR) of the independent variables for which the univariate analysis returned a p -value < 0.05 after multicollinearity was checked for, which means variables had collinearity with each other. The probabilities for entry and removal were 0.05 and 0.10, respectively. No multicollinearity was considered when the tolerance was above 0.1.

The data were double entered and automatically checked with EpiData 3.0; and the statistic analyses were performed on SPSS 19.0 (SPSS Inc., IL, USA). All p values were two-tailed at the significant level of $\alpha = 0.05$.

3. Results

3.1. Characteristics of the subjects

A total of 3092 women aged 60 and above were recruited in this survey, among which 49 cases were lost for the follow-up survey (22 were from Huayang County, 15 from Xinhua County and 12 from Chengqiao County), with a successful response up to 98.4%.

The median age of the 3043 participants was 71.0 years (60.0–98.0 years old) and the standard deviation was 8.3 years. Over 80% of them were having permanent residential registration, and 71.5%

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