

# Risk Factors for Falls Among Elderly Men in a Veterans Home

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**Background:** Falls are major causes of mortality and morbidity in the elderly. Cognitive dysfunction, poor physical function and medical comorbidities are associated with many factors contributing to falls. The main purpose of this study was to explore the risk factors of falls among older institutionalized Chinese men in Taiwan.

**Methods:** Residents aged over 65 in a veterans care home in northern Taiwan were enrolled for study after they gave their full consent. Falling was defined as a fall within the past 180 days as defined by the Minimum Data Set (MDS). Physical function was determined by MDS resource utilization group activity of daily living score (RUG ADL score). Cognitive status was measured by MDS cognition scale (MDS COGS).

**Results:** In total, 585 residents (mean age, 80.9 ± 5.4 years) were enrolled. Among all study subjects, 92.8% were physically independent and 20.2% were moderately cognitive impaired according to MDS COGS. By definition, 48 subjects (8.2%) had a past history of fall. Compared with non-fallers, fallers were significantly older (82.4 ± 5.5 years vs. 80.7 ± 5.4 years;  $p=0.047$ ) and had poorer functional status according to the MDS RUG ADL score (5.0 ± 2.3 vs. 4.3 ± 1.6;  $p=0.044$ ). Subjects with past history of anxiety disorder and cardiovascular disease were more prone to fall, and subjects who took hypnotics were also at a higher risk of falling. By using multivariate logistic regression, we found that higher RUG ADL score (odds ratio [OR], 1.18; 95% confidence interval [CI], 1.08–1.37;  $p=0.017$ ) and hypnotic use (OR, 2.0; 95% CI, 1.0–4.1;  $p=0.048$ ) were both independent risk factors for falls.

**Conclusion:** The prevalence of fall in the past 180 days was 8.2% among elderly residents in a veterans care home in northern Taiwan. The independent risk factors for falls in this setting included poorer functional status and hypnotic use. [*J Chin Med Assoc* 2008;71(4):180–185]

**Key Words:** accidental falls, cognition, elderly, geriatrics, risk factors

## Introduction

Falls and related injuries are major issues of care in the elderly because of associated mortality and morbidity. In the elderly population, falls are a significant cause of hospital admission and nursing home placement.<sup>1</sup> A study of care homes in England showed that residents fell 2–6 times a year on average.<sup>2</sup> About a third of falls in hospitals and care homes resulted in various physical injuries, of which 3–5% were fractures.<sup>3</sup> In

addition to physical injuries, falls have tremendous impact on the elderly in terms of loss of function, anxiety, depression, increased hospital length of stay and increased economic burden.<sup>4–6</sup>

Dementia is common in the elderly; the prevalence was 5.9–9.4% in community-dwelling elderly and 57.2% among residents living in long-term care facilities.<sup>7,8</sup> Also, cognitive dysfunction shares many common risk factors with falls, such as comorbidities, visual impairment, muscle strength and balance.<sup>9,10</sup> Nevitt



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et al found that fall-related injuries were associated with poorer performance in trail making test, a screening tool for subcortical dementia.<sup>11</sup> Furthermore, poorer ability of immediate recall was predictive for falls,<sup>12</sup> and demented nursing home residents had a 2-fold greater risk of falling than non-demented residents.<sup>13</sup> However, Oliver et al found no significant association between falls and dementia or cognitive impairment in a meta-analysis.<sup>14</sup> Although hundreds of risk factors for falls have been reported in Western countries, similar studies are lacking in Taiwan, especially in veterans care homes (VCH). Therefore, our main purpose was to explore the potential risk factors for falls among elderly Chinese men living in a VCH in Taiwan.

## Methods

### Participants

Residents of a VCH in northern Taiwan were recruited for this study and were enrolled after giving consent. The Chinese version of Minimum Data Set (MDS) Nursing Home 2.1 was implemented, and several related studies were initiated simultaneously. All subjects were interviewed by trained research nurses. Past medical history, as well as psychotropic agent and hypnotic use, were recorded according to the available medical records in the VCH. The entire study was approved by the Ethics Committee of National Yang Ming University and the InterRAI headquarters.

### Measures

#### Falls

Falls were defined by combining the result of MDS item section J4a (fall in the past 30 days) and J4b (fall in the past 31–180 days) (Appendix A). Subjects were defined as fallers when J4a or J4b was positive.

#### Physical function

The physical function of the residents was determined by MDS resource utilization group activity of daily living (RUG ADL) score, which included eating, bed mobility, transferring and toileting<sup>15</sup> (Appendix B). Subjects who were classified as independent in all 4 items were considered physically independent.

#### Cognitive function

Cognitive function was evaluated by MDS Cognitive Scale (Appendix C), which classified all subjects into “intact–mild impairment”, “mild–moderate impairment”, “moderate–severe impairment” and “severe–very severe impairment”.<sup>16</sup>

### Statistical analysis

Data of continuous variables in the text and tables were expressed as mean  $\pm$  standard deviation. Serial comparisons between subjects with and without falls were performed by Student's *t* test,  $\chi^2$  test or Fisher's exact test when appropriate. Multivariate logistic regression model was used to evaluate independent factors for falls. For all tests, statistical significance was defined as  $p < 0.05$ . SPSS version 12.0 software (SPSS Inc., Chicago, IL, USA) was used to perform all statistical analyses.

## Results

In total, 585 residents (mean age,  $80.9 \pm 5.4$  years) were enrolled; 354 of them had been living in the VCH for over 5 years. Among all study subjects, 92.8% were physically independent and 20.2% were mildly to moderately cognitive impaired according to MDS COGS (Table 1). By definition, 48 subjects (8.2%) had a history of falls. Compared to subjects without a history of falls, fallers were significantly older ( $82.4 \pm 5.5$  years *vs.*  $80.7 \pm 5.4$  years;  $p = 0.047$ ) and had poorer functional status according to the MDS RUG ADL score ( $5.0 \pm 2.3$  *vs.*  $4.3 \pm 1.6$ ;  $p = 0.044$ ). Moreover, subjects with a past history of anxiety disorder and cardiovascular disease were more prone to falling and subjects who took hypnotics also had a higher risk of falls (Table 2). Cognitive function was similar between subjects with and without a history of falls (Table 3). By using multivariate logistic regression, we found that higher RUG ADL score and hypnotic use were both independent risk factors for falls (Table 4).

**Table 1.** Demographic data of the 585 male study subjects

	n (%)
Age*	$80.9 \pm 5.4$ yr
Institutionalization	
< 5 yr	231 (39.5)
$\geq 5$ yr	354 (60.5)
In the same institute	332 (93.8)
MDS COGS	
Intact–mild impairment	467 (79.8)
Mild–moderate impairment	118 (20.2)
Moderate–severe impairment	0 (0)
Severe–very severe impairment	0 (0)

\*Data presented as mean  $\pm$  standard deviation. MDS COGS = minimum data set cognition scale.

**Table 2.** Comparison between subjects with and without a history of falls in the past 180 days\*

	Without history of falls (n=537)	With history of falls (n=48)	p
Age (yr)	80.7±5.4	82.4±5.5	0.047 <sup>†</sup>
MDS RUG ADL score	4.3±1.6	5.0±2.3	0.044 <sup>†</sup>
MMSE	26.7±3.8	26.0±4.7	0.208
Medical history			
Hypertension	50.5	56.3	0.442
Diabetes mellitus	19.6	18.8	0.893
Cardiovascular disease	5.2	12.5	0.039 <sup>†</sup>
Stroke	9.3	6.4	0.503
Parkinson's disease	3.2	2.1	0.693
Osteoporosis	0.7	2.1	0.335
Osteoarthritis	14.3	8.3	0.349
Depression	2.0	6.3	0.068
Anxiety	0.2	2.1	0.031 <sup>†</sup>
Psychotropic agent use	7.6	12.5	0.235
Hypnotic use	14.2	29.2	0.006 <sup>†</sup>

\*Data presented as mean ± standard deviation or %; <sup>†</sup>significant difference. MDS RUG ADL score = minimum data set resource utilization group activity of daily living score; MMSE = Mini-Mental State Examination.

**Table 3.** Comparison of cognitive function between subjects with and without a history of falls in the past 180 days

MDS COGS	Total	Without history of falls	With history of falls	p
Intact–mild impairment	467	429 (91.9%)	38 (8.1%)	0.853
Mild–moderate impairment	118	108 (91.5%)	10 (8.5%)	
Total	585	537	48	

MDS COGS = minimum data set cognition scale.

**Table 4.** Independent risk factors for falls among 585 residents in a veterans home

Item	Odds ratio	95% confidence interval	p
MDS RUG ADL score	1.18	1.08–1.37	0.017*
Hypnotic use	2.02	1.00–4.06	0.048*
Age			0.076
MDS COGS			0.357
Cardiovascular disease			0.210
Anxiety disorder			0.214

\*Significant difference. MDS RUG ADL score = minimum data set resource utilization group activity of daily living score; MDS COGS = minimum data set cognition scale.

## Discussion

The issue of elderly care is unique whether in the community<sup>17</sup> or in long-term care facilities.<sup>18</sup> It has been reported that half of the residents in long-term care facilities may fall at least once every year,<sup>19</sup> which is significantly different from the result of this study (8.2% residents reported a history of falls in the preceding 180 days). However, a report from another

VCH in southern Taiwan found that the incidence of falls among VCH residents was only 3.1% in the past 3 months.<sup>20</sup> Such a significant difference in epidemiologic results may be explained by the relatively preserved physical functional status among VCH residents, but under-reporting of falls is another possible explanation.

Falls may result in profound adverse effects on the elderly, with or without physical injuries. Preventive

strategies for falls in hospitals and long-term care facilities are still insufficient.<sup>14</sup> Therefore, it is essential to identify the target population at most risk of falls to maximize the effectiveness of any proposed intervention. A previous study showed that the incidence of falls increased with age because of aging and multiple comorbid pathologies,<sup>21</sup> which was also the case in this study. Physical function is an important component of healthy life, but the relationship between physical function and falls is complex. Muscle strength and endurance decline progressively after the fifth decade of life,<sup>22</sup> which may cause impairment of physical function and dependence in activities of daily living. With significant muscle strength and endurance decline, elderly people are often unable to prevent a trip or slip from becoming a fall. Muscle weakness, a well established risk factor for falls,<sup>23</sup> may make advancing age an unavoidable risk factor for falls.

In addition to older age and functional status, we also found that past history of cardiovascular disease, anxiety and hypnotic use were all significantly related to past history of falls in the VCH. The association between cardiovascular disease, anxiety and falls may be secondary to drug therapy. Patients with cardiovascular disease were frequently treated by antihypertensives, diuretics and nitrate-containing agents, which are all associated with postural dizziness and falls. Moreover, anxiolytic agents, mostly benzodiazepines, also had a strong association with falls. However, a comprehensive drug list for every study subject was not available in this study, except psychotropic agents and hypnotic use. Further investigation is needed to clarify the possible link between falls and cardiovascular disease or anxiety. Additionally, the medical diagnosis mainly came from chart review and self report, which needs further confirmations.

The association between cognitive deficits and falls had been described extensively.<sup>11-13</sup> Nevertheless, such an association was not observed in this study, which was similar to the result of the meta-analysis done by Oliver et al.<sup>14</sup> Changes in equilibrium and limb coordination may be evident in the early stage of mild cognitive impairment,<sup>24</sup> which implies a higher risk of falls among cognitively impaired subjects. However, compared with the Mini-Mental State Examination, the MDS COGS has a lower rate of detecting mild cognitive impairment.<sup>25</sup> Inability to identify residents with mild cognitive dysfunction may overestimate the incidence of falls in the cognition intact group. In fact, VCH in Taiwan are similar to assisted living settings in other countries. All VCH residents basically share quite homogeneous conditions in cognition, functional status and many other characteristics. Residents with

significant behavioral problems may be referred to the mental health care system in veterans' hospitals. All these situations should be taken into consideration when interpreting our study results. Furthermore, this study employed a cross-sectional design to explore the risk factors for falls but not a case-control design. Therefore, a significant difference in case number between fallers and non-fallers may be unavoidable. To overcome this limitation, a prospective case-control study is needed.

In conclusion, in a VCH in northern Taiwan, residents with older age, poorer physical functional status, past medical history of cardiovascular disease, anxiety disorder or current hypnotic users were more prone to falls. However, functional status and hypnotic use were the only independent risk factors for falls in this VCH in Taiwan.

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**Appendix A.** Fall definition in Minimum Data Set
 

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ACCIDENTS	(Check all that apply) Fell in past 30 days (J4a) Fell in past 31–180 days (J4b)
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**Appendix B.** RUG-III ADL index in Minimum Data Set
 

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ADL variable	Score
Bed mobility, toilet use, and transfer:	
Independent or supervision	1
Limited assistance	3
Extensive assistance or total dependence:	
Other than 2-person physical assist	4
2 or more persons physical assist	5
Eating:	
Independent or supervision	1
Limited assistance	2
Extensive assistance or total dependence	3

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**Appendix C.** MDS COGS scoring sheet

MDS item	MDS scoring	MDS COGS scoring (max score = 10)*
<b>Cognitive patterns</b>		
Short-term memory	memory problem = 1 memory OK = 0	memory problem = 1 memory OK = 0
Long-term memory	memory problem = 1 memory OK = 0	memory problem = 1 memory OK = 0
Location of own room	does not recall = 0 does recall = 1	does not recall = 1 does recall = 0
Knows he/she is in a nursing home	does not recall = 0 does recall = 1	does not recall = 1 does recall = 0
No orientation items recalled	none recalled = 1 otherwise = 0	none recalled = 1 otherwise = 0
Decision-making	independent = 0 modified independence = 1 moderately impaired = 2 severely impaired = 3	independent = 0 modified independence = 1 moderately impaired = 2 severely impaired = 3
<b>Communication patterns</b>		
Making self understood	understood = 0 usually understood = 1 sometimes understood = 2 never/rarely understood = 3	understood = 0 usually understood = 0 sometimes understood = 0 never/rarely understood = 1
<b>Physical functioning</b>		
Dressing self performance	independent = 0 supervision = 1 limited assistance = 2 extensive assistance = 3 total dependence = 4	independent = 0 supervision = 0 limited assistance = 0 extensive assistance = 0 total dependence = 1

\*Scores 0 and 1 represent cognitively intact-mild impairment, scores 2-4 represent cognitively mild-moderate impairment, scores 5-8 represent cognitively moderate-severe impairment, and scores 9 and 10 represent cognitively severe-very severe impairment.