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Short Communication

Exploring factors contributing to falls in home-dwelling older adults: A cross-sectional study in Northeastern Thailand

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Abstract

Falls are the most common accidents among older adults in home settings. Older adults experience falls due to several risk factors. In 2005, Thailand became an aging society, with projections indicating that by 2021, older adults would represent the majority of the population, and by 2035, approximately 30 percent of the population would be older adults. Approximately 3 million fall episodes transpire among older adults each year in Thailand, leading to almost 60,000 hospitalizations. The aim of this study was to examine the factors associated with falls among older adults in northeastern Thailand, hypothesizing that characteristics such as cognitive capacity, visual acuity, hearing acuity, balance ability, and mobility are associated with fall risk in this population. A cross-sectional analytical study involved 264 older adults aged 60 years or older using a questionnaire and a battery of tests that assessed the participants' cognitive capacity, eyesight proficiency, hearing ability, balancing ability, and mobility. The variables that exhibited a statistically significant association ($p<0.05$) were employed in a binary logistic regression analysis. The results revealed that falls among home-living older adults were significantly associated with sex, family size, congenital issues, and mobility. Older adults who were female and had a large family, congenital disorders, or mobility impairments were at a higher risk of falls, which emphasizes the need for personalized prevention strategies. It is recommended to adopt a proactive healthcare strategy to prevent falls and ensure safe living conditions. Interventions aimed at improving balance, mobility, and mental health, as well as encouraging an active lifestyle, may reduce the risk of falls among older adults living in the community. The findings may aid private and government agencies in developing effective fall prevention programs for older adults living at home.

Keywords: Falls, older adults, cognitive capacity, balancing ability, mobility ability

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Introduction

Falls are the most common accidents among older adults in home settings [1,2], driven by various risk factors, including muscle weakness, balance and vision impairments, chronic medical conditions (such as diabetes or arthritis), certain medications, and home hazards [3-5]. Patients with cognitive impairments, including dementia and Alzheimer's disease, exhibit a heightened risk of falling compared to those without such impairments [6]. Additionally, fall rates are higher

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in women and increase in both sexes with worsening blindness and visual impairment [3,7]. Impaired attention and executive function are associated with decreased walking speed, instability, and an increased risk of future falls [8,9]. Consequently, the Mini-Cog, a cognitive assessment tool, is frequently employed to identify individuals at risk of falling [10]. Additionally, the Timed Up and Go test, which assesses gait and balance, supplemented by a 30-second chair standing test and handgrip evaluation, is essential for evaluating mobility and reducing fall risk in older adults [11].

Several studies have examined the occurrence of falls among older adults residing in the community, consistently demonstrating a significant association between physical performance and the likelihood of falling [8,9,12,13]. A study reported that most falls in Serbian households occurred outdoors on wooden floors partially covered with carpets or rugs during daylight hours while walking (49%), with an overall fall incidence of 15.8% and resulting injuries such as brain hematomas and soft tissue contusions [12]. Another study further demonstrated that older adults with poor physical performance and high fall risk experience increased rates of mortality and impairment in various domains [13]. In addition, older individuals with reduced physical abilities are more susceptible to falls [13], highlighting the critical importance of fall prevention and the relationship between fall risk, physical performance, and other health outcomes.

Thailand became an aging society in 2005, with projections indicating that by 2035, approximately 30% of the population is expected to be older adults [14,15]. Nearly 3 million fall incidents occur among older adults annually in Thailand, resulting in approximately 60,000 hospitalizations [16]. Furthermore, a daily mortality rate of four patients is reported, with accidental falls occurring most frequently among older adults during the rainy season [17]. A study reported a fall prevalence of 12.1%, identifying risk factors such as female gender, unemployment, cognitive impairment, semi-dependent functional capacity, balance issues, vision and hearing impairments, medication use, reliance on assistive devices, and access to outdoor restrooms [18].

Insufficient attention has been given to the northeastern region of Thailand and the older adults living in the community, highlighting the need for targeted research. The aim of this study was to examine the factors associated with falls among older adults in northeastern Thailand, hypothesizing that characteristics such as cognitive capacity, visual acuity, hearing acuity, balance ability, and mobility are associated with fall risk in this population.

Methods

Study design and setting

A cross-sectional study was conducted from June to December 2023 on older adults aged 60 years or older residing in Ubon Ratchathani Province, Northeastern Thailand. The older adults were evaluated using a questionnaire and a battery of tests that assessed the participants' cognitive capacity, eyesight proficiency, hearing ability, balancing ability, and mobility. The factors associated with falls were then assessed.

Sample size and sampling method

The study population comprised older adults residing in That Subdistrict, Ubon Ratchathani Province, Thailand, along with their associated households. This subdistrict consists of a total of 11 villages and 714 households. The sample size formula for proportions was employed for calculating sample size, defined with the following parameters: the total population size of 714 households, the coefficient under the standard normal curve at the 95% confidence level of 1.96, the estimated proportion of 0.333 (obtained from a literature review [19]), and the precision of the estimate, set at 0.04995. The calculated sample size for the study was 232 older adults, which was increased to 264 to account for potential dropout. Accidental sampling was employed to recruit participants across 11 communities. The data collection was conducted in the participant's home. One individual, the eldest in the household, was selected from each household.

Participant criteria

The inclusion criteria included: (1) male and female older adults aged 60 years and above; (2) the eldest individual in their household; (3) possessed the ability to communicate and comprehend; (4) had sound judgment, and have no impairments in speaking, listening, reading, or hearing; (5) willingness to participate in an interview and eager to contribute to data collection for research purposes. Participants were excluded based on the following criteria: (1) inability to understand and/or respond to the questions or complete the Timed Up and Go tests; (2) had a serious or sudden illness; and (3) had cognitive impairment. Dropout criteria involved participants wishing to withdraw from the study project throughout their involvement.

Questionnaire

The questionnaire included closed-ended questions that collected data on sex, age, marital status, family size, home characteristics, medication use affecting balance, and fall history among older adults. The second part evaluated the physical conditions, comprising five components: cognitive capacity, eyesight proficiency, hearing, balance and mobility. Cognitive capacity was assessed using the Mini-Cog tool, which includes a clock-drawing test and a three-word recall task. A score of ≤3 indicates cognitive impairment [20]. Eyesight proficiency (visual acuity) was evaluated across five categories: long-sightedness, short-sightedness, cataracts, glaucoma, and age-related macular degeneration, with a “yes” response indicating vision impairment [20]. The hearing was assessed through a finger rub test, where a “cannot hear” response in one ear suggests hearing issues [20]. The balance was evaluated using the complete tandem stance test, where failure to maintain foot alignment or stand for over 10 seconds indicates compromised balance [21]. The mobility was assessed with the Timed Up and Go test, which measured the time taken to rise from a chair, walk 3 meters, turn, walk back, and sit down. A time of less than 12 seconds indicates a low risk of falling [22].

Questionnaire validity and reliability test

The validity and reliability of the questionnaire were not assessed in this study since they have been validated and tested in previous studies. The Mini-Cog tool was demonstrated to have a sensitivity of 0.90 (95%CI: 0.87–0.93), specificity of 0.71 (95%CI: 0.65–0.76) [23]; and a Cohen's kappa coefficient of 0.80 [24]. The finger rub test for hearing assessment had an area under the receiver operating characteristic (ROC) curve of 0.944 to predict hearing impairment [25]. The tandem stance test for balance has a Cronbach’s alpha reliability greater than 0.87 [26] while the Timed Up and Go test has a sensitivity of 76.2%, specificity of 91.1%, and Kappa value of 0.680 [11].

Data collection

Data collection was conducted through direct face-to-face interviews performed by trained enumerators, while participants’ physical assessments were conducted by trained community health volunteers. For those with reading or writing difficulties, trained interviewers read the questions aloud and recorded their responses. Information on falls among older adults, including details about housing type and characteristics, was collected through face-to-face interviews. Community health volunteers, experienced in conducting interviews and physical assessments, facilitated the data collection process. To ensure participant safety, fall risk screenings were carried out under the supervision of the principal investigator.

Study variables

The dependent variable of the study was the incidence of falls among older adults living at home within the previous six months. The main independent variables assessed in this study were cognitive capacity, visual acuity, hearing function, and balance mobility. In addition, other plausible independent variables included sex, age, marital status, family size, home characteristics, medication use affecting balance, and fall history.

Statistical analysis

The univariable analysis was first conducted to obtain the crude odds ratios (ORs) and 95% confidence interval (CIs) of factors associated with falls. Following this, a multivariable analysis

was performed incorporating variables with a $p<0.25$ from univariate analysis to identify factors associated with falls, as per previous studies [19,27]. This analysis facilitated the calculation of the adjusted odds ratio (aOR) and 95%CIs. Data analyses were conducted using SPSS v.29.0 software (IBM, New York, USA) with $p<0.05$ was considered statistically significant.

Results

Characteristics of the included participants

The final sample of the study comprised 264 older adults, and their characteristics are presented in **Table 1**. Among the participants, predominantly female, 61.4% were in the early-old-age group (60–69 years), and 60.2% resided with a partner in households of at least four members. Additionally, 51.5% lived in single-story homes, 57.2% in low-floor residences, 72.0% had congenital diseases, and 67.4% were on medication (**Table 1**).

Table 1. Characteristics of the included participants (n=264)

Characteristics	Frequency (%)
Sex	
Male	102 (38.6)
Female	162 (61.4)
Age (year), median (min-max)	68 (60–93)
60–69	159 (60.2)
70–79	74 (28.0)
≥80	31 (11.8)
Marital status	
Single	29 (11.0)
Couple	139 (52.7)
Separated	96 (36.3)
Number of individuals in the family (person), median (min-max)	4 (1–10)
1–3	128 (48.5)
≥4	136 (51.5)
Attributes of the dwelling	
One-story house with low floor	151 (57.2)
One-story house with high floor	35 (13.3)
Two-story house	78 (29.5)
Congenital diseases	
No	74 (28.0)
Yes	190 (72.0)
Usage of medications that impact balance	
No	86 (32.6)
Yes	178 (67.4)

Fall history of older adults

A total of 12.1% of participants reported experiencing falls in the previous six months, with 37.5% of these incidents attributed to tripping. The home environment was identified as the setting for 53.1% of all falls, with the garage being the second most common location, accounting for 18.8%. The majority of falls occurred between 6:00 a.m. and 12:00 p.m. (43.8%), followed by 12:00 p.m. to 6:00 p.m. (31.3%). Families were the primary source of assistance in 65.6% of cases, and among those who experienced falls, 75% sustained injuries such as scrapes, bruises, sprains, or strains. (**Table 2**).

Table 2. History of falls among the included participants (n=264)

Fall history	Frequency (%)
Experience of falls in the past six months	
No	232 (87.9)
Yes	32 (12.1)
Causes of falls (n=32)	
Tripping	12 (37.5)
Slipping	9 (28.1)
Misstepping	7 (21.9)
Falling from a height	4 (12.5)
Locations of falls (n=32)	
Bedroom	1 (3.1)

Fall history	Frequency (%)
Bathroom	4 (12.5)
Living room	4 (12.5)
Parking garage	6 (18.8)
Around a house	17 (53.1)
Time of falls (n=32)	
00:00-06:00 a.m.	8 (25.0)
06:00-12:00 a.m.	14 (43.8)
12:00-18:00 p.m.	10 (31.2)
First person to provide assistance (n=32)	
Spouse	7 (21.9)
Descendants	21 (65.6)
Relatives	4 (12.5)
Characteristics of injuries caused by falls (n=32)	
Unharmed	6 (18.8)
Scrapes, bruises, sprains, strains, and other ailments	24 (75.0)
Fractures of the wrist, spine, or other bones	2 (6.2)

Physical fitness of older adults

Physical fitness test indicated that 89.4% of participants had no hearing difficulties, while 81.1% reported no mobility issues. However, in the present study, 53.0% of older adults exhibited visual impairments, 34.8% experienced balance issues, 26.5% had cognitive impairment, and 18.9% had movement impairment (**Table 3**).

Table 3. Physical fitness among the included participants (n=264)

Physical fitness tests	Frequency (%)
Cognitive capacity	
No cognitive impairment	194 (73.5)
Have cognitive impairment	70 (26.5)
Visual acuity	
No eyesight issues	124 (47.0)
Have eyesight issues	140 (53.0)
Hearing acuity	
No hearing issues	236 (89.4)
Have hearing issues	28 (10.6)
Balance ability	
Able to balance	172 (65.2)
Unable to balance	92 (34.8)
Mobility ability	
No movement impairment	214 (81.1)
Have movement impairment	50 (18.9)

Factors associated with falls among older adults

Our univariate analyses indicated that gender, age, congenital disease, use of medications affecting balance, hearing ability, and movement ability were associated with fall incidence (**Table 4**). Women were 7.19 times more likely to fall at home than men (OR: 7.19; 95%CI: 2.13–24.29, $p<0.001$). Individuals aged 80 years and older had a 4.24-fold higher risk of falling compared to those aged 60 to 69 years (OR: 4.24; 95%CI: 1.64–10.95, $p=0.017$). Participants with congenital disease had a 4.26-fold increased risk of home falls (OR: 4.26, 95%CI: 1.26–14.45, $p=0.020$), while those taking medications impairing balance faced a 2.90-fold higher risk (OR: 2.90; 95%CI: 1.07–7.11, $p=0.021$). Hearing-impaired individuals were 5.40 times more likely to fall at home (OR: 5.40; 95%CI: 2.22–13.14, $p<0.001$) while participants with mobility impairments had an 8.04-fold increased risk of falling (OR: 8.04; 95%CI: 3.64–17.74, $p<0.001$) (**Table 4**).

Table 4. Univariate logistic regression showing factors associated with falls among older adults (n=264)

Factors	Total	Fall experienced (%)	Crude OR	95%CI	*p*-value
Sex					<0.001*
Male	102	3 (2.9)	1		
Female	162	29 (17.9)	7.19	2.13–24.29	
Age (year)					0.017*

Factors	Total	Fall experienced (%)	Crude OR	95%CI	*p*-value
60–69	159	14 (8.8)	1		
70–79	74	9 (12.2)	1.43	0.59–3.48	
≥80	31	9 (29.0)	4.24	1.64–10.95	
Marital status					0.558
Single	29	4 (13.8)	1		
Couple	139	14 (10.1)	0.70	0.21–2.30	
Separated	96	14 (14.6)	1.07	0.32–3.54	
Number of individuals in the family (person)					0.182
1–3	128	12 (9.4)	1		
≥4	136	20 (14.7)	1.67	0.78–3.56	
Attributes of the dwelling					0.525
One-story house with low floor	151	17 (11.3)	1		
One-story house with high floor	35	3 (8.6)	0.74	0.20–2.68	
Two-story house	78	12 (15.4)	1.43	0.65–3.18	
Congenital disease					0.020*
No	74	3 (4.1)	1		
Yes	190	29 (15.3)	4.26	1.26–14.45	
Usage of medications that impact balance					0.021*
No	86	5 (5.8)	1		
Yes	178	27 (15.2)	2.90	1.07–7.81	
Cognitive capacity					0.063
No cognitive impairment	194	19 (9.8)	1		
Have cognitive impairment	70	13 (18.6)	2.10	0.98–4.52	
Visual acuity					0.124
No eyesight issues	124	11 (8.9)	1		
Have eyesight issues	140	21 (15.0)	1.81	0.84–3.93	
Hearing acuity					<0.001*
No hearing issues	236	22 (9.3)	1		
Have hearing issues	28	10 (35.7)	5.40	2.22–13.14	
Balance ability					0.060
Able to balance	172	16 (9.3)	1		
Unable to balance	92	16 (17.4)	2.05	0.97–4.32	
Mobility ability					<0.001*
No movement impairment	214	14 (6.5)	1		
Have movement impairment	50	18 (36.0)	8.04	3.64–17.74	

* Statistically significant at $p<0.05$

The multivariable analysis included the following variables: sex, age, number of family members, congenital diseases, dwelling characteristics, use of medications affecting balance, cognitive capacity, visual acuity, hearing acuity, balance ability, and mobility ability (**Table 5**). However, only sex, family size, having congenital disorder, and having mobility impairment were associated with falls in older adults' homes (**Table 5**). Older women were 7.30 times more likely to fall compared to older men (aOR: 7.30; 95%CI: 1.80–29.64, $p=0.005$) (**Table 5**). Those with four or more family members had a 2.98-fold increased likelihood of falling compared to those with one to three family members (aOR: 2.98; 95%CI: 1.13–7.33, $p=0.027$). Additionally, older adults with congenital disorders were 4.67 times more likely to experience falls (aOR: 4.67; 95%CI: 1.02–21.36, $p=0.047$), and those with mobility impairment had a 5.86-fold higher risk (aOR: 5.86; 95%CI: 1.87–18.30, $p=0.002$) (**Table 5**).

Table 5. Multivariable logistic regression showing actors associated with falls among the included participants

Factors	Total	Fall experienced (%)	Adjusted OR	95%CI	*p*-value
Sex					0.005*
Male	102	3 (2.9)			
Female	162	29 (17.9)	7.30	1.80–29.64	
Age (year)					0.181
60–69	159	14 (8.8)			
70–79	74	9 (12.2)	0.70	0.24–2.04	
≥80 year	31	9 (29.0)	2.38	0.72–7.91	
Number of individuals in the family (person)					0.027*
1–3	128	12 (9.4)			
≥4	136	20 (14.7)	2.98	1.13–7.83	

Factors	Total	Fall experienced (%)	Adjusted OR	95%CI	*p*-value
Attributes of the dwelling					0.900
One-story house with low floor	151	17 (11.3)			
One-story house with high floor	35	3 (8.6)	0.72	0.16–3.23	
Two-story house	78	12 (15.4)	0.88	0.33–2.32	
Congenital diseases					
No	74	3 (4.1)			
Yes	190	29 (15.3)	4.67	1.02–21.36	
Usage of medications that impact balance					0.809
No	86	5 (5.8)			
Yes	178	27 (15.2)	0.85	0.23–3.10	
Cognitive capacity					0.784
No cognitive impairment	194	19 (9.8)			
Have cognitive impairment	70	13 (18.6)	1.16	0.39–3.38	
Visual acuity					0.751
No eyesight issues	124	11 (8.9)			
Have eyesight issues	140	21 (15.0)	0.85	0.32–2.27	
Hearing acuity					0.088
No hearing issues	236	22 (9.3)			
Have hearing issues	28	10 (35.7)	2.75	0.86–8.84	
Balance ability					0.543
Able to balance	172	16 (9.3)			
Unable to balance	92	16 (17.4)	0.73	0.26–2.01	
Mobility ability					0.002*
No movement impairment	214	14 (6.5)			
Have movement impairment	50	18 (36.0)	5.86	1.87–18.30	

* Statistically significant at $p<0.05$

Discussion

In the present study, 12.1% of older adults experienced falls in the previous six months, with 37.5% caused by tripping and 53.1% occurring at home. This incidence aligns with a previous study finding in Bangkok, Thailand, that reported a 12.94% fall rate among community-dwelling older adults classified as low-risk [28]. The present study found significant associations between factors such as sex, the number of family members, having congenital diseases, and having mobility impartment with falls among community-dwelling older adults. The findings indicated that older women were 7.30 times more likely to fall at home compared to older men. Women are more prone to impairments than men, leading to increased mobility issues as they age [29]. These results align with two previous studies, which also reported that women experience falls more frequently than men [30,31].

Our study found that older adults with congenital disease were found to have a 4.67-fold higher risk of experiencing falls at home compared to those without congenital disease. A study reported that falls among older adults were frequently associated with health conditions such as hypertension, stroke, peripheral vascular disease, chronic obstructive pulmonary disease, and other geriatric syndromes [27]. Furthermore, we also found that older adults with mobility impairment were at a significantly higher risk of falls, as mobility limitations are often associated with advancing age [32]. Mobility impairments have also been linked to cognitive decline and other comorbidities of which impaired cognitive function adversely affects mobility retention [33]. These are consistent with studies highlighting the pathophysiology of falls related to balance disorders [34,35]. Similarly, a study identified a connection between the health of community-dwelling older adults and specific home characteristics, reflecting age-related declines in functional capacity to perform daily activities [36].

In the present study, physical fitness assessments revealed that 53.0% of older adults had visual impairments, while 26.5% exhibited cognitive impairments. Both visual and cognitive impairments are chronic conditions that substantially impact daily functioning [37], adversely affecting emotional and mental well-being [38-41]. These findings align with those of Getachew *et al.* who reported a 36.95% prevalence of visual impairment [42], and Muhammad *et al.* who noted that 20.03% of older women experienced cognitive impairment [43]. Additionally, studies have established a strong correlation between depressive symptoms, poor vision, and fall risk among older adults [44,45].

However, this study found no statistically significant relationship between falls and participants' use of medications that affect balance, cognitive function, visual acuity, auditory acuity, or equilibrium. This lack of significance may be attributed to increased awareness among older adults about potential physical vulnerabilities, prompting them to adopt more cautious behaviors in daily activities to prevent falls. In Thailand, older adults with physical impairments also receive additional support and supervision from caregivers, often through government-affiliated programs, which may mitigate fall risks.

This study has several limitations. First, the findings primarily reflect data from female participants (61.4%), suggesting the need for further exploration of male perspectives to ensure sex-representative conclusions. Additionally, the retrospective approach, which relied on self-reported fall incidents over the past six months, may lack the precision of prospective data collection. Nonetheless, it remains a practical method to identify fall risks and inform early intervention strategies. Future research, however, should consider prospective methodologies, such as home visits to assess fall rates, with an emphasis on evaluating both physical fitness and environmental factors to enhance prevention efforts.

Conclusion

Sex, family size, congenital disorder, and mobility impairment are associated with an increased risk of falls among older adults. Older adults who were female, belonged to larger families, had congenital disorders, or experienced mobility impairments were at higher risk of falls. It is recommended that a proactive healthcare strategy be adopted to prevent falls and ensure safe living conditions. Interventions to enhance balance, mobility, and mental health, along with promoting an active lifestyle, may help reduce fall risk among community-dwelling older adults. These findings may aid private and government agencies in developing effective fall prevention programs for older adults living at home.

Ethics approval

Ethical clearance was obtained from Ethical Committee for Human Research, Ubon Ratchathani University, Mueang Si Khai, Thailand (Approval number: UBU-REC-55/2566), adhered to Declaration of Helsinki.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

Declaration of artificial intelligence use

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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