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Accidental Falls Related to Physical and Environmental Risk Factors Among Older Hill Tribe Adults in Northern Thailand

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Abstract:

Objective: Falls remain a cause of disability in the elderly. The present study was carried out to estimate the prevalence of falls among the hill tribe elderly population in Northern Thailand and identify its associated factors.

Material and Methods: A cross-sectional study was conducted in participants from 61 hill tribe villages in Chiang Rai province, Thailand aged more than 60 years. A simple random method was used to select the participants. A questionnaire was developed and validated for data collection. Timed-up and go test (TUGT) was used to assess the dynamic balance and risk of falls in the participants. Logistic regression was used to evaluate the associations between the study variables (p-value≤0.05).

Results: One hundred eighty-two participants were recruited into the study with a mean age of 69.54 years (S.D.=7.02). 59.9 % were women. It was found that 17.6% of elderly who fell in the previous 6 months and 28.0% of elderly who risks of falls as assessed by the TUGT. The multiple logistic regression model showed that tribe (adjusted odds ratio (aOR)=4.40, 95% confidence interval (CI)=1.88 to 22.02), dizziness (aOR=3.40, 95% CI=1.70 to 16.70), history of fall in the last 6 months (aOR=2.42, 95% CI=1.06 to 8.64), location of falls (aOR=1.37, 95% CI=1.02 to 18.22), and the 15-item geriatric depression scale (GDS-15) (aOR=12.91, 95% CI=1.07 to 84.85) were the associated risk factors for having a serious fall for hill tribe elderly.

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Conclusion: This study provides important determining factors associated with elderly falls, which can assist in developing and implementing an appropriate fall prevention program through environmental adjustments for the elderly.

Keywords: elderly, factors, falls, hill tribe, timed-up and go test

Introduction

Falls among the elderly remain a serious cause of injury and impairment. Even though many governments and organizations have highlighted this problem as needing attention for their aging populations, the World Health Organization (WHO) reports that the rate of serious or impairing falls is not reducing. Earlier studies have reported that the frequency of elderly falls varies in different locations and nations based on various factors such as culture, tasks, and daily activities[1, 2]. Fall prevalence is further linked to fall prevention initiatives, as evidenced by systematic studies and clinical practice guidelines[1-3] .

As a proportion of the overall population, the elderly population in Thailand has been increasing in recent years, as in many western countries rate. As a result, it is necessary for the government to enact policies or programs to ensure the elderly receive adequate care which it will be necessary for the government to innovate things to look after the growing senior population[4]. Studies have found that various health promotion programs designed to reducing the risk of falls in the Thai elderly are beneficial[5,6]. To provide further reduction of falls, a fall risk identification program could be beneficial. Many tools for assessing fall risk are routinely used in clinical settings. The timed-up-and-go test (TUGT), Berg Balance Scale (BBS), Balance Evaluation - Systems Test (BESTest), Physiological Profile Assessment (PPA), and others may be useful for identifying fall risk in the elderly[7,8].

The TUGT is one of the gold standards tests for elderly fall screening examinations. Shumway-Cook et al. found in 2000 that the TUGT was a sensitive and specific measure for identifying the elderly at risk of falling. Previous research has shown that it has strong psychometric qualities, including validity, intra- and inter-reliability for testing[9]. This test is also commonly used in physical therapy to assess lower extremity function and mobility. For the elderly, the TUGT assesses dynamic stability when walking. According to the research, the majority of falls among the elderly occur while walking[9]. Changes in the physiological system caused by aging weaken dynamic stability and increase the risk of falling. In another study, Beauchet et al. (2011) found that TUGT time was linked to a history of falls in the elderly[10].

The varied locations and landscapes of Thailand demonstrate the many cultures and beliefs that may be influenced by daily life activities. All the hill tribe people live in mountainous and uneven terrain, and the residential environment or housing such as rough floor, inadequate lighting, and land is sloped, - might increase the risk of falling. Although prior studies have been done on the fall prevalence among Thai elderly in general, there is a dearth of data regarding fall prevalence in specific Thai populations such as the hill tribe elderly. The current study was conducted to quantify the prevalence of falls among the hill tribe elderly population and to identify the risk variables. It is important to determine the factors associated with falls and promote appropriate fall prevention programs in the hill tribe setting.

Material and Methods

Study design and setting

Data were obtained through a cross-sectional survey to extract information from the hill tribe older adult population in Chiang Rai province in the northern region of Thailand.

The research villages were chosen using a simple random procedure, with 10 villages from three tribes; Hmong, Akha, and Lahu[11]. The study population was designated as the hill tribe seniors who resided in the research villages.

Study population

The elderly hill tribe residents who matched the following criteria were eligible: a) identified themselves as one of the three major tribes, b) were over 60 years old, and c) had lived in the research area for at least one year. There was no problem with selected individuals being able to converse in Thai because four research assistants who could speak the three hill tribe languages had been recruited and taught for three days prior to the start of the study.

Research instruments

The research data were collected from various instruments and tests, namely a) a questionnaire for collecting general information and medical history, b) a timed up and go test (TUGT), c) the Thai-Mental State examination (TMSE) to assess the risk of dementia, d) the 15-item Geriatric Depression Scale (GDS-15), e) another questionnaire for surveying the opinions of elderly on housing safety associated with falls in the elderly, and f) the surveying risk points within the home of the study hill tribe elderly participants.

All questionnaires and assessment tools were tested for reliability and validity before use. The demographic data in this questionnaire included age, gender, tribe, and education. The medical history questions collected information on underlying diseases, musculoskeletal problems, neurological diseases, sensory impairment, visual problems, dizziness, alcohol consumption, exercise activity, medicine intake, and history of falls in the previous 6 months.

The TUGT measures the time it takes a person to rise from an armchair, walk 3 meters, turn, walk back to the chair, and sit down again. It was initially designed as a clinical assessment of dynamic balance in older persons, with times of more than 13.5 seconds indicating a risk of falling[12]. Podsiadlo and Richardson advocated using the original test as a brief measure of fundamental movement abilities for frail community-dwelling elderly by timing the task rather than evaluating patients subjectively[13].

A GDS-15 was utilized to measure the level of depression among the participants. This instrument had passed reliability and validity testing in a variety of groups and countries. It was then tested and studied in Thai persons, receiving a Cronbach's alpha of 0.85 and a sensitivity of 0.89. In terms of interpretation, a GDS-15 score of more than 6 is considered depressive[14].

The TMSE is used to identify older individuals with cognitive impairment. The cut-off points for having a cognitive impairment are less than 14 (sensitivity=0.35 and specificity=0.81) for those who are illiterate, less than 17 (sensitivity=0.57 and specificity=0.94) for those who have completed their primary education, and less than 22 (sensitivity=0.92 and specificity=0.93) for those who have completed their high school[15].

The questionnaire for surveying the opinions on housing safety associated with falls in the elderly consisted of 9 questions asking about the participant's opinions on the safety of housing conditions, with an index of item objective congruence (IOC) value of 0.80 for all items. Environmental health professionals conducted the surveyed risk points with the home of the hill tribe elderly. It assessed all seven aspects, including floor type, floor level, keeping things overhead, unstable furniture, unsafe electrical equipment, lighting, and air flow.

Data collection procedures

For each tribe, eight villages were chosen at random from a list of the three hill tribe village rosters. To schedule an appointment with participants, an official letter was written to the local headman. All necessary information about the study project was supplied on the day of the meeting between

the research team, selected village headmen, and the village committee. Following approval from the village headman, ten older folks who satisfied the eligibility requirements were chosen at random from a list of people over the age of 60. The following day, interviews were scheduled with the participants.

Before beginning each interview, all pertinent project information was reviewed with the participant, and an informed consent form was signed by fingerprint from each participant. Participants who could not communicate in Thai were interviewed by a trained research assistant. All interviews took place in a private room. Each interview was 20 minutes long. The participants were then assessed for their risk of falling using the TUGT test three times (with a 1–2–minute rest period between each attempt); the study used the best–time TUGT measurement for data analysis.

Statistical analysis

For analysis, descriptive and inferential statistics were utilized. The mean and standard deviation were used to represent continuous data with a normal distribution, while percentages were used to analyze categorical data. Logistic regression was performed to examine the significance of the associations between variables at alpha 0.05. Statistical Package for the Social Sciences (SPSS) version 20.0 (SPSS Inc., Chicago, IL, USA) was used for all analyses.

Ethics statement

The study, including the tools utilized in the study, was approved by the Mae Fah Luang University's Institutional Review Board and Ethics Committee (approval number REH–62092). All information gleaned from the interviews was saved in a protected file that only the researchers had access to using a password. Each participant received a tiny souvenir of appreciation.

Results

Demographic characteristics

The analysis comprised information from 182 individuals who provided reliable information. The participants' mean age was 65.29 years (S.D.=6.71), with 59.9% being women, 36.8% being Hmong, 30.2% being Akha, and 33.0% being Lahu. 61.5% had a normal level of body mass index (BMI). In terms of health, 28.0% had an underlying disease, such as 36.3% with a musculoskeletal disease, 5.5% with a neurological disease, and 22.0% with visual problems (Table 1). The TUGT tests found that the fall risk among the hill tribe elderly population was 28.0%. (Table 2).

The factors associated with fall risk in the hill tribe elderly

Binary logistic regression was used to determine the relationship between independent factors such as personal characteristics and health problems and the probability of falling (Table 1). After correcting for all possible confounder factors, including age with multivariate logistic regression, five variables were revealed to be associated with falls: tribe, dizziness, history of fall in the previous 6 months, location of fall, and GDS–15 score more than 6 represents depression. The Akha tribe had a higher risk of falling than the Hmong, with an adjusted odds ratio (aOR) of 4.40 (95 confidence interval (CI)=1.88 to 22.02). The hill tribe elderly who reported dizziness had a higher risk of falling than those who did not, with an aOR 3.40 times (95% CI=1.70 to 16.70), and those who had a history of falls in the last 6 months had a higher risk of falling than those who did not, with an aOR 2.42 times (95% CI=1.06 to 8.64), and those who had the location of the fall inside the house had a higher risk of falling than those who had the fall location outside. Individuals with a GDS–15 score greater than 6 had a higher risk of falling than those with a score less than 6, with an aOR of 12.91 times (95% CI=1.07 to 84.85). (Table 3)

The survey of the opinions on housing safety associated with falls in the hill tribe elderly population, according to participant's opinions revealed that the elderly

Table 1 The characteristics of the study hill tribe elderly participants (n=182)

Characteristic	n (%)	Falls	
		Yes (%)	No (%)
Age[a] (years)	65+6.71		
60–69	137 (75.3)	37 (27.0)	100 (73.0)
70–79	36 (19.8)	10 (27.8)	26 (72.2)
80 years and above	9 (4.9)	4 (44.4)	5 (55.6)
Female gender	109 (59.9)	32 (29.4)	77 (70.6)
Tribe			
Hmong	67 (36.8)	25 (37.3)	42 (62.7)
Akha	55 (30.2)	16 (29.1)	39 (70.9)
Lahu	60 (33.0)	10 (16.7)	50 (83.3)
No education	172 (94.5)	47 (27.3)	125 (72.7)
Medical condition			
Underlying disease	51 (28.0)	20 (39.2)	31 (60.8)
Medication use	47 (25.8)	19 (40.4)	28 (59.6)
Alcohol consumption	13 (7.1)	1 (7.7)	12 (92.3)
Regular exercise	91 (50.0)	22 (24.2)	69 (75.8)
Musculoskeletal disease	66 (36.3)	30 (45.5)	36 (54.5)
Neurological disease	10 (5.5)	9 (90.0)	1 (100.0)
Sensory impairment	3 (1.6)	2 (66.7)	1 (33.3)
Visual problem	40 (22.0)	15 (37.5)	25 (62.5)
History of falls in the last 6 months	32 (17.6)	31 (96.9)	1 (3.1)
Inside home fall location	29 (15.9)	25 (86.2)	4 (13.8)
Dizziness	71 (39.0)	35 (49.3)	36 (50.7)
BMI[a]	22.68+4.14		
Normal	112 (61.5)	29 (25.9)	83 (74.1)
Under weight	26 (14.3)	7 (26.9)	19 (73.1)
Obese level 1	38 (20.9)	12 (31.6)	26 (68.4)
TMSE[a]	19.82+6.83		
Risk of dementia	114 (62.6)	31 (27.2)	83 (72.8)
GDS[a]	5.79+3.64		
Risk of depression	23 (12.6)	4 (17.4)	19 (82.6)
House style			
Traditional hill tribes	26 (14.3)	19 (73.1)	7 (26.9)
Mixed	59 (32.4)	13 (22)	46 (78)
New	94 (51.6)	18 (19.1)	76 (80.9)
Other	3 (1.6)	1 (33.3)	2 (66.7)
Location of fall			
Indoor	25 (13.7)	7 (28.0)	18 (72.0)
Around the house	110 (60.4)	32 (29.1)	78 (70.9)
Outdoors	14 (7.7)	2 (14.3)	12 (85.7)
Farm or garden	33 (18.1)	10 (30.3)	23 (69.7)
No electric supply	4 (2.2)	2 (50.0)	2 (50.0)
Type of fall			
Slip	34 (18.7)	27 (79.4)	7 (20.6)
Stepping	4 (2.2)	4 (100.0)	
Clash	7 (3.8)	6 (85.7)	1 (14.3)

BMI=body mass index, TMSE=Thai mental state examination, GDS=geriatric depression scale, n=number
[a]mean±standard deviation

Table 2 Prevalence of falls in the study hill tribe elderly participants

Score	n	%
Falls in the last 6 months	32	17.6
TUGT >12 second (risk of falls)	51	28.0

n=number, TUGT=timed up and go test

Table 3 Binary logistic regression analysis identifying the factors associated with falls in the study hill tribe elderly participants (n=182)

Characteristic	Crude OR	95% CI		Adjusted OR	95% CI	
		Lower	Upper		Lower	Upper
Age (reference: 60–69 years)						
70–79 years	0.96	0.42	2.18	1.56	0.31	7.78
80 years and above	0.46*	0.11	1.81	0.32	0.03	3.42
Female gender (reference: male)	0.84	0.43	1.64			
Tribe (reference: Hmong)						
Akha	1.45*	0.67	3.11	4.40**	1.88	22.02
Lahu	2.97	1.28	6.89	2.84	0.55	14.72
Medical condition (reference: no condition)						
Underlying disease	0.48	0.24	1.06			
Medication use	1.50	0.95	2.13			
Alcohol consumption	0.44*	0.15	1.25	3.93	0.30	51.61
Regular exercise	1.46*	0.76	2.81	3.53	0.85	14.66
Musculoskeletal disease	0.26*	0.13	0.52	0.62	0.17	2.28
Neurological disease	5.27*	1.85	15.04	0.13	0.01	1.92
Sensory impairment	2.30*	0.68	7.73	3.12	0.08	84.34
Visual problem	1.32*	0.91	1.92	1.84	0.45	7.84
Dizziness	2.40*	1.66	3.41	3.40**	1.70	16.70
History of falls in the last 6 months (reference: no)	14.19*	5.10	39.48	2.42**	1.06	8.64
Location of fall–Inside the home (reference: outside)	30.52*	9.79	95.13	1.37**	1.02	18.22
GDS–15 (reference: score <6)	1.20*	1.02	2.40	12.91**	1.07	84.85

OR=odd ratio, CI=confidence interval, GDS–15=15–item geriatric depression scale
*Crude odds ratio significance level at 0.20
**Adjusted odds ratio significance level at 0.05

Table 4 The opinions on housing safety associated with falls in the study hill tribe elderly participants

The factors related to risk of falls	Agree n (%)	Disagree n (%)	Uncertain n (%)
1. A safe home is essential to your life	5 (2.7)	175 (96.2)	2 (1.1)
2. Accident risk is increased by ground outside the house	15 (8.2)	165 (90.7)	2 (1.1)
3. A restroom with a slippery floor has a probability of accidental falls	22 (12.1)	159 (87.4)	1 (0.5)
4. Without guardrails on a split-level floor, the danger of accidents increases	21 (11.5)	156 (85.6)	5 (2.7)
5. Inadequate lighting increases the risk of accidents.	21 (11.5)	157 (86.3)	4 (2.2)
6. Placing items overhead or on the back of a cabinet increases the risk of accidents	34 (18.7)	139 (76.4)	9 (4.9)
7. Electrical equipment and appliances increase the risk of accidents	27 (14.8)	151 (83.0)	4 (2.2)
8. When a dangerous point is found or if there is damage in the house, it must be repaired immediately	11 (6.0)	171 (94.0)	-
9. Would you like to improve your home to make it safe?	7 (3.8)	170 (93.4)	-

n=number

Table 5 Surveying risk points within the home of the study hill tribe elderly participants

The most common home safety hazards	Inside house n (%)	Toilet n (%)	Hallways n (%)	Kitchen room n (%)	Bedroom n (%)
Slippery floor/rough floor	119 (65.4)	50 (27.5)	5 (2.7)	7 (3.8)	1 (0.5)
Split-level floor increases risk of falling	134 (73.6)	21 (11.5)	17 (9.3)	9 (4.9)	1 (0.5)
Keeping things overhead/place things beyond reach	102 (56.0)	12 (6.6)	39 (21.4)	26 (14.3)	3 (1.6)
The furniture is unstable	116 (63.7)	7 (3.8)	22 (12.1)	35 (19.2)	2 (1.1)
Electrical equipment is in an unsafe condition	119 (65.4)	11 (6.0)	37 (20.3)	15 (8.2)	
Lighting	107 (58.8)	10 (5.5)	42 (23.1)	9 (4.9)	14 (7.7)
Air flow	126 (69.2)	8 (4.4)	33 (18.1)	3 (1.6)	12 (6.6)

n=number

Discussion

Due to the increase in the population of elders in Thailand, falls are an emerging public health problem. Although much literature about this problem and its prevention is available from developed countries, only limited data on occurrence, risk factors, and measures for preventing falls is available from developing countries. This study found that advanced age, tribe, increased medicine intake, alcohol consumption, and poor health state of the elderly or underlying disease all predisposed the elders to falls. According to the multivariate logistic regression model, five factors were related to falls among the hill tribe elderly population: tribe, history of falls in the previous 6 months, depression, dizziness and location of falls. Members of the Akha tribes were more likely to fall than elders of the Hmong tribes (p-value<0.05). These findings were similar to research done in the basic health unit coverage region, which found greater rates of falls related to tribes and depression (Table 3).

Falls are generally considered unexpected accidents. Thus, statistics have shown that fall incidence were generated from intrinsic and extrinsic factors. One study suggested that there might be a causal process that causes falls, and they do not occur just by chance[16]. Therefore, research continues to investigate an association, if it exists, with factors contributing to the falls so that they could be prevented or reduced[5,17].

The Akha hill tribe's occupation is related to high land in which the land is sloped. It may increase the risk of falling among hill tribe elderly people. In one study, the majority of falls occurred in the environmental house on the route to the toilet[7]. In the interviews, many participants said that their falls were caused by slipping on a wet or rough floor, and split-level floor (Table 5). Other studies have found a greater number of falls among females compared to males, and this difference was explained in terms of physiological characteristics and musculoskeletal system, hormonal changes associated with menopause, or performing multiple tasks at the same time[18,19].

Up to 39% of the elderly suffer from vestibular problems, which cause dizziness, and 7% will have vertigo at some point in their lives. Dizziness in the elderly can be caused by a variety of factors, including sensory, ocular, vestibular, neurologic, cardiovascular, and muscular[20]. According to a 2009 study by Agrawal et al., age influences the chance of having a balance disorder. 85% of adults aged 80 and up showed evidence of balance impairment and an increased risk of falling[21].

Falls and depression have been occasionally linked. A recent meta-analysis of 17 prospective studies found an odds ratio of 1.63 (95% CI: 1.36-1.94) for the relationship between depression and falls[22]. The previous study suggests that the elderly who have depression have an increased risk of falls due to insomnia, inappropriate dietary (vitamin D and folate deficits), and weight loss[23].

The household environment has been reported to be a factor in the majority of falls[19]. Uneven or slick floor surfaces (including the presence of carpets and mats), tripping hazards such as obstacles on the floor, insufficient illumination, poorly constructed or maintained staircases without handrails, and dangerously placed furniture have all been identified as increasing the risk of falling, tripping, or slipping in the elderly[24]. According to an Australian study, the bedroom was the most often reported location for falls and fall injuries among older people who had been released from the hospital in the preceding six months[25]. This might be because older adults utilize fewer fall prevention methods in their bedrooms, such as using assistive devices sparingly near their beds. It is likely that discrepancies in where objects are located around the house are related to the amount of time individuals spend in particular areas. The elderly, for example, may spend more time in their bedrooms than anywhere else[26].

From this study, the residential environment was effect to fall in elderly. Therefore, decreasing the environmental danger potentially reduce the risk of falling. Previous study found that the building and environment of house were a risk factor for falls and worry about falling in elderly[27]. Studenski and colleagues reported the bathroom or toilet was rated as the most dangerous room, with several risks present in over half of the homes evaluated. The most common hazards in this study were those related to slippery, uneven, or blocked floors or surfaces, as well as the lack of sufficient handrails to hold on to[28].

Many of the older persons in this research did not believe their homes were unsafe despite the fact that they were potentially quite dangerous (Table 4). It is necessary to create measures to boost the desire of elderly persons to make adjustments to improve the safety of their homes[27]. Individual senior perspectives on assessing fall danger areas in their homes are low. Assessing fall risks is necessary to ensure that elders can feel at ease in their

own houses. Other limitations faced by hill tribe elders are that it is difficult to modify older homes, many household arrangements are tied to cultural conventions and beliefs, and there is a shortage of funds for house development.

Throughout the investigation, there were certain limitations. First, the participants were asked their opinions of safety in their houses, and individual perspectives may have influenced the responses. Most individuals believed in their culture, and they placed less emphasis on making their houses safe. Second, several participants, particularly those over the age of 70, had difficulty understanding the questions.

Conclusion

Although this study focused on demographic features and extrinsic causes of falls, factors linked to health status and environment should also be prioritized. The development of preventative techniques is important, dependent on research on the risks associated with each of these home hazards, intrinsic factors, and functional impairments. Because physical limitations and environmental problems interact to cause many falls, a method that combines medical and physical therapy examinations with a home environment assessment may be very helpful. It is critical to identify the risk factors for falls so that effective fall prevention strategies may be developed and implemented for the hill tribal environment. Furthermore, creating new tools to test elderly persons with high functional levels is important, as early diagnosis of persons with balance abnormalities may aid in the implementation of a physical training program to prevent falls.

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Conflict of interest

All authors declare that they have no conflicts of interest.

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