

Research article

Mental health, fall prevention behaviors, and home environments related to fall experiences among older adults from ethnic groups in rural Northern Thailand

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ABSTRACT

Accidental falls pose significant threats to older adults' health and safety. This study investigates the associations between mental health, fall prevention behaviors, home environments, and yearly falls among older adults of various ethnicities. Conducted in rural ethnic areas of two provinces in northern Thailand, this cross-sectional study utilized multi-stage sampling to survey 462 older adults aged 60 and above, including Mien, Hmong, Karens, and indigenous people. Participants self-reported their history of accidental falls and provided mental health (GHQ-28) data. Univariate logistic regression highlighted associations between falls and mental health problems (OR = 14.87, 95%CI = 7.51–29.43) and the score of fall prevention behaviors (OR = 0.37, 95%CI = 0.31–0.45). Home environment factors, including floor type, floor risk factors, and stair safety features, were significantly related to falls ($p < .05$). Multivariable analysis identified gender, financial status, underlying disease, vision impairment, mental health problems, and fall prevention behaviors as independent predictors of past-year falls among ethnic older adults ($p < .05$), explaining 84.7 % of the variation in log odds of falling. This study underscores the heightened fall risks among ethnic minority older adults with mental health issues while emphasizing the protective role of fall prevention behaviors.

1. Introduction

The aging population is growing rapidly, leading to an increase in health-related falls among older adults, significantly burdening healthcare systems [1]. Falls, often caused by geriatric degeneration affecting mobility, balance, and daily activity quality [2], are more frequent in women, with a reported 15.3 % fall rate over six months according to the Thai National Health Examination Survey (2019–2020) [3]. Northern Thailand, home to a diverse demographic including hill tribes, lowlanders, and indigenous populations in mountainous regions, may be at high risk for unstable life and mental health due to socio-economic and healthcare access limitations

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[4]. Our previous research indicates that 25.1 % of these ethnic older adults experienced falls within the last year [5], with a higher incidence in rural areas compared to urban due to factors like unsafe home environments [6,7]. These falls are multifactorial, driven by both intrinsic elements like health conditions and demographic traits, and extrinsic factors such as environmental hazards [8].

Home environments, including both interior and exterior conditions, significantly influence fall risks among older adults. Over half of such falls occur around the house due to factors like slippery floors, improperly high stairs, wet bathrooms, and unsafe living areas [7,9,10]. In northern Thailand, homes of ethnic older adults often feature challenging layouts due to their hillside locations, including vertical wooden planks, gabled roofs of thatch or bamboo, uneven flooring, and poorly lit paths leading to remotely located bathrooms [11,12]. Cultural preferences also vary; for example, the Hmong and Yao tribes generally prefer single-story homes, whereas the Karen opt for two-story structures, affecting the safety of walkways and toilet paths [13]. Despite these known risks, research exploring the specific home environment characteristics and their impact on fall incidents among ethnic older adults remains sparse [5].

Fall behaviors in older adults can be categorized into risk and prevention types [14]. Common risk behaviors include haste, carelessness, improper use of assistive devices, inappropriate footwear, and insufficient exercise [15]. Despite the efficacy of numerous fall prevention interventions [16], participation rates remain low due to challenges like inconsistent educational systems, varying program designs, and gaps in communication between healthcare providers and patients [1,17,18]. Research indicates that fall prevention is influenced by factors such as gender, BMI, family living arrangements, functional mobility, and fear of falling [17,19]. Enhancements in home and community environments are crucial as they not only promote fall prevention behaviors but also support broader public health strategies aimed at reducing fall risks through environmental design and community-focused initiatives [20,21].

Mental health is a significant risk factor for falls, increasing both the occurrence and severity of injuries among older adults [22]. Studies show that severe mental health issues, including depression and stress, elevate the risk of both initial and recurring falls [22–24]. Furthermore, the variation in mental health risks among older adults can often be attributed to differences in the ethnic and socio-demographic backgrounds of these groups [25]. Despite this, the link between mental health and falls has been understudied in rural ethnic populations.

To better understand the various factors that contribute to fall risk, this study aimed to investigate mental health, fall prevention behaviors, and environmental factors in the context of a rural ethnic community, as well as their associations with falls among older adults from minority groups in northern Thailand. Demographic and health information were also examined as key factors in relation to mental health problems, fall prevention behaviors, and falls. Our testable hypotheses are: 1) Enhanced fall prevention behaviors lead to fewer falls; 2) Mental health problems are linked to increased fall accidents; and 3) Environments contribute to reduced fall risks. The findings from this study are expected to inform targeted interventions by government and health organizations to decrease the incidence of fall-related injuries.

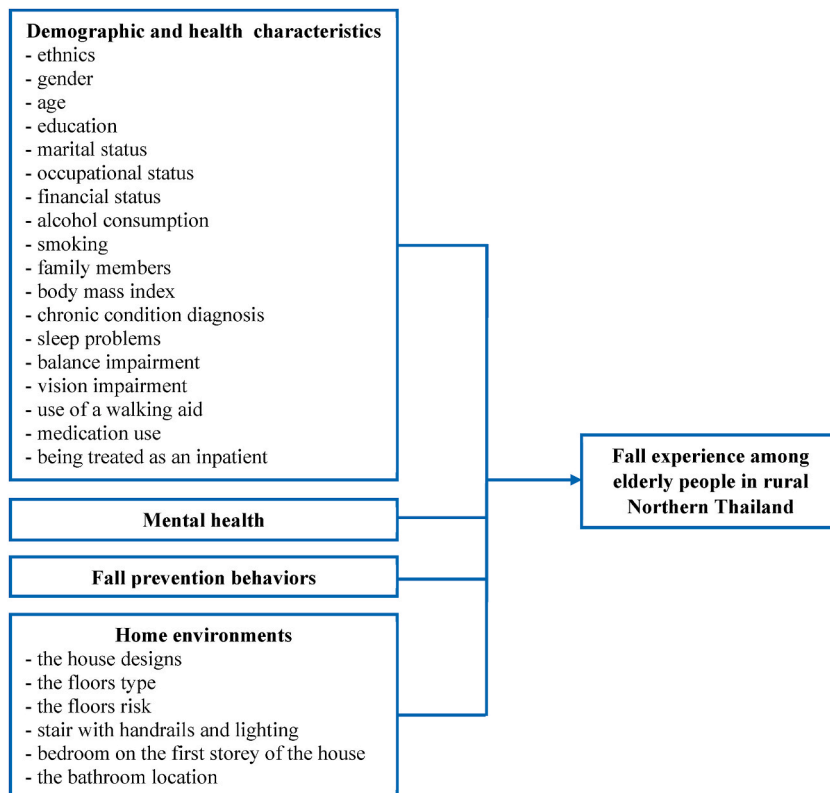


Fig. 1. A conceptual framework examining the association between independent variables and fall experience.

2. Materials and methods

2.1. Study design and participants

A cross-sectional study was conducted from February to May 2021, as part of the "Unit of Excellence: Health Promotion and Quality of Life" and a health survey focusing on older adults from ethnic minority groups in northern Thailand. The study's conceptual framework (Fig. 1) encompassed independent variables associated with accidental falls, including demographic and health characteristics, mental health, fall prevention behaviors, and home environment. The research area's remote, forested, and mountainous terrain posed logistical challenges for access and medical facilities, as previously detailed [5].

Participants were selected via multi-stage sampling from two provinces in Upper Northern Thailand (Fig. 2), characterized by large ethnic minority populations. One province comprised Mien and Hmong populations (highlanders and hill tribe settlers), while the other included Karens and indigenous peoples (lowlanders). Within each province, one district and sub-district were randomly sampled using the lottery method. Collaboration with local government municipalities facilitated access to lists of older adults, extracted from databases like the Health Data Center program (2018–2020) and Primary Care Units of the Java Health Center Information System (JHCIS) provided by public health officers. The total number of potential participants across 31 villages in two subdistricts was 2015.

Inclusion criteria encompassed females and males aged 60 years and above, registered with the High Area Health Development Center (Marginalized Ethnic Groups), Ministry of Public Health, residing in the area for at least two years, proficient in the local language, and not diagnosed with psychiatric conditions. Participants with cognitive impairment were excluded. The sample size was computed for estimating a single proportion of 50 % (defining 95 % confidence level and ± 5 % precision), with a 20 % increase for incomplete data, giving a total of 462 older adults.

Ethical approval was obtained from the University of Phayao, Thailand (No.1.3/020/63), and informed consent was obtained from

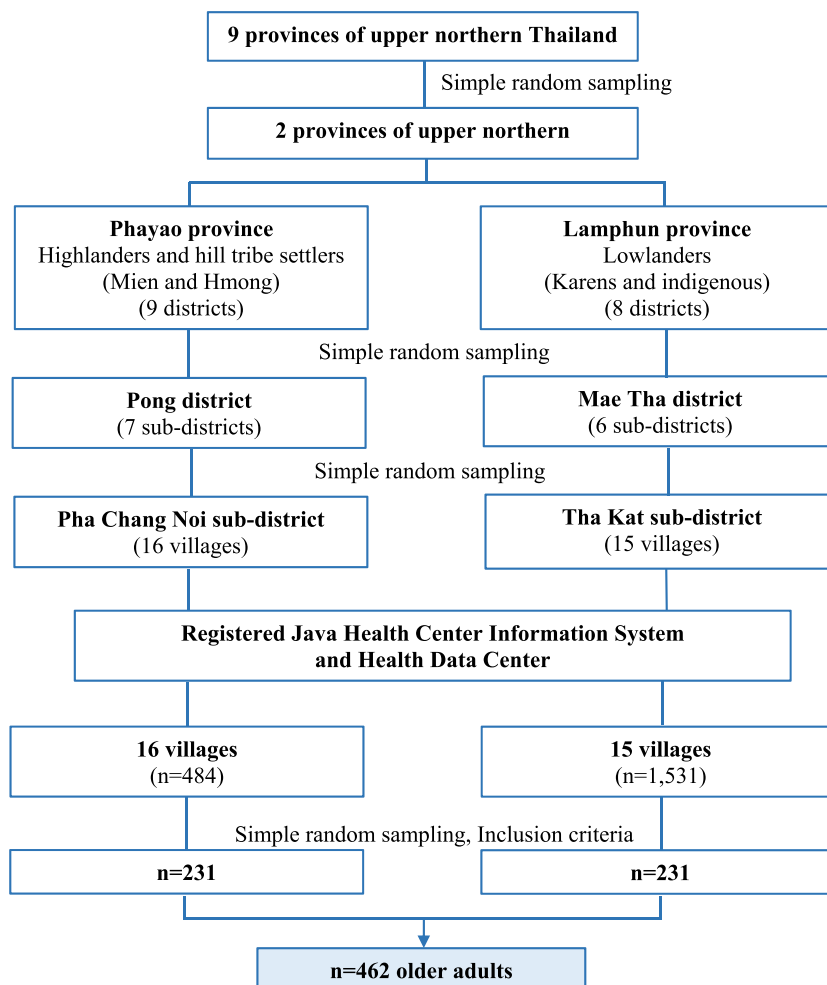


Fig. 2. Flow diagram of participants.

all participants before inclusion. Survey data were securely entered into a password-protected database on the first author’s computer.

2.2. Data collection

Interviewer-administered questionnaires were conducted in the participants’ homes between 9:00 a.m. and 5:00 p.m. by trained researchers using local dialects in plain language. The researchers filled out the questionnaires because older adults with poor visual acuity could not fully understand the content of the questionnaire by themselves. The questionnaire contained four parts, which were administered in the following order: demographic and health characteristics, home environment, mental health, and fall prevention behaviors. Each participant responded to the questionnaire on general information including occupation, family members, sleep problems, balance impairment, vision impairment, use of a walking aid, medication use, and being treated as an inpatient. In addition, our current study used the previously published 1-year fall history and socio-demographic data including gender, age, marital status, education, income sufficiency, alcohol consumption, smoking, BMI, and chronic condition diagnosis [5].

Information about home environments included 1) the house design (i.e., single-story and raised house), 2) the floor type (i.e., soil, wooden, cement and tile), 3) the floor risk (i.e., slippery, uneven or different levels, furniture or equipment obstructing the path, carpet, and walking across the wires), 4) stairs with handrails and lighting, 5) bedroom on the first story of the house, and 6) the bathroom location (i.e., outside and inside the house).

We used the General Health Questionnaire (GHQ: 28) (Thai version) to assess mental health, which was developed to be suitable for Thai older adults [26]. The questionnaire consisted of the following four parts: 1) somatic symptoms (items 1–7), 2) anxiety and insomnia (items 8–14), 3) social dysfunction (items 15–21), and 4) severe depression (items 22–28). The questionnaire was a self-assessment with responses on a four-point Likert scale. The score was translated to 0-0-1-1 with a total score of 28. Scores of 6 and above indicated a mental health problem; however, the score was used as a screening tool to detect those likely to have or to be at risk of developing psychiatric disorders.

Table 1
Demographic and health characteristics, mental health, and fall prevention behaviors of older adults classified by ethnic group.

Variables	Overall (n = 462) n(%)	Karen (n = 164) n(%)	Mien (n = 112) n(%)	Indigenous (n = 96) n(%)	Hmong (n = 90) n(%)	P-value
Occupation						<.001 ^a
Farmer	162(35.1)	30(18.3)	50(44.6)	39(40.6)	43(47.8)	
Hunter-gatherer	79(17.1)	31(18.9)	14(12.5)	26(27.1)	8(8.9)	
Weaver	33(7.1)	10(6.1)	7(6.3)	8(8.3)	8(8.9)	
Unemployed	188(40.7)	93(56.7)	41(36.6)	23(24.0)	31(34.4)	
Number of family members						<.001 ^a
1–3 persons	233(50.4)	115(70.1)	42(37.5)	42(43.8)	34(37.8)	
≥ 4 persons	229(49.6)	49(29.9)	70(62.5)	54(56.2)	56(62.2)	
Mean ± SD	3.98 ± 2.15	3.12 ± 1.81	4.70 ± 2.40	4.23 ± 2.01	4.38 ± 2.03	
Min - Max	1–12	1–12	1–12	1–7	1–9	
Sleep problem						<.001 ^a
No problem	263(56.9)	103(62.8)	56(50.0)	48(50.0)	56(62.2)	
Low level	93(20.1)	13(7.9)	32(28.6)	21(21.9)	27(30.0)	
Moderate or high levels	106(22.9)	48(29.3)	24(21.4)	27(28.1)	7(7.8)	
Balance impairment						0.054 ^a
Yes	78(16.9)	33(20.1)	18(16.1)	20(20.8)	7(7.8)	
No	384(83.1)	131(79.9)	94(83.9)	76(79.2)	83(92.2)	
Self-reported vision impairment						0.629 ^a
Yes	83(18.0)	31(18.9)	16(14.3)	17(17.7)	19(21.1)	
No	379(82.0)	133(81.1)	96(85.7)	79(82.3)	71(78.9)	
Using walking assistive device						0.155 ^a
Yes	39(8.4)	13(7.9)	5(4.5)	9(9.4)	12(13.3)	
No	423(91.6)	151(92.1)	107(95.5)	87(90.6)	78(86.7)	
Taking medication						0.689 ^a
Yes	44(9.5)	13(7.9)	13(11.6)	8(8.3)	10(11.1)	
No	418(90.5)	151(92.1)	99(88.4)	88(91.7)	80(88.9)	
Having been treated as inpatient						0.584 ^a
Yes	90(19.6)	28(17.1)	26(23.2)	18(18.8)	20(22.2)	
No	370(80.4)	136(82.9)	86(76.8)	78(81.2)	70(77.8)	
Mental health problem						0.034 ^a
Yes (≥6 scores)	250(54.1)	91(55.5)	63(56.3)	40(41.7)	56(62.2)	
No (<6 scores)	212(45.9)	73(44.5)	49(43.8)	56(58.3)	34(37.8)	
Mean ± SD	5.73 ± 2.20	5.80 ± 2.16	5.83 ± 2.16	5.05 ± 1.93	6.21 ± 2.43	
Min - Max	2–13	2–13	2–12	3–11	3–11	
Fall prevention behaviors (score)						0.98 ^b
Mean ± SD	21.41 ± 3.04	21.68 ± 3.00	21.29 ± 3.00	21.65 ± 2.97	20.77 ± 3.15	
Min - Max	14–28	16–28	15–26	14–27	16–26	

^a Chi-square test.

^b One-way ANOVA.

Fall prevention behaviors were modified from the existing research and consisted of ten questions using a Likert scale with three choice options for the answers to gauge the scale: 1) never, 2) sometimes, and 3) regularly, which is given a score of 1, 2, and 3, respectively. The total score ranges from 10 to 30 on this scale, with a higher score indicating higher compliance with fall prevention behaviors. Examples of questions are, “You choose to wear clothes that are the right size for your body, not too big or too long”; “You like reaching down to pick up things with your whole hand”; “You always keep the bathroom floor dry”; or “You exercise your thigh muscles, such as walking or stretching”.

The questionnaire contents were examined by three experts from the areas of gerontological nursing, mental health, and public health and were revised before a pilot study was performed on 30 older adults. The Cronbach’s alpha coefficient reported the reliability of the questionnaire as 0.88 for mental health and 0.90 for fall prevention behaviors.

2.3. Statistical analysis

Descriptive statistics (minimum, maximum, mean, standard deviation, frequency, and percentage) were presented for the characteristics of the participants. The Chi-square test was used to examine differences in categorical variables among ethnic groups, while one-way analysis of variance (ANOVA) was used to examine differences in fall prevention behavior scores. We used binary logistic regression to investigate factors associated with mental health problems and accidental falls, as well as linear regression to investigate factors associated with fall prevention behaviors. Initially, univariable analysis was performed to examine the association between each independent variable and the outcome. Variables with $P < .20$ from the univariable analysis were selected as candidates for inclusion in the multivariable analysis. We used the enter method to eliminate an insignificant variable with the largest p-value from the model until only statistically significant variables remained (final model). Statistical significance was defined as a p-value of less than 0.05. The variance inflation factor (VIF) of all variables in the final model was less than 1.5, indicating no multicollinearity. We conducted analyses using SPSS software (SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Participant characteristics and home environment

A total of 462 older adults were included, predominantly women (51.7 %), aged between 60 and 104 years (mean age: 68.22 years). Education was limited, with only 21.2 % having received formal education, and 34.0 % reporting sufficient income. Health indicators revealed that 51.1 % had abnormal BMI, 42.6 % had underlying diseases, 34.6 % drank alcohol, and 22.7 % smoked. Ethnic groups differed significantly in demographic and health factors such as age, education, marital status, financial status, BMI, underlying diseases, and cohabitation status.

Participant characteristics are detailed in Table 1. The average number of family members was four; 67.0 % of the older adults lived with their children, 62.1 % with their spouse, 22.1 % with their grandchild, and 11.5 % with their son/daughter-in-law. They reported having a vision impairment (18.0 %), with eyesight problem (short-sightedness, long-sightedness, astigmatism) at 50.6 % and eye diseases (cataract, glaucoma) at 49.4 %. Half of them (54.1 %) had a mental health problem. The mean score of participants’ fall prevention behaviors was 21.41 ± 3.04 .

In terms of fall occurrence as previously reported [5], some participants had fallen in the previous 12 months (25.1 %) with single

Table 2
Home environments of older adults classified according to ethnic group.

Variables	Overall (n = 462) n(%)	Karen (n = 164) n(%)	Mien (n = 112) n(%)	Indigenous (n = 96) n(%)	Hmong (n = 90) n(%)	P-value
House design						<.001 ^a
Single-story house	200(43.3)	41(25.0)	66(58.9)	48(50.0)	45(50.0)	
Raised house	262(56.7)	123(75.0)	46(41.1)	48(50.0)	45(50.0)	
Type of floors						<.001 ^a
Soil	26(5.6)	2(1.2)	12(10.7)	4(4.2)	8(8.9)	
Cement or tile	251(54.3)	68(41.5)	72(64.3)	62(64.6)	49(54.4)	
Wooden	185(40.0)	94(57.3)	28(25.0)	30(31.3)	33(36.7)	
Floor without risk factors						0.042 ^a
Yes	286(61.9)	103(62.8)	64(57.1)	70(72.9)	49(54.4)	
No	176(38.1)	61(37.2)	48(42.9)	26(27.1)	41(45.6)	
Stairs with handrails and lighting						<.001 ^a
Yes	213(46.1)	109(66.5)	29(25.9)	40(41.7)	35(38.9)	
No	249(53.9)	55(33.5)	83(74.1)	56(58.3)	55(61.1)	
Bedroom on the first floor						0.335 ^a
Yes	95(20.6)	30(18.3)	19(17.0)	24(25.0)	22(24.4)	
No	367(79.4)	134(81.7)	93(83.0)	72(75.0)	68(75.6)	
Bathroom location						<.001 ^a
Outside the house	315(68.2)	133(81.1)	69(61.6)	63(65.6)	50(55.6)	
Inside the house	147(31.8)	31(18.9)	43(38.4)	33(34.4)	40(44.4)	

^a Chi-square test.

falls at 81.9 % and recurrent falls at 18.1 %. Additionally, the most falls occurred in the afternoon (48.3 %), followed by the evening (34.5 %), and the morning (31.0 %). Falls around the house were found to be 65.5 %, followed by outdoor falls such as agricultural areas, forests, and hills (24.1 %), and indoor falls (20.7 %). Table 2 illustrates home environment characteristics. Approximately 61.9 % of respondents reported that their home floor was free of risk factors such as slippery or uneven floors, carpeted walkways, and objects or obstacles in walkways.

3.2. Factors associated with mental health problems and fall prevention behaviors

The multivariable analysis of logistic regression showed that five factors – gender, age, underlying disease, alcohol drinking, and family size – can account for 14.4 % of the variance in the log odds of mental health problem in older adults ($p < .05$) (Table 3). The results of multiple linear regression revealed that gender, age, occupation, financial status, BMI, and alcohol consumption were significantly related to the fall prevention behaviors among ethnic older adults ($p < .05$, $R^2 = 19.0$ %) (Table 4).

3.3. Factors associated with one-year falls

Variables associated with one-year falls among ethnic older adults are presented in Table 5. Increased score in fall prevention behaviors significantly reduced the odds of falling (62.7 % decrease per unit increase), while mental health problems increased the odds (14.87 times higher). Home environment factors were significant in univariate analysis but not in multivariable model. In the final model, gender, financial status, underlying disease, vision impairment, fall prevention behaviors, and mental health problems collectively explained 84.7 % of the variation in log odds of falling.

4. Discussion

Our findings highlight significant associations between falls and mental health problems, inadequate fall prevention behaviors, and unsafe home environments among ethnic older adults in Northern Thailand. Over half of the adults surveyed, particularly in the Hmong, Mien, and Karen communities, exhibited severe mental health issues influenced by a mix of social, psychological, and biological factors [27]. This vulnerability is aligned with broader literature showing that such complexities increase the likelihood of falls [27]. Studies across Asia and the US further underscore the link between depression and heightened fall risk [22,24]. Cognitive impairments, prevalent among over half of the hill-tribe adults, exacerbate physical vulnerabilities and fall risks [13,23]. Addressing these risks necessitates enhanced access to medical services like counseling and occupational therapy tailored to the cultural and social specifics of Thai hill tribes [13].

Almost half of the participants in our study scored moderately to low on fall prevention behaviors, primarily due to insufficient knowledge about fall risks, which in turn affects self-care practices [28]. Enhancing fall prevention education through robust, interactive, and engaging interprofessional programs is crucial [18,29]. However, language barriers limit the effectiveness of these programs, as many older adults struggle with the official language [30]. To overcome this, it's essential to involve medical staff fluent in tribal languages and initiate public health education for local youth, thereby improving access to health services [13,16,30].

Engagement in fall prevention activities significantly lowers fall risks among older adults, as behavioral decisions directly impact

Table 3
Factors associated with mental health problem among ethnic older adults by binary logistic regression.

Factors	Mental health problem					
	Univariable			Multivariable		
	OR	95%CI	P-value	OR	95%CI	P-value
Ethnics						
Karen vs Indigenous	1.75	1.05, 2.90	0.032*			
Mien vs Indigenous	1.80	1.04, 3.12	0.037*			
Hmong vs Indigenous	2.31	1.28, 4.15	0.005*			
Gender (male)	0.58	0.39, 0.84	0.004*	0.48	0.32, 0.73	0.001*
Age (≥ 70 years)	1.99	1.34, 2.94	0.001*	1.81	1.11, 2.96	0.020*
Education (yes)	0.66	0.42, 1.03	0.068			
Marital status (married)	1.16	0.66, 2.03	0.612			
Occupation						
Farmer vs No	0.95	0.62, 1.45	0.815			
Hunter-gatherer vs No	0.93	0.55, 1.57	0.785			
Weaver vs No	1.98	0.89, 4.39	0.092			
Financial status (sufficient)	0.79	0.54, 1.17	0.241			
BMI (normal)	0.59	0.40, 0.85	0.004*			
Underlying disease (yes)	2.44	1.66, 3.57	<0.001*	1.70	1.09, 2.67	0.020*
Alcohol drinking (yes)	1.62	1.09, 2.39	0.015*	1.93	1.23, 3.01	0.004*
Smoking (yes)	-0.09	0.59, 1.41	0.685			
Number of family members (≥ 4)	0.48	0.33, 0.69	<0.001*	0.56	0.38, 0.83	0.004*

Note: CI = Confidence interval; OR = Odds ratio.

Table 4
Factors associated with fall prevention behaviors among ethnic older adults by linear regression.

Factors	Fall prevention behaviors					
	Univariable			Multivariable		
	B	95%CI	P-value	B	95%CI	P-value
Ethnics						
Karen vs Indigenous	0.01	−0.76, 0.77	0.988			
Mien vs Indigenous	−0.39	−1.22, 0.44	0.353			
Hmong vs Indigenous	−0.91	−1.78, −0.04	0.041*			
Gender (male)	1.21	0.66, 1.75	<0.001*	1.47	0.92, 2.02	<0.001*
Age (years)	−0.05	−0.09, −0.01	0.007*	−0.09	−0.13, −0.05	<0.001*
Education (yes)	0.43	−0.25, 1.11	0.215			
Marital status (married)	0.24	−0.81, 0.83	0.591			
Occupation						
Farmer vs No	−0.35	−0.98, 0.28	0.278	−0.90	−1.53, −0.27	0.005*
Hunter-gatherer vs No	−0.89	−1.68, −0.10	0.027	−1.31	−2.07, −0.56	0.001*
Weaver vs No	−2.07	−3.18, −0.96	0.001*	−1.55	−2.62, −0.48	0.005*
Financial status (sufficient)	1.30	0.73, 1.88	<0.001*	0.92	0.37, 1.46	0.001*
BMI (normal)	1.26	0.71, 1.80	<0.001*	0.87	0.35, 1.39	0.001*
Underlying disease (yes)	−1.41	−1.96, −0.86	<0.001*			
Alcohol drinking (yes)	−0.98	−1.55, −0.40	0.001*	−1.14	−1.69, −0.59	<0.001*
Smoking (yes)	−0.17	−0.83, 0.49	0.616			
Number of family members (person)	−0.06	−0.19, 0.07	0.335			

Note: B = Unstandardized coefficient; CI = Confidence interval.

fall-related risks [31]. This study underscores the effectiveness of measures like wearing suitable clothes and shoes, maintaining clean and safe living environments, and regular exercise. Regular participants in such activities have shown a 25 percent reduction in fall incidents [32]. However, issues such as inappropriate footwear exacerbate fall risks, particularly during farming activities in rural areas [33]. Misconceptions about aging and falls can also hinder effective prevention, as some elders with overly confident attitudes about their physical abilities face increased risks due to poor postural balance [34,35]. Simple home modifications like removing clutter, cleaning slippery floors, and enhancing lighting are effective in mitigating fall risks [36]. Community health workers, including nurses and public health professionals, play a vital role in promoting these behaviors and improving awareness among older adults, thereby enhancing the sustainability of fall prevention efforts [13,37].

Differences in floor types significantly affect fall risks among ethnic older adults, with cement, tile, or soil surfaces increasing incidents due to their slipperiness and unevenness [38]. Conversely, safer floor conditions and organized living spaces mitigate these risks [38]. Although multivariable analysis showed that home environment characteristics generally had insignificant impacts, specific features like poorly lit stairs without handrails markedly increase fall risks [9,39]. Our findings highlight the importance of considering the unique cultural and environmental contexts of ethnic minority groups in designing fall prevention strategies. Holistic health approaches, including multidomain interventions that incorporate environmental modifications tailored to these specifics, have the potential to enhance effectiveness significantly [13,21,38].

Gender, financial status, underlying diseases, and visual impairment significantly impact fall risks among ethnic older adults. Studies indicate that women over 70 are more prone to falls [40], and limited personal income exacerbates access barriers to health services, enhancing fall risks particularly among ethnic groups [4,41]. Comorbidities also correlate with an increased likelihood of falls [42]. Furthermore, visual impairments significantly contribute to fall incidents, as they can prevent older adults from seeing home hazards, increasing accidents particularly in rural settings [43].

Mental health problems in ethnic older adults were significantly linked to gender, age, underlying diseases, alcohol consumption, and family dynamics, consistent with evidence that female adults and those aged over 70 face higher mental health risks [25,44]. Chronic conditions and the scarcity of medical resources in remote areas further aggravate these mental health challenges [45]. Social support is recognized as a crucial protective factor against mental health disorders, offering substantial benefits [46]. Additionally, excessive alcohol use is frequently observed among those with mental health issues, with more than 10 % of psychogeriatric admissions linked to substance abuse [47,48]. The COVID-19 pandemic has exacerbated these mental health issues, increasing alcohol dependency among older adults [49]. In hill tribe communities, where large, extended families are common, the robust familial networks provide essential support and influence health outcomes significantly. This cultural context underscores the importance of family in both stabilizing and enhancing the mental and physical health of older adults [50–53]. Tailoring mental health interventions to leverage these strong family bonds and addressing the unique social and environmental challenges faced by hill tribes are crucial for effective healthcare delivery [13,50,51].

Our study demonstrated that fall prevention behaviors among ethnic older adults are significantly influenced by gender, age, occupation, financial status, BMI, and alcohol consumption. Notably, males reported higher engagement in fall prevention behaviors than females, supported by their greater propensity for self-management actions [17,54]. Physical limitations due to aging, such as muscle mass deterioration and reduced mobility, particularly impact farmers, hunter-gatherers, and weavers, increasing their fall risk due to occupational hazards like prolonged sitting which leads to physical discomfort and weakness [55]. Financial stability was also linked to better fall prevention practices, with those having higher income more likely to maintain safer environments and access

Table 5
Demographic and health characteristics, mental health, fall prevention behaviors, and home environments associated with falls among ethnic older adults by binary logistic regression.

Factors	Fall Experience					
	Univariable			Multivariable		
	OR	95%CI	P-value	OR	95%CI	P-value
Ethnics						
Karen vs Indigenous	1.22	0.64, 2.32	0.554			
Mien vs Indigenous	1.78	0.91, 3.47	0.091			
Hmong vs Indigenous	2.82	1.44, 5.54	0.003*			
Gender (male)	0.26	0.16, 0.42	0.001*	0.25	0.09, 0.66	0.005*
Age (≥70 years)	3.14	2.03, 4.84	0.001*			
Education (yes)	0.31	0.16, 0.61	0.001*			
Marital status (married)	0.98	0.51, 1.87	0.950			
Occupation						
Farmer vs No	1.05	0.62, 1.76	0.858			
Hunter-gatherer vs No	1.72	0.95, 3.13	0.074			
Weaver vs No	6.07	2.77, 13.29	<0.001*			
Financial status (sufficient)	0.07	0.03, 0.16	<0.001*	0.08	0.02, 0.27	<0.001*
BMI (normal)	0.27	0.17, 0.43	<0.001*			
Underlying disease (yes)	8.24	5.01, 13.56	<0.001*	9.60	3.57, 25.86	<0.001*
Alcohol drinking (yes)	2.28	1.48, 3.51	<0.001*			
Smoking (yes)	1.34	0.82, 2.18	0.236			
Living with husband/wife (yes)	0.54	0.35, 0.82	0.004*			
Sleep problem						
Low level vs No	1.22	0.70, 2.12	0.493			
Moderate or high levels vs No	1.98	1.21, 3.26	0.007*			
Balance impairment (yes)	0.95	0.54, 1.68	0.867			
Vision impairment (yes)	5.49	3.31, 9.09	<0.001*	5.59	1.77, 17.61	0.003*
Using walking aid (yes)	1.76	0.88, 3.52	0.108			
Taking medication (yes)	1.62	0.84, 3.15	0.152			
Being treated as inpatient (yes)	1.82	1.10, 2.99	0.019*			
Mental health problem (yes)	14.87	7.51, 29.43	<0.001*	8.79	2.96, 26.09	<0.001*
Fall prevention behaviors (scores)	0.37	0.31, 0.45	<0.001*	0.44	0.36, 0.55	<0.001*
House design (raised house)	0.88	0.58, 1.34	0.547			
Type of floors						
Soil vs Wooden	2.59	1.08, 6.17	0.032*			
Cement or tile vs Wooden	1.60	1.01, 2.53	0.044*			
Floor without risk factors (yes)	0.23	0.14, 0.35	<0.001*			
Stairs with handrails and light (yes)	0.64	0.42, 0.98	0.042*			
Bedroom on the first floor (yes)	1.16	0.70, 1.93	0.569			
Bathroom location (outside)	1.05	0.67, 1.65	0.834			

Note: CI = Confidence interval; OR = Odds ratio.

necessary safety equipment [56]. However, alcohol consumption negatively affected fall prevention efforts, with drinkers exhibiting poorer safety behaviors. Addressing these disparities requires a comprehensive approach that includes socioeconomic considerations, targeted health interventions, and enhancements to medical and health infrastructure to support safe behaviors across this diverse population [4,13].

The study’s strength is its evidence of an association between mental health and falls in older adults, suggesting that surveillance and fall prevention efforts should focus more on older adults with mental health issues. However, this study has several limitations due to its cross-sectional design, which hampers causal inference. Data collection during Thailand’s second COVID-19 wave may have also heightened reported mental health disorders. Cultural and linguistic diversity among participants could affect data accuracy and limit generalizability. Additionally, reliance on older adults’ recall for past-year fall incidents introduces potential bias. Despite these challenges, this research provides initial insights into the household environments, fall prevention behaviors, and mental health impacts on falls among minority older adults. Future studies should refine methodologies to overcome these limitations and continue promoting mental health and fall prevention to reduce risks, particularly among highland (Mien, Hmong) and lowland (Karen) communities.

5. Conclusion

The risk of falls among ethnic minority older adults is significantly influenced by mental health problems and fall prevention behaviors, as well as the home environment. Effective fall prevention requires integrated public health interventions that encompass mental health screenings, fall preventive behavior enhancements, environmental safety improvements, and supportive policies tailored to the needs of rural communities.

Ethics statement

All procedures performed in the study involving human participants were in accordance with the ethical standards of the Ethics Committee of the University of Phayao, Thailand (No.1.3/020/63) The study was conducted in accordance with the Declaration of Helsinki the Belmont Report, CIOMS Guideline, and International Conference on Harmonization in Good Clinical Practice (ICH-GCP).

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Prakasit Tonchoy: Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Katekaew Seangpraw:** Writing – original draft, Validation, Supervision, Methodology, Funding acquisition, Data curation, Conceptualization. **Parichat Ong-Artborirak:** Writing – review & editing, Writing – original draft, Validation, Software, Project administration, Formal analysis, Data curation, Conceptualization. **Supakan Kantow:** Software, Resources, Investigation, Data curation. **Nisarut Auttama:** Resources, Investigation, Data curation. **Monchanok Choowanthanapakorn:** Resources, Investigation, Data curation. **Sorawit Boonyathee:** Validation, Resources, Investigation, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e37306>.

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