

Analysis and prevention of falls among community-dwelling older adults in southern Thailand

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Abstract

Aim: To analyse fall prevalence, risk factors and perceptions among Thai older adults to design a prevention model.

Design: Quantitative and qualitative data were collected using a convergent parallel mixed-methods design.

Methods: A cross-sectional analysis was conducted using secondary data from health screenings of older adults in 20 subdistrict hospitals in southern Thailand from January 2018 to September 2019 ($n = 12,130$). In-depth interviews (IDIs) and focus group discussions (FGDs) were conducted with purposively sampled participants who were representatives of older adults and stakeholders ($n = 50$).

Results: The quantitative analysis showed that the prevalence of falls was 12.1%. The independent risk factors were female gender, employment status, cognitive impairment, semi-dependent functional ability, balance problems, vision impairment, hearing difficulties, use of medications, reliance on assistive devices and access to outdoor toilets. The qualitative analysis revealed misconceptions on falls and fall prevention measures among older adults and community stakeholders. In Thailand, healthcare providers and community nurses play a crucial role in providing primary advice and conducting interventions, yet they encounter obstacles due to lack of personnel, time constraints, limited resources, inadequate support and unclear policies. Stakeholders stress the urgency of improving practice guidelines, developing evidence-based strategies and aligning with government policies.

Conclusions: Fall risk factors and prevention challenges among older adults were identified. Effective fall prevention programmes are needed.

Impact: The identified fall events may guide public health agencies and local administrations in planning fall prevention programmes. For implementation in Thai communities, teamwork among leaders and stakeholders is key.

Patient or Public Contribution: IDIs and FGDs were conducted with older adults, village health volunteers, nurses, healthcare providers, local organization administrators and village headmen.

KEYWORDS

fall prevention measure, nursing, perception of falls, Thai older adults

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1 | INTRODUCTION

Falls pose a significant risk to community-dwelling older adults worldwide, resulting in unintentional injuries and premature death (World Health Organization, 2007). The World Health Organization (2021) mentioned that low- and middle-income countries, particularly in the Western Pacific and Southeast Asia, account for over 80% of fall-related fatalities. Moreover, death rates were the highest among individuals aged 60 and over in all regions. Falls not only present a severe public health problem but are also the leading cause of restricted activity and diminished quality of life among older adults. However, this issue is often neglected, particularly in developing countries. While fall rates vary globally based on factors such as region, sex and community-dwelling status, it is estimated that 28%–35% of individuals aged 64 and over experience falls annually, a figure that increases to 32%–42% for those over the age of 70 (WHO, 2007). Furthermore, specific studies conducted in Southeast Asia have demonstrated a fall prevalence of 29% among older adults in Indonesia (Susilowati et al., 2020) and approximately 15.3% among community-dwelling older adults in Thailand (Aekplakorn et al., 2021). These findings highlight the need for targeted interventions in the region.

1.1 | Background

The current body of knowledge on falls among older adults has investigated various aspects, including the prevalence and risk factors (Aekplakorn et al., 2021; Ngamsangiam & Suttanon, 2020; Wu & Ouyang, 2017), perception of falls (Vincenzo et al., 2022) and stakeholder perspectives on fall prevention (Markle-Reid et al., 2017; Mendoza-Núñez et al., 2019). However, notable gaps in the existing literature must be addressed. Specifically, limited attention has been paid to the geographical region of southern Thailand and its community-dwelling older adults, emphasizing the need for research specific to this population. Moreover, studies examining the perception of falls among older adults and the perspectives of stakeholders involved in fall prevention efforts in this context are lacking. Furthermore, although some fall prevention models and interventions have been developed (Montero-Odasso et al., 2021), their applicability and effectiveness in addressing the unique needs and challenges of community-dwelling older adults in southern Thailand remain uncertain.

2 | THE STUDY

2.1 | Aims

To bridge these gaps, this study aimed to analyse the prevalence of falls, identify risk factors, explore the perception of falls and understand the perspectives on fall prevention. These findings provide a holistic understanding of falls among older adults and can

guide public health agencies, local administrations and community leaders in planning and implementing effective fall prevention programmes, thereby addressing the specific needs and challenges faced in reducing fall rates and improving the well-being of older adults in this region.

3 | METHODS

3.1 | Study setting

This study was conducted in 20 purposively selected subdistricts located in seven provinces of southern Thailand: Nakhon Si Thammarat, Pattalung, Surathani, Chumporn, Songkhla, Krabi and Panga. The total population was 421,020 of which 31,530 were older adults.

3.2 | Study design

In a convergent parallel mixed-methods design, quantitative and qualitative data were collected simultaneously and analysed separately to integrate the findings during the interpretation stage (Creswell, 2014), as summarized in Figure 1. The triangulation of qualitative and quantitative data was achieved, and data collection continued until saturation.

3.2.1 | Quantitative component

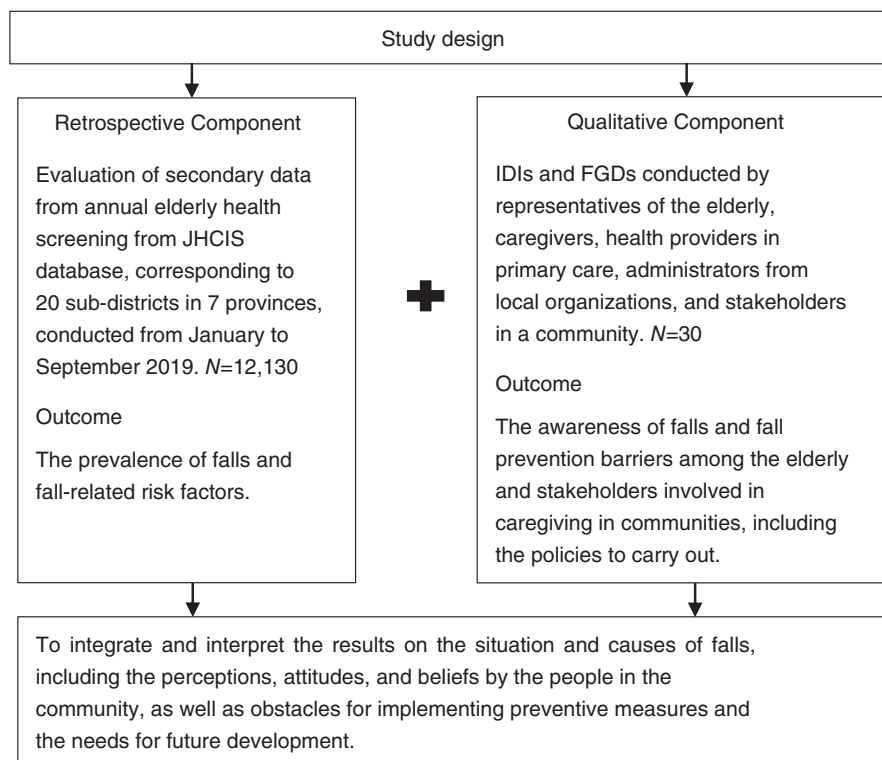
This cross-sectional analysis utilized secondary data from the Joint Health Care Information System (JHCIS) database, derived from the annual health screenings of older adults. Data were obtained from 20 subdistrict health-promoting hospitals in southern Thailand from January 2018 to September 2019. In each subdistrict, a list of all older adults was extracted from a database provided by public health officers. Each list contained approximately 600–700 older adults with a total sample size of 12,130, representing 38.5% of the total older adult population.

The primary objective of this study was to determine the prevalence of falls among Thai older adults in southern communities. The secondary aim was to study factors associated with and predictive of falls in this population.

Inclusion and exclusion criteria

Older adults were included in this study. The sole criterion for inclusion was an age requirement of at least 60, encompassing all older adults who had registered to receive services at each of the 20-subdistrict health-promoting hospitals in southern Thailand. The data used for the analysis were obtained from the JHCIS database, which contains information on older adults who met the inclusion criteria. The exclusion criterion involved removing incomplete data that did not align with the purpose of the study. This indicates a

FIGURE 1 The mixed-methods design of the study, consisting of two components: retrospective and qualitative. FGD, focus group discussion; IDI, in-depth interview.



purposeful selection process for gathering data that met the specific objectives of this study.

Procedure

The JHCIS database of 20 subdistrict health-promoting hospitals was utilized for the period of January 2018 to September 2019. The monitoring of fall episodes was achieved through the annual health screening of older adults, specifically utilizing the screening form provided by the Ministry of Public Health. The screening form incorporates pertinent questions concerning an individual's history of falls. Moreover, a multifactorial screening approach for health problems in older adults was implemented to comprehensively assess and identify the potential risk factors associated with falls.

Trained village health volunteers conducted the screenings that specifically captured fall histories and related factors. The data collectors underwent comprehensive training on variable definitions and the standardized use of the data collection instrument to ensure accurate data entry. The test was supervised by a principal investigator to enhance its reliability. A second researcher carefully checked the data to ensure completeness, accuracy and clarity.

Data collection

The Risk Factor Model proposed by the World Health Organization (2007) was used to guide the selection of predictive variables. Therefore, the collected data were classified into four sections. The sections were demographic characteristics, health profiles, behavioural and environmental characteristics. Each of them, in turn, consists of several variables. (1) Demographic characteristics include seven areas: age, sex, educational level,

marital status, religion, current employment status and living arrangement. (2) Health profiles, which cover body mass index computed as the weight in kilograms divided by the square of the height in meters, classified into three categories as follows: (i) chronic conditions when diagnosed by a physician with at least one of the following diseases: hypertension, diabetes, heart disease, stroke, Parkinson's disease, asthma, arthritis, seizures or cancer (Paliwal et al., 2017); (ii) cognitive impairment, as assessed by the MMSE Mental State Examination Thai version-2002, which considers a maximum of 30 points. Aekplakorn (2016) determined that the cut-off points indicated cognitive impairment, that is, 14 for older adults who are illiterate or did not complete elementary school, 17 for elementary education and 22 for higher educational levels. Cognitive impairment is indicated below these values. (iii) Functional ability was assessed using the modified Barthel Index of Activities of Daily Living (ADL), which includes feeding, dressing, bathing, toileting and transferring from beds or chairs. Ranging from 0 to 20, we considered three groups: dependent or bedridden (0–4), semi-dependent (5–11) and independent or active older adults (≥ 12). Balance was assessed using the full tandem stance test. Older adults with impaired balance are those who cannot stand with their feet in a straight line or for more than 10s. Visual impairment was assessed using a Snellen chart or an E chart for illiterate individuals. Visual impairment was deemed to exist when the best-corrected visual acuity was less than 20/40. Hearing problems were assessed by asking, 'Do you have difficulty with your hearing?' The answers were categorized as yes/no. (3) Behaviours focused on three areas: the use of medications, where the older adults took four or more drugs or potential medicines causing dizziness or sleepiness (i.e. hypnotics, antidepressants and tranquilisers) in the same month

(Ming & Zecevic, 2018). The reference for exercise behaviour was moderate-intensity aerobic activity for at least 150 min per week or 3 days per week. The use of assistive devices included walkers, canes or sticks. The answers were categorized as yes/no. (4) Environmental hazards assessed six areas: indoor home areas, including at least one of the following items: slippery floor, dim lighting and uneven ground surface; stairs without handrails or with broken parts; bathrooms or toilets located outside the home; Asian squat toilet; bathrooms or toilets without grab bars; and the bedroom being located upstairs. Each item required a yes/no response.

Statistical analysis

The collected data were analysed using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics of frequencies and percentages were used to describe the characteristics of fall prevalence. Chi-squared cross-tabulation tests were applied categorical variables to distinguish between fallers and non-fallers. Variables that were significant ($p < .05$) were used for binary logistic regression analyses. First, using univariate analysis, we obtained crude odds ratios (OR) and 95% confidence intervals (CI). Then, we used a multivariable analysis with the 'enter method' to identify the predictive factors for falls, from where we obtained the adjusted OR and 95% CI. Therefore, this study used both longitudinal data and statistical analysis techniques to associate and predict risk factors for falls.

3.2.2 | Qualitative component

Data collection involved conducting in-depth interviews (IDIs) and focus group discussions (FGDs) to explore the perceptions, beliefs and attitudes of older adults and stakeholders regarding falls among older adults and fall prevention in the community. The data collection period spanned from October to December 2019.

Inclusion and exclusion criteria

The selection criteria for the participants aimed at ensuring diversity in different community sectors. This study used a purposive sampling approach. The chosen participants included older adults, community leaders, healthcare providers, caregivers and representatives from relevant organizations. The participants were selected from 20 subdistricts and attended a seminar titled, 'The development of elderly care project in Southern Thailand', from October 8 to 11, 2019. Participants who refused to provide meaningful responses to the interviews were excluded. Participants who declined consent were excluded from the IDIs and FGDs.

We recruited a total of 50 participants, including representatives of older adults ($n=30$, age 61–78) and stakeholders ($n=20$, age 45–78), such as nurses ($n=3$), administrators from subdistrict health-promoting hospitals ($n=3$), health volunteers ($n=4$), village headmen ($n=3$), the permanent secretary of the subdistrict administration organization (SAO) ($n=3$) and SAO executives ($n=4$), from 20 subdistricts across seven provinces in Thailand. Older adults and

stakeholders were recruited through purposive sampling. They attended a seminar of the project titled, 'The development of elderly care in the community', from October 8 to 11, 2019 organized by the School of Nursing of Walailak University.

Five FGDs were conducted at Walailak University, each consisting of 8–10 participants. Three focus groups included older adults and took place in a conference room at the nursing school, while the other two focus groups involved stakeholders in a separate conference room. Different arrangements are often required in FGDs to enhance data richness by promoting diverse perspectives, encouraging participation and facilitating open discussions.

Additionally, seven IDIs were conducted with four executives from SAOs and three administrators from subdistrict health-promoting hospitals. Open-ended questions were tailored to each community's circumstances to gather comprehensive insights into fall operations and prevention strategies.

Procedure and data collection

Qualitative data were collected through FGDs and individual IDIs. Participants involved in the FGDs shared their experiences and perspectives on falls and fall prevention using prompts. FGDs lasted 60–80 min, were audio recorded with consent and followed a semi-structured interview guide (Table 1). Non-verbal cues were observed, and interviews were recorded and verified.

At the beginning of the FGDs, the objective of the discussion was explained in the local language, and the participants were assured that the information would only be used for research purposes. Participants were asked to provide written informed consent and were reassured that they could withdraw from the discussion at any time. After welcoming everyone at the beginning of each session, the facilitator requested that the participants narrate their experiences of fall events such as tripping or slipping. This acted as a thought-provoking instrument for the participants. The facilitator then introduced a series of prompts to address the desired information. Each session was audio recorded with the permission of the respondents. Pseudonyms were used to protect the privacy and anonymity of the participants. A second investigator observed all sessions and took field notes.

For the IDIs, open-ended questions tailored to each community's circumstances were used to explore their perspectives on fall operations and prevention strategies. IDIs lasted 30–50 min, were recorded, verified and transcribed.

Data collection continued until saturation, ensuring that sufficient information was gathered. The work of the interviewer consisted in making a script or list of topics before interviewing, asking questions confidently to allow the interviewees to feel comfortable, observing and taking notes on the interviewees' body language and gestures, and transcribing and verifying the recordings with the interviewee. Two assistant researchers transcribed audio recordings for accuracy, while a second investigator observed sessions and took detailed field notes. All FGDs and IDIs were audio recorded with the participants' consent and the transcriptions were verified by the interviewees. Participants' privacy was protected using pseudonyms.

TABLE 1 Semi-structured interview questions guide for focus group discussion.

Interview topic	Objective	Open-ended questions	Probes
Circumstances of falls	Elicit information about the situation of fall among older adults in 20 subdistricts	1. Can you share any specific instances of falls that you have observed or experienced among older adults in the community?	Could you describe the location and time of these falls?
		2. What are some common factors or situations that contribute to falls among older adults in this community?	Are there any environmental hazards or specific activities that increase the risk of falls?
		3. How do you perceive the impact of falls on the lives of older adults in terms of physical, psychological and social aspects?	Are there any notable consequences or challenges faced by older adults after a fall?
Perception on fall among older adults	Discuss the perception on falls	1. What are your perceptions and beliefs about falls among older adults?	Can you share any personal experiences or observations related to falls?
			How do you think falls impact the lives of older adults?
			Are there any cultural or societal beliefs that influence how falls are perceived?
		2. What do you think are the main risk factors for falls among older adults?	In your opinion, what are some of the common causes or contributors to falls?
			Are there any specific health conditions or physical impairments that increase fall risk?
			Are there any environmental factors that you believe contribute to falls?
		3. What strategies or measures do you think are effective in preventing falls among older adults?	Have you come across any fall prevention programmes or initiatives?
			What are some actions or behaviours that you believe can help reduce fall risk?
			Are there any specific interventions or assistive devices that you think are beneficial?
		4. What strategies or measures do you think are effective in preventing falls among older adults?	Have you come across any fall prevention programmes or initiatives?
Perception on fall prevention	Discuss the current fall prevention measures in 20 subdistricts		What are some actions or behaviours that you believe can help reduce fall risk?
			Are there any specific interventions or assistive devices that you think are beneficial?
		5. What barriers or challenges do you see in implementing fall prevention measures?	Are there any obstacles that older adults face in accessing fall prevention resources?
			Do you think there are any cultural or societal factors that hinder fall prevention efforts?
			Are there any gaps in knowledge or awareness about fall prevention among stakeholders?
		1. What are your thoughts and beliefs about fall prevention among older adults in this community?	Are there any cultural or traditional practices related to fall prevention?
		2. How important do you think fall prevention is in promoting the health and well-being of older adults?	What are some common misconceptions or myths about fall prevention?
		3. What do you perceive as the main barriers or challenges to implementing fall prevention strategies in this community?	Are there any specific resources or support that you think would be helpful in promoting and sustaining fall prevention efforts?

(Continues)

TABLE 1 (Continued)

Interview topic	Objective	Open-ended questions	Probes
Executives' perspectives	(1) Discuss on the perspectives	1. As a stakeholder in the elderly care system, what role do you think you play in preventing falls among older adults?	How do you currently address fall prevention in your role or organization?
	(2) In depth-interview	2. What are the main challenges or gaps in the current fall prevention practices or programmes in this community?	Are there any collaborative opportunities or potential partnerships for improving fall prevention efforts?
		3. What recommendations or suggestions do you have for developing effective and sustainable fall prevention initiatives?	Are there any specific cultural or contextual factors that should be considered in designing fall prevention interventions?

Data analysis

The research team transcribed all transcripts and audio and video recordings to ensure accuracy through independent comparison and improvement by two research assistants. Data management and analysis were performed using Nurse App software (<http://nurseapp.hccrg.org/index.php>). A thematic analysis was conducted to identify the main themes. Independent coding by the primary and secondary investigators established the coding framework. Any discrepancies were resolved through discussions among all investigators until a consensus was reached. The first investigator applied the coding framework to code the remaining transcripts and any new codes that emerged were added to the code list with input from the second and third investigators. The codes were then organized into broader categories aligned with the emerging themes identified in the data. The findings are presented as themes and categories, with supporting quotes provided.

Ethical considerations

Oral and written informed consent was obtained from all participants. Ethical clearance was obtained from the Ethics Review Committee of Research Involving Human Research Subjects, Health Sciences Group, Walailak University (WUEC-19-068-01).

4 | RESULTS

4.1 | Results of the quantitative component

4.1.1 | General characteristics

The secondary data consisted of 12,130 community-dwelling older adults with a mean age of 71.22 years (SD 8.49) and an age range of 60–104 years. The results are summarized in Table 2. Demographically, the younger-old age group (60–69 years) accounted for 49.9% of the population, followed by the medium-old group (70–79 years) with 31.0% and the very old group (80 years or older) with 19.1%. Females accounted for 59.8% of the sample, while males accounted for 40.2%. The majority had a primary school education (74.3%) and identified as Buddhists (93.8%). Almost two-thirds (63.1%) of the participants were single or unpartnered. Approximately half of

the participants reported being unemployed (50.4%), and most lived with family members or others (75.6%).

Regarding health variables, 46.5% of the participants reported being overweight or obese, whereas 6% reported being underweight. Approximately 36.3% of participants had at least one chronic condition. The proportions of participants with cognitive impairment, functional disability ($ADL < 12$) and balance problems were 3.1%, 10.7% and 38.6%, respectively. Additionally, 30.3% had vision problems and 18.8% had hearing problems.

Concerning behaviours, 35.3% of participants used four or more medications or one risky drug. Nearly half (48.3%) were poorly exercised and approximately 14.2% reported using assistive devices for walking.

Regarding the environment, hazards in home areas with at least one risk item were present in 43.4% of cases. Two-thirds (66.8%) of houses had stairs or steps without handrails or had broken parts. Furthermore, 19.3% of the toilets were located outside the home. Remarkably, most toilets (73.3%) were Asian squats, and 65.1% lacked a grab bar. Finally, 32.8% of participants had bedrooms located upstairs.

4.1.2 | Prevalence of falls among older adults in the community

The overall prevalence of falls, defined as the percentage of respondents who experienced at least one fall within the last 6 months, was 12.1%. Prevalence increased with age, as reported for the categories of 60–69, 70–79 and over 80 years, yielding 9.5%, 12.1% and 18.8%, respectively (Table 2). The prevalence was 13.4% among women and only 10.1% among men.

4.1.3 | Factors associated with falls among older adults

Table 2 highlights the significant factors ($p < .05$) associated with falls among older adults. Demographic risk factors, including age, sex, education level, marital status and employment status, showed significant associations. Health profile factors such as chronic conditions, cognitive impairment, functional disability, balance problems, visual

TABLE 2 Prevalence and characteristics of falls among the elderly in southern Thailand.

Characteristics	Fallers <i>n</i> (%)	Non-fallers <i>n</i> (%)	Total <i>n</i> (%)	χ^2	<i>p</i>
All	1467 (12.1)	10,664 (87.9)	12,130		
Age (years)				136.17	<.001
60–69	575 (9.5)	5478 (90.5)	6053 (49.9)		
70–79	457 (12.1)	3305 (87.9)	3762 (31.0)		
≥80	435 (18.8)*	1879 (81.2)	2315 (19.1)		
Gender				29.72	<.001
Male	494 (10.1)	4384 (89.9)	4878 (40.2)		
Female	973 (13.4)	6279 (86.6)	7252 (59.8)		
Educational level				10.51	.032
Illiterate or no formal education	140 (12.4)	988 (87.6)	1128 (9.3)		
Primary school	1128 (12.5)	7883 (87.5)	9011 (74.3)		
Secondary school and above	199 (10.0)	1791 (90.0)	1990 (16.4)		
Marital status				72.49	<.001
Married	689 (15.4)	3789 (84.6)	4478 (36.9)		
Single/divorce/separate/widow	778 (10.2)	6874 (89.8)	7652 (63.1)		
Religion				.47	.789
Buddhism	1377 (12.1)	9999 (87.9)	11,376 (93.8)		
Islam	85 (11.7)	643 (88.3)	728 (6.0)		
Christianity	5 (19.2)	21 (80.8)	26 (0.2)		
Current employment status				134.56	<.001
Unemployed	948 (15.5)	5168 (84.5)	6116 (50.4)		
Employed	519 (8.6)	5495 (91.4)	6014 (49.6)		
Living arrangement				1.63	.202
Living alone	338 (11.4)	2621 (88.6)	2959 (24.4)		
Living with others	1129 (12.3)	8042 (87.7)	9171 (75.6)		
BMI (kg/m ²)				2.30	.513
Underweight (<18.0)	99 (13.5)	633 (86.5)	732 (6.0)		
Normal (18–22.9)	699 (12.2)	5050 (87.8)	5749 (47.4)		
Overweight (≥ 23)	669 (11.8)	4980 (88.2)	5649 (46.5)		
Chronic conditions				15.95	<.001
No	865 (11.2)	6857 (88.8)	7722 (63.7)		
Yes	602 (13.7)	3806 (86.3)	4408 (36.3)		
Cognitive impairment				128.90	<.001
No	1350 (11.5)	10,400 (88.5)	11,750 (96.9)		
Yes	117 (30.8)	263 (69.2)	380 (3.1)		
Functional ability				355.32	<.001
Independent (ADL ≥ 12)	1102 (10.2)	9730 (89.8)	10,832 (89.3)		
Semi-dependent (ADL 5–11)	285 (29.0)	698 (71.0)	983 (8.1)		
Dependent (ADL 0–4)	80 (25.4)	235 (74.6)	315 (2.6)		
Balance problems				1119.71	<.001
No	316 (4.2)	7134 (95.8)	7450 (61.4)		
Yes	1151 (24.6)	3529 (75.4)	4680 (38.6)		
Vision impairment				164.51	<.001
No	824 (9.7)	7633 (90.3)	8457 (69.7)		
Yes	643 (17.4)	3030 (82.5)	3673 (30.3)		

(Continues)

TABLE 2 (Continued)

Characteristics	Fallers <i>n</i> (%)	Non-fallers <i>n</i> (%)	Total <i>n</i> (%)	χ^2	<i>p</i>
Hearing problems				175.18	<.001
No	1005 (10.2)	8838 (89.8)	9843 (81.2)		
Yes	462 (20.2)	1821 (79.8)	2283 (18.8)		
Medications				1079.75	<.001
No	385 (4.9)	7462 (95.1)	7847 (64.7)		
Yes	1082 (25.3)	3201 (74.7)	4283 (35.3)		
Poorly exercised				20.09	<.001
No	678 (10.8)	5593 (89.2)	6271 (51.7)		
Yes	789 (13.5)	5070 (86.5)	5859 (48.3)		
Assistive devices				49.23	<.001
No	1171 (11.3)	9236 (88.7)	10,407 (85.8)		
Yes	296 (17.2)	1427 (82.8)	1723 (14.2)		
Hazards in home areas				696.33	<.001
No	361 (5.3)	6507 (94.7)	6868 (56.6)		
Yes	1106 (21.1)	4156 (78.9)	5262 (43.4)		
Stairs without handrails				1.49	.224
No	508 (12.6)	3518 (87.4)	4026 (33.2)		
Yes	959 (11.8)	7145 (88.2)	8104 (66.8)		
Toilet located outside home				6.26	.012
No	1138 (11.9)	8427 (88.1)	9565 (80.7)		
Yes	315 (13.8)	1966 (86.2)	2281 (19.3)		
Asian squat toilet				33.19	<.001
No	483 (14.9)	2752 (85.1)	3235 (26.7)		
Yes	984 (11.1)	7911 (88.9)	8895 (73.3)		
Toilet without grab bar				1.43	.231
No	533 (12.6)	3701 (87.4)	4234 (34.9)		
Yes	934 (11.8)	6962 (88.2)	7896 (65.1)		
Bedroom located upstairs				0.63	.426
No	968 (11.9)	7171 (88.1)	8139 (67.2)		
Yes	499 (12.5)	3492 (87.5)	3991 (32.8)		

Note: Bivariate associations (demographic/health/behaviour/environment variables for older adults by fall status, fallers vs. non-fallers), using the chi-squared test for categorical variables. Fallers: those who had experienced at least one fall in the past 6 months. Hazards in home areas: at least one of slippery floor, dim lighting and uneven ground surface.

Abbreviations: BMI, body mass index; ADL, Barthel Index of Activities of Daily Living.

*Means a significance.

impairment and hearing problems were also found to be significantly associated. Behavioural characteristics, such as medication use, exercise habits and the use of assistive devices demonstrated significant associations with falls. Additionally, environmental factors such as home hazards, bathrooms located outside the house and the presence of Asian squat toilets were significantly related to falls.

4.1.4 | Independent risk factors for falls

Binary logistic regression analyses of falls are provided in Table 3, including both univariate and multivariate analyses, in which only

the statistically significant factors in Table 2 were considered. These results allowed us to identify significant, independent risk factors for falls, which corresponded to $p < .05$, as shown in the final column of Table 3. The odds ratio represents the odds of experiencing a fall in the presence of a given risk factor compared to the odds of falling in the absence of that risk factor. The confidence interval provides a range of values within which the true odds ratio is likely to decrease, with a confidence level of 95%.

The results identified several significant independent risk factors for falls including being a woman (odds ratio [OR] 1.3, 95% confidence interval [CI] 1.02–1.66), cognitive impairment (OR 1.7, 95% CI 1.15–2.50), semi-dependent functional ability (ADL 5–11) (OR 1.8,

TABLE 3 Logistic regression of risk factors for falls among older adults in southern Thailand (n = 12,130).

Risk factor	Univariable			Multivariable		
	Crude OR	95% CI	p	Adjusted OR	95% CI	p
Age (years)						
70–79	1.32	1.16–1.50	<.001	1.02	.87–1.19	.800
≥80	2.21	1.93–2.52	<.001	1.01	.84–1.21	.939
Gender, female	1.38	1.23–1.54	<.001	1.27	1.11–1.46	.001
Educational level						
Primary school	1.01	.84–1.22	.92	1.01	.82–1.25	.928
Secondary school and above	.78	.62–.99	.04	1.04	.80–1.35	.771
Marital status						
Single/divorce/separate/ widow	.62	.56–.70	<.001	.92	.80–1.05	.218
Current employment status	.52	.46–.58	<.001	.77	.67–.88	<.001
Chronic conditions	1.25	1.12–1.40	<.001	.67	.59–.78	<.001
Cognitive impairment	3.43	2.32–3.90	<.001	1.69	1.26–2.25	<.001
Functional ability						
Semi-dependent (ADL 5–11)	3.61	3.11–4.19	<.001	1.75	1.44–2.11	<.001
Dependent (ADL 0–4)	3.01	2.31–3.90	<.001	.97	.69–1.35	.837
Balance problems	7.36	6.46–8.39	<.001	4.74	3.86–5.81	<.001
Vision impairment	1.95	1.75–2.19	<.001	1.23	1.06–1.42	.006
Hearing problems	2.23	1.97–2.52	<.001	1.21	1.02–1.43	.025
Medications	6.26	5.27–6.45	<.001	5.10	4.45–5.83	<.001
Poorly exercised	1.28	1.15–1.43	<.001	.99	.87–1.13	.905
Assistive devices	1.64	1.43–1.88	<.001	1.23	1.04–1.45	.015
Hazards in home areas	4.80	4.23–5.44	<.001	1.12	.91–1.38	.289
Toilet located outside home	1.19	1.04–1.36	.012	1.31	1.11–1.53	.001
Asian squat toilet	.71	.63–.78	<.001	.91	.79–1.04	.160

Note: Reference groups: age 60–69 years, male, illiterate or no formal education, married, unemployed, ADL ≥12, and negative binary answers.

Abbreviations: CI, confidence interval; OR, odds ratio.

95% CI 1.12–2.84), balance problems (OR 4.7, 95% CI 3.21–6.90), visual impairment (OR 1.2, 95% CI 1.02–1.45), hearing impairment (OR 1.2, 95% CI 1.01–1.44), medication use (OR 5.1, 95% CI 2.94–8.90), assistive device use (OR 1.2, 95% CI 1.00–1.45) and having a toilet located outside the house (OR 1.3, 95% CI 1.02–1.70). Employment was found to reduce the risk of falls (OR 0.8, 95% CI 0.68–0.95). Chronic conditions were initially identified as a significant risk factor in the univariate analysis, but this association disappeared in the multivariate analysis where chronic conditions were associated with a reduced risk of falls by approximately 30% (OR 0.7, 95% CI 0.58–0.86).

These results showed that women are 1.3 times more likely to report a fall in the past 6 months than men. The risk of falls increases 1.7 times for persons with cognitive impairment and 1.8 times for individuals with functional abilities in the semi-dependent group. Moreover, for balance problems, the increase was 4.7 times, and for vision impairment and hearing problems, 1.2 times. The use of medications resulted in an increase of 5.1 times and the use of assistive

devices, 1.2 times. Concerning toilets located outside the house, the risk increases by 1.3 times. By contrast, for employed older adults, the risk is reduced by approximately 20%. In the univariate analysis, chronic conditions were found to increase the risk of falls, whereas in the multivariate analysis, they were found to reduce the risk of falls by approximately 30%. These findings have important implications for fall prevention strategies, particularly in high-risk populations such as older adults with cognitive impairment or balance problems.

4.2 | Results of the qualitative component

FGDs included 30 older adults and 13 stakeholders, while IDIs involved four SAO executives and three subdistrict health-promoting hospital administrators. The qualitative analysis identified six themes and sub-themes related to perceived falls, fall prevention and the perspectives of executifall prevention. These findings are presented in Table 4.

TABLE 4 Themes and sub-themes' qualitative analysis.

Theme	Sub-themes
1. Perceived falls among the older adults	(1) Falls as an inevitable part of aging. (2) Unpredictability of falls (3) Awareness of consequences of falls (4) Non-disclosure of minor falls
2. Self-efficacy on fall prevention among older adults	(1) Awareness and participating in fall prevention activities. (2) Being careful and maintaining one's physical health are important.
3. Negative attitudes on fall prevention among older adults	(1) Physical impairments and shame (2) Fear of falling (3) Disagreement with home modification (4) Belief of increased risk with exercise
4. Perception of falls among health providers in the community	(1) Perceived severity of fall problems (2) Limitations in time and resources (3) Discouragement due to lack of policy and support
5. The perception of falls among stakeholders	(1) Proactive subdistrict administrators tackle falls among older adults (2) Community leaders spearheading older adult safety initiatives (3) Village health volunteers committed to fall prevention
6. Executive perspectives on fall prevention measures and implementation challenges	(1) The prevailing patterns of fall prevention among Thai older adults residing in 20 communities. (2) Addressing the lack of clarity in fall prevention measures.

4.2.1 | Theme 1: Perceived falls among older adults in the community

Falls as an inevitable part of aging

One participant recognized that falls could occur because of aging and declining health. The individual shared,

I used to stumble and fall when I attempted to stand up quickly due to my weak legs, but I believe it's acceptable and common for older adults.

(Female, 75)

Falls are perceived as unpredictable events

The uncertainty raises concerns regarding accidental falls. For instance, two older adults shared their experiences of recent falls, expressing confusion and an inability to explain how they had happened.

I was walking in the garden as usual, but I couldn't understand how I fell. It was unexplainable.

(Male, 81)

I was being cautious, taking slow and short steps to prevent falls, but a few days ago, I fell and woke up on the floor. There was nothing I could do to prevent it.

(Female, 78)

Perceived serious complications of falls in older adults

One older adult expressed this concern, saying,

I've encountered people who fell and became unable to walk. They had to rely on wheelchairs, and I don't want that to happen to me.

(Female, 69)

Non-reporting of minor falls to family

Two older adults chose not to disclose their minor falls to spare their family members from the burden and worry. One participant explained the following:

I fell, but it wasn't a serious injury, so I kept it to myself. If I told my husband, he would become worried, and it might raise his blood pressure.

(Female, 71)

Another shared,

If I mentioned that I fell, my children would restrict me from doing anything else. I want them to see that I am still in good health.

(Male, 73)

4.2.2 | Theme 2: Self-efficacy on fall prevention

Perceived benefit and participation in fall prevention activities

Older adults recognize the advantages of fall prevention and actively participate in community activities that focus on preventing falls. One participant highlighted the benefits of daily walking exercises in keeping their legs strong, stating,

My daily walking exercise helps maintain the strength of my legs.

(Female, 75)

The importance of being careful and maintaining one's physical health

The older adults prioritize caution, maintaining a healthy body, and learning self-care skills to prevent falls. One individual noted,

Falls happen due to a lack of carefulness. To avoid falling, I mustn't rush.

(Female, 69)

4.2.3 | Theme 3: Negative attitudes on fall prevention

Physical impairments and shame

Three participants viewed physical impairment as a hindrance to engaging in exercise for fall prevention, leading to feelings of shame and a tendency to avoid physical activity. One participant stated the following:

My joints and legs are stiff. Exercising will cause more pain. I get tired easily, and it will only worsen it.

(Female, 76)

Another mentioned,

I'm old, so I don't like to showcase funny exercise moves.

(Male, 75)

In addition, one individual shared,

I have high blood pressure and diabetes, and I'm afraid to do anything. I fear a relapse.

(Male, 72)

Fear of falling

Older adults often develop a fear of falling driven by past falls and concerns about future accidents. One individual expressed this sentiment as follows:

I fell down a lot. Now I don't want to go out and have to wait for my children to take me out. So, I think it is safer to stay at home.

(Female, 75)

Disagreement with home modification

Older adults often reject home modifications, believing that falls at home result from personal carelessness rather than from the physical environment. One participant expressed this sentiment as follows:

I think home improvement is unnecessary. I'm accustomed to it, and it's costly. Besides, I don't want to inconvenience others.

(Male, 81)

Belief of increased risk with exercise

In terms of older adults' attitudes towards exercise, one participant expressed concern about the increased risk of accidents while engaging in such activities. The person stated,

My daughter doesn't want me to go out and walk or do exercises like these. If I feel dizzy and faint, my other children will hold her responsible.

(Female, 74)

4.2.4 | Theme 4: Perception of falls among community health workers

Perceived severity of falls

Healthcare providers assess fall problems based on their experiences. One nurse shared,

I've encountered two bedridden elderly individuals in our community due to falls. Providing care involves making home visits for urethral catheterization. Unfortunately, family members have had to sacrifice their employment to ensure that these patients receive essential assistance.

(Nurse, 55)

Perceived limitations of time and resources

The staff is willing to provide advice and assess fall risk; however, they face limitations in terms of time, personnel and educational materials. One nurse shared,

I try to advise high-risk elderly individuals to prevent falls, but time constraints and a lack of resources make it challenging. Additionally, there are unclear

guidelines and a shortage of teaching materials for fall prevention training.

(Nurse 49)

Discouragement due to lack of policy

The staff was disheartened as the fall prevention operation failed to align with the agency's policy indicators. The Director of subdistrict health-promoting hospital explained the following:

There was a lack of clear policy for fall prevention and assessments focused on other health issues. As a result, potential errors in the data were not addressed due to prioritizing other urgent indicators.

(Director of SD-HPHT, 59)

4.2.5 | Theme 5: Perceptions of falls among community stakeholders

Proactive subdistrict administrators addressing falls among older adults

Subdistrict administrators actively address falls among older adults, demonstrating their commitment to prevention efforts. One administrator shared,

We participated in the 'Development of an older adult care system' project and eagerly seek preventive measures for the upcoming year.

(Administrator, 58)

Community leaders spearheading older adult safety initiatives

Community leaders prioritize the safety of older adults and actively engage in public relations and environmental modifications. A village headman expressed,

I am willing to utilize a community radio for sharing news and knowledge.

(Male Village Headman, 52)

The SAO Permanent Secretary expressed a desire to improve the environment, stating,

We want to enhance the environment but seek guidance through a standardized approach.

(SAO Permanent Secretary, 52)

Village health volunteers committed to fall prevention

Village health volunteers with a strong volunteer spirit are acutely aware of falls among older adults in their community.

They actively engage in learning opportunities and contribute to community projects. One volunteer emphasized her enthusiasm, stating,

Fall prevention for older adults is interesting and valuable, not just for others but also for my own mother.

(Female Health Volunteer, 43)

4.2.6 | Theme 6: Executive perspectives on fall prevention measures and implementation challenges

Fall prevention practices among Thai older adults in 20 communities

There are two types of fall prevention practices employed by older adults along with community support:

1. Self-care practices. Thai older adults employ self-care practices for fall prevention, including increased caution in movement, regular exercise and organizing their environments. These practices align with the Thai daily lifestyle, as one participant stated

Thai older adults have practices that align with the Thai daily lifestyle, such as practicing mindfulness through meditation and abstaining from alcohol according to Buddhist teachings.

(Female, 56)

2. Community-based fall prevention measures and stakeholder support
 1. Public health and related agencies.
 2. The local government is responsible for maintaining road conditions and providing adequate lighting.
 3. Community leaders, including village health volunteers who conduct fall risk screenings, and village headmen who support health promotion campaigns. An administrator highlighted,

Older adults participate in exercise activities, such as Thai dancing named 9-square table, in elderly clubs.

(Male Administrator, 56)

Addressing the lack of clarity in fall prevention measures

There is a general lack of clarity regarding fall prevention measures and implementation plans are absent. An administrator from subdistrict health-promoting hospitals expressed,

We have not addressed the issues faced by individuals with balance problems who are at high risk of falls.

(Male Administrator, 58)

Additionally, an executive of the SAO stated,

We still lack knowledge on fall prevention and require standardized guidelines.

(Male Executive, 51)

5 | DISCUSSION

The integration of the quantitative and qualitative findings in this study offers a multifaceted analysis of falls among community-dwelling older adults in southern Thailand. While, traditionally, some research was focused on individual fall risk factors, our study adopts a holistic approach, considering individual, community and policy-level perspectives. The findings provide insights for tailoring region-specific fall prevention programmes addressing both physical and psychological aspects. As well, this study contributes to the advancement of fall risk analysis and prevention by bridging individual-level interventions, engaging stakeholders and aligning with contextually relevant policies.

According to our findings, the prevalence of falls was estimated to be 12.1%, which is consistent with the findings of the Sixth National Health Examination Survey of 15.3% (Aekplakorn et al., 2021). However, our prevalence rate was lower than that reported in other Asian countries such as India (36.8%) and China (19.3%) (Mane et al., 2014; Wu & Ouyang, 2017). These variations may be attributed to differences in population characteristics, cultural factors, access to healthcare and environmental factors across countries (Wehner-Hewson et al., 2022).

In the univariate analysis, we classified fall risk factors into four categories (WHO, 2007): demographic, health profile, behavioural and environmental. Regarding the first one, age and sex were significant contributors (Aekplakorn et al., 2021; Gale et al., 2016). Higher risk in women may be attributed to factors such as declining bone mass and frailty, since it occurs more rapidly in females, especially after menopause (Daly et al., 2013; WHO, 2007). And age-related increases in fall risks can be attributed to physical frailty, reduced mobility and diminished functional capacity (Cheng & Chang, 2017).

In the multivariate analysis, we identified several predictive risk factors. First, employed older adults exhibited a lower risk of falls than their unemployed counterparts. This finding is supported by previous research (Kim et al., 2020; Kumar et al., 2014) and may be attributed to the greater mobility, positive emotions, self-esteem and cognitive abilities often observed among individuals who are still actively engaged in work. Consequently, promoting employment opportunities and career advancement may serve as measures to reduce fall risks. As well, individuals with cognitive impairment, regardless of its severity, also exhibited an increased risk of falls, which is consistent with previous findings (Allali et al., 2017) and arises from their altered gait patterns (Montero-Odasso & Speechley, 2018).

Our study also revealed that declined functional ability, characterized by ADL scores in the semi-dependent level (ADL 5–11), significantly increased the risk of falls. This is consistent with a systematic review conducted by Ngamsangiam and Suttanon (2020). Logically, weakened muscle strength diminishes functionality and increases frailty, and therefore the risk of falls, especially in the presence of environmental hazards. Balance problems are another significant risk factor, which was also confirmed by Jeon et al. (2017). Aging can lead to balance problems, affecting sensory systems like vestibular, somatosensory and visual. They jointly increase fall risks, especially when combined with factors like cognitive and hearing impairments, or taking polypharmacy (Threapleton et al., 2022; WHO, 2007). Therefore, strategies aim to improve physical strength, balance and overall functional ability through targeted interventions and exercise programmes.

In line with previous research (Singh & Maurya, 2022), our study emphasizes that individuals with visual impairment face an elevated risk of falls, particularly those being blind. Maintenance of good visual acuity is essential for spatial awareness, obstacle detection and the perception of environmental cues that are crucial for safe mobility. Similarly, hearing loss emerges as another predictive risk factor, in agreement with Lin and Ferrucci (2012). Hearing loss can hinder the individual ability to perceive environmental warnings, ultimately affecting orientation and balance control. Therefore, we recommend regular visual and hearing assessments, the use of corrective lenses and hearing aids, as well as environmental modifications to address sensory challenges effectively.

The finding that multiple medications, particularly sedatives, hypnotics and antidepressants, increase the risk of falls, was also reported by Ming and Zecevic (2018). The Expert Panel on the American Geriatrics Society Beers Criteria (2019) highlights potential side effects involving balance, coordination and cognitive functions. Actually, in Thailand, healthcare providers, and particularly community nurses, play a crucial role in providing primary care advice and conducting medication reviews for older adults.

The use of assistive devices was identified as another risk factor. In fact, West et al. (2015) found that users of such devices were 12 times more likely to experience a fall within 3 months than non-users. While these devices can improve mobility and independence, they may also increase fall risks due to an inadequate knowledge and hazardous environments.

Outdoor toilets were also identified as a significant risk factor, in line with a previous study conducted in rural Thailand by Iamtrakul et al. (2021). Their associated risks include inadequate lighting, uneven or slippery floors, obstacles along the pathway to the bathroom and the length of the path (Sophonratanapokin et al., 2012), and are accentuated in the case of older adults with functional disability and cognitive and sensory impairments (WHO, 2007).

Another important aim of our study was to discuss the perceptions and experiences of falls among older adults, stakeholders and executives in the community, as this shed light on falls and fall prevention measures. Participants recognized weakened legs and

age-related health issues as contributing factors, the latter being aligned with previous research (Fernandes et al., 2021; Stevens et al., 2017). Additionally, some of them expressed guilt and attributed falls to their carelessness, in agreement with Kiyoshi-Teo et al. (2020), who indicated that perceiving falls as permanent or difficult to prevent risks may lead to acceptance and non-compliance with prevention guidelines.

Participants also expressed concerns about the unpredictability and serious consequences of falls, emphasizing the importance of improving fall prevention strategies and providing accurate information to address misconceptions. The study also revealed that older adults often choose not to disclose minor falls to their family members, fearing that this would burden them. This finding aligns with previous research that highlighted the cultural expectations among Chinese older people (Horton & Dickinson, 2011). However, it is important to note that nondisclosure of falls, even minor ones, may hinder the implementation of appropriate preventive interventions.

In contrast, older adults demonstrate self-efficacy in fall prevention through active participation in community activities. In this respect, Vincenzo et al. (2022) support the positive impact of self-care practices, and Stevens et al. (2017) prioritize being careful while walking and maintaining a healthy body.

On the other hand, some participants exhibited negative attitudes towards fall prevention activities, citing physical impairments and feelings of shame as barriers to engaging in them. Others reported challenges related to physical fitness and impaired mobility (Fernandes et al., 2021), and expressed difficulties in performing exercises due to physical limitations, experiencing symptoms such as shortness of breath and fatigue. Furthermore, some participants expressed a fear of falling, leading to restricted activities and a sense of unsteadiness (Laing et al., 2011).

For their part, healthcare providers and community nurses acknowledge the severity of falls based on their experience. However, they encounter challenges such as time constraints, limited resources, inadequate support and unclear fall prevention policies which impede their efforts, which agrees with Loganathan et al. (2015). As well, the study findings indicate that community stakeholders are willing to implement fall prevention projects, but their knowledge and experience are limited, as also explained Mendoza-Núñez et al. (2019). This highlights the importance of engaging stakeholders in collaborative efforts to implement fall prevention strategies effectively at the community level. In this line, previous research (Markle-Reid et al., 2017) identified key practice themes, such as tailoring initiatives to the local context, establishing connections, promoting communication, shaping a vision, fostering skill development, coordinating projects and sharing knowledge. However, falls among older adults are not prioritized as a public health concern in middle-income countries as Thailand.

5.1 | Strengths and limitations

The main implications of this study regarding research, practice and policies can be summarized as follows:

First, it expands the current knowledge on falls among older adults by offering both quantitative and qualitative perspectives. The identified risk factors for falls can serve as valuable guidelines for future research and facilitate the development of targeted interventions and preventive measures. The qualitative data underscore the significance of incorporating subjective experiences and perceptions.

Second, healthcare providers can utilize the study's findings to develop tailored fall prevention strategies and improve communication with older adults. Collaboration among community stakeholders is essential for implementing comprehensive prevention programmes.

Finally, policymakers are crucial in supporting and financing those programmes. Strategies should focus on addressing significant risk factors, such as cognitive and sensory impairments, promoting occupation, balance and strength training, conducting medication reviews, improving hazardous environments and providing education on device usage. It is necessary to connect research findings with government policies to enhance the knowledge and promote standard practices, in collaboration with local organizations.

On the other hand, regarding the limitations, the recall of fall history by older adults in the past 6 months without verification may be inexact, especially for those with cognitive impairment. Therefore, caregivers were required to confirm this information.

Secondary data can be biased by the individuals who gathered the data. Thus, data collectors were trained on variable definitions and the standardized use of such databases. The principal investigator supervised the participants to improve their reliability. A second researcher checked the final data for completeness, accuracy and clarity.

There are different perceptions and definitions of falls among older adults, researchers, healthcare providers and village health volunteers. Therefore, we used the local language for fall screening and communication in this study.

6 | CONCLUSIONS

Falls among community-dwelling Thai older adults are influenced by several factors. Our quantitative analysis identified significant risk factors that can be targeted by interventions. And our qualitative findings emphasized the importance of understanding older adults' self-perceptions and perspectives on falls. This study highlights the importance of evidence-based prevention models and the need for cooperation among policymakers, healthcare providers and community leaders. On the other hand, barriers for a successful implementation include limited awareness among older adults and their families, inadequate knowledge among community leaders, insufficient personnel and lack of standardized guidelines. Therefore, establishing comprehensive guidelines and taking successful actions are crucial to effectively reduce falls among older adults and enhance their safety and well-being.

AUTHOR CONTRIBUTIONS

Uraivan Pantong, Urai Jareaprapal: Made substantial contributions to conception and design, or acquisition of data, or analysis

and interpretation of data; **Uraiwan Pantong, Isabel Trapero, Urai Jareaprapal**: Involved in drafting the manuscript or revising it critically for important intellectual content; **Uraiwan Pantong, Isabel Trapero, Urai Jareaprapal**: Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; **Uraiwan Pantong, Isabel Trapero, Urai Jareaprapal**: Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest to disclose.

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DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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