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ORIGINAL ARTICLE

SELECTED FACTORS RELATED TO THE RISK OF FALLS AMONG HOSPITALIZED OLDER ADULT PATIENTS

Apinya Wongpiriyayothar[1]*, Kunnicha Ruangchaithaweesuk[1], Palita Pulperm[2], Wichuta Ninnun[2]

1. Faculty of Nursing, Mahasarakham University, Thailand
2. Suddhavej Hospital, Faculty of Medicine, Mahasarakham University, Thailand

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***Corresponding Author**
Apinya Wongpiriyayothar
apinya.w@msu.ac.th

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ABSTRACT

Hospitalized older adult patients have a high risk of falls due to their health conditions. Therefore, this study aims to examine the relationships between body mass index (BMI), osteoarthritis, cognitive function, activities of daily living (ADLs), and the risk of falls among hospitalized older adult patients. The researchers employed a descriptive correlational research design with 110 older adult patients admitted to a university hospital in Northeast Thailand. The patients were selected through simple random sampling by the Osteoarthritis Screening Form, the Cognitive Impairment Test, the Barthel Index Scale, and the Morse Fall Scale. The data were analyzed using descriptive statistics and Spearman's rank correlation. The study's results demonstrated that three factors had statistically significant correlations with the risk of falls: osteoarthritis (r_s = 0.31, p = 0.001), cognitive function (r_s = 0.26, p = 0.008), and ADLs (r_s = -0.45, p = 0.001). Meanwhile, BMI was not correlated with the risk of falls. This study concludes that osteoarthritis, cognitive function, and ADLs are associated with an increased risk of falls. Therefore, nurses should evaluate patients' risk of falls, related factors, create interventions to promote exercise, and enhance ADL skills to reduce the risk of falls in hospitalized older adult patients.

Keywords: *Fall prevention; fall risk assessment; older adult patients*

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BACKGROUND

Frontal falls are common among older adults and a leading cause of mortality and serious injury (World Health Organization, 2021). Such falls have a global prevalence of 26.5% (Sala, Darvishi, Ahmadipanah, Shohaimi, & Mohammadi, 2022). Moreover, 38.2% of falls resulted in injuries, and 85.9% of those injuries involved direct impact to the injured body part. The hips and pelvis were more frequently affected than the head (Komisar et al., 2022). Hip, head, and facial injuries, as well as fractured bones from falls, have resulted in hospitalization (Choi, Choi, DiNitto, Marti, & Kunik, 2019).

Fall prevention during hospital stays is a major concern for older adult patients. Among older adult patients admitted to a hospital, 65% are at high risk of falling, 47.2% have a history of falls, and 14.8% have suffered fractures due to falls (Akturk & Ister, 2019). A previous study also found that there were 4.4 falls of hospitalized older adult patients per 1,000 patient days. Moreover, patients with multimorbidity are highly medicated, have a history of falls in the past year, and those with an orthostatic hypotension diagnosis were the most likely to experience falls in hospital (Magnuszewski, Wojszel, Kasiukiewicz, & Wojszel, 2022).

Another study discovered that a high risk of falls was linked to secondary diagnosis, intravenous therapy, diuretics, urine incontinence, visual impairment, and heart failure (Falcão, Costa, Fernandes, Pontes, Vasconcelos, & Oliveira, 2019), cancer, diabetes mellitus (Mata, Azevedo, Policarpo, & Moraes, 2017). Additionally, several characteristics, such as body mass index, gait balance, ability to perform daily living activities, and cognitive impairment, were found to be associated with falls (Lecktip, Woratanarat, Bhubhanil, & Lapmanee, 2019).

In Thailand, most studies have focused on the risk of falls among older adults in the community. Meanwhile, a study found that 56.60% of hospitalized older adult patients have experienced falls. The risk factors for falls include emotional state, confusion, dizziness, incontinence, mobility issues, and the use of certain medications (Nooake, Puttapitukpo, & Thiengwiboonwon, 2022). Another study highlighted additional factors associated with falls in hospitals, including previous falls, mental and emotional states, the use of hypnotics and anticonvulsant medications, the absence of a caregiver, and stays exceeding seven days (Tamee, Chaiphibalsarisdi, & Apiruknapanond, 2018).

In this study, the authors utilized the Morse Fall Scale, a specific scale for evaluating patients' risk of falls in the hospital. Falls, secondary diagnoses, ambulatory aids, intravenous therapy, gait type, and mental state are all included in the scale's risk assessment (Morse, 2022). The factors associated with the risk of falls in hospitalized older adults selected for this study were body mass index (BMI), osteoarthritis, activities of daily living (ADLS), and cognitive function. Therefore, this descriptive correlational study aims to explore the relationships between BMI, osteoarthritis, ADLs, cognitive function, and the risk of falls among hospitalized older patients. The results may provide valuable insights for preventing falls within this vulnerable population.

METHOD

Study design

This study employed a descriptive correlational design to examine the relationships between BMI, osteoarthritis, ADLs, cognitive function, and the risk of falls among hospitalized older adult patients.

Sample/ Participants

The sample included older adult patients aged 60 and above who have been admitted to a university-based hospital in Northeast Thailand for at least 24 hours. This study applied the following inclusion criteria: 1) men and women, 2) appropriate awareness and can provide a correct evaluation of person, place, and time, 3) verbal communication capability, and 4) willingness to participate in the study. Participants exhibiting abnormal symptoms such as fatigue, body pain, and changes in vital signs during data collection were excluded.

The data analysis was conducted using the power analysis software G* Power (version 3.1.9.7) to estimate the sample size for Pearson's correlation coefficient (r) using a power of 0.85, an effect size of 0.30, and an alpha of 0.05, an attrition rate of 15%. The minimum sample size obtained was 110 people. Participants were selected using the simple random sampling method with a random number table to pre-randomize the order of patients admitted to the hospital.

Instruments

This study utilized the following data collection tools:

1) The Demographic and Health Data Recording Forms included information on gender, age, marital status, education, occupation, body mass index (BMI), diagnosis, comorbid diseases, and medications.

2) The Osteoarthritis Screening Form (OSF) was created by the Ministry of Public Health, Thailand (2021). The OSF is a dichotomous questionnaire for assessing individuals' osteoarthritis condition. The assessment comprises five items that denote symptoms: stiffness, crepitus, bony tenderness, bony enlargement, and palpable warmth, each of which can be responded to with a 'yes' (1 point) or 'no' (0 points). If a patient answers 'yes' to two questions, they may have osteoarthritis.

3)The Barthel Index for Activities of Daily Living Scale (BIA) was adapted from the Barthel Index by Collin, Wade, Davies, and Horne and subsequently translated and modified into Thai by Jitapunkul, Kamolratanakul, and Bunnag (1994). This scale assesses 10 ADLs and mobility tasks, including feeding, grooming, transferring, toileting, mobility, dressing, stair climbing, bathing, bowel control, and bladder control. Each activity was rated on a scale of 0-1, 0- 2, or 0-3, indicating a range from dependent to independent. The total score ranges from 0 to 20. A guideline interprets the scores as follows: 0-4 (total dependency), 5-8 (severe dependency), 9-11 (moderate dependency), and 12-20 (independence).

4) The 6-Item Cognitive Impairment Test (6CIT) was developed by Brooke and Bullockin in 1999 and translated into Thai by Aree-Ue and Youngcharoen (2020). This test evaluates cognitive function through 6 questions. The first question requires the patient to recall a five-item address (0 = no error, 2 = 1 error, 4 = 2 errors, 6 = 3 errors, 8 = 4 errors, and 10 = all errors). The second question asks the patient to count backward from 20 to 1 (0 = all correct, 2 = 1 error, 4 = more than one error). The third question asks the patient to list the months of the year in reverse order (0 = all correct, 2 = 1 error, 4 = more than one error). Three questions about orientation are used to ask the patients, "What year is it?" (0 = correct, 4 = incorrect), "What month is it?" and "What is the time?" (0 = correct, 3 = incorrect). The total score of the 6-CIT ranges between 0 and 28. A score of 0–7 means no cognitive impairment, 8–9 means mild cognitive impairment, and 10-28 means significant cognitive impairment.

5) The Morse Fall Scale (MFS) was developed by Morse and subsequently translated into Thai by Pongpan Aroonsang (Morse, 2023). The scale assesses fall risk based on six criteria: 1) history of falls (0 = none, 25 = present); 2) secondary diagnosis (0 = absent, 25 = present); 3) use of ambulatory aids (0 = bed rest/nurse assistance, 15 = crutches/cane/walker, 30 = furniture); 4) intravenous or heparin lock (0 = absent, 20 = present); 5) gait type (0 = normal/bed rest/immobile, (10 = weak, 20 = impaired); and 6) mental status (0 = oriented to own capabilities, (15 = forgets limitations). A cumulative score may range from 0 to 125. A score below 25 signifies low risk, a score between 25 and 44 denotes moderate risk, and a score of 45 or higher indicates high risk (Morse, 2022).

Data collection

During the data collection process, the researchers listed new patients in order of admission. If the sequence of the patient's admission matched the random sequence from the random number table and the patient met the inclusion criteria, the researchers invited them to participate in the study. The researchers gave the patients information about the study's objectives and procedures. The patients were asked to sign a consent form to express their willingness to participate. The interviews and observations, which lasted between 20 and 30 minutes, were used to gather data on the patient's demographics and health, OSF, BIA, 6CIT, and MFS. The data collection period spanned from April to June 2024.

Data analysis

The researchers used the mean, standard deviation, frequency, and percentage of the OSF, BIA, 6CIT, and MFS scores to analyze the demographic and health data. The Kolmogorov-Smirnov test was used to determine the normality distribution of all variables. As the data were not

normally distributed, the Spearman rank correlation coefficient (r_s) was used to examine the correlations between BMI, osteoarthritis, ADLs, cognitive function, and fall risk among hospitalized older adult patients.

Ethical consideration

This study was approved by Maharsarakham University's Ethical Committee for Research Involving Human Subjects (No. 503-503/2023).

RESULT

The participants' demographic and illness data

Table 1 shows the demographic and illness data for 110 participants, comprising 50% males and 50% females. The average age was 70.55 years. Most were married (67.5%), unemployed (39.1%), and had completed primary education (65.45%). The participants' illness information showed that 50% were admitted with eye difficulties, 83.6% had comorbid diseases, and 59.1% took one to five medications.

Table 1. Demographic and Illness data of the participants (n=110)

Data	N (%)	Mean (SD)	Min-Max
Gender			
Male	55 (50.00)		
Female	55 (50.00)		
Age (years)		70.55 (7.31)	60-86
Marital status			
Single	8 (7.30)		
Marries	74 (67.30)		
Divorced	28 (25.40)		
Occupation			
Not working	43 (39.10)		
General employment	1 (.90)		
Business	6 (5.45)		
Pensioner	21 (19. 10)		
Farmers	39 (35.45)		
Education level			
No formal education	1 (.90)		
Primary school	72 (65.45)		
Secondary school	6 (5.45)		
High school	8 (7.30)		
Diploma	2 (1.80)		
Undergraduate degree	18 (16.40)		
Postgraduate degree	3 (2.70)		
Problem due to hospitalization			
Eye conditions	55 (50.00)		
Medicine conditions	41 (37.27)		
Surgical conditions	14 (12.73)		
Comorbidity			
No	18 (16.40)		
Yes	92 (83.60)		
Top five comorbidities			
Hypertension	61 (55.50)		
Diabetes mellitus	50 (45.50)		
Dyslipidemia	33 (30.00)		
Cancer	14 (12.70)		
End stage renal disease	10 (9.10)		
Amount of medication taken		5.72 (3.83)	1-15
2-5 medicines	65 (59.10)		
6-10 medicines	27 (24.50)		
10-15 medicines	18 (16.40)		

The participants' BMI, osteoarthritis, cognitive function, activities of daily of living, and the risk of fall data

Table 2 presents the participants' BMI, osteoarthritis, cognitive function, ADLs, and risk of falls. Most of the participants' BMIs were normal (42.73%; mean = 22.79, SD = 3.96). As much as 71.8% had no osteoarthritis, 55.5% showed no cognitive impairment, 94.5% were able to perform ADLs with minimal assistance, and 37.3% were at moderate risk of falling.

Table 2. Data of body mass index, osteoarthritis, cognitive function, activities of daily of living, and risk of fall of the participants (n=110)

Factors	N (%)	Mean (SD)	Min-Max
Body Mass Index (BMI)		22.79 (3.96)	14.69-38.67
Underweight (< 18.50 kg/m2)	16 (14.55)		
Normal weight (18.50-22.90 kg/m2)	47(42.73)		
Overweight (23.00-27.40 kg/m)	34 (30.90)		
Obesity (> 27.50 kg/m2)	13 (11.82)		
Osteoarthritis		0.90 (1.18)	0-5
No (<2)	79 (71.80)		
Yes (>2)	31 (28.20)		
Cognitive Function		7.74 (6.17)	10-28
No cognitive impairment (0-7)	61 (55.50)		
Mild cognitive Impairment (8 – 9)	15 (13.60)		
Significant cognitive impairment ((10-28)	34 (30.90)		
Activities of Daily of Living (ADL)		17.99 (3.32)	3-20
Slight dependency or independence (12 – 20)	104 (94.50)		
Moderate dependency (9-11)	2 (1.80)		
Severe dependency (5-8)	3 (2.37)		
Total dependency (< 4)	1 (9.00)		
Risk of fall		37.88 (25.30)	0-110
Low risk of fall (0 -24)	34 (30.9)		
Moderate risk of fall (25-45)	41 (37.30)		
High risk of fall (> 45)	35 (31.80)		

Correlations between the participants' body mass Index, osteoarthritis, cognitive function, activities of daily living, and the risk of falls

Table 3 shows that statistically significant correlations were found between osteoarthritis (r_s = 0.31, p = 0.001), cognitive function (r_s = 0.26, p = 0.008), ADLs (r_s = -0.45, p =0.001), and the risk of falls among older adults who were hospitalized. No significant relationship was found between BMI and the risk of falls (r_s = 0.02, p = 0.803).

Table 3. Correlations between Body Mass Index (BMI), osteoarthritis, cognitive function, Activities of Daily of Living (ADL), and risk of fall among of the participants (n=110)

Factors	r_s	p-value
Body Mass Index (BMI)	0.02	0.803
Osteoarthritis	0.31*	0.001
Cognitive function	0.26*	0.008
Activities of Daily of Living (ADL)	-0.45**	0.001

DISCUSSION

This study's results indicated a correlation between osteoarthritis, cognitive function, ADLs, and the risk of falls in hospitalized older adults. Conversely, no significant correlation was identified between BMI and the risk of falls. Among the 110 older adult patients with a fall risk, most exhibited a moderate to high risk of falling, specifically 37.3% to 31.8%.

Furthermore, the results showed that three primary factors were associated with increased fall risk. First, osteoarthritis was found in 28.2% of patients, contributing to an unbalanced gait and impaired mobility, possibly due to knee pain. Second, significant cognitive impairment was observed in 30.9% of patients, while 13.6% had mild cognitive impairment, which led to difficulties in recognizing their movement limitations. Finally, some of the older adult patients required assistance with specific ADLs, further elevating their risk of falling. The study's results diverged from those of previous research by Lecktip et al. (2019), which linked BMI, gait balance, ADLs, and cognitive impairment to falls. In contrast, our study did not find a correlation between BMI and the risk of falls.

Bally et al. (2023) reported that activities of daily living were not associated with falls in hospitalized older adult patients. However, they found that medication usage correlates with increased fall risk. Magnuszewski et al. (2022) identified various parameters pertinent to fall assessment, including health status, psycho-physical abilities, nutritional status, risk of falls, and frailty syndrome. Their findings indicated that a history of falls in the previous 12 months, orthostatic hypotension, Parkinson's disease, and taking statins, benzodiazepines, and the use of insulin were associated with in-hospital falls.

Our study utilized the Morse Fall Scale to evaluate fall risk, taking into account a history of falls within the previous three months, secondary diagnoses, intravenous therapy, ambulatory aids, gait and transfer abilities, and mental status. Of the 110 hospitalized older adult patients, 30.9% were at low risk, 37.3% were at moderate risk, and 30.8% were at high risk of falls. Additionally, 83.6% of the patients had comorbidities.

Their top five comorbidities included hypertension, diabetes mellitus, dyslipidemia, cancer, and end-stage renal disease. All the patients took more than two medications, and half had eye problems. Therefore, the likelihood of falling may increase due to these factors. In Thailand, cultural and contextual characteristics of the older population, especially in rural regions such as Northeast Thailand, may influence fall risk during hospitalization. Most older adults in this region live with extended families and are often dependent on informal caregivers who may lack awareness of fall prevention strategies. Furthermore, the prevalence of comorbidities such as hypertension, diabetes, and osteoarthritis is high among Thai older adults, which could be attributed to dietary patterns, low physical activity, and limited geriatric health education. Nooake, Puttapitukpo, and Thiengwiboonwon (2022) reported that dizziness, confusion, and incontinence—often compounded by polypharmacy—were common contributors to falls among Thai hospital patients. Similarly, Tamee, Chaiphibalsarisdi, and Apiruknapanond (2018) identified lack of caregiver presence, use of sedative medication, and prolonged hospital stays as significant factors. These findings underscore the importance of incorporating culturally informed, context-specific assessments and interventions to prevent falls among older Thai patients.

Two recent studies investigated factors related to the risks of falls in hospitalized older adult patients. The first study supported our findings that cognitive impairment is associated with the risk of falls and other factors related to activities of daily living and movement, including frailty and sarcopenia (Caetano, Neto, Santos, & Fhon, 2023). The second study found that having a bed with no rails, as well as standing, walking and using a wheelchair increased the risk of falls. Additionally, respiratory disease, complex care, and mental health issues were identified as risk factors (Hodgson et al., 2023). In our study, these identified factors were incorporated into the fall risk evaluation using the Morse Fall Scale.

Moreover, this study indicated no significant relationship between BMI and fall risk. This finding may be explained by the fact that most patients in our study (42.73%) had average BMIs of 22.79 kg/m^2, which falls within the normal range. Trevisan et al.'s (2018) study supports this finding, as they identified a correlation between BMI and fall risk, noting that the likelihood of falling increased significantly among individuals categorized as being underweight or overweight. Specifically, fall risk increased by 1.09 times for a BMI of 17 kg/m^2 to 1.07 times for a BMI of 37.5 kg/m^2. Ogliari et al. (2021) also found that underweight participants had a higher fall risk, but obese participants did not demonstrate a similar correlation. Additionally, Bankar and Deshpande (2021) found no significant relationship between obesity and fall risk. These results suggest that BMI alone may not be a reliable predictor of fall risk in older adults, highlighting the need for a more comprehensive approach to risk assessment in this population.

However, this study has its limitations. Although the authors controlled for selection bias by using randomized recruitment, the data on osteoarthritis, activities of daily living, cognitive function, and fall risk score were not normally distributed. Therefore, the study's findings cannot be generalized and applied to older adults in other hospitals. Nevertheless, the results help healthcare providers understand fall risk and related factors in the context of a university hospital in Northeast Thailand.

CONCLUSION AND RECOMMENDATION

The study's findings indicate that osteoarthritis, cognitive function, and activities of daily living are associated with an increased risk of falls among hospitalized older adult patients. In contrast, BMI is not. Based on this data, nurses and other

healthcare professionals can use assessment instruments to evaluate osteoarthritis, cognitive function, ADLs, and fall risk in older adult patients. Older adult patients should be encouraged to engage in exercises to enhance muscle strength and improve gait balance. They should also be provided access to ambulatory aids, such as crutches, canes, or walkers.

Nurses should regularly evaluate the cognitive abilities of hospitalized older adult patients using standardized tools, encourage regular activity and exercise when clinically feasible, monitor patient cognitive responses to medications, and maintain an organized environment to minimize confusion and promote brain function. Patients and families should be educated about fall prevention strategies. Significant changes in cognitive impairment should prompt a referral to a physician for appropriate management. Nurses should also support rehabilitation and physical therapy efforts that strengthen muscles and improve joint movement for older adult patients who are dependent on assistance.

A duplication study is required to examine the relationship between BMI, osteoarthritis, cognitive function, ADLs, and the risk of falls in other hospitals. Further studies can also investigate programs that promote healthy aging, exercise, gait balance, cognitive function, and help with daily tasks using an experimental research design to prevent falls among hospitalized older adult patients.

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