

Prevalence of Fall among Elderly in Rural Sabah and Its Associated Factors

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Abstract

Falls are a leading cause of injury among older adults, often resulting in significant physical, psychological, and social consequences. This study aims to determine the factors that contribute significantly to fall risks among the older adults in rural Sabah. A cross-sectional community study was conducted in the Kudat Division, Sabah, Malaysia from January to June 2021. Using multistage random sampling, 700 adults aged ≥ 60 years were recruited, excluding those with severe disability, mental illness, or institutionalized. Data were collected through face-to-face interviews with a structured questionnaire adapted from the validated Japanese Gerontological Evaluation Study (JAGES) tool, and anthropometric measures were taken to calculate body mass index (BMI). Logistic regression was performed in SPSS version 27 to identify factors associated with falls. The prevalence of falls among the elderly is 19%. The significant factors include the age ≥ 80 years old: higher adjusted odds ratio (AOR) for falls (AOR = 2.01); overweight: significantly higher risk (AOR = 4.17); walking difficulty: elevated risk (AOR = 1.69); and poor current health status: increased likelihood of falls (AOR = 1.88). In conclusion, these findings highlight key demographic and health-related factors associated with falls among the rural elderly population, contributing to a clearer understanding of fall risk in non-urban settings.

Keywords: fall risk, older adult, rural, Sabah

Abstrak

Prevalensi Jatuh pada Lansia di Pedesaan Sabah dan Faktor-faktor yang Memengaruhinya Jatuh merupakan penyebab utama cedera pada lansia yang seringkali menimbulkan konsekuensi fisik, psikologis, dan sosial yang signifikan. Penelitian ini bertujuan untuk mengetahui faktor-faktor yang berkontribusi secara signifikan terhadap risiko jatuh pada lansia di daerah pedesaan Sabah. Penelitian cross-sectional berbasis komunitas dengan ini dilakukan di Divisi Kudat, Sabah, Malaysia dari Januari hingga Juni 2021. Dengan menggunakan multistage random sampling, penelitian ini melibatkan sebanyak 700 orang dewasa berusia ≥ 60 tahun, dengan pengecualian mereka yang memiliki disabilitas parah, gangguan mental, atau tinggal di panti jompo. Data dikumpulkan melalui wawancara tatap muka dengan kuesioner terstruktur yang diadaptasi dari Japanese Gerontological Evaluation Study (JAGES) yang telah tervalidasi, dan pengukuran antropometri dilakukan untuk menghitung body mass index (BMI). Model Regresi logistik dilakukan menggunakan SPSS versi 27 untuk mengidentifikasi faktor-faktor yang berkaitan dengan jatuh. Prevalensi jatuh di kalangan lansia adalah 19%. Faktor-faktor signifikan meliputi usia ≥ 80 tahun: adjusted odds ratio (AOR) yang lebih tinggi untuk jatuh (AOR = 2,01); kelebihan berat badan: risiko yang secara signifikan lebih tinggi (AOR = 4,17); kesulitan berjalan: risiko yang meningkat (AOR = 1,69); dan kondisi kesehatan saat ini yang buruk: kemungkinan jatuh yang lebih tinggi (AOR = 1,88). Hasil penelitian menyoroti faktor-faktor demografis dan kesehatan berkaitan dengan kejadian jatuh pada populasi lansia di daerah pedesaan yang berkontribusi pada pemahaman yang lebih baik mengenai risiko jatuh pada lingkungan non-pedesaan.

Kata Kunci: lanjut usia, pedesaan, risiko jatuh, Sabah

Introduction

Falls are a major public health concern worldwide, particularly in ageing populations, where they often lead to serious health and social consequences. The World Health Organization (WHO) recognizes it as a substantial public health issue, particularly in ageing populations (Rudnicka et al., 2020). The increasing prevalence and severity of falls among older adults necessitates an urgent focus on understanding and addressing the factors contributing to this phenomenon. Recent studies have highlighted a range of risk factors associated with falls. These include age-related physiological changes such as gait and balance disorders, chronic conditions like osteoarthritis, and lifestyle factors (Beauchet & Montero-Odasso, 2020; Zhang et al., 2023). Environmental influences, particularly in rural settings, also significantly contribute to the risk of fall. There is a need for comprehensive fall prevention strategies considering these diverse risk factors (Montero-Odasso et al., 2021). Similarly, another study highlighted the impact of chronic conditions like osteoporosis and arthritis on fall risk (Zhang et al., 2023).

Falls are a leading cause of injury among older adults, often resulting in significant physical, psychological, and social consequences. The WHO has identified falls as a significant public health problem, especially in ageing populations (Rudnicka et al., 2020). The complications arising from falls in the elderly are manifold. Falls can lead to severe injuries, such as fractures and head traumas, and can significantly impair mobility and independence. They are also associated with a high risk of hospitalization and long-term care (Ye et al., 2021). Beyond the physical implications, falls can have profound psychological impacts, often leading to a fear of falling, which can further limit activity levels and social engagement, contributing to a decline in quality of life (Ang et al., 2020). Furthermore, the study's findings can potentially inform healthcare policies and intervention strategies. Understanding these risk factors is crucial in developing effective fall prevention

strategies. A study noted that tailored intervention programmes considering local socio-economic and cultural contexts are essential for effective fall prevention (Montero-Odasso et al., 2021). This is particularly relevant for rural Sabah, where traditional lifestyles and rural settings may influence the implementation and efficacy of such programmes.

In Malaysia, the situation mirrors this global trend. According to the National Health and Morbidity Survey (NHMS) 2018, approximately 18.6% of Malaysians aged 60 years and above reported experiencing at least one fall in the past 12 months, with a higher prevalence observed in rural areas (Institute for Public Health, 2020). With an ageing population, the incidence of falls among the elderly is rising, posing a significant challenge to public health systems and society. Rural areas, such as those in Sabah, present unique challenges due to limited access to healthcare services, uneven terrain, and reduced availability of community support, which can exacerbate the risks and consequences of falls (Yorulmaz & Mohamed, 2019). This study aims to determine the sociodemographic and health-related factors associated with falls among the elderly in rural Sabah. By focusing on a community-based population in a rural Malaysian setting, the study provides critical insights that help fill the specific gap in literature regarding fall-related risk factors in non-urban environments. These findings can support the development of more context-sensitive prevention strategies.

Methods

Study Setting. The participants from Kudat Division between January and June 2021 (6 months duration) were evaluated for inclusion. Located on the west coast of Sabah, Kudat Division covers the 4,623 km² area. Kudat Division has an estimated population of 162,900 with a population density of 35 persons per km² (National Digital Department, Malaysia, 2024). Kudat Division comprises three districts, namely Kudat, Kota Marudu, and Pitas.

Study Design and Sampling. This cross-sectional study was conducted within a community-based setting. A total of 700 patients were included in this study. This study was conducted among the elderly who had experienced a fall in the past six months. Subjects included in this study were adult patients aged 60 and above who stayed in the Kudat Division. The exclusion criteria were patients with mental illness or disability. The patients who stayed in an institution, including prison, were also excluded from this study.

The study focused on a sample size of 700 elderly individuals residing in the Kudat region. This study employed a multistage random sampling technique. The participants were selected randomly at the final stage in the selected villages in the Kudat Division to ensure a diverse representation of the elderly population in the Kudat Division. This included considerations for age, gender, socio-economic status, and living arrangements.

Sample Size. The sample size was calculated using G*Power software (version 3.1), based on an estimated prevalence of falls among the elderly at 18%, with a 95% confidence level and 5% margin of error. The initial calculated sample size was 601. To account for possible non-response or incomplete data, a 15% buffer was added, resulting in a final target of 692 participants. After screening based on inclusion and exclusion criteria, 700 elderly individuals were successfully enrolled in the study.

Data Collection. After the ethics committee's approval, the researcher explained the study's purpose and methodology to the subjects. If the subjects agreed to participate in this study, they must sign the consent form. Participants' information was collected through structured questionnaires. The research in Kudat, Sabah, utilized a combination of interviews, surveys, and physical examination to gather comprehensive data on elderly abuse. Data were collected using structured questionnaires adapted from the Japanese Gerontological Evaluation Study (JAGES),

a validated tool for assessing fall-related factors in older adult populations.

Additionally, interviews and case studies were conducted to gain deeper insights into specific instances of abuse and the contextual factors surrounding these cases. The anthropometric measurements (height and weight) were collected. Patients' weight and height were measured using a digital weighing scale with the height measurement (OEM ZT-150 A). The Body Mass Index (BMI) was calculated by dividing weight (in kg) over height (in metres squared). All subjects were interviewed face-to-face at the time of the study period. The researcher interviewed the subjects using Malay, English, or the local language.

Data Analysis. Data were analysed using IBM SPSS version 27. The dependent variable in this study was the history of falls, recorded as either 'yes' or 'no', within the past six months. The independent variables consisted of sociodemographic characteristics, including age, gender, marital status, education level, and living arrangement. Health behaviour variables included smoking and alcohol consumption. Clinical and health-related conditions such as diabetes mellitus, hypertension, musculoskeletal disease, and depressive symptoms were also considered. Additionally, variables reflecting general health status and functional condition were analysed, including body mass index, abdominal circumference, weak hand grip strength, and self-rated current health status. Several factors related to activities of daily living were included, such as walking, climbing stairs, visual, and hearing difficulty, and problems with memory or concentration.

Bivariate analysis was performed using simple logistic regression to identify associations between each independent variable and the presence of falls. Variables with a p-value less than 0.05 in the bivariate analysis were included in the multivariate logistic regression model. The backward stepwise method was used to determine the final set of independent predictors.

The results were reported as beta values, standard errors, adjusted odds ratios, and 95% confidence intervals. Statistical significance was determined at the $p < 0.05$ level.

Research Ethics. Ethical approval to conduct the study was obtained from the Ethical and Scientific Committee of the Faculty of Medicine and Health Science, Universiti Malaysia Sabah [JKEtika 1/23(35)]. Consent was considered obtained once the participant agreed voluntarily to participate after detailed explanations about the nature of the study, including the confidentiality of their responses, were explained.

Results

Table 1 examines various sociodemographic factors and their association with falls. The significant factor is the age group, which is that elderly individuals aged ≥ 80 years old had a

higher likelihood of falls (Odds Ratio (OR) = 2.05; $p = 0.01$) compared to those aged 60–79 years.

Table 2 focuses on health behaviors and comorbid conditions. Significant findings include smoking: less likelihood of falls among smokers (OR = 0.66); alcohol consumption: higher likelihood of falls among alcohol drinkers (OR = 1.41); Diabetes Mellitus an increased risk of falls (OR = 1.48); Hypertension (HPT): elevated risk (OR = 1.59); musculoskeletal disease: higher likelihood of falls (OR = 1.60); depressive symptoms: significantly associated with falls (OR = 1.59); BMI: overweight individuals had a higher risk (OR = 3.06); and weak hand grip: associated with an increased risk of falls (OR = 1.57).

Table 3 evaluates health status and daily living activities. Notable associations include poor

Table 1. Bivariable Analysis of Sociodemographic Factors Associated with Falls Among Elderly in The Sabah Rural Area

Variable	Total N (%)	History of fall		OR ¹	p-value	95% CI ²
		Yes (n = 133) f (%)	No (n = 567) f (%)			
Prevalence	700	133 (19.0)	567 (81.0)	-	-	-
Age group						
60-79 years old	621 (88.7)	109 (17.6)	512 (82.4)	-	-	-
≥ 80 years old	79 (11.3)	24 (30.4)	55 (69.6)	2.05	0.01*	1.22–3.46
Gender						
Female	362 (51.7)	65(18.0)	297 (82.0)	-	-	-
Male	338 (48.3)	68 (20.1)	270 (79.9)	1.15	0.47	0.60–1.27
Marital Status						
Married	523 (74.7)	96 (18.4)	427 (81.6)	-	-	-
Single/widow	177 (25.3)	37 (20.9)	140 (79.1)	1.17	0.46	0.77–1.80
Working status						
Working	279 (39.9)	49 (17.6)	230 (82.4)	-	-	-
Not working	421 (60.1)	84 (20.0)	337 (80.0)	0.86	0.43	0.58–1.26
Education level						
Secondary/tertiary School	93 (13.3)	13 (14.0)	80 (86.0)	-	-	-
Primary School	289 (41.3)	52 (18.0)	237 (82.0)	1.67	0.12	0.88–2.19
Illiterate	318 (45.4)	68 (21.4)	250 (78.6)	1.24	0.30	0.83–1.85
Financial status						
Financial comfort	299 (42.7)	54 (18.1)	245 (81.9)	-	-	-
Financial difficulty	401 (57.3)	79 (19.7)	322 (80.3)	1.11	0.58	0.76–1.63
Living arrangement						
Living with others	627	117 (18.7)	510 (81.3)	-	-	-
Living alone	73	16 (21.9)	57 (78.1)	1.22	0.50	0.68–2.20

¹OR: odds ratio; ²95% CI: 95% confidence interval; * $p < 0.05$ indicates statistical significance

Table 2. Bivariable Analysis of Health Behavior and Comorbidities Factors Associated with Falls Among Elderly in The Sabah Rural Area

Variable	Total n (%)	History of fall		OR ¹	p	95% CI ²
		Yes (n = 133) f (%)	No (n = 567) f (%)			
Smoking						
No	593 (84.7)	118 (19.9)	475 (80.1)	-	-	-
Yes	107 (15.3)	15 (14.0)	92 (86.0)	0.66	0.16	0.37–1.17
Alcohol consumption						
No	586 (83.7)	106 (18.1)	480 (81.9)	-	-	-
Yes	114 (16.3)	27 (23.7)	87 (76.3)	1.41	0.17	0.87–2.27
Diabetes Mellitus						
No	568 (81.1)	101 (17.8)	467 (82.2)	-	-	-
Yes	132 (18.9)	32 (24.3)	100 (75.8)	1.48	0.09	0.94–2.33
Hypertension (HPT)						
No	288 (41.1)	43 (14.9)	245 (85.1)	-	-	-
Yes	412 (58.9)	90 (21.8)	322 (78.2)	1.59	0.02*	1.07–2.38
Musculoskeletal disease						
No	540 (77.1)	93 (17.2)	447 (82.8)	-	-	-
Yes	160 (22.9)	40 (25.0)	120 (75.0)	1.60	0.03*	1.05–2.44
Depressive symptoms						
No	471 (67.3)	78 (16.6)	393 (83.4)	-	-	-
Yes	229 (32.7)	55(24.0)	174 (76.0)	1.59	0.02*	1.08–2.35
BMI						
Normal	207 (29.6)	47 (22.7)	160 (77.3)	-	-	-
Underweight	82 (11.7)	6 (7.3)	76 (92.7)	0.82	0.35	0.55–1.24
Overweight	411 (58.7)	80 (19.5)	331 (80.5)	3.06	0.01*	1.29–7.28
Abdominal circumference						
Normal	268 (28.3)	49 (18.3)	219 (81.7)	-	-	-
Abnormal	432 (61.7)	84 (19.4)	348 (80.6)	1.08	0.70	0.73–1.60
Weak hand grip						
No	474 (67.7)	79 (16.7)	395 (83.3)	-	-	-
Yes	226 (32.3)	54 (23.9)	172 (76.1)	1.57	0.02*	1.06–2.32

¹OR: odds ratio; ²95% CI: 95% confidence interval, * $p < 0.05$ indicates statistical significance

current health status: significantly higher risk of falls (OR = 2.01); walking difficulty: strong association with falls (OR = 1.96); difficulty climbing upstairs: increased risk (OR = 1.56); visual difficulty: higher likelihood of falls (OR = 1.85); hearing difficulty: slightly increased risk (OR = 1.39); and difficulty in remembering/concentrating: associated with a higher risk of falls (OR = 1.73).

Table 4 provides a multivariable analysis of various factors. Key insights include the age >80 years old: higher adjusted odds ratio (AOR) for falls (AOR = 2.01), overweight: significantly higher risk (AOR = 4.17), walking difficulty: ele-

vated risk (AOR = 1.69) and poor current health status: increased likelihood of falls (AOR = 1.88).

Discussion

This study highlighted that the prevalence of falls among the elderly in rural Sabah stands at 19.0%, underscoring a notable public health issue. This rate aligns with global observations, which increasingly identify falls in older adults as a critical concern. Falls in the elderly not only lead to significant morbidity and mortality but also contribute to a decrease in quality of life and increased healthcare costs (Rudnicka et al., 2020). In various regions, the prevalence of

falls in older populations varies widely, influenced by environmental risks, lifestyle, and chronic conditions. Studies from different countries have reported prevalence rates ranging from 15% to 30%. These variations in prevalence highlight the complex interplay of demographic, environmental, and health-related factors contributing to falls. Recognizing the multifaceted nature of this issue is crucial for developing targeted prevention strategies and interventions tailored to specific communities. The multivariate analysis identified several key factors sig-

nificantly associated with falls: age over 80, being overweight, walking difficulty, and poor current health status. The study's findings shed light on critical factors influencing fall risk among the elderly in rural Sabah. The significant associations observed with age over 80, overweight status, functional limitations, and poor health status emphasize the need for multifaceted fall prevention strategies that consider physical and psychological health.

Elderly individuals over 80 had a significantly

Table 3. Bivariable Analysis of Health Status and Activity of Daily Living (ADL) Factors Associated with Falls Among the Elderly in Sabah Rural Area

Variable	Total N (%)	History of fall		OR ¹	p	95% CI ²
		Yes (n = 133) f (%)	No (n = 567) f (%)			
Poor current health status						
No	641 (91.6)	115 (17.9)	526 (82.1)	-	-	-
Yes	59 (8.4)	18 (30.5)	41 (69.5)	2.01	0.02*	1.11–3.62
Worried of fall						
No	41 (5.9)	6 (14.6)	35 (85.4)	-	-	-
Yes	659 (94.1)	127 (19.3)	532 (80.7)	1.39	0.46	0.57–3.38
Walking difficulty						
No	311 (44.4)	42 (13.5)	269 (86.5)	-	-	-
Yes	389 (55.6)	91 (23.4)	298 (76.6)	1.96	< 0.01*	1.31–2.92
Difficulty climbing upstairs						
No	524 (74.9)	90 (17.2)	434 (82.8)	-	-	-
Yes	176 (25.1)	43 (24.4)	133 (75.6)	1.56	0.04*	1.03–2.35
Visual difficulty						
No	123 (17.6)	15 (12.2)	108 (87.8)	-	-	-
Yes	577 (82.4)	188 (20.5)	459 (79.5)	1.85	0.04*	1.04–3.30
Hearing difficulty						
No	399 (57.0)	67 (16.8)	332 (83.2)	-	-	-
Yes	301 (43.0)	66 (21.9)	235 (78.1)	1.39	0.87	0.95–2.03
Difficulty in remembering/concentrating						
No	110 (15.7)	14 (12.7)	96 (87.3)	-	-	-
Yes	590 (84.3)	119 (20.2)	471 (79.8)	1.73	0.71	0.96–3.14

¹OR: odds ratio; ²95% CI: 95% confidence interval; **p* < 0.05 indicates statistical significance

Table 4. Multivariable Analysis of Factors Associated with Falls Among Elderly in The Sabah Rural Area

Variable	B	S. E	Wald	Crude		Adjusted	
				OR ¹	95% CI ²	OR ¹	95% CI ²
Age >80 years old	0.70	0.29	5.87	2.05	1.22–3.46	2.01	1.14–3.56
Overweight	1.43	0.46	9.56	3.06	1.29–7.28	4.17	1.69–10.30
Walking difficulty	0.53	0.22	6.00	1.96	1.31–2.92	1.69	1.11–2.58
Poor current health status	0.63	0.32	3.94	2.01	1.11–3.62	1.88	1.00–3.50

¹OR= odds ratio; ²95% CI= 95% confidence interval

higher risk of falling than those aged 60–79 (adjusted OR = 2.01; 95% CI = 1.14–3.56). This finding aligns with existing literature suggesting increased fall risk in advanced age due to factors like increased vulnerability of this age group, decreased mobility, balance issues, and chronic health conditions. The study indicates that fall risk factors are predominantly linked to age-related physiological changes (Montero-Odasso et al., 2021). As people age, they often experience a decline in physical capabilities, including reduced muscle strength, joint flexibility, and slower reflexes. These changes can affect balance and gait, increasing the risk of falls. Additionally, sensory impairments like diminished vision and hearing further exacerbate this risk. Older adults often have multiple health conditions, which can compound their risk of falling (Grimmer et al., 2019). Another study discusses how frailty, more prevalent in those over 80, contributes to an increased risk of falls (Gale et al., 2016). This group's increased prevalence of co-morbidities further compounds this risk. For instance, interventions for those over 80 may focus more on balance and strength training.

Being overweight was another significant factor associated with falls (adjusted OR = 4.17; 95% CI = 1.69–10.30). This could be attributed to the additional stress on the musculoskeletal system and balance difficulties associated with excess body weight. Research indicates that older obese individuals face a significantly higher risk of falls, along with increased pain and inactivity post-fall, underscoring the negative consequences of obesity on fall risk among the elderly (Hamza et al., 2018). Additionally, obesity in the elderly is linked to reduced activity levels, which could contribute to a heightened fear of falling (Byard & Ritchey, 2021). Excess body weight can impair balance and mobility, making it harder to recover from slips or trips. Additional weight can strain the musculoskeletal system, impacting the ability to maintain balance and increasing the workload on the body during movement, thereby elevating the risk of falls. The strategies for overweight in-

dividuals might include weight management programmes alongside physical therapy.

Difficulty in walking was significantly associated with an increased risk of falls. The adjusted OR was 1.69 (95% CI = 1.11–2.58). These difficulties may indicate underlying physical limitations or health conditions that increase fall risk. A study highlighted the importance of functional mobility as a determinant of fall risk (Peel et al., 2019). Factors such as impaired balance, gait disorders, and neurological conditions have also been associated with a higher risk of falls in the elderly (Woo et al., 2017). Difficulties in activities of daily living, such as walking, climbing stairs, or maintaining balance, indicate reduced physical functioning, often resulting from muscle weakness, joint pain, or other mobility impairments. These functional limitations increase the likelihood of a fall and the potential severity of injuries resulting from such incidents. Moreover, research has shown that reduced functional capacity, often associated with age-related decline in muscle strength and joint flexibility, significantly contributes to the risk and frequency of falls among older adults (Tornero-Quiñones et al., 2020). This underlines the importance of addressing functional impairments through targeted interventions such as strength training and balance exercises to mitigate fall risks (Chantanachai et al., 2021). In highlighting the multifactorial nature of falls, reporting poor current health status was associated with a higher likelihood of falls (adjusted OR = 1.88, 95% CI = 1.00–3.50). Poor health status often encompasses various factors like chronic diseases, functional limitations, and overall physical and mental health deterioration, which can contribute to falls. A study indicated that chronic conditions, particularly physical impairment, significantly predict falls (de Rekeneire et al., 2014). Poor health status encompasses a range of conditions, each contributing differently to the risk of falls. This includes chronic conditions like arthritis, diabetes, and cardiovascular diseases, which can individually or collectively heighten the likelihood of falls. These chronic diseases impair balance, coor-

dination, and physical strength, thus elevating the fall risk (Immonen et al., 2020).

Moreover, poor health status is often a reflection of both physical and mental health deterioration. Conditions such as cognitive decline, depression, and sensory impairments not only compromise balance and coordination but also negatively impact cognitive function and overall mobility, further increasing fall risk among the elderly (Laurence & Michel, 2017). The interplay of these multiple health issues underscores the need for comprehensive health assessments in fall prevention strategies. Furthermore, understanding modifiable risk factors is essential in developing effective fall prevention strategies. A study highlighted the importance of addressing risk factors such as obesity and physical impairment to prevent falls (Dokuzlar et al., 2020). This study will examine these modifiable factors, offering insights into potential interventions that could significantly reduce the risk of falls among the elderly in rural Sabah.

Conclusion

This study found that 19% of elderly people in rural Sabah had experienced falls. Four main factors were linked to a higher risk of falling: being 80 years or older, being overweight, having walking difficulties, and having poor self-rated health. These results show that falls in older adults are caused by a combination of physical and health-related issues. By identifying these risk factors in a rural Malaysian setting, this study contributes valuable knowledge to the limited research on falls in rural areas. It can inform future studies on fall risk in similar populations.

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