Original Article

Risk factor analysis of falls in elderly patients at the geriatric and internal medicine clinics of a general hospital: A cross-sectional study

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Abstract

Background: Increasing life expectancy has led to a larger elderly population vulnerable to health problems, particularly fall risk. Falls in older adults can result in injury, disability, and death, thus requiring comprehensive risk analysis.

Objective: This study aimed to analyze risk factors associated with falls among elderly patients in the Geriatric and Internal Medicine Clinics of a General Hospital.

Methods: A cross-sectional quantitative study was conducted among 85 elderly respondents at Dr. Rivai Abdullah General Hospital, Banyuasin. Data were collected using structured questionnaires, environmental observation, and medical records. Data analysis consisted of univariate, bivariate using Chi-Square test, and multivariate logistic regression.

Results: Multivariate analysis revealed that independence level was the most dominant factor significantly associated with fall risk (p=0.000; OR=0.176; 95% CI=0.069–0.450). Non-independent elderly had a 73.9% probability of experiencing falls. Other factors such as age, gender, education, comorbidities, environment, and polypharmacy showed no significant association (p>0.05).

Conclusion: Independence level is the main determinant influencing fall risk in elderly patients. Fall prevention strategies should focus on promoting independence through physical exercise, occupational therapy, family support, and interprofessional interventions. Further studies should explore psychosocial, lifestyle, and nutritional factors.

Background

The increase in life expectancy has led to a growing elderly population, which on one hand reflects the success of health development, but on the other hand increases vulnerability to health problems, particularly the risk of falls (Ginting & Lubis, 2023). Falls among older adults represent a serious public health concern as they can result in injuries, disability, and even mortality (Baharudin, Zurimi & Jiali, 2024). Risk factors for falls are influenced by biological, social, environmental, and lifestyle aspects (Chindapol, 2025). In Indonesia, the problem of falls among older adults is becoming increasingly relevant in the context of epidemiological transition, which has heightened the burden of degenerative diseases (Darmawati, Najah & Prasetyo, 2024). Therefore, examining fall risk factors among the elderly is essential to support prevention strategies and the planning of health interventions (Arifiati, Prasaja & Kurniawan, 2024).

Research has shown that falls are not solely related to physical conditions but also linked to mobility, the musculoskeletal system, and nutritional status (Johnson, Su, Henning & Ren, 2025). Age-related muscle mass decline exacerbates physical limitations and increases the risk of falls (Babaev, 2024). Low levels of physical activity have also been identified as a significant factor associated with frailty and a greater likelihood of falls (Battista et al., 2025). A European study confirmed that energy expenditure and activity levels are closely associated with body composition and health risks in older adults (Dericioglu, Methven & Clegg, 2025). Thus, falls in the elderly should be regarded as a multifactorial phenomenon that requires comprehensive evaluation (Kaynat et al., 2024).

Beyond biological factors, environmental and social aspects also contribute to the incidence of falls in older adults (Chindapol, 2025). Unsafe housing conditions, poor lighting, and the absence of environmental modifications

increase fall risks (Chen et al., 2025b). Lifestyle patterns such as smoking and unhealthy dietary habits further aggravate comorbid conditions and heighten susceptibility to falls (Harahap et al., 2021). In Indonesia, elderly health care challenges also include limited social and spiritual support, which affect mental health and engagement in daily activities (Imeldawati, Simamora & Margaretha, 2022). Hence, preventive approaches must integrate biological, social, spiritual, and environmental dimensions (Astuti et al., 2021).

In terms of healthcare services, hospitals and geriatric clinics play a pivotal role in screening fall risk among older adults (Ariyanti, Sigit & Marbun, 2023). Integrated screening facilitates early identification of high-risk patients and supports timely intervention (Astuti et al., 2021). However, the implementation of fall risk screening in many healthcare facilities remains limited due to constraints in human resources, availability of instruments, and data integration systems (Heryani, Iriansyah & Ardiansyah, 2023). Although the Indonesian government holds a legal responsibility to provide health services for the elderly, implementation often remains suboptimal. This underscores the importance of research focusing on fall risk factors in geriatric and internal medicine settings (Baharudin, Zurimi & Jiali, 2024).

Mobility is a crucial determinant of fall risk, particularly among older adults with chronic diseases such as hypertension (Konitatillah et al., 2021). Declines in mobility are directly associated with higher incidence of falls in this population (Arifiati, Prasaja & Kurniawan, 2024). Other chronic diseases, including stroke, hypertension, and metabolic disorders, further exacerbate fall risk (Darmawati, Najah & Prasetyo, 2024). Recent studies also highlighted the relationship between confidence in maintaining balance and fall occurrence (Kaynat et al., 2024). Therefore, assessment of mobility, disease status, and psychological factors should be an integral part of fall risk analysis in older adults (Chen et al., 2025b).

In addition to clinical factors, technological advancements have influenced fall prevention strategies (Ben-shahar, 2025). Artificial intelligence-based safety scoring in health systems offers opportunities to enhance early detection of fall risks (Gazali, 2024). From a global perspective, long-term pesticide exposure may affect neurological health and balance in the elderly (Birolli et al., 2024). Moreover, immune changes associated with chronic diseases further compromise older adults' conditions and increase fall susceptibility (Guoqling, 2025). Consequently, multidisciplinary interventions combining technological, clinical, and environmental approaches are highly needed (Dalmijn et al., 2023).

Socio-cultural contexts also play a critical role in shaping older adults' behavior toward fall prevention (Chindapol, 2025). Shifts in family structure, education levels, and access to healthcare services influence the readiness of older adults to prevent falls (Imeldawati, Simamora & Margaretha, 2022). Community-based health education has proven effective in increasing awareness of fall risks (Arifiati, Prasaja & Kurniawan, 2024). Therefore, interventions that incorporate social and cultural dimensions are more effective than purely medical approaches (Kaynat et al., 2024). This highlights the need for research on fall risk factors that integrates local socio-cultural contexts (Heryani, Iriansyah & Ardiansyah, 2023).

Taken together, the evidence demonstrates that fall risk in older adults is a multidimensional issue encompassing biological, environmental, social, and healthcare factors (Astuti et al., 2021). Research conducted in geriatric and internal medicine clinics is crucial to obtain a more comprehensive understanding of these risk factors (Baharudin, Zurimi & Jiali, 2024). Therefore, the aim of this study is to analyze fall risk factors among elderly patients in the Geriatric and Internal Medicine Clinics of a general hospital.

Methods

Study Design

This study employed a quantitative design with a cross-sectional approach, which aims to examine the dynamics of correlation between risk factors and outcomes through a single-time observation of a population (Notoatmodjo, 2020). The cross-sectional design was chosen because it enables the analysis of relationships between variables simultaneously without requiring long-term follow-up. It is also considered more efficient in terms of time and cost, making it suitable for clinical studies

involving large and heterogeneous populations such as older patients in hospitals. The study was conducted at the Geriatric Clinic and Internal Medicine Outpatient Clinic of Dr. Rivai Abdullah General Hospital, Banyuasin Regency, from April to May 2025. The site was selected because it serves as a referral center for elderly patients with diverse comorbidities, providing greater opportunities to identify multiple fall risk factors in this population.

Sampling

Sample size determination was carried out using the Slovin formula, which considers population size and a tolerable margin of error. This approach ensured that the selected sample was representative of the target population, thereby increasing the generalizability of the findings. After calculating the required sample size, purposive sampling was applied to recruit participants with specific characteristics, namely older adults receiving care at the Geriatric Clinic or Internal Medicine Clinic of Dr. Rivai Abdullah Hospital. The inclusion criteria were: age ≥60 years, ability to communicate, and willingness to participate by signing informed consent. Exclusion criteria included severe cognitive impairment, critical illness, and refusal of participation by patients or family members. This method was expected to yield a sample aligned with the study objectives.

Instruments

Data were collected using structured questionnaires and observation sheets developed from relevant literature on fall risk in older adults. The questionnaire consisted of several components, including demographic characteristics (age, sex, education), clinical factors (comorbidities, medication use or polypharmacy), level of independence in daily activities, and environmental risk factors. Observation sheets were used to assess home environment conditions, such as lighting, availability of bathroom handrails, and floor condition. Instrument validity was established through expert judgment by medical-surgical nursing lecturers and clinical practitioners experienced in geriatric care. Reliability testing was conducted on 30 respondents outside the study sample using Cronbach's alpha, which confirmed adequate internal consistency. In addition, the questionnaire incorporated the

hospital's standardized fall risk assessment scale to enhance measurement rigor.

Data Collection

Data collection involved both primary and secondary sources. Primary data were obtained directly from respondents through structured interviews using the questionnaire and observation of physical and environmental conditions. Interviews were conducted by the researcher and trained enumerators to ensure consistency in data collection techniques. Enumerators received short training on question delivery, observation methods, and documentation procedures to maintain validity and reliability. Secondary data were extracted from patient medical records, including disease history, treatment, and previous fall incidents. Data collection followed several stages: obtaining hospital approval, recruiting respondents, providing study information, securing informed consent, and administering questionnaires. All collected data were checked daily by the researcher for accuracy before analysis.

Data Analysis

Data analysis was conducted in three stages: univariate, bivariate, and multivariate. Univariate analysis described the frequency distribution and percentages of study variables, such as demographic characteristics, comorbidities, environmental factors, independence levels, and polypharmacy. Bivariate analysis employed the Chi-Square test to examine associations between independent variables and the dependent variable (fall incidence). Statistical significance was set at $p \leq 0.05$, and prevalence ratios (PRs) were calculated to estimate the strength of association for each factor. Multivariate analysis was conducted using binary logistic regression with the backward LR method. Variables with $p < 0.25$ in the bivariate analysis were included as candidates in the regression model. The selection process continued until a final model was obtained with significant predictors ($p < 0.05$). The results were presented as odds ratios (ORs) with 95% confidence intervals (CIs), indicating the strength of association between risk factors and fall incidence after adjusting for other variables.

Ethical Considerations

Ethical aspects of the study were addressed in accordance with the principles of health research ethics: respect for persons, beneficence, non-maleficence, and justice. Prior to data collection, ethical approval was obtained from the institutional health research ethics committee. All participants were provided with written information explaining the study's objectives, benefits, procedures, and potential risks. Written informed consent was obtained from each participant before enrollment. Confidentiality was ensured by coding respondents' identities in questionnaires and databases. Data were used solely for research purposes and were not disclosed without consent. Participants were assured that the study involved no harmful interventions and that they had the right to withdraw from participation at any time without consequences.

Results

This section presents the findings of the study on risk factors for falls among elderly patients at the Geriatric and Internal Medicine Clinics of Dr. Rivai Abdullah General Hospital, Banyuasin. The data are reported based on univariate, bivariate, and multivariate analyses in accordance with the study design. The univariate analysis provides an overview of respondent characteristics, including age, sex, educational level, independence in daily activities, comorbidities, environmental factors, and polypharmacy. Subsequently, bivariate analysis was conducted to examine the associations between each risk factor and fall incidence among older adults. Table 1 presents the frequency distribution of responden.

Table 1. Frequency Distribution of Respondents by Demographic Characteristics

Variables	Frequency (n)	Percentage (%)
Age		
Elderly	73	85,9
Late Elderly	12	14,1
Sex		
Male	32	37,6
Female	53	62,4
Education		
Low	83	97,6
High	2	2,4
Level of Independence		
Dependent	39	45,9
Independent	46	54,1
Comorbidities		
Present	80	94,1
Absent	5	5,9
Environmental Factors		
At risk	57	67,1
Not at risk	28	32,9
Polypharmacy		
Yes	66	77,6
No	19	22,4
Fall Risk		
At risk	38	44,7
Not at risk	47	55,3

Based on Table 1, the majority of respondents were in the elderly age group (85.9%), with a higher proportion of females (62.4%) compared to males (37.6%). Most respondents had a low educational level (97.6%), indicating limited health literacy capacity. The level of independence was relatively balanced, with 54.1% being independent and 45.9% dependent. Nearly all respondents (94.1%) had comorbidities, which represent one of the main factors contributing to an increased risk of falls. From an environmental perspective, 67.1% of respondents lived in conditions classified as at risk for falls. In addition, the majority of

respondents experienced polypharmacy (77.6%), which may increase the potential adverse effects of medications on body balance. Overall, 44.7% of respondents were identified as being at risk of falls, while 55.3% were not, illustrating that nearly half of the elderly population in this study had a high vulnerability to fall incidents.

Table 2. Bivariate Analysis of Fall Risk Factors Among Elderly Patients in the Geriatric and Internal Medicine Clinics

Variables	Fall Risk				p-value	PR (95% CI)
	At risk (n)	(%)	Not at risk (n)	(%)		
Age						-
Elderly	31	42,5	42	57,5	0,477	
Late Elderly	7	58,3	5	41,7		
Sex						-
Male	12	37,5	20	62,5	0,416	
Female	26	49,1	27	50,9		
Education						-
Low	38	42,8	45	54,2	0,50	
High	0	0,0	2	100		
Level of Independence						2,556 (1,497-4,362)
Dependent	26	66,7	13	33,3	0,000	
Independent	12	26,1	34	73,9		
Comorbidities						-
Present	37	46,3	43	53,8	0,374	
Absent	1	20	4	80		
Environmental Factors						-
At risk	29	50,9	28	49,1	0,161	
Not at risk	9	32,1	19	67,9		
Polypharmacy						-
Yes	33	50	33	50	0,117	
No	5	26,3	14	73,7		

Based on Table 2, the results of the bivariate analysis showed that age, sex, educational level, comorbidities, environmental factors, and polypharmacy were not significantly associated with fall risk among older adults (p > 0.05). Late elderly participants had a higher proportion of fall risk (58.3%) compared to early elderly (42.5%); however, this difference was not statistically significant (p = 0.477). Similarly, females tended to have a higher proportion at risk of falls (49.1%) compared to males (37.5%), but the association was not significant (p = 0.416). Older adults with low educational levels showed a fall risk of 42.8%, while none of those with higher education were classified as at risk, yet this finding remained statistically insignificant (p = 0.50).

The only variable that demonstrated a significant association with fall risk was the level of independence (p = 0.000). Non-independent older adults had a higher fall risk (66.7%) compared to those who were independent (26.1%), with a Prevalence Ratio (PR) of 2.556 (95% CI: 1.497–4.362). This indicates that non-independent elderly individuals were 2.5 times more likely to experience falls compared to independent ones.

Table 3. Multivariate Logistic Regression Analysis of Fall Risk Factors in the Geriatric Clinic

Variable	B	Sig. (p-value)	OR	95%CI
Level of independence	-1,735	0,000	0,176	0,069-0,450
Constant	1,041			

Although older adults with comorbidities were more likely to be at risk of falls (46.3%) than those without comorbidities (20%), the association was not statistically significant (p =

0.374). Similarly, older adults living in risky environments had a higher fall risk (50.9%) than those in safe environments (32.1%), though this difference was also not significant (p = 0.161). With regard to polypharmacy, elderly patients experiencing polypharmacy had a higher risk of falls (50%) compared to those without polypharmacy (26.3%); however, the result was not statistically significant (p = 0.117).

As presented in Table 3, the results of multivariate logistic regression analysis identified the level of independence as the dominant factor associated with fall risk among older adults. The regression model demonstrated that non-independent elderly individuals had a 73.9% probability of experiencing falls, indicating a substantially higher risk compared to those who were independent. The Cox & Snell R Square (0.156) and Nagelkerke R Square (0.209) values suggest that the level of independence accounted for approximately 15.6%–20.9% of the variance in fall risk, while the remaining proportion was influenced by other factors outside the model. This finding highlights that functional independence plays a crucial role in determining fall vulnerability in geriatric patients.

Discussion

This study revealed that the level of independence was the dominant factor associated with fall risk in older adults, with non-independent elderly individuals having a 73.9% probability of experiencing falls. This finding is consistent with previous studies indicating that decreased mobility and independence significantly contribute to fall incidence (Konitatillah et al., 2021). Functionally limited older adults are more likely to have poor coordination, reduced balance, and dependence on others, thereby increasing their risk of falls (Kaynat et al., 2024). This condition is further exacerbated by advanced age, which is closely related to physiological decline, including musculoskeletal and neuromuscular systems (Johnson et al., 2025). Such degeneration reduces muscle capacity to support body weight (Babaev, 2024). Therefore,

independence is an important indicator for assessing fall vulnerability among older adults.

In addition to independence, this study found that age, sex, education, comorbidities, environmental factors, and polypharmacy were not significantly associated with fall risk. These findings differ from prior research suggesting that environmental factors such as poor lighting, slippery floors, and lack of home modifications can increase fall risk (Chindapol, 2025). However, in this study, environmental factors were not significant, possibly because most respondents were receiving care in healthcare facilities with better safety standards (Chen et al., 2025b). Similarly, polypharmacy did not show a significant association despite evidence in other studies linking it to falls through drug-related side effects such as dizziness and hypotension (Guoqling, 2025). This discrepancy may be explained by the close medical supervision provided to respondents, which helped minimize the adverse effects of polypharmacy (Birolli et al., 2024). Thus, these findings highlight the contextual role of healthcare quality and supervision in mitigating fall risks.

The study also showed that sex was not significantly associated with fall risk, although women had a higher proportion of falls compared to men. Other studies have indicated that women are more vulnerable due to lower bone density and higher risk of osteoporosis (Darmawati, Najah & Prasetyo, 2024). However, in this study, the lack of significance may be attributable to compensatory effects of healthcare interventions and family support (Imeldawati, Simamora & Margaretha, 2022). Similarly, education level was not significantly related to fall risk, despite evidence suggesting that low education contributes to reduced health literacy and fall-preventive behaviors (Heryani, Iriansyah & Ardiansyah, 2023). These results imply that sociodemographic factors do not act as single predictors of fall risk but interact with environmental and healthcare conditions (Arifiati, Prasaja & Kurniawan, 2024).

Comorbidities were also not significant in this study, even though nearly all respondents had

chronic illnesses (Boibalan, 2024; Saputra, Fauziah, & Saputra, 2024). Previous studies have identified comorbidities such as hypertension, stroke, and diabetes mellitus as contributors to fall risk by reducing functional capacity and affecting sensory systems (Harahap et al., 2021). The divergent findings in this study may be attributed to the high level of medical monitoring received by respondents, which minimized the risk of falls due to comorbidities (Ariyanti, Sigit & Marbun, 2023). This aligns with the view that fall prevention requires integration of medical and nursing interventions (Astuti et al., 2021). Thus, while comorbidities have potential influence, effective management within healthcare facilities can reduce their impact (Chen et al., 2025b).

Logistic regression analysis in this study produced Cox & Snell R Square and Nagelkerke R Square values of 0.156 and 0.209, respectively. This indicates that the level of independence explained approximately 15.6%–20.9% of the variance in fall risk, leaving 79.1%–84.4% of the variance attributable to other factors. Prior studies have emphasized that falls among the elderly are multifactorial and cannot be explained by a single determinant (Battista et al., 2025). Sedentary lifestyle, low physical activity, and reduced metabolic energy contribute to frailty and increased fall risk (Dericioglu, Methven & Clegg, 2025). Furthermore, psychosocial factors such as loneliness, low self-confidence, and limited spiritual support may also worsen vulnerability (Imeldawati, Simamora & Margaretha, 2022). Thus, further research is required to explore additional risk factors not included in the current model.

These findings underscore the importance of comprehensive fall risk screening in healthcare facilities, particularly in geriatric and internal medicine clinics. Routine screening enables healthcare providers to identify high-risk patients and implement early preventive interventions (Ariyanti, Sigit & Marbun, 2023). This aligns with government policies that mandate elderly health services as part of Indonesia's legal framework (Heryani, Iriansyah & Ardiansyah, 2023). Simple interventions such as tandem walking exercises, home

modifications, and the use of assistive devices have been proven effective in reducing fall risk (Arifiati, Prasaja & Kurniawan, 2024). Hence, this study provides practical implications for strengthening fall prevention programs in healthcare settings (Rekawati et al, 2025; Wilda, 2024).

Beyond clinical aspects, environmental and sociocultural factors remain crucial in fall prevention. A study in Thailand highlighted that home modifications and family support play major roles in reducing fall risks (Chindapol, 2025). Social factors such as educational attainment, family support, and access to healthcare services can either strengthen or weaken the effectiveness of medical interventions (Ginting & Lubis, 2023). Lifestyle changes, including dietary improvements, regular physical activity, and stress management, also reduce fall risk (Harahap et al., 2021). Therefore, fall prevention strategies must be multidimensional, integrating clinical, environmental, social, and psychological approaches (Astuti et al., 2021).

Taken together, this study contributes significantly to understanding fall risk factors among older adults, particularly in geriatric and internal medicine settings. The findings reinforce that lack of independence is a critical factor that should be prioritized in geriatric care (Konitatillah et al., 2021). However, given the relatively low R Square values, future studies are encouraged to include additional variables such as psychosocial factors, lifestyle, and nutritional status (Battista et al., 2025). Furthermore, an interprofessional approach involving physicians, nurses, physiotherapists, and family members is essential to reduce fall risks (Astuti et al., 2021). Thus, this study may serve as a foundation for developing both community- and hospital-based interventions to enhance safety and quality of life in the elderly population.

Conclusion and Recommendation

This study confirms that the level of independence is the most influential factor associated with fall risk among elderly patients in the geriatric and internal medicine clinics. Non-independent older adults were found to be more vulnerable to falls compared to those who

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were independent, whereas age, sex, education, comorbidities, environmental conditions, and polypharmacy did not show significant associations. These findings suggest that fall prevention strategies for older adults should prioritize efforts to enhance independence through physical exercise programs, occupational therapy, and support from both families and healthcare professionals.

Hospitals are encouraged to strengthen routine fall risk screening and involve interprofessional teams in designing integrated interventions. Families also play a critical role by providing continuous support, modifying the home environment to improve safety, and assisting older adults in their daily activities. Furthermore, future research should incorporate psychosocial factors, lifestyle, and nutritional status to broaden the understanding of fall determinants in the elderly population. Overall, the findings of this study may serve as a foundation for strengthening geriatric nursing policies and practices that are more comprehensive, with the aim of improving safety and quality of life among older adults.

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Declaration of conflict of interest

The authors declare no competing interests.

Declaration on the Use of AI

No AI tools were used in the preparation of this manuscript.

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