



ANALYSIS OF RISK FACTORS ASSOCIATED WITH FALLS AMONG STROKE PATIENTS

Ria Roswita*, Nurhayati, I Gusti Ayu Putu Desy Rohana, Puspita Hanggit Lestari

School of Nursing, Poltekkes Kemenkes Banjarmasin, Jl. M Jl. Mayjen Sutoyo S No.408, Pelambuan, Banjarmasin Barat, Banjarmasin, Kalimantan Selatan 70118, Indonesia

School of Nursing, Poltekkes Kemenkes Jakarta III, Jl. Arteri JORR Jatiwarna, Pondok Melati, Bekasi, Jawa Barat 17415, Indonesia

*roswitaria@gmail.com

ABSTRACT

Stroke is one of the leading causes of disability and mortality worldwide, including in Indonesia. Older adults with stroke are at high risk of experiencing long-term complications, one of which is falls due to impaired motor function, balance, and physical function. This study aimed to identify the risk factors associated with falls among post-stroke patients in three provinces in Indonesia. This quantitative study employed a cross-sectional design and was conducted in South Kalimantan, Jakarta, and Palembang. The independent variables were fall risk factors, while the dependent variable was the occurrence of falls among post-stroke patients. Data were collected using the Morse Fall Scale (MFS) with an intraclass correlation coefficient (ICC) of 0.825, sensitivity of 66.7%, and specificity of 81.6%. A total of 150 post-stroke patients were recruited using purposive sampling and the analysis using Chi Square Test. The analysis showed that, among the eight characteristics examined, four variables were significantly associated with fall risk: age ($p = 0.040$), sex ($p = 0.045$), marital status ($p = 0.041$), and stroke duration ($p < 0.001$). In contrast, education ($p = 0.508$), occupation ($p = 0.966$), health problems ($p = 0.166$), and body mass index (BMI) ($p = 0.123$) were not significantly associated with fall risk. These findings highlight the importance of considering demographic characteristics and stroke duration in the identification and prevention of fall risk among post-stroke patients.

Keywords: fall; fall risk; stroke

How to cite (in APA style)

Roswita, R., Nurhayati, N., Rohana, I. G. A. P. D., & Lestari, P. H. (2026). Analysis of Risk Factors Associated with Falls among Stroke Patients. *Indonesian Journal of Global Health Research*, 8(4), 1371–1378. <https://doi.org/10.37287/ijghr.v8i4.2563>.

INTRODUCTION

Stroke is one of the leading causes of disability and mortality worldwide, including in Indonesia. Stroke patients, particularly older adults, experience various long-term complications that can significantly affect their quality of life, one of which is an increased risk of falls. Falls among older adults with stroke can result not only in physical consequences, such as injuries, fractures, and immobility, but also in psychological consequences, including fear of engaging in activities, depression, and increased dependence on others in performing activities of daily living.

In Indonesia, stroke was ranked as the leading cause of death according to the 2018 Basic Health Research, with its prevalence increasing with advancing age (Kemenkes, 2019). At the same time, the older population continues to grow due to increasing life expectancy and demographic changes. According to data from Statistics Indonesia, the number of older adults increased from 18 million (7.6%) in 2010 to 27 million (10%) in 2020 and is projected to reach approximately 40 million (13.8%) by 2035 (WHO, 2021). As the older population increases, the risk of falls is also expected to rise. The combination of aging and a history of stroke further increases vulnerability to falls, particularly due to impaired balance, muscle weakness, impaired coordination, and persistent neurological deficits.

Falls are a significant public health problem, particularly among older adults. The World Health Organization (WHO) reports that falls are the second leading cause of unintentional injury-related

deaths worldwide (WHO, 2021). Approximately 684,000 people die from falls each year, with approximately 80% of these deaths occurring in low- and middle-income countries (WHO, 2021). In developing countries such as Indonesia, fall-related incidents are often not systematically documented; nevertheless, their impact on quality of life and the economic burden is substantial.

The incidence of falls in Indonesia is relatively high. According to Riskesdas 2018, falls were the leading cause of injury, accounting for 40.9% of reported injuries (Kemenkes, 2019). The incidence of falls was 49.4% among individuals aged 55–64 years, 67.1% among those aged 65–74 years, and 78.2% among those aged ≥ 75 years (Kemenkes, 2019). These findings indicate that the incidence of falls increases with advancing age. Falls can result in physical consequences ranging from minor to severe injuries and can also cause psychological consequences, such as fear of movement, reduced participation in daily activities, increased dependence, and long-term disability.

Several international studies have reported that the prevalence of falls among stroke patients is approximately 7% during the first week after stroke, increasing to 37% within one to six months after stroke and reaching 73% after one year (European Stroke Organisation, 2019). In Indonesia, however, evidence regarding fall risk factors among stroke patients remains limited and tends to be based on local studies. This lack of comprehensive data poses challenges in developing effective, evidence-based fall prevention strategies.

Fall risk among older adults with stroke is multifactorial and includes intrinsic factors, such as advanced age, sex, limb weakness, cognitive impairment, and a previous history of falls, as well as extrinsic factors, such as the use of walking aids, certain medications, and an unsafe environment. Identifying these risk factors is essential for recognizing patients at high risk of falls and implementing timely and appropriate preventive interventions.

METHOD

This study employed a quantitative research design with a cross-sectional approach. The study was conducted in three regions of Indonesia: South Kalimantan, Jakarta, and Palembang. The study population consisted of post-stroke patients residing in these three regions. A total of 150 post-stroke patients were recruited using a non-probability sampling technique with purposive sampling. Participants were selected based on the predetermined study criteria. Prior to data collection, the researchers obtained the necessary research permissions and informed consent from the participants. Data collection began with the preparation of the research instruments and informed consent forms. The questionnaire consisted of two components: sociodemographic characteristics and fall risk assessment. Sociodemographic variables included age, sex, education level, occupation, religion, health problems, marital status, and body mass index (BMI). Fall risk was assessed using the Morse Fall Scale (MFS) (Morse, 1989). The MFS has demonstrated acceptable reliability and diagnostic performance, with an intraclass correlation coefficient (ICC) of 0.825, sensitivity of 66.7%, and specificity of 81.6%. The questionnaire was administered to the participants to assess their risk of falls. The independent variables in this study were the potential risk factors for falls, including sociodemographic and health-related characteristics. The dependent variable was fall risk among post-stroke patients, as assessed using the Morse Fall Scale. This study was approved by the Ethics Committee of the Health Polytechnic of Banjarmasin (No.063/KEPK-PKB/2026).

RESULT

The characteristics of the respondents assessed in this study included age, sex, education level, occupation, health problems, marital status, duration of stroke, and body mass index (BMI). These characteristics were assessed to provide an overview of the clinical and demographic profiles of the stroke patients included in the study, particularly in relation to fall risk. The detailed demographic characteristics of the respondents are presented in Table 1, showing the distribution of participants according to each characteristic and providing an overall description of the study population and potential factors associated with falls.

Table 1.
Respondent characteristics (n = 150)

Variabel	f	%
Age		
Adult	70	46,7 %
Elderly	80	53,3 %
Gender		
Female	89	59,3 %
Male	61	40,7 %
Education		
None	2	1,3 %
Elementary	41	27,3 %
Junior High School	29	19,3 %
Senior High School	59	39,3 %
University	19	12,7 %
Occupation		
Unemployed	12	8 %
Private Sector	44	29,3 %
Civil Servant	6	4 %
Self Employed	44	29,3 %
Homemaker	69	46 %
Retired	5	3,3 %
Labores	8	5,3 %
Farmer	3	2 %
Security Guard	1	0,7 %
Helath Problems		
No Health Promlems	13	8,7 %
Hypertension	114	76 %
Diabetes Mellitus	23	15,3 %
Marital Status		
Widowed (Female)	15	10 %
Widowed (Male)	6	4 %
Married	124	82,7 %
Never Married	5	3,3 %
Duration of Stroke		
> 5 Year	132	88 %
< 5 Year	18	12 %
IMT		
Normal	101	67,3 %
Overweight	29	19,3 %
Obesity	20	13,3 %

The results showed that the respondents were predominantly older adults (53.3%) and female (59.3%). The predominance of older adults in this study may be associated with the increasing incidence of stroke with advancing age. In terms of educational attainment, most respondents had completed senior high school (39.3%), followed by elementary school (27.3%) and junior high school (19.3%). Regarding occupation, the majority of respondents were homemakers (46.0%), followed by self-employed individuals (29.3%). This finding may be attributed to the predominance of female respondents and older adults in the study population, resulting in a higher proportion of homemakers. Most respondents were married (82.7%), indicating that the majority had a spouse who could provide social support in daily activities, including assistance with mobility and fall prevention. In addition to these characteristics, other risk factors included the health problems experienced by the respondents. Most respondents had hypertension (76.0%), followed by diabetes mellitus (15.3%). Uncontrolled hypertension and diabetes mellitus are established risk factors for stroke. Furthermore, the duration of stroke was a notable characteristic, with 88.0% of respondents having experienced a stroke for more than five years, while 12.0% had experienced a stroke for less than five years. This finding indicates that most respondents were in the chronic phase of stroke, which may be associated with various functional impairments, including limb weakness, altered gait

patterns, activity limitations, and impaired balance. Regarding body mass index (BMI), the majority of respondents had a normal BMI (67.3%), while 19.3% were classified as obese and 13.3% as overweight. Thus, 32.6% of respondents were classified as overweight or obese, which may increase the risk of metabolic and cardiovascular disorders. The study also assessed the risk of falls among stroke patients across the three study sites. The results are presented in Table 2. Fall risk was assessed using the Morse Fall Scale (MFS), which categorizes patients into low-, moderate-, and high-risk groups.

Table 2.
Falls Risk Among Patients (n = 150)

Falls Risk	Total	
	f	%
Low	7	4,7 %
Moderate	11	7,3 %
High	132	88 %

The results showed that the majority of respondents were classified as having a high fall risk (88.0%), while 7.3% were classified as having a moderate fall risk and 4.7% as having a low fall risk, based on the Morse Fall Scale (MFS). These findings indicate that the majority of stroke patients in this study had a high vulnerability to falls. The MFS assesses six components: history of falling, secondary diagnosis, ambulatory aid, intravenous therapy, gait/transferring, and mental status. A score of ≥ 45 is categorized as indicating a high risk of falls (Morse et al., 1989).

Table 3.
Association of Patient Characteristics with Fall Risk Among Stroke Patients (n = 150)

Variabel	f (%)	X ²	Significance
Age			
Adult	70 (46,7 %)	6.414	0,040
Elderly	80 (53,3 %)		
Gender			
Female	89 (59,3 %)	6.202	0,045
Male	61 (40,7 %)		
Education			
None	2 (1,3 %)	9.261	0,508
Elementary	41 (27,3 %)		
Junior High School	29 (19,3 %)		
Senior High School	59 (39,3 %)		
University	19 (12,7 %)		
Occupation			
Unemployed	12 (8 %)	8.729	0,966
Private Sector	44 (29,3 %)		
Civil Servant	6 (4 %)		
Self Employed	44 (29,3 %)		
Homemaker	69 (46,0 %)		
Retired	5 (3,3 %)		
Labores	8 (5,3 %)		
Farmer	3 (2 %)		
Security Guard	1 (0,7 %)		
Health Problems			
No Health Problems	13 (8,7 %)	9.136	0,166
Hypertension	114 (76,0 %)		
Diabetes Mellitus	23 (15,3 %)		
Marital Status			
Widowed (Female)	15 (10 %)	13.138	0,041
Widowed (Male)	6 (4 %)		
Married	124 (82,7 %)		
Never Married	5 (3,3 %)		
Duration of Stroke			
> 5 Year	132 (88 %)	28.586	0,000
< 5 Year	18 (12 %)		
IMT			
Normal	101 (67,3 %)	7.264	0,123

Overweight	29 (19,3 %)
Obesity	20 (13,3 %)

An analysis of fall risk factors was conducted to determine the association between respondent characteristics and fall risk among stroke patients. Statistical analyses were performed using a significance level of $\alpha = 0.05$. Variables were considered statistically significantly associated when the p -value was <0.05 . Of the eight characteristics examined, four variables showed statistically significant associations with fall risk: age ($p = 0.040$), sex ($p = 0.045$), marital status ($p = 0.041$), and stroke duration ($p < 0.001$). In contrast, education level ($p = 0.508$), occupation ($p = 0.966$), health problems ($p = 0.166$), and body mass index (BMI) ($p = 0.123$) were not statistically significantly associated with fall risk.

DISCUSSION

Respondent Characteristics

Regarding age, the respondents in this study tended to belong to the older age group. Age is a non-modifiable risk factor for stroke and is associated with age-related physiological changes, including declines in muscle strength, mobility, coordination, and balance (Nguyen et al., 2024). In terms of sex, women constituted a larger proportion of the respondents in this study. Differences in sex distribution may be influenced by population composition, age characteristics, the prevalence of risk factors, and the characteristics of patients receiving healthcare services.

Regarding educational attainment, most respondents had primary to secondary education, while the proportion with higher education was relatively small. Education is an important social characteristic that may influence an individual's ability to access and understand health information, including information related to disease management, medication, rehabilitation, and complication prevention. A meta-analysis by (Nguyen et al., 2024), involving 19 studies and 157,715 patients, showed that lower educational attainment was associated with a greater likelihood of poorer functional outcomes after stroke.

Regarding occupational characteristics, the majority of respondents were homemakers. This finding warrants attention because (Nguyen et al., 2024) reported that lower socioeconomic status, including being unemployed or engaged in manual occupations, was associated with poorer outcomes following stroke. Regarding comorbid health conditions, the findings of this study indicate that hypertension was the most prevalent condition among the respondents. Hypertension is a major contributor to stroke, and individuals with hypertension have an approximately threefold higher risk of stroke than those without hypertension (WHO, 2025a). Diabetes mellitus was the second most common comorbidity. Persistently elevated blood glucose levels in individuals with diabetes can damage blood vessels and increase the risk of cardiovascular diseases, including stroke (WHO, 2024).

Regarding marital status, most respondents were married and therefore had a spouse who could potentially provide social support during the recovery process. Spousal and family support may assist patients with medication adherence, rehabilitation, activities of daily living, and implementation of fall-prevention measures. In terms of stroke duration, most respondents had experienced stroke for more than five years, indicating that the majority were in the chronic phase of stroke. During this phase, patients may experience persistent residual impairments, including limb weakness, altered gait patterns, activity limitations, and impaired balance. WHO, (2025b) identifies motor deficits and gait disturbances as potential long-term consequences of stroke.

Regarding BMI, some respondents were classified as overweight or obese. This finding is important because overweight and obesity are associated with various metabolic and cardiovascular conditions, including hypertension, diabetes, and stroke. WHO, (2025b) identifies overweight and obesity as modifiable risk factors that should be addressed in stroke prevention. Overall, the characteristics of the respondents revealed a population predominantly consisting of older adults,

women, individuals with senior high school education, homemakers, patients with hypertension, married individuals, patients with a stroke duration of more than five years, and individuals with a normal BMI. This profile indicates that the respondents were predominantly older stroke survivors with a relatively long disease duration and a substantial burden of vascular comorbidities. The combination of aging, long-term post-stroke conditions, and comorbid diseases provides an important context for understanding fall risk. Fall risk among stroke survivors is multifactorial, with consistent evidence highlighting the importance of mobility impairment, balance dysfunction, activity limitations, cognitive impairment, psychological factors, certain medications, and a history of falls (Xu et al., 2018).

Falls Risk

Most respondents obtained an MFS score of ≥ 45 , indicating an accumulation of several risk factors assessed by the Morse Fall Scale (MFS). Among stroke patients, impaired gait and transfer ability may be important concerns due to limb weakness, impaired coordination, and balance dysfunction. In addition, a history of falls, the use of ambulatory aids, and the presence of comorbidities may contribute to higher MFS scores. Studies involving post-stroke patients have demonstrated that the MFS can be used to identify levels of fall risk, although the predictive performance of the instrument may vary depending on population characteristics and patients' clinical conditions (Strini et al., 2021).

The high fall risk observed in this study should also be interpreted in the context of the respondents' characteristics. Most respondents were older adults and had experienced stroke for more than five years. Advancing age may be accompanied by declines in muscle strength, balance, coordination, and mobility. Meanwhile, long-term stroke may result in persistent neurological and functional impairments. These conditions may affect patients' ability to walk and perform transfers safely, potentially increasing scores on the gait/transferring component of the MFS. (Xu et al., 2018) demonstrated that mobility and balance impairments are strongly associated with falls among stroke survivors.

The findings of this study are also consistent with previous research on fall risk among post-stroke patients, which has demonstrated that stroke survivors may have a high risk of falls when assessed using the MFS. Nevertheless, the high proportion of respondents classified as having a high fall risk based on the MFS does not mean that most respondents will necessarily experience an actual fall. The MFS is a screening and risk assessment tool rather than an instrument for confirming the occurrence of falls. However, the predominance of the high-risk category highlights the importance of incorporating fall-prevention strategies into the management of stroke patients. These findings further support the need for a multidimensional approach to fall prevention, as fall risk among stroke patients is not determined by a single factor but rather by interactions among neurological impairment, motor function, balance, mobility, age, history of falls, use of ambulatory aids, comorbidities, medications, and environmental factors (Xu et al., 2018).

Association Between Respondent Characteristics and Fall Risk

The analysis demonstrated significant associations between several participant characteristics and fall risk among stroke patients. Of the eight variables analyzed, age, sex, marital status, and stroke duration were significantly associated with fall risk, whereas education, occupation, health problems, and body mass index (BMI) were not statistically significantly associated with fall risk. Age was significantly associated with fall risk, which may be attributed to age-related declines in muscle strength, balance, coordination, sensory function, and mobility. These age-related changes may be further exacerbated by post-stroke neurological impairments, thereby increasing susceptibility to falls. Age, motor function, mobility, and balance have been consistently identified as factors associated with fall risk among stroke survivors (Abdollahi et al., 2022; Peltzer et al., 2020) Sex was also significantly associated with fall risk. Differences in fall risk between men and women may be related to differences in balance, mobility, physical activity, muscle strength, and

bone density (Peltzer et al., 2020; Xie et al., 2022). Furthermore, Xie et al., (2022) reported that women may have a higher likelihood of experiencing fear of falling after stroke.

Marital status was significantly associated with fall risk. A study by Djurovic et al., (2021) reported that individuals living alone had a higher risk of falls. This finding may be related to the availability of spousal support in assisting with daily activities, patient mobility, and access to healthcare services (Windani et al., 2020). Family support is an important aspect of safe mobility and fall prevention among stroke patients (Jesuthasan et al., 2025). Stroke duration demonstrated the strongest statistical association with fall risk. Most respondents in this study had experienced stroke for more than five years. A longer duration after stroke may be accompanied by persistent residual impairments, including limb weakness, gait disturbances, mobility limitations, and balance impairment. Mobility and balance impairments are known to be strongly associated with falls among stroke survivors (Xu et al., 2018). Stroke rehabilitation guidelines also emphasize the importance of rehabilitation interventions to improve mobility and balance (Jesuthasan et al., 2025).

In contrast, education, occupation, health problems, and BMI were not significantly associated with fall risk. These findings indicate that, within the context of this study, there was insufficient statistical evidence to establish these characteristics as factors associated with fall risk. Fall risk among stroke patients is complex and multifactorial, arising from interactions among neurological status, motor function, balance, mobility, age, history of falls, use of ambulatory aids, comorbidities, medications, and environmental factors (Xu et al., 2018). These findings underscore the importance of comprehensive fall-risk assessment among stroke patients, incorporating demographic, clinical, functional, and environmental factors.

CONCLUSION

The findings of this study indicate that age, sex, marital status, and stroke duration are significantly associated with fall risk among post-stroke patients. In contrast, educational attainment, occupation, health problems, and body mass index (BMI) were not significantly associated with fall risk. These findings highlight the importance of considering demographic characteristics and stroke duration when identifying and preventing fall risk among post-stroke patients.

REFERENCES

- Abdollahi, M., Whitton, N., Zand, R., Dombovy, M., Parnianpour, M., Khalaf, K., & Rashedi, E. (2022). A Systematic Review of Fall Risk Factors in Stroke Survivors: Towards Improved Assessment Platforms and Protocols. In *Frontiers in Bioengineering and Biotechnology* (Vol. 10). Frontiers Media S.A. <https://doi.org/10.3389/fbioe.2022.910698>
- Djurovic, O., Mihaljevic, O., Radovanovic, S., Kostic, S., Vukicevic, M., Georgievski Brkic, B., Stankovic, S., Radulovic, D., Simic Vukomanovic, I., & Radevic, S. R. (2021). Risk Factors Related to Falling in Patients after Stroke. In *Iran J Public Health* (Vol. 50, Number 9). <https://creativecommons.org/licenses/by-nc/4.0/>
- European Stroke Organisation. (2019, May 10). Falls After Stroke. <https://eso-stroke.org/falls-after-a-stroke/>
- Jesuthasan, A., Maung, M., Ajina, S., & Warburton, E. (2025). Rehabilitation Guidelines in Stroke. In *British Journal of Hospital Medicine* (Vol. 86, Number 12). MA Healthcare Ltd. <https://doi.org/10.12968/hmed.2024.1040>
- Kemenkes. (2019). Laporan Nasional Riskesdas 2018.
- Nguyen, M. T. H., Sakamoto, Y., Maeda, T., Woodward, M., Anderson, C. S., Catiwa, J., Yazidjoglou, A., Carcel, C., Yang, M., & Wang, X. (2024). Influence of Socioeconomic Status on Functional Outcomes After Stroke: A Systematic Review and Meta - Analysis. *Journal of the American Heart Association*, 13(9). <https://doi.org/10.1161/JAHA.123.033078>
- Peltzer, K., Hapsari Susilowati, I., Sabarinah Sabarinah, I., & Pengpid, S. (2020). Prevalence and risk factors associated with falls among community-dwelling and institutionalized older adults in Indonesia. In *Malaysian Family Physician* (Vol. 15, Number 1).

- Strini, V., Schiavolin, R., & Prendin, A. (2021). Fall risk assessment scales: A systematic literature review. In *Nursing Reports* (Vol. 11, Number 2, pp. 430–443). MDPI. <https://doi.org/10.3390/nursrep11020041>
- WHO. (2021, April 26). Falls.
- WHO. (2024, November 14). Diabetes. <https://www.who.int/news-room/fact-sheets/detail/diabetes>
- WHO. (2025a, September 25). Hypertension. <https://www.who.int/news-room/fact-sheets/detail/hypertension>
- WHO. (2025b, December 19). Stroke. <https://www.who.int/news-room/fact-sheets/detail/stroke>
- Windani, C., Sari, M., Rahayu, U., & Fauziah, N. (2020). Overview of Falling and Risk Factors of Falling in The Elderly in Bandung, Wes Java, Indonesia.
- Xie, Q., Pei, J., Gou, L., Zhang, Y., Zhong, J., Su, Y., Wang, X., Ma, L., & Dou, X. (2022). Risk factors for fear of falling in stroke patients: a systematic review and meta-analysis. *BMJ Open*, 12(6), e056340. <https://doi.org/10.1136/bmjopen-2021-056340>
- Xu, T., Clemson, L., O'Loughlin, K., Lannin, N. A., Dean, C., & Koh, G. (2018). Risk Factors for Falls in Community Stroke Survivors: A Systematic Review and Meta-Analysis. *Archives of Physical Medicine and Rehabilitation*, 99(3), 563-573.e5. <https://doi.org/10.1016/j.apmr.2017.06.032>