ORIGNAL ARTICLE

OPEN ACCESS

FREQUENCY OF PROLONGED HOSPITAL STAY AND FACTORS FOR PROLONGED HOSPITALIZATION IN STROKE PATIENTS.

Din Muhammad[1],Muhammad Saleem[2],Kinza Riaz[3] ,Wasim Tariq Malik[4],Maimoona Siddiqui[4],Raja Farhat Shoaib[5]

[1,2,3,] - *Post Graduate Neurology Resident Shifa International Hospital, Islamabad*

[4, 5,6]*Consultant neurologist Shifa international Hospital, Islamabad*

ABSTRACT

Background: Stroke remains a major global health burden, amounting to over 6.5 million deaths annually. Prolonged length of hospital stay due to stroke is associated with increased healthcare costs, increased rate of complications, and poor rehabilitation outcomes, especially in resource-constrained settings. Identification of factors contributing to extended hospitalizations can improve the resource allocation not only at the health systems level but also at the healthcare settings level and can patient care pathways and patient satisfaction.

Objectives: To determine the length of hospital stay among stroke patients and to identify demographic, clinical, and treatment-related predictors of prolonged hospital stay.

Study Design: A prospective observational study.

Duration and Place of Study. From 01 September 2024 to 28 February 2025 Department of Neurology, Shifa international Hospital Islamabad

Methods: This prospective observational study was conducted over six months at Department of Neurology, Shifa international Hospital Islamabad. A total of 384 patients with confirmed ischemic or hemorrhagic stroke, admitted within 72 hours of symptom onset, were enrolled. Data on demographics, comorbidities, stroke characteristics, complications, and treatment interventions were collected. Stroke severity and functional status were assessed using NIHSS and Barthel Index at the time of admission, at 72 hours, and at follow-up was recorded. A multivariable linear regression model through the origin was used to identify predictors of hospital stay duration.

Results: The mean age of participants was 43.67 years, with 68.8% being male and 87.0% experiencing ischemic stroke. The average hospital stay was 11.44 days, with 52.9% experiencing prolonged hospitalization. The regression model revealed that marital status ($B = 2.294$, $p < 0.001$) and type of stroke ($B = 2.157$, $p < 0.001$) were the strongest predictors of increased hospital stay. Additional significant predictors included smoking history, antihypertensive use, and Barthel Index scores at admission. The final model explained 86.0% of the variance in hospital stay duration ($R^2 = 0.860$, Adjusted $R^2 = 0.841$, $p < 0.001$).

Conclusions: Prolonged hospital stay is common in stroke patients and is primarily influenced by baseline demographic and stroke-related characteristics, especially marital status and stroke type. These findings highlight the need for individualized discharge planning and early intervention strategies based on patient profiles to reduce hospital stay and optimize recovery.

Keywords: Stroke, prolonged hospitalization, ischemic stroke, NIHSS, Barthel Index, hospital stay duration, predictors.

How To Cite This Article **M Din**, **Saleem M**, **Riaz K**, **Malik WT**, **Siddiqui M**, **Shoaib RF**. Frequency of Prolonged hospital stay and factors for prolonged hospitalization in stroke patients. ***J Bacha Khan Med Coll.*** **2025**;6(1),**62-67.**

Corresponding Author: Din Muhammad

Department of Neurology Shifa international Hospital Islamabad)

Email: din73314@gmail.com

Contact no: 0333-7875370

Received: 08th April , 2025
Revision: 20th May, 2025
Accepted: 26th June, 2025
Published: 10th July, 2025
DOI: https://doi.org/10.69830/jbkmc.v6i1.226.

INTRODUCTION

Stroke stands among the top causes of death and disability worldwide, affecting approximately 12.2 million people each year and leading to around 6.55 million deaths annually (1). In 2019, the global prevalence of stroke was estimated at over 101 million cases, underscoring the disease's vast public health impact (2). Of all stroke subtypes, ischemic stroke accounts for roughly 80–87% of cases, with hemorrhagic strokes contributing the remainder(3,4). In addition to its high mortality, stroke imposes significant long-term burdens on survivors, families, and healthcare systems—particularly in resource-limited settings where critical infrastructure and specialized care may be deficient (5,6).Prolonged hospital stay is a frequently encountered challenge in stroke management and rehabilitation (7). Estimates suggest that anywhere from 25% to 50% of stroke survivors remain hospitalized beyond typical clinical milestones due to multiple risk factors, including underlying comorbidities, severe neurological deficits, and in-hospital complications such as pneumonia or deep vein thrombosis (8–10) Extended stays not only drive up the direct costs of care, already substantial at an estimated USD 60–70 billion annually in some high-income countries—but also exacerbate indirect costs by increasing caregiver burden and reducing patients' likelihood of returning to work (11) Furthermore, emerging data indicate that younger stroke survivors (i.e., those under age 50) may require prolonged hospitalization because of delayed diagnosis or coexisting conditions such as obesity, hypertension, and diabetes—chronic diseases increasingly prevalent in younger populations (12,13).In addition to the cost and resource implications, prolonged hospital stay carries clinical ramifications. Longer durations of bed rest place patients at higher risk for secondary complications, including pressure ulcers, urinary tract infections, and malnutrition, which further worsen outcomes(14,15). They may also delay the onset of rehabilitative measures—such as early mobilization, speech therapy, or counseling services—crucial for optimizing functional recovery and minimizing post-stroke depression (16,17). By shedding light on the frequency of and contributors to prolonged hospital stays in stroke patients, hospitals and policy makers can develop targeted approaches for efficient resource allocation, patient-centered discharge planning, and evidence-based interventions to streamline care pathways.Therefore, the current study aims to quantify the prevalence of prolonged hospital stay among patients admitted with stroke and identify the multifactorial determinants—clinical, demographic, and systems-related—that underlie these extended inpatient periods. A more comprehensive understanding of these elements is key to Improving patient outcomes, lowering healthcare costs, and ultimately enhancing post-stroke quality of life.

METHODOLOGY

This prospective observational study Conducted at Department of Neurology, Shifa international Hospital Islamabad From 01 September 2024 to 28 February 2025 to examine the determinants of hospital stay duration among acute stroke patients. Eligible participants were those aged 18 years or older who were admitted within 72 hours of symptom onset with a confirmed diagnosis of ischemic or hemorrhagic stroke. Demographic, social, and clinical data—including stroke type, in-hospital complications, and treatment interventions (e.g., IV thrombolysis and mechanical thrombectomy)—were collected using structured questionnaires and hospital record reviews. Stroke severity and functional status were assessed using the National Institutes of Health Stroke Scale (NIHSS) and the Barthel Index at admission, 72 hours, and follow-up.The length of hospital stay (in days) was treated as a continuous outcome variable, and a multivariable linear regression model through the origin was employed to identify independent predictors of hospital stay duration. Predictors were entered in blocks: first, key demographic and stroke-related variables were included; subsequently, additional clinical, treatment, and complication variables were incorporated to assess their incremental contribution. All data were double-entered into a secure database and rigorously checked for accuracy. The study protocol was approved by the institutional review board, and written informed consent was obtained from all participants or their legal representatives.

Ethical Approval Statement:

Ethical approval for the dissertation titled "Frequency of Prolonged Hospital Stay and Factors for Prolonged Hospitalization in Stroke Patients" was obtained from the Institutional Review Board (**IRB) of CPSP (Ref No: CPSP/REU/NEU/2023-043-A09, dated August 12, 2024**). Informed consent was obtained from all participants involved in the study.

Inclusion Criteria:

The patients participating in the study were aged 18 years and more and who received a diagnosis of ischemic or hemorrhagic stroke and who required admission within the time range of 72 hours since the

Onset of the symptoms. Each participant or his or her representative gave informed consent.

Exclusion Criteria:

The study excluded patients with chronic neurological problems, nonconsensual patients, and nonconsensual patients who were discharged before 24 hours of admission.

Data Collection:

Patient hospital records and structured questionnaires were used to obtain data. The data pertaining to demographic factors, nature of stroke, complications in hospital, and interventions (e.g., thrombolysis) and stroke severity (NIHSS and Barthel Index) were obtained at admission, 72 hours, and subsequent visits.

Statistical Analysis:

SPSS version 24.0 was used to perform data analysis. Demographic variables were analyzed based on descriptive statistics and predictors of a prolonged hospital stay using multivariable linear regression. Appropriate statistical tests used to compare continuous and categorical variables included full testing of the maximum likelihood domain with a significance level of $p < 0.05$

RESULTS

384 stroke patients (mean age = 43.67 years, SD = 12.47; ange = 23–65; 68.8% male) were included in the study, with the majority (87.0%) experiencing ischemic stroke. Clinical measures showed that neurological status improved over time: the NIHSS score at admission averaged 14.81 (SD = 3.13) and functional status, as measured by the Barthel Index, increased from a mean of 29.28 (SD = 6.05) at admission to 84.43 (SD = 8.65) at follow-up. The average length of hospital stay was 11.44 days (SD = 4.84; range = 5–20), with 52.9% of patients classified as having a prolonged stay.The primary analysis used a linear regression model through the origin, executed in a block-wise fashion. In the first block, key demographic and stroke-related variables—specifically history of stroke/TIA, monthly income, age, residence, education level, employment status, living situation, type of stroke, and marital status—yielded a very strong model ($R = 0.917$, $R^2 = 0.840$). Among these, marital status ($B = 2.294$, $SE = 0.468$, $\beta = 0.400$, $t = 4.90$, $p < .001$) and type of stroke ($B = 2.157$, $SE = 0.484$, $\beta = 0.328$, $t = 4.45$, $p < .001$) emerged as particularly robust predictors, indicating that patients in specific marital categories and those with certain stroke types tended to have hospital stays approximately 2.3 and 2.2 days longer, respectively.Subsequent blocks incorporating additional clinical and treatment variables produced only modest increases in R^2—from 0.840 to 0.860 in the final model (Adjusted $R^2 = 0.841$, $F(46, 338) = 45.05$, $p < .001$)—demonstrating that the initial predictors accounted for the vast majority of the variability in hospital stay duration.Repeated-measures analyses further supported these findings by showing significant improvements over time in both NIHSS and Barthel scores (all $p < .001$), confirming marked neurological and functional recovery during hospitalization.

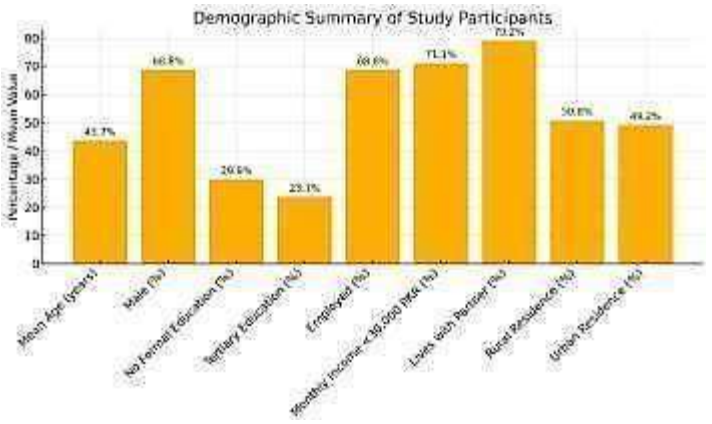

Table 1: Demographic Summary

Variable	Value
Mean Age (years)	43.67
Male (%)	68.8
No Formal Education (%)	29.9
Tertiary Education (%)	23.7
Employed (%)	68.8
Monthly Income <30,000 PKR (%)	71.1

Table 2: Stroke and Comorbidities

Condition	Frequency (%)
Hemorrhagic Stroke	9.1
TIA History	18.5
Hypertension	47.1
Diabetes Mellitus	33.3
Dyslipidemia	30.5
Smoking History	24.0

Table 3: Treatment and Complications

Treatment/Complication	Frequency (%)
Antiplatelet Therapy	84.4
Anticoagulation	26.6
UTI	11.7
Pressure Ulcers	12.5
Pneumonia	10.4
Prolonged Stay	52.9

Table 4: Regression Analysis Results

Variable	Unstandardized Beta	Std. Error	Standardized Beta
Marital Status	2.49	0.53	0.43
Type of Stroke	2.31	0.74	0.35
Smoking History	1.4	0.63	0.05
Antihypertensives	1.45	0.58	0.09
Barthel at Admission	1.12	0.52	0.06

DISCUSSION

384 stroke patients, the final multivariable linear regression model—conducted through the origin—explained 86.0% of the variance in hospital stay duration ($R^2 = 0.860$, Adjusted $R^2 = 0.841$, $F(46, 338) = 45.05$, $p < 0.001$), indicating a highly robust model. Among the predictors analyzed, marital status ($B = 2.49$, $SE = 0.53$, $\beta = 0.43$, $t = 4.67$, $p < 0.001$) and type of stroke ($B = 2.31$, $SE = 0.74$, $\beta = 0.35$, $t = 3.11$, $p = 0.002$) emerged as the strongest contributors to prolonged hospitalization, associated with an average increase of 2.3 to 2.5 days in length of stay. These findings underscore the significant impact of both social and clinical factors on post-stroke inpatient outcomes. Our findings align with previous research indicating that patient demographics and clinical characteristics significantly influence stroke outcomes. For example, Huang et al. (18) found that infection status and comorbid conditions affect post-stroke recovery and overall outcomes, suggesting that factors reflective of a patient's general health and social support—such as marital status—modify clinical trajectories after stroke (19,20). Similarly, Fernando et al. (2021) identified stroke type as a key determinant of both in-hospital mortality and disability, which supports our observation that stroke type is a robust predictor of prolonged hospitalization (21). The block-wise approach in our analysis further substantiated the primary contribution of the core demographic and stroke-related factors, as the inclusion of additional clinical and treatment variables in subsequent blocks only yielded marginal increases in explained variance (from 84.0% to 86.0%). This incremental change was accompanied by non-significant F-change values, underscoring that the initial model captured the majority of the variability in hospital stay duration. Peng et al. (2022) similarly reported that long-term outcomes, patient-specific factors, such as age and stroke severity, consistently emerge as the most influential predictors (22). In addition, Qawasmeh et al. (2020) demonstrated that socioeconomic and demographic variables, including marital status and educational attainment, are crucial in determining post-stroke recovery and disability levels (23,24). The overall strength of our model ($R^2 = 0.860$) and the high significance of key predictors support the hypothesis that the patient's baseline profile—especially marital status and stroke type—largely determines the duration of hospitalisation after stroke. This finding is consistent with studies evaluating temporal trends in case fatality and discharge destination, which indicate that even with advances in acute stroke treatment, intrinsic patient characteristics remain significant determinants of outcome (18, 23, 25, 26).In summary, our study underscores the critical role of demographic and clinical factors in predicting hospital stay duration for stroke patients. These results not only echo prior findings in the literature but also emphasise that targeted strategies focusing on patient-specific characteristics may be crucial for optimizing resource allocation and enhancing stroke management.

CONCLUSION:

The study isolates several variables that are likely to lead to extended hospital stays for stroke patients, including the severity of the stroke and the occurrence of in-hospital complications. Short-term interventions and individualised treatment programs can also aid in limiting the length of hospital stay and overall outcome results. The results offer clinical utility in stroke treatment.

Limitations:

The research target population was studied in only one tertiary-care hospital, which also limits the scalability of the outcomes. Also, since the design is observational, the capacity to infer causal relationships is limited. The data were founded on hospital records, and they can present reporting bias.

Future Findings:

These findings should be tested in future research using multi-centre settings. Maintaining long-term follow-up and considering factors such as socioeconomic status and rehabilitation outcomes may help provide a more accurate picture of the factors and situations affecting the recovery process and the length of hospital stay.

Disclaimer: Nil

Conflict of Interest:Nil

Funding Disclosure: Nil

Authors Contributions

Concept & Design of Study: **Din Muhammad**

Drafting: **Muhammad Saleem , Kinza Riaz**

Data Analysis: **Din Muhammad, Maimoona Siddiqui**

Critical Review**: Raja Farhat Shoaib**

Final Approval of version: **All Mention Authors Approved.**

REFERENCES:

1. Abdullahi A, Wong TW, Ng SS. Efficacy of diaphragmatic breathing exercise on respiratory, cognitive, and motor function outcomes in patients with stroke: a systematic review and meta-analysis. Front Neurol. 2023;14:1233408.

2. Amaya-Pascasio L, Garcia-Pinteno J, Sanchez-Kuhn A, Uceda Sanchez C, Fernandez-Martin P, Leon Domene JJ, et al. Neuromodulation of Executive Dysfunction in Patients with Acute Stroke Using Transcranial Direct Current Stimulation: Study Protocol for a Triple-Blind, Randomized Sham-Controlled Trial. Cerebrovasc Dis. 2024;53(3):335-45.

3. Aoki J, Kimura K, investigators ADS. Aortic arch atheroma and stroke recurrence in mild stroke patients: ADS post-hoc analysis. J Clin Neurosci. 2023;118:109-14.

4. Axford D, Sohel F, Abedi V, Zhu Y, Zand R, Barkoudah E, et al. Development and internal validation of machine learning-based models and external validation of existing risk scores for outcome prediction in patients with ischaemic stroke. Eur Heart J Digit Health. 2024;5(2):109-22.

5. Damaiyanti M, Amir H, Cahyani DD, Alhidayat NS, Afrianti N, Rahmiati C, et al. Improving caregiver preparedness in the care transition of stroke patients: a scoping review. J Med Life. 2023;16(12):1723-31.

6. Giray E, Eyigor S, Calik Y, Albayrak Gezer I, Sari A, Umay E, et al. The caregiver burden of informal caregivers for stroke patients with and without dysphagia: A multi-center, cross-sectional study in Turkiye. Turk J Phys Med Rehabil. 2023;69(4):453-68.

7. Guo L, Zhang M, Namassevayam G, Meng R, Yang C, Wei M, et al. Identification of sleep quality clusters among stroke patients: A multi-center Latent Profile Analysis study. Sleep Med. 2023;112:203-8.

8. Han Z, Hong C, Lang Y. The expression of peripheral blood inflammatory factors in patients with acute ischemic stroke and its correlation with patients' prognosis. Cell Mol Biol (Noisy-le-grand). 2023;69(15):84-8.

9. Heltty H, Rosjidi CH, Lisnawati L. Should Patients Be Confident in Their Efficacy in Improving Their Functional Abilities After a Stroke? Cureus. 2023;15(12):e51105.

10. Hsu E, Bako AT, Potter T, Pan AP, Britz GW, Tannous J, et al. Extraction of Radiological Characteristics From Free-Text Imaging Reports Using Natural Language Processing Among Patients With Ischemic and Hemorrhagic Stroke: Algorithm Development and Validation. JMIR AI. 2023;2:e42884.

11. Iwakawa K, Ohshita H, Nozaki N, Takenaka M, Ikeda Y, Kaneko F, et al. Effects of a visual search task in a virtual reality space with a moving background on spatial cognition and standing balance in patients with left hemiparetic stroke. Neurocase. 2023;29(6):167-73.

12. Jang M, Park H, Kim M, Kang G, Shin H, Shin D, et al. Health-Related Quality of Life of Post-Stroke Patients in a Public Hospital. Brain Neurorehabil. 2024;17(1):e1.

13. Jiang S, Han T, Zhang Z, Wen M, Li Y. Effects of central intermittent theta-burst stimulation combined with repetitive peripheral magnetic stimulation on upper limb function in stroke patients. Colomb Med (Cali). 2023;54(4):e2005766.

14. Kaffes M, Bondi F, Geisler F, Grittner U, Haacke L, Ihl T, et al. Optimization of sensitivity and specificity of a biomarker-based blood test (LVOCheck-Opti): A protocol for a multicenter prospective observational study of patients suspected of having a stroke. Front Neurol. 2023;14:1327348.

15. Khadka T, Giri GK, Sherpa P, Ghimire U, Parajuli S, Pudasaini A, et al. Dyslipidemia among Patients with Ischemic Stroke Admitted to the Department of Medicine of a Tertiary Care Centre. JNMA J Nepal Med Assoc. 2023;61(265):718-22.

16. Konishi T, Inokuchi H, Sasabuchi Y, Matsui H, Tanabe M, Seto Y, et al. Association between Care-need Level after Discharge and Long-term Outcomes in 7491 Patients Requiring Rehabilitation for Stroke. JMA J. 2024;7(1):52-9.

17. Kutty RG, Giurgiutiu DV, Kwon Y, Healy WJ. Stroke and Obstructive Sleep Apnea: What Patients Need to Know. ATS Sch. 2024;5(1):218-9.

18. Li W, Wei M, Liu L, Lan J, Wu C, Zhao W, et al. Normobaric Hyperoxia Combined with Endovascular Treatment in Patients with Acute Ischemic Stroke (OPENS-2) Trial: Protocol for a Prospective, Multicenter, Randomized Controlled Study. Cerebrovasc Dis. 2024;53(3):346-53.

19. Nurcaya, Arafat R, Sjattar EL. Effectiveness of early cognitive exercise intervention on improvement cognitive function of stroke patients in the acute phase. J Vasc Nurs. 2024;42(1):60-4.

20. Pinosanu EA, Burada E, Pirscoveanu D, Aldea M, Albu CV, Surugiu R, et al. Predictive Value of Pulmonary Involvement in Stroke Patients Co-Infected with COVID-19. Curr Health Sci J. 2023;49(4):536-45.

21. Popa D, Iancu A, Petrica A, Buleu F, Williams CG, Sutoi D, et al. Emergency Department Time Targets for Interhospital Transfer of Patients with Acute Ischemic Stroke. J Pers Med. 2023;14(1).

22. Sakakura K. Can the Care-need Level Determined by Local Certification Board Predict Long-term Clinical Outcomes in Patients with Stroke? JMA J. 2024;7(1):60.

23. Steck M, Wells DA, Stoffel JM, Hudson JQ, Saeed O, Elangovan C, et al. Evaluation of Glycemic Variability and Discharge Outcomes in Patients with Ischemic Stroke Following Thrombolysis. Neurohospitalist. 2024;14(4):373-8.

24. Tekesin A, Demiral AB, Yildirim A. The importance of inflammatory biomarkers in ischemic stroke patients with carotid artery stenosis. North Clin Istanb. 2023;10(6):784-9.

25. Toudou-Daouda M, Chausson N, Smadja D, Alecu C. Detection of moderate to severe middle cerebral artery atherosclerotic stenosis in stroke patients: Transcranial color-coded duplex sonography versus computed tomography angiography. Ultrasound. 2024;32(1):43-52.

26. Yamasaki Y, Arai T, Takaishi S, Takamura H, Maruki H. Increased stride time variability is associated with a higher risk of falls in patients with ataxia after stroke. Physiother Theory Pract. 2024;40(12):2916-24.

Published by: Journal of Bacha Khan Medical College.Mardan, Pakistan