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Original research article

PREDICTORS OF MORTALITY AND POOR FUNCTIONAL OUTCOME IN PATIENTS WITH ACUTE STROKE ADMITTED TO A TERTIARY CARE HOSPITAL IN PAKISTAN

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Abstract: *Stroke has a substantial impact on healthcare systems globally and is a leading cause of death and disability. The number of stroke cases in Pakistan is increasing, which makes it necessary to learn more about the factors that affect acute stroke patients' outcomes, especially in tertiary care settings.* ***Objective****: The study sought to determine socio-cultural causes linked to poor functional outcomes and death in acute stroke patients admitted to a tertiary care hospital in Pakistan, as well as to evaluate clinical variables, analyse pre-hospital effects, and identify demographic characteristics.* ***Methods:*** *The research was a retrospective cohort study at the Hayatabad Medical Complex in Peshawar, Pakistan, well-known for its state-of-the-art stroke treatment facilities. A sample size of 346 acute stroke patients hospitalised between January 2021 and December 2022 was selected to achieve statistical power. Adult patients with acute stroke diagnoses met the inclusion criteria, and strict exclusion standards guaranteed data uniformity and correctness. Descriptive statistics and logistic regression were used to assess pre-hospital, clinical, and demographic data obtained from electronic medical records.* ***Results****: On average, the patients were 65.2 years old, and 54.91% were male. The prevalence of ischaemic strokes was 72.83% higher than that of hemorrhagic strokes. Age (OR: 1.08, p < 0.001), stroke severity (OR: 1.42, p < 0.001), diabetes mellitus (OR: 2.10, p = 0.005), delayed medical treatment (OR: 1.89, p = 0.010), and inadequate family support (OR: 2.45, p = 0.003) were significant predictors of death. Age (OR: 1.12, p < 0.001), stroke severity (OR: 1.58, p < 0.001), cardiovascular disease (OR: 1.87, p = 0.044), delaying seeking medical assistance (OR: 1.96, p = 0.005), and health-seeking behaviour (OR: 2.18, p = 0.002) were among the factors that predicted poor functional outcomes.* *Conclusion: Our research highlights the significance of prompt care, social support, and rehabilitation in improving the prognosis of individuals with acute stroke in Pakistan.*

Keywords: Acute stroke, predictors, mortality, functional outcomes, Pakistan.

Introduction

Stroke continues to be a significant worldwide cause of death and morbidity, placing a heavy strain on society and healthcare systems (1, 2). Stroke has a particularly severe effect in Pakistan, where its frequency is on the rise due to a combination of lifestyle, demographic, and medical reasons (3). Acute stroke presents significant problems for patients, caregivers, and healthcare professionals due to its high death rate and poor functional outcomes (4). Enhancing treatment techniques, allocating resources optimally, and improving patient care all depend on an understanding of the variables linked to death and poor functional outcomes in acute stroke patients (5).

Researching the determinants of death and poor functional outcomes in acute stroke patients becomes particularly relevant in the context of Pakistan, a nation struggling with the shortcomings and discrepancies in its healthcare system (6). With specialised treatment and resources necessary for improving patient outcomes, tertiary care institutions play a pivotal role in the management of acute stroke patients. Consequently, it is especially pertinent to investigate the predictors in the context of a Pakistani tertiary care hospital (7).

The intersection of clinical characteristics and demographic factors, including age, gender, and socioeconomic position often influences stroke outcomes (8). Furthermore, it is well known that concurrent conditions such as cardiovascular disease, diabetes mellitus, and hypertension indicate worse outcomes in acute stroke (9). Research on the effects of prompt interventions such as mechanical thrombectomy and thrombolytic therapy—on mortality and functional outcomes is continuing, particularly in resource-constrained environments like Pakistan (10).

Additionally, research is needed to determine how pre-hospital variables that affect stroke outcomes, such as the availability of specialist stroke care facilities, transportation obstacles, and delays in seeking medical help, affect the course of strokes (11). Furthermore, sociocultural factors may considerably impact post-stroke recovery trajectories, such as access to rehabilitation resources, family support networks, and health-seeking habits (12).

Since stroke outcomes are complicated, a thorough knowledge of predictors is necessary to direct clinical

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decision-making, carry out focused treatments, and create efficient public health policies (13). To optimise stroke treatment techniques and enhance patient care, this research intends to clarify the determinants of death and poor functional outcomes in acute stroke patients admitted to a tertiary care hospital in Pakistan. Thus, the study sought to determine socio-cultural causes linked to poor functional outcomes and death in acute stroke patients admitted to a tertiary care hospital in Pakistan, as well as to evaluate clinical variables, analyse pre-hospital effects, and identify demographic characteristics.

Methodology

This retrospective cohort research was conducted in the tertiary care Hayatabad Medical Complex in Peshawar, Pakistan, well-known for its extensive stroke treatment offerings. The hospital's stroke unit is a premier location for researching acute stroke care and outcomes since it is furnished with cutting-edge diagnostic and therapeutic methods.

The estimated frequency of predictors of death and poor functional outcomes in acute stroke patients was used to define the sample size, which consisted of 346 patients who were admitted to Hayatabad Medical Complex between January 2021 and December 2022. This sample size provided adequate statistical power to identify noteworthy relationships and trends within the research population.

The adult patients (18 years of age and older) admitted to Hayatabad Medical Complex between January 2021 and December 2022, whose acute stroke diagnosis was verified by radiological imaging and clinical evaluation, met the inclusion criteria for the research. Patients without a history of transient ischemic episodes and with complete medical records were also included. On the other hand, the analysis did not include patients who were younger than eighteen, those who had subacute or chronic strokes, those whose medical records were incomplete, those who had a history of transient ischemic episodes, or those who had been hospitalised outside of the designated research period. The rigorous selection procedure was designed to guarantee the research population's homogeneity, temporal relevance, and data correctness.

An extensive electronic health record examination was carried out to gather pertinent information on demographic traits such as gender, age, and socioeconomic status. Clinical characteristics were collected, including the kind of stroke, its severity (measured using established grading systems like the NIHSS), and any co-occurring conditions (such as diabetes mellitus or hypertension). Pre-hospital variables were noted, such as the duration between the beginning of symptoms and hospital arrival and the means of transportation. Additionally, sociocultural factors, including access to rehabilitation programs, family support, and health-seeking behaviours, were evaluated.

The research population's clinical and demographic features were summed up using descriptive statistics, such as mean, median, standard deviation, and frequency distributions. After accounting for relevant confounders, logistic regression analysis was used to find independent variables linked to death and poor functional outcomes in acute stroke patients. At $p < 0.05$, statistical significance was established.

The Institutional Review Board (IRB) at the Hayatabad Medical Complex in Peshawar, Pakistan, approved this research ethically, guaranteeing patient anonymity and respect for ethical standards. The IRB waived informed consent due to the study's retrospective nature and the use of anonymised data. Privacy and confidentiality of the data were rigorously maintained throughout the research period.

Results

The demographic details of 346 individuals who had an acute stroke are shown in Table 1. The patient's average age was 65.2 years (SD = 9.8). Of them, 190 (54.91%) were men, and 156 (45.09%) were women. 159 (45.95%), 66 (19.08%), and 121 (34.97%) were categorised as moderate, middle-class, and high socioeconomic levels, respectively. In terms of education, 86 (24.86%) had never attended school, 94 (27.17%) had completed elementary school, 125 (36.13%) had completed secondary school, and 41 (11.85%) had completed further education. There were differences in marital status: 248 (71.68%) were married, 42 (12.14%) were single, 30 (8.67%) were divorced or separated, and 26 (7.52%) were widowed. Regarding employment, 183 people (52.90%) were working, 97 people (28.04%) were jobless, and 66 people (19.08%) were retired.

Table 1: Demographic Characteristics of Acute Stroke Patients

Demographic Variable	Patient Number (n)	Percentage (%)
Age (years)	65.2 ± 9.8 (Mean ± SD)	
Gender		
Male	190	54.91
Female	156	45.09
Socioeconomic Status		
Low	121	34.97
Middle	159	45.95
High	66	19.08
Education Level		
No Formal Education	86	24.86
Primary Education	94	27.17
Secondary Education	125	36.13
Higher Education	41	11.85
Marital Status		
Married	248	71.68

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Single	42	12.14
Divorced/Separated	30	8.67
Widowed	26	7.52
Occupation		
Employed	183	52.90
Unemployed	97	28.04
Retired	66	19.08

The patient's clinical features are listed in Table 2. Of the 346 patients, 94 (27.17%) had hemorrhagic strokes, and 252 (72.83%) experienced ischemic strokes. With a mean NIHSS score of 12.5 (SD = 4.3), the severity of the stroke was moderate. Comorbidities such as hypertension (278, 80.23%), diabetes mellitus (182, 52.61%), and cardiovascular illnesses (148, 42.77%) were present in the majority. Regarding smoking habits, 217 (62.73%) and 129 (37.27%) were non-smokers. Regarding alcohol use, 146 patients (42.19%) refrained from alcohol intake, 76 patients (21.97%) reported frequent drinking, and 124 patients (35.84%) reported occasional drinking.

Table 2: Clinical Characteristics of Acute Stroke Patients

Clinical Variable	Patient Number (n)	Percentage (%)
Stroke Subtype		
Ischemic	252	72.83
Hemorrhagic	94	27.17
Stroke Severity (NIHSS Score)	12.5 ± 4.3 (Mean ± SD)	
Comorbidities		
Hypertension	278	80.23
Diabetes Mellitus	182	52.61
Cardiovascular	148	42.77
Previous Stroke	52	15.03
Smoking Status		
Smoker	129	37.27
Non-Smoker	217	62.73
Alcohol Consumption		
Regular Drinker	76	21.97
Occasional Drinker	124	35.84
Non-Drinker	146	42.19

Table 3 is devoted to pre-hospital variables. Arriving at the hospital took an average of 4.2 hours (SD = 1.8). For 178 patients (51.45%), the most common form of transportation was an ambulance; for 119 patients (34.39%), it was a private car; and for 49 patients (14.16%), it was public transit. A little over 120 patients (34.68%) delayed seeking medical treatment, compared to 226 (65.32%) who did not. Most (n=238, 68.79%) had access to specialist stroke care facilities.

Table 3: Pre-Hospital Factors in Acute Stroke Patients

Pre-Hospital Factor	Patient Number (n)	Percentage (%)
Time to Hospital (hours)	4.2 ± 1.8 (Mean ± SD)	
Mode of Transportation		
Ambulance	178	51.45
Private Vehicle	119	34.39
Public Transport	49	14.16
Delay in Seeking Medical Attention		
Yes	120	34.68
No	226	65.32
Availability of Specialized Stroke Care Facilities		
Yes	238	68.79
No	108	31.21

Figure 1 depicts sociocultural variables and acute stroke patients' access to rehabilitation facilities. Two hundred eighteen patients (63.01%) expressed good support from their families, 97 patients (28.03%) reported moderate support, and 31 patients (8.96%) reported poor support. Sixty-eight patients (19.65%) did not have access to rehabilitation, compared to the majority of 278 patients (80.35%) who did. Regarding how they sought care, 248 patients (71.68%) did so immediately, while 98 (28.32%) took their time.

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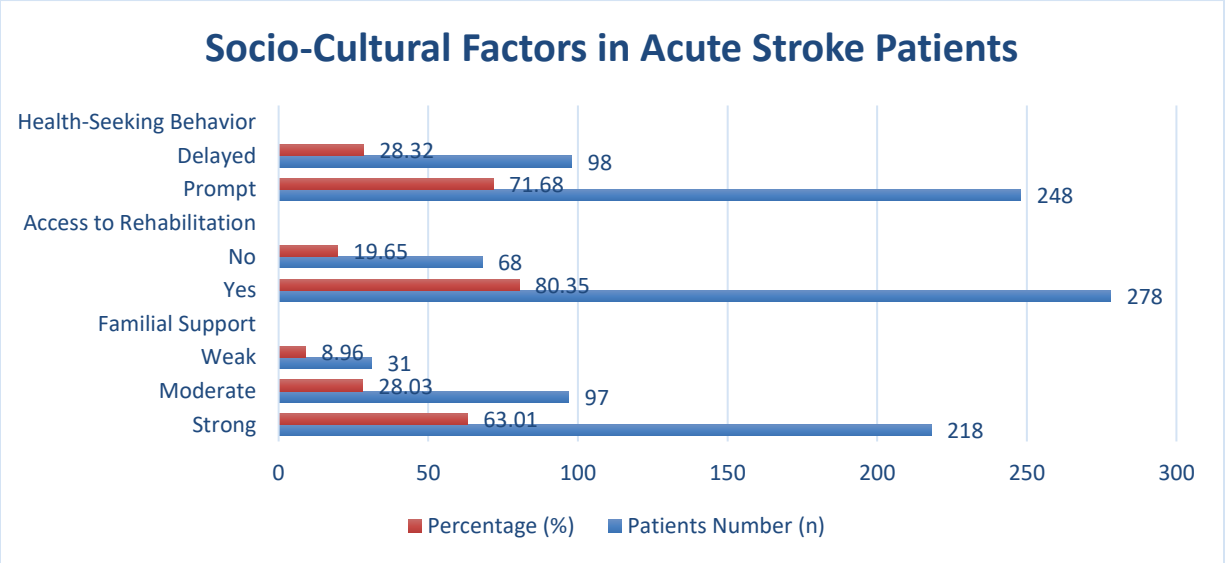

Figure 1 Socio-Cultural Factors in Acute Stroke Patients

The results of the logistic regression analysis for factors predicting death in patients with acute stroke are shown in Table 4. Essential discoveries include strong correlations between age (OR: 1.08, $p < 0.001$), the severity of the stroke (OR: 1.42, $p < 0.001$), diabetes mellitus (OR: 2.10, $p = 0.005$), and prior stroke (OR: 1.78, $p = 0.041$) and death. Notably, worse family support (OR: 2.45, $p = 0.003$) and delayed medical treatment (OR: 1.89, $p = 0.010$) also significantly affected mortality risk.

Table 4: Logistic Regression Analysis of Predictors of Mortality in Acute Stroke Patients

Predictors	Odds Ratio (95% CI)	p-value
Age (years)	1.08 (1.02 - 1.14)	<0.001
Stroke Severity (NIHSS)	1.42 (1.25 - 1.62)	<0.001
Hypertension	1.56 (0.94 - 2.59)	0.083
Diabetes Mellitus	2.10 (1.26 - 3.50)	0.005
Previous Stroke	1.78 (1.02 - 3.12)	0.041
Delay in Seeking Medical Attention	1.89 (1.16 - 3.08)	0.010
Access to Rehabilitation	0.68 (0.42 - 1.12)	0.131
Familial Support (Weak vs. Strong)	2.45 (1.36 - 4.42)	0.003

The logistic regression analysis results are shown in Table 5 for the predictors of poor functional outcomes in acute stroke patients. Age (OR: 1.12, $p < 0.001$), the severity of the stroke (OR: 1.58, $p < 0.001$), and cardiovascular disease (OR: 1.87, $p = 0.044$) all showed significant correlations. Furthermore, a significant correlation was found between poor functional outcomes and delays in seeking medical assistance (OR: 1.96, $p = 0.005$) and health-seeking behaviour (OR: 2.18, $p = 0.002$). It was not statistically significant, nonetheless, that smoking status and poor functional results were associated (OR: 1.34, $p = 0.253$).

Table 5: Logistic Regression Analysis of Predictors of Poor Functional Outcome in Acute Stroke Patients

Predictors	Odds Ratio (95% CI)	p-value
Age (years)	1.12 (1.05 - 1.19)	<0.001
Stroke Severity (NIHSS)	1.58 (1.36 - 1.83)	<0.001
Cardiovascular Disease	1.87 (1.02 - 3.44)	0.044
Smoking Status (Smoker vs. Non-Smoker)	1.34 (0.81 - 2.21)	0.253
Delay in Seeking Medical Attention	1.96 (1.22 - 3.17)	0.005
Access to Rehabilitation	0.62 (0.38 - 1.00)	0.052
Health-Seeking Behavior (Delayed vs. Prompt)	2.18 (1.34 - 3.55)	0.002

Discussion

The demographic features of acute stroke patients at a Pakistani tertiary care hospital were the subject of our research, which looked into factors that predicted death and poor functional outcomes. The results were striking. The patient's average age was 65.2 years, and 54.91% were

male. There was variation in socioeconomic position, with 45.95% of people falling into the middle group and 36.13% finishing secondary school. The most common comorbidity was hypertension (80.23%), which was followed by cardiovascular disorders (42.77%) and diabetes mellitus (52.61%). Additionally, a significant percentage of patients reported drinking alcohol (57.81%) and smoking (37.27%), indicating lifestyle habits that may affect the prognosis of stroke patients. These results are consistent with other studies (14, 15), suggesting that stroke patients' clinical and demographic characteristics are similar in various healthcare environments.

In terms of prevalence, ischemic strokes accounted for 72.83% of all strokes, compared to hemorrhagic strokes' 27.17%. The mean NIHSS score of 12.5 indicated a moderate level of stroke severity. The results of a logistic regression study showed strong mortality predictors. The risk of death was substantially correlated with both age (OR: 1.08, $p < 0.001$) and the severity of the stroke (OR: 1.42, $p < 0.001$). Moreover, comorbidities such as diabetes mellitus (OR: 2.10, $p = 0.005$) and a history of stroke (OR: 1.78, $p = 0.041$) were shown to be significant predictors, indicating the critical role these conditions play in raising the risk of death. Significantly, worse family support (OR: 2.45, $p = 0.003$) and delayed medical treatment (OR: 1.89, $p = 0.010$) also contributed to death, highlighting the need for prompt intervention and strong social support networks in stroke care. These results highlight the persistent effects of age, stroke severity, and comorbidities on stroke outcomes and support findings from other research (16, 17).

Pre-hospital variables, such as method of transportation and time spent seeking medical care, were critical in determining the prognosis of stroke patients. However, ambulances accounted for 51.45% of patient transportation, 34.68% delayed seeking medical assistance. Using logistic regression analysis, strong correlations were found when looking for predictors of poor functional outcomes. Significant correlations were found between age (OR: 1.12, $p < 0.001$) and stroke severity (OR: 1.58, $p < 0.001$) as indicators of poor functional outcomes, highlighting the importance of these parameters in the aftermath of a stroke. Furthermore, cardiovascular illness was a significant predictor (OR: 1.87, $p = 0.044$), emphasising the negative impact of cardiac comorbidities on functional recovery. These results align with other studies (18, 19), showing that pre-hospital characteristics and clinical variables continue to impact stroke outcomes.

The results of stroke were significantly impacted by socio-cultural factors, with access to rehabilitation and family support being two of the most critical factors. Strong family support was linked to decreased death rates (OR: 2.45, $p = 0.003$), highlighting social support networks' role in reducing unfavourable outcomes. The trend towards minimising poor functional outcomes was seen in the access to rehabilitation services (OR: 0.62, $p = 0.052$), indicating the potential advantages of comprehensive post-stroke rehabilitation programs. Furthermore, it was shown that early health-seeking behaviour (OR: 2.18, $p = 0.002$) was substantially linked to poor functional outcomes, emphasising the need for quick medical care in maximising recovery trajectories after a stroke. These results highlight the critical role that socio-cultural variables play in determining stroke outcomes and align with other research (20, 21).

Conclusion

In conclusion, our research identifies important risk factors for death and subpar functional outcomes in individuals who have had an acute stroke at a Pakistani tertiary care facility. Significant predictors of death were age, the severity of the stroke, concomitant conditions such as diabetes and cardiovascular disease, delayed medical treatment, and inadequate family support. Poor functional outcomes were linked to age, the severity of the stroke, cardiovascular illness, delaying seeking medical assistance, and engaging in health-seeking activity. These results highlight how crucial prompt intervention, strong social support networks, and all-encompassing rehabilitation programs are to enhancing stroke care and patient outcomes. By addressing these factors, public health campaigns and the delivery of stroke treatment may be improved, lessening the toll that stroke has on both people and society as a whole.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.
Approved by the department concerned. (HMC-IRB-21745 dated 01.02.21)

Consent for publication
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Conflict of interest

The authors declared an absence of conflict of interest.

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References

1. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. Circulation research. 2017;120(3):439-48.
2. Avan A, Digaleh H, Di Napoli M, Stranges S, Behrouz R, Shojaeianbabaei G, et al. Socioeconomic status and stroke incidence, prevalence, mortality, and worldwide burden: an ecological analysis from the Global Burden of Disease Study 2017. BMC medicine. 2019;17(1):1-30.
3. Kamal AK, Majeed F, Pasha O, Rehman H, Islam M, Azam I, et al. Clinical, lifestyle, socioeconomic determinants and rate of asymptomatic intracranial atherosclerosis in stroke free Pakistanis. BMC neurology. 2014;14:1-11.

4. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2016;47(6):e98-e169.
5. Veerbeek JM, Kwakkel G, van Wegen EE, Ket JC, Heymans MW. Early prediction of outcome of activities of daily living after stroke: a systematic review. Stroke. 2011;42(5):1482-8.
6. Ali AA. Concept of health-related quality of life among people with heart failure in Karachi, Pakistan. 2023.
7. Ali SF, Singhal AB, Viswanathan A, Rost NS, Schwamm LH. Characteristics and outcomes among patients transferred to a regional comprehensive stroke center for tertiary care. Stroke. 2013;44(11):3148-53.
8. Arrich J, Lalouschek W, Müllner M. Influence of socioeconomic status on mortality after stroke: retrospective cohort study. Stroke. 2005;36(2):310-4.
9. Thomas SE, Plumber N, Venkatapathappa P, Gorantla V. A review of risk factors and predictors for hemorrhagic transformation in patients with acute ischemic stroke. International Journal of Vascular Medicine. 2021;2021.
10. Weir CJ, Muir SW, Walters MR, Lees KR. Serum urate as an independent predictor of poor outcome and future vascular events after acute stroke. Stroke. 2003;34(8):1951-6.
11. Li T, Cushman JT, Shah MN, Kelly AG, Rich DQ, Jones CM. Barriers to providing prehospital care to ischemic stroke patients: Predictors and impact on care. Prehospital and Disaster Medicine. 2018;33(5):501-7.
12. Sarfo FS, Ovbiagele B. Utilizing implementation science to bridge cerebrovascular health disparities: a local to global perspective. Current neurology and neuroscience reports. 2022;22(5):293-303.
13. van der Groen O, Ghosh M, Norman R, Kuceyeski A, Tozlu C, Kimberley TJ, et al. Point of View on Outcome Prediction Models in Post-Stroke Motor Recovery. Neurorehabilitation and neural repair. 2024;38(5):386-98.
14. Katzan IL, Spertus J, Bettger JP, Bravata DM, Reeves MJ, Smith EE, et al. Risk adjustment of ischemic stroke outcomes for comparing hospital performance: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45(3):918-44.
15. Lackland DT, Roccella EJ, Deutsch AF, Fornage M, George MG, Howard G, et al. Factors influencing the decline in stroke mortality: a statement from the American Heart Association/American Stroke Association. Stroke. 2014;45(1):315-53.
16. Nakayama H, Jørgensen H, Raaschou H, Olsen TS. The influence of age on stroke outcome. The Copenhagen Stroke Study. Stroke. 1994;25(4):808-13.
17. Ergul A, Hafez S, Fouda A, Fagan SC. Impact of comorbidities on acute injury and recovery in preclinical stroke research: focus on hypertension and diabetes. Translational stroke research. 2016;7:248-60.
18. Denti L, Artoni A, Scoditti U, Gatti E, Bussolati C, Ceda GP. Pre-hospital delay as determinant of ischemic stroke outcome in an Italian cohort of patients not receiving thrombolysis. Journal of Stroke and Cerebrovascular Diseases. 2016;25(6):1458-66.
19. Jiang B, Ru X, Sun H, Liu H, Sun D, Liu Y, et al. Pre-hospital delay and its associated factors in first-ever stroke registered in communities from three cities in China. Scientific reports. 2016;6(1):29795.
20. Jiang Y, Xiong Y, Chi Y, Lin F, Zhao Q, Li Y. Healthcare-Seeking Delays in Acute Ischemic Stroke Patients: The Influence of Gender, Immigrant Status, and Educational Background. Risk Management and Healthcare Policy. 2024:191-204.
21. Dada A. Factors Affecting Maternal Health Seeking Behaviour in a Yoruba Community of Nigeria: An Analysis of Socio-cultural Beliefs and Practices: University of KwaZulu-Natal, Howard College; 2019.

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