Distribution and determinants of stroke severity among patients treated in public hospitals in the Lake Region counties of Kenya

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ABSTRACT

Stroke ranks as the fifth leading cause of death in the United States, impacting nearly 795,000 individuals annually and resulting in fatalities for about 20% of those affected within the first year after the event. Global estimate reports suggest that the number of individuals experiencing strokes has increased in the range of 7.1% to 9.6% mortalities, 15 million people suffer a stroke annually, 5 million deaths occur, and 5 million people develop disabilities. In Kenya the incidence and prevalence of stroke largely remain unknown due to substantial gaps in the national data. A recent study conducted in rural hospitals revealed a stroke prevalence of 0.6% in a referral hospital in western Kenya. The aim of this study was to assess the distribution and determinants of stroke severity among patients treated in public hospitals in the lake region counties of Kenya. This research was guided by Donabedian model. A mixed-methods research approach was employed. A total of 173 stroke patients were enrolled in the study from four county referral hospitals, with 87 allocated to the intervention group(two hospitals) and 86 to the control group(two hospitals).Data was collected using a structured questionnaire, key interview guide, health facility checklist, and a review of patient health records. Both descriptive and inferential statistical analyses were applied with significance set at $p \leq 0.05$. The National Hospital Institute of Stroke Scale (NHISS) scores was used and categorized stroke as mild (0–4), moderate (5–15) and severe (≥16).The results revealed that among the study participants 47.4% (n=82) had mild stroke, 37.6% (n=65) had moderate stroke while 15% (n=26) had severe stroke. Further, the findings on the type of stroke revealed that among the participants 62.4% (n=108) had Ischemic stroke while 37.6% (n=65) had hemorrhagic type of stroke. Qualitative findings revealed that patient factors such as age, comorbidities, stroke type, and severity level, distance, time of onset, presentation to the health facility and level of severity contributed to the patient-outcomes. In conclusion, stroke severity at admission is skewed towards moderate to severe types of stroke. This distribution is influenced by a combination of clinical, socio-demographic, and health system factors. In particular, low socioeconomic status, poor health literacy, and geographic barriers delay access to care, leading to more severe neurological outcomes. Overall, the study demonstrates a clear relationship between stroke type and severity, with more severe presentations observed among patients with hemorrhagic stroke. This study recommends that, targeted strategies should focus on improving the control of modifiable risk factors, enhance early health-seeking behavior, and increase investment in stroke units and diagnostic capacity within public hospitals.

Keywords: Stroke Distribution, Determinants, Stroke Severity, Public Hospitals, Kenya

I. INTRODUCTION

Globally, stroke is a major public health challenge accounting to millions of deaths annually leaving many survivors with cognitive, physical, emotional and social impairments according to the World Health Organization [WHO] reports. Over the last decades, stroke has been known to be the problem of developed and high-income countries; however the burden has increasingly shifted to the low, medium income countries including Kenya (WHO, 2020). Poor and limited access to preventive health care services, diagnosis, management inadequacies of cardiovascular conditions risk factors has highly contributed to an increase in stroke cases in these low-income settings. Worldwide and in developed countries, the number of individuals experiencing strokes has increased in the range of 7.1% to 9.6% mortalities (Edwardson, 2023).Statistics show that 15 million people suffer a stroke annually, 5 million deaths occur and 5 million people develop disabilities (WHO, 2020). The WHO report further states that 12.7 million people suffer from stroke as a result of high blood pressure. However, the ageing population above 65 years remains at risk (WHO, 2020). Stroke patients frequently receive care in emergency departments and hospital units for their condition (Caplan, 2022).

In Sub-Saharan Africa including Kenya, stroke burden in developing countries stands at 86% globally, and has become a significant contributor to illness and death attributed to the increasing prevalence of non-communicable diseases, such as hypertension, diabetes mellitus, and obesity, as well as lifestyle-related risk factors(WHO, 2020; Tesema et al., 2020). These challenges may contribute to variations in stroke severity at presentation, which in turn

affects treatment outcomes, rehabilitation needs, and overall quality of life among stroke patient survivors(Alene et al., 2020 ; WHO, 2020).

In Kenya, understanding the determinants of stroke severity is crucial for improving clinical management and guiding public health interventions. Stroke severity is influenced by multiple factors such as age, gender, pre-existing medical conditions such as hypertension and diabetes, lifestyle behaviors, time to hospital presentation, distance to the health care facility, knowledge and availability of acute care services. Identifying these determinants within specific regional contexts can help healthcare providers and policymakers design targeted prevention strategies, strengthen early detection and treatment, and allocate healthcare resources more effectively (Mosisa et al., 2023; Tamrat et al., 2022).

The Lake Region Counties of Kenya, include; Kisumu, Kericho, Homa Bay, Siaya, Migori, and Kisii which have distinct and unique demographic, socioeconomic, political and healthcare access challenges. Public hospitals in this area serve large populations with limited diagnostic and treatment resources. Despite a rising burden of stroke, there is limited empirical data on stroke severity and the factors influencing its presentation among patients attending these hospitals. Therefore, this study aims to examine the distribution and determinants of stroke severity among patients treated in public hospitals in the Lake Region counties of Kenya. By analyzing patient characteristics, clinical factors, and health system variables associated with stroke severity, the study seeks to generate evidence that can support improved stroke management and inform policy decisions aimed at reducing the burden of stroke in the region. By examining patient characteristics, clinical factors, and health system variables linked to stroke severity, the study aims to produce evidence that can enhance stroke management and guide policy decisions focused on reducing the burden of stroke in the region.

1.1 Statement of the Problem

Globally, sub-Saharan Africa (SSA) has the highest stroke burden with a steadily increasing incidence (WHO, 2020). Stroke occurs mostly among the young population that may progress to severe situations due to uncontrolled risk factors leading to a high cost of living, financial constraints, poor socio-economic situations and finally to disability. However, there are glaring gaps in all areas during stroke care. This is due to poor health infrastructure, shortage of specialists, poor health financing models, lack of and poor implementation of health policies and resources, and poor leadership and governance that characterize most health systems in SSA (Waweru & Gatimu, 2021). According to the World Health Organization (WHO), the global burden of stroke has increased significantly over the past few decades, with the majority of cases occurring in developing countries and a growing public health concern (WHO, 2020). Review reports in Africa that published data within the past decades show an annual stroke rate of 316 per 1000, and a prevalence of up to 1460 per 100,000, and a 3-year mortality rate greater than 80 % (Akinyemi et al., 2021).

In Kenya, the rising prevalence of non-communicable diseases such as hypertension, diabetes mellitus, and cardiovascular conditions has contributed to an increasing incidence of stroke combined with lifestyle risk factors, and limited access to preventive health services, have placed a significant burden on the healthcare system. Stroke severity at the time of hospital admission is a critical determinant of patient outcomes, including mortality, morbidity, level of disability, and the need for long-term rehabilitation. Early identification and management of stroke are essential in reducing complications and improving recovery. However, in many public healthcare facilities in Kenya, particularly in resource-limited settings, challenges such as delayed hospital presentation, inadequate diagnostic capacity, limited specialized care, and insufficient stroke management infrastructure may contribute to worse clinical outcomes and higher stroke severity among patients (Edzie et al., 2022).

In Kenya, the incidence and prevalence of stroke largely remain unknown due to substantial gaps in the national data (Waweru & Gatimu, 2021). A scoping review done by Waweru and Gatimu (2021) revealed a stroke prevalence of 0.6% in a referral hospital in western Kenya. These findings underscore that adopting structured acute-stroke management protocols in public health facilities in Western region, Kenya is greatly required. Further the consulted literature had limited documentation studies a gap which this study sought to address. The paucity of data on stroke care makes it difficult for healthcare providers and policymakers to design targeted interventions aimed at improving stroke prevention, early detection, and effective management. Without adequate information on the determinants of stroke severity, efforts to reduce stroke-related morbidity and mortality in the region remain constrained (Naing et al., 2022; Virani et al., 2020).

Therefore, there is a need to investigate the distribution and determinants of stroke severity among patients treated in public hospitals in the Lake Region counties of Kenya. Understanding these factors will provide valuable insights for improving clinical care, guiding resource allocation, and strengthening public health strategies aimed at reducing the burden of stroke in the region.

1.2 Research Objectives

i. To assess the distribution and determinants of stroke severity among patients treated in public hospitals in the Lake Region counties of Kenya
ii. To determine the stroke severity among patients treated in public hospitals in the Lake Region counties of Kenya

II. LITERATURE REVIEW

2.1 Theoretical Framework

This study used the Donabedian model of care which focuses on improving stroke care by promoting better patient outcomes. The Donabedian model has three components; structure, process and outcome. In the context of healthcare delivery, the model's structure refers to the elements of the setting which are the public hospitals within the lake region county that manage and take care of stroke patients. The structure has various elements on the clinical management strategies that includes; procedures, clinical pathways, guidelines and other management strategies used on the care for stroke patients. The model also considers the equipment used to diagnose potential underlying conditions, and ensuring that patients receive proper and efficient care. The process involves actions and activities that occur while providing care to stroke patients and outcomes are the results of care on stroke patients and the population's health related to health care (Virani et al., 2020; Toral, 2021).

2.1.1 Donabedian Model

The Donabedian Model of Care is relevant to the study on stroke patient management in public hospitals within the Lake Region counties,and the context of care delivery to stroke patients remains crucial (Virani et al., 2020; Eglseer et al., 2021). The model emphasizes three key components: structure, process, and outcomes.The structure component includes material resources such as hospital facilities, equipment, and human resources like healthcare providers. Important factors include the number of healthcare workers, their qualifications, and their training in stroke management.The process component focuses on the clinical management strategies used in stroke care. This involves rapid patient assessment, accurate diagnosis, timely treatment, coordinated care, and continuous evaluation. The study applied clinical management strategies and monitored how healthcare providers implemented them over time.The outcomes component refers to the results of the care provided to stroke patients, including mortality rates, functional recovery, and complications. Overall, the study demonstrates that the availability of resources and qualified healthcare providers (structure) influences the effectiveness of clinical management strategies (process), which in turn determines patient health outcomes (Fant & Lakomy, 2019; Kernan et al., 2021).

According to the model, and its link to the current study, care involved material resources such as facilities and equipment, human resources included health care providers who were taking care of stroke patients in public hospitals within the lake region counties. The number of health care providers, their qualifications and training on stroke management strategies are also important (Fant & Lakomy, 2019). Additionally, the use of clinical management strategies, training on stroke care, as well as stroke care management, is vital components of this care. Donabedian model of care is connected to the current study through a process (clinical management strategy) which is a crucial step in caring for stroke patients. The process involves a rapid initial assessment that guides the making of the right diagnosis, providing treatment, coordinating care and evaluating the care in a step-wise manner (Amatangelo & Thomas, 2020). Consequently, in terms of caring for stroke patients, it involves providing interventions at the right time, way and to the required standards (Wang et al., 2020). Therefore, the current study employed a clinical management strategy for stroke patients, which was then followed up by the health care providers who provided care to stroke patients in the study areas for a period of time. Furthermore, the third component involves the consequences or outcomes of the treatment given to stroke patients that includes the changes observed in patients and their health status, such as mortalities, functional status and complications developed or not (Amatangelo & Thomas, 2020).

Therefore, in the current study, the model demonstrated how structure impacted the process, resulting in outcomes that determined the study objective.

2.2 Empirical Review

2.2.1 Distribution and determinants of stroke severity

In an empirical review done on the effect of a perceived health belief-promoting program combined with a mobile application on preventive behaviors in young adults at risk of stroke, findings revealed that the mean on stroke preventive behaviors in the experimental group after receiving the health belief-promoting program combined with the mobile application was higher than before joining the study (M = 37.72, SD = 5.48 and M = 29.96, SD = 4.69; t = 6.588, p = .000) and that of the control group with statistical significance (M = 30.36, SD = 4.98; t = -4.968, p = .000). Therefore, nurses and healthcare providers should implement the program to promote health beliefs in young adults with stroke risks so that they can practice appropriate stroke prevention behaviors (George, 2020).

A study examining regional disparities in the social determinants of stroke severity found that, after age adjustment, black or African American patients had higher mean NIHSS scores and higher rates of minor stroke symptoms compared to white patients ($p < 0.01$ for both). ZIP codes with higher mean NIHSS scores were significantly correlated with lower median household income ($r = -0.61$, $p < 0.01$), lower educational attainment ($r = -0.71$, $p < 0.001$), and higher proportions of minority populations ($r = 0.50$, $p < 0.02$). Patients with higher mean scores across all

measures were more likely to use medicare rather than private insurance ($p < 0.0001$) and to arrive at the hospital via emergency medical services rather than private transport ($p < 0.01$). The findings also indicate that male patients, with a mean pre-stroke mRS score of 0.7237, had a 0.36 higher mean score than female patients and a 14.85% higher incidence of moderate stroke severity ($p = 0.0102$). However, when discharge NIHSS scores were categorized by severity, no significant differences in incidence rates were observed between categories. Regarding race and ethnicity, black or African American patients presented with higher mean initial and discharge NIHSS scores than white patients, consistent with previous studies showing higher initial NIHSS scores among non-Hispanic black patients compared to non-Hispanic white patients (Jones et al., 2020). Additionally, lower socioeconomic status and educational attainment were associated with poorer stroke symptom recognition and lower awareness of the Face-Arm-Speech-Time (FAST) public health campaign (Raab, 2021; Rioux et al., 2022).

A prospective cohort study done on patient-level and system-level determinants of stroke fatality across 16 large hospitals in Ghana and Nigeria revealed that the study had important clinical and policy implications. The high prevalence of severe strokes and intracerebral hemorrhage necessitates investments in developing and strengthening emergency services to transport patients for urgent care. Setting up stroke units is now a necessity in all regional capitals and possibly district hospitals to provide emergency assessment and care for stroke patients. The excess deaths due to aspiration pneumonia, elevated blood pressure, and decubitus ulcers might be amenable to enacting appropriate protocols for screening for dysphagia after stroke, management of hypertension, and optimizing nursing care (Prust et al., 2022).

2.2.2 Stroke Severity

In a study done on factors influencing the severity of ischemic strokes findings showed that the highest stroke severity was found in old age ([>64 years]), and patients with cardio embolic and unclassified (> one etiology) strokes, while the lowest severity was found in small artery occlusion strokes. Higher fasting serum triglyceride levels were associated with lower stroke severity and vice versa ([P=.002]). Among supra-aortic large artery atherosclerosis, the pre-stroke anti-platelet ([52 %]) and beta blocker use ([53.6 %]) was significantly associated with lower stroke severity. In cardio embolic strokes active smoking was associated with increased severity ([90%]) from the American Heart Association (Knisey et al., 2023).

A study done on determinants of stroke severity revealed that, an enormous burden of severe stroke among all stroke types and subtypes, with significant implications for the stroke care system in West Africa, had a background and baseline of stroke severity probably partly responsible for poor stroke outcomes in sub- Saharan Africa. However, there is a paucity of information on determinants of stroke severity among indigenous Africans which discovered dietary and radiological factors independently associated with stroke severity. Reduced meat consumption and high vegetable consumption could reduce the likelihood of developing severe stroke in the population (Akinyemi et al., 2021).

III. METHODOLOGY

3.1 Research Design

This study employed a quasi-experimental research design with a qualitative approach to assess the distribution and determinants of stroke severity among patients treated in public hospitals in the lake region counties of Kenya. The two groups were from two of each comparable referral hospitals. The mixed method approach was suitable for the study to provide a comprehensive, holistic and accurate picture of the determinants and distribution of stroke severity in the region by combining both quantitative and qualitative data. Further to these, it was to strengthen the reliability and credibility of the overall study findings, enable the researchers get the statistical and reasons behind the findings, generate concepts in the field of health care and have a better understanding of the problem under investigation.

3.2 Study Area

The research took place in the Lake Economic Bloc region of Kenya-Kakamega, Kisumu, Kericho and Kisii counties. The counties were purposively selected due to their capacity to handle emergencies, they are situated along the major highways, admission of referrals and treatment of stroke patients, and they serve a large population of patients with a stroke prevalence of 6.1% from the western region of Kenya. The county referral hospitals provide neuroimaging services that include; Computed Tomography (CT-scan) and Magnetic Resonance Imaging (MRI) for stroke patients. In addition to this, the hospitals do offer other services like thrombolytic medications.

3.3 Target Population

The target population included all patients who presented to the hospitals in the study with stroke during the research and health care providers who were providing direct care to stroke patients and met the inclusion criteria.

3.4 Sampling Procedure and Sample Size

Table 1

Sample Size Distribution

Participant Category	Total Sample size(n)	Participant Distribution	Unit Allocation	Notes
Stroke patients	N=173	Intervention=87 Control=86	All legible hospital admissions	Total population sampling was used to include all eligible and available patients, minimizing selection bias.
Health care providers	N=20	Intervention (10) from each of the two participating hospitals)	Accident & Emergency areas Medical wards Critical care units Medical Out-patient clinics	Included; nurses, clinical officers, neurologists/physicians, and unit in-charges involved in direct stroke care.

Total Population Sampling of stroke patients who were eligible and available for this study was used to ensure that as much information as possible would be gathered from this population, thus avoiding bias, A total of 173 patients who were admitted to the four (4) health facilities during the period of the study were included with 87 in the intervention group and 86 in the control group.

Twenty (20) health care providers were also included in the study, that is, ten (10) from each of the two (2) participating county referral hospitals that were in the intervention group. The health care providers included participants from each of the units that provided direct care to stroke patients: Accident and Emergency, medical ward, critical care unit, medical out-patient department. The health care providers included nurses, clinical officers, neurologists or physicians and unit in charges.

3.5 Data Collection Instruments and Procedures

Data were collected using multiple tools, including a structured questionnaire, a key informant interview guide, and a health facility checklist covering all aspects of stroke. Information gathered included patient demographics (age, gender, education level, marital status and residence), date of stroke diagnosis, stroke subtype (ischemic or hemorrhagic), occurrence of single or multiple strokes, and history of cigarette smoking or alcohol use prior to the current event. Care-related details, such as whether a computed tomography scan was performed, were also recorded. Patients were followed up every three months after discharge to assess their status. Content validity was ensured by conducting a pre-test that assessed the representativeness and clarity of the research tools. Construct validity was ensured through the involvement of expert opinion from practitioners in the field and my supervisors who have vast experience and are familiar with the measure and the phenomenon under study. Thus, validity and reliability was utilized for data collection procedure and administered in both groups. Cronbach test on the clinical management strategy domains that resulted in an alpha value of 0.77 which is acceptable.Data collection was conducted from the hospitals using the research tools and involved prospective data collection till the target was arrived at for the study period.

3.6 Data Analysis

Data collected were analyzed using both descriptive statistics (frequencies and percentages) and inferential statistics.

3.7 Ethical Considerations

This study was conducted in accordance with the ethical standards for research where human subjects were involved. Ethical approvals were obtained from relevant institutions to include; clearance for data collection by the Directorate of Postgraduate Studies, of MMUST Ref: MMU/COR: 509099, ethical clearance and approval was obtained from the MMUST Institutional Ethical Review Committee Ref., No.: MMUST/ISERC/069/2024 and Research permit from National Commission for Science, Technology & Innovation Ref. No.531472. Permission was then sought and obtained from the hospital's administrators where the study was conducted. Informed consent was obtained from all study participants with explanations of the study purpose, procedures, and potential risks and benefits. Study subjects were informed and assured of voluntary participation and that they were free to withdraw from the study at any given time without affecting the care they received. Confidentiality and privacy were maintained by assuring the study participants that their records were well kept and only accessed by the researcher. Research findings were presented using tables and figures that helped in ensuring a clear understanding and aided interpretation.

IV. FINDINGS & DISCUSSION

4.1 Findings

4.1.1 Socio- Demographic Information

Table 2 shows results on the socio-demographic characteristics of the study participants. The study participants comprised of 87 and 86 participants in the intervention and control group respectively. Findings on socio-demographics show that majority 76.3% (n=132) of the participants were in the age category of 40-49 years with a mean age of the participants was 44.9 ± 4.9 years. Majority, 61.3% (n=106) were female, married 80.9% (n=140), attained education at the college level 33.5% (n=58) and were employed 59.5% (n=103). Among the participants, 78% (n=135) lived more than 10 km away from the health facility. Majority, 67.6% (n=117) had no health insurance, with only 20.2 (35) reporting to have active Social Health Insurance (SHA).

Table 2

Socio-demographic Characteristics of Stroke Patients

Variables	Categories	Intervention n (%)	Control n (%)	Total n (%)
Age in years	30-39	9 (10.3)	8 (9.3)	17 (9.8)
	40 – 49	71 (81.6)	61 (70.9)	132 (76.3)
	≥50	7 (8.1)	17 (17 (19.8)	24 (13.9)
Mean age (± SD)	44.9 ± 4.9 years			
Gender	Male	35 (40.2)	32 (37.2)	67 (38.7)
	Female	52 (59.8)	54 (62.8)	106 (61.3)
Marital status	Single	14 (16.1)	0 (0.0)	14 (8.09)
	Married	65 (74.7)	75 (87.2)	140 (80.9)
	Divorced	0 (0.0)	1 (1.2)	1(0.6)
	Widowed	8 (9.2)	10 (11.6)	18(10.4)
Education	Primary	19 (21.8)	9 (10.5)	28 (16.2)
	Secondary	18 (20.7)	16 (18.6)	34 (19.7)
	College	25 (28.7)	33 (38.4)	58 (33.5)
	Degree/Masters	25 (28.7)	28 (32.6)	53 (30.6)
Occupation	Employed	44 (50.6)	59 (68.6)	103 (59.5)
	Self employed	26 (29.9)	18 (20.9)	44 (25.4)
	Unemployed	17 (19.5)	9 (10.5)	26 (15.0)
Distance to facility (km)	< 10	21 (24.1)	17 (19.8)	38 (22)
	>10	66 (33.3)	69 (38.4)	135 (78)
Health Insurance status	SHA	20 (23.0)	15 (17.4)	35 (20.2)
	Private Insurance	9 (10.3)	12 (14.0)	21 (12.1)
	No insurance	58 (66.7)	59 (68.6)	117 (67.6)

4.1.2 Stroke Severity and type

Table 3 provides severity and type of stroke among participants. Stroke severity was measured using the National Institutes of Health Stroke Scale (NIHSS).The scores range from 0 to 42, with higher scores indicating severe neurological deficit. For the data analysis related to stroke severity, the NIHSS scores were categorized as mild (0–4), moderate (5–15) and severe (≥16). The findings revealed that among the study participants 47.4% (n=82) had mild stroke, 37.6% (n=65) had moderate stroke while 15% (n=26) had severe stroke. Further, the findings on the type of stroke, revealed that among the participants 62.4% (n=108) had Ischemic stroke while 37.6% (n=65) had hemorrhagic type of stroke.

Table 3

Severity and Type of Stroke among Participants

Variable	Category	Intervention Group % (n)	Control Group % (n)	Total % (n)
Stroke Severity	Mild	35 (40.7)	47 (54.0)	82 (47.4)
	Moderate	42 (48.8)	23 (26.4)	65 (37.6)
	Severe	9 (10.5)	17 (19.5)	26 (15.0)
Type of Stroke	Ischemic	54 (62.8)	54 (62.8)	108 (62.4)
	Hemorrhagic	32 (37.2)	33 (37.9)	65(37.6)

4.1.3 Determinants of Stroke Severity, Type, Patient Factors

Table 4 findings revealed that, patients in the intervention group were 1.4 times more likely to have had good outcome compared to those in the control (RR: 1.4; 95%CI: 1.2 – 1.7; p = 0.0002). Likewise, patients who had ischemic type of stroke had better outcome (RR: 1.4; 95%CI: 1.2 – 1.6; p = 0.0008), similar to those with severe stroke (RR: 1.2; 95%CI: 1.0 – 1.4; p = 0.066) although the relationship was marginally statistically significant. On the contrary, a significantly smaller proportion of patients with cardiac disease (RR: 0.7; 95%CI: 0.6 – 0.9; p = 0.004), diabetes/cardiac disease (RR: 0.8; 95%CI: 0.7 – 0.9; p = 0.013), diabetes/hypertension/cardiac disease (RR: 0.8; 95%CI: 0.6 – 0; p = 0.004) were less likely to have had good outcome compared to their counterparts. Generally, this implies that the additional burden of other chronic conditions worsens the outcome of hospitalized stroke patients.

Table 4

Findings on patient related factors and determinants

Variables	n	Intervention Group n (%)	Control Group n (%)	RR	95% CI	P value
Age in years						
< 50	149	45 (30.2)	104 (69.8)	1.2	1.0 – 1.5	0.072
≥ 50	24	3 (12.5)	21 (87.5)			
Gender						
Male	67	22 (32.8)	45 (67.2)	1.1	0.9 – 1.4	0.234
Female	106	26 (24.5)	80 (75.5)			
Education						
Primary	28	12 (42.9)	16 (57.1)	1.3	0.9 – 1.8	0.051
Beyond Primary	145	36 (24.8)	109 (75.2)			
Smoking						
Yes	96	27 (28.1)	69 (71.9)	1.0	0.8 – 1.2	0.901
No	77	21 (27.3)	56 (72.7)			
Alcohol						
Yes	98	31 (31.6)	67 (68.4)	1.1	0.9 – 1.4	0.192
No	75	17 (22.7)	58 (77.3)			
Family history of stroke						
Yes	131	40 (30.5)	91 (69.5)	1.2	1.0 – 1.4	0.148
No	42	8 (19.1)	34 (80.9)			
Type of Stroke						
Ischemic	108	54 (62.8)	54 (62.8)	1.4	1.2 – 1.6	0.0008
Hemorrhagic	65	32 (37.2)	33 (37.9)			
Severe stroke						
Yes	85	29 (34.1)	56 (65.9)	1.2	1.0– 1.43	0.066
No	88	19 (21.6)	69 (78.4)			
Comorbidity						
Yes	69	12 (17.4)	57 (82.6)	0.8	0.7 – 0.9	0.013
No	104	36 (34.6)	68 (65.4)			
Yes	88	16 (18.2)	72 (81.8)	0.8	0.6 – 0.9	0.004
No	85	32 (37.7)	53 (62.3)			
Distance to hospital						
< 10 km	38	11 (28.9)	27 (71.1)	1.0	0.8 – 1.3	0.8.51
> 10 km	135	37 (27.4)	98 (72.6)			

4.1.4 Health Facility Related Determinants

Qualitative findings from key informant interviews on facility factors included; availability of equipment and supplies, infrastructure and specialized units, efficiency of referral and support services and institutional support are as the excerpts indicated here;

> *"The availability of essential equipment such as CT scan services, monitoring devices and basic emergency drugs greatly influences the severity of stroke. When these resources are available , patient assessment and treatment are much faster* (KII15)."27th March 2025.

"Facilities with dedicated stroke or high-dependency units are better able to manage patients with all subtypes of stroke patients especially severe strokes. Limited bed space and lack of specialized units in some hospitals affect the continuity and quality of stroke care (KII1)."27th March 2025.

"Effective referral systems within and between facilities are important for the management of all stroke types especially the hemorrhagic type. Delays in referrals or lack of timely access to physiotherapy and support from hospital management play a key role. When administration prioritizes stroke care by ensuring adequate staffing, supplies, and supportive supervision, the patients with stroke improve and receive the best care (KII14)."27th March 2025.

Imaging services done in a timely manner within the facilities help in determining the type of stroke, and prompts early stroke care interventions (KII17)." 27th March 2025.

4.2 Discussion

The current study findings reported that there was an improvement in stroke severity among stroke patients in the study group than the control upon intervention, where findings of stroke type and severity of the stroke was measured using the NHISS tool. Among the critical elements examined was an initial patient assessment, where the findings revealed that among the study participants 47.4% (n=82) had mild stroke, 37.6% (n=65) had moderate stroke while 15% (n=26) had severe stroke. This study is in line with a study done on the effect of a clinical pathway on patients with stroke determining the outcome (Oliveira et al., 2023).

On the other hand, stroke severity on the intervention arm improved upon application of the integrated clinical management strategy and involved a component of a Glasgow Coma Scale (GCS) which is a vital tool for assessing neurological status of the stroke patient within 15 minutes of arrival or from recognition of signs and symptoms of stroke and stroke screening, although the majority were assessed promptly, the fact that over a quarter experienced delays highlights the need for improved responsiveness in emergency care in relation to the level of stroke and type (Jackova et al., 2020).

Findings on the type of stroke, revealed that among the participants 62.4% (n=108) had Ischemic stroke while 37.6% (n=65) had hemorrhagic type of stroke (Table 2). The results concur with a community-based study done on how to recognize stroke, risk factors in ischemic stroke and subtypes (Toral, 2021; Jackova et al., 2020). Findings from previous studies support the associations observed in the present study. In Ghana, Sarfo et al. (2021) demonstrated that stroke subtype was significantly linked to higher socioeconomic status and increased stroke severity, suggesting that stroke characteristics may influence long-term mortality outcomes. In addition, evidence from a review by Nutakki et al. (2021) emphasizes the growing importance of sex differences in stroke risk and predictors, reporting that women have a higher lifetime risk of stroke and account for more than half of stroke-related deaths. These observations are consistent with the current study's findings. Furthermore, existing literature indicates that stroke subtype is a critical determinant of stroke severity and mortality. Hemorrhagic stroke, particularly intracranial hemorrhage, has been shown to present with greater initial severity, higher mortality, and poorer long-term neurological outcomes compared with ischemic stroke, as reported in data from the Cochrane Central Register of Controlled Trials (Mosisa et al., 2023).

However, the current study revealed that, there was an improvement in stroke severity on stroke patients on the intervention compared to the control group. Further to the care management there was documented evidence on the proper identification of stroke severity which served as an indicator for planned and coordinated care by the health care providers, thus measuring stroke severity using the available tools like the Glasgow coma scale, neurological chart and the NHISS Scale (Camacho & Lip, 2024). Similarly in another study done in Madagascar on the proportion of stroke types found out that, of the 223 patients with CT-confirmed stroke, 57.4% (128/223, 95% CI: 51-64%) had an ischemic stroke and 42.6% (95/223, 95% CI: 36-49%) had an intracranial hemorrhage. The majority (89.5%; 85/95, 95% CI: 83-96%) of intracranial hemorrhages were intracerebral; 4.2% (4/95, 95% CI: 0-8%) had a subdural hematoma, 5.3% (5/95, 95% CI: 1-10%) had a subarachnoid hemorrhage, there was one isolated intraventricular hemorrhage (1.1%; 1/95, 95% CI: -1-3%). The prevalence of hypertension among stroke patients was high (86.6%; 187/216, 95% CI: 82-91%) (Riedmann et al., 2022).This study concurs with the current study where most of the patients had ischemic type of stroke.

A study conducted by Yi et al. (2020) on the prevalence of stroke and stroke risk factors results revealed that, a total of 16,892 people included in analysis had an overall prevalence of stroke of 3.1% (95% CI 2.6-3.9%), 17.1% of participants were the high-risk stroke population. After full adjustments, hypertension, diabetes, dyslipidemia, overweight, lack of exercise and family history of stroke were significantly associated with overall stroke and ischemic stroke. The largest contributor was hypertension (population-attributable risk 23.6%), followed by dyslipidemia, physical inactivity, family history of stroke, diabetes, and overweight. However, only hypertension (OR = 3.66, 95% CI 1.82-8.23) was significantly associated with hemorrhagic stroke. The findings are in line with the current study in terms

of age and lifestyle changes, where the prevalence of stroke and high-risk stroke population was high among adults aged ≥40 years in southwestern China.

Consistently, in a case control study done on stroke in young adults' result findings showed that, among the 51 patients with stroke, 39(76.5%) had ischemic stroke and 12(23.5%) had hemorrhagic stroke. The mean age was 36.8 years (SD 7.4) for stroke patients (cases) and 36.8 years (SD 6.9) for controls. Female patients predominated in both groups 56.9% in cases and 52.9% in controls. Risk factors noted were HIV infection, OR 3.57 (95% CI 1.16-10.96), elevated waist to hip ratio, OR 11.59(95% CI 1.98-68.24) and sickle cell disease, OR 4.68 (95% CI 1.11-19.70). On the contrary, this study found a protective effect of oral contraceptive use for stroke OR 0.27 95% CI 0.08-0.87 and that there was no association between stroke and hypertension, diabetes, and hyperlipidemia (Boot et al., 2020).

In a retrospective cross-sectional study done in Ghana on Computed Tomography (CT) patterns of intracranial infarcts. Results revealed that, about 50.6% of the study participants were females with an average age of 62.59±13.91 years. Males were affected with ischemic strokes earlier than females (p<0.001). The risk factors considered were, hyperlipidemia (59.5%), hypertension (49.0%), Type 2 diabetes mellitus (DM-2) (39.6%) and smoking (3.0%). The three commonest ischemic stroke CT scan features were wedge-shaped hypo density extending to the edge of the brain (62.8%), sulcal flattening/effacement (57.6%) and loss of grey-white matter differentiation (51.0%), which were all significantly associated with hypertension. Small deep brain hypodensities, the rarest feature (2.2%), had no significant association with any of the risk factors considered in the study (Edzie et al., 2022).Therefore the study revealed that, there was no significant association between the other CT scan features and sex. Generally, most of the risk factors and the CT scan features were significantly associated with increasing age that concurs with the current study.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study demonstrated that, a substantial proportion of patients experienced moderate to severe strokes**,** highlighting the ongoing burden of stroke-related morbidity. This finding therefore suggests that, early presentation of patients to the hospitals, referrals, limitation to care access may influence clinical outcomes for patients with stroke. Further, the findings on the type of stroke, revealed that among the participants 62.4% (n=108) had Ischemic stroke while 37.6% (n=65) had hemorrhagic type of stroke.

This finding is consistent with the global, regional and local trends that underscore the pattern and distribution of modifiable vascular risk factors in stroke occurrence. Hemorrhagic strokes that are often associated with higher severity and mortality rates, emphasizes the need for early detection and optimal management of hypertension and other risk factors. Overall, the study demonstrates a clear relationship between stroke type and severity, with more severe presentations observed among patients with hemorrhagic stroke.

5.2 Recommendations

This study recommends that stroke care should incorporate the use of an effective integrated care pathway for stroke patients structured across the full continuum of care; from acute management to long-term community follow-up and tailored to patient demographics, stroke type, and stroke severity. Early stratification using validated tools such as the NIH Stroke Scale is essential to guide clinical decision-making, intensity of treatment, and rehabilitation planning.

Stroke care strategies should differentiate between ischemic and hemorrhagic stroke, with timely reperfusion and antithrombotic strategies emphasized for ischemic stroke, and focused blood pressure control and complication management for hemorrhagic stroke. Severity-based tailoring is critical, with mild strokes benefiting from early supported discharge and community-based follow-up, while moderate to severe strokes require intensive, multidisciplinary rehabilitation and structured caregiver involvement. In addition to this, proper identification of stroke severity is an indicator for appropriate plan of care by the multidisciplinary team (neurologists, neurosurgeon and neuro nurses), wherever they observe stroke patients.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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