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**Prevalence of Stroke and Its Associated Factors Among Patients Attending the
Emergency Department at Butare University Teaching Hospital, Rwanda**

Irabishohoje Didier and Amos Habimana, PhD



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 ^{1*} Irabishohoje Didier
Mount Kenya University, Rwanda
 ² Amos Habimana, PhD
Mount Kigali University

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Abstract

Purpose: Stroke is a major global public health concern, ranking as the second leading cause of death and the third leading cause of adult disability. Low- and middle-income countries (LMICs), including Rwanda, bear a disproportionate burden, accounting for approximately 85% of global stroke incidence. This study aimed to determine the prevalence of stroke and its associated risk factors among patients presenting to the emergency department at Butare University Teaching Hospital in Rwanda.

Methodology: A retrospective, cross-sectional study design was employed. Medical records of patients admitted to the emergency department over a one-year period were reviewed. A systematic random sampling technique was used to select 383 patient files, with data extracted using a structured checklist. The data were entered and analyzed using SPSS version 20. Descriptive statistics such as frequencies, percentages, and means were used to summarize patient characteristics and prevalence of conditions. Inferential statistics, including chi-square tests and logistic regression, were applied to examine associations between identified risk factors and clinical outcomes. The results were presented using tables, charts, and narrative summaries to enhance clarity and interpretation.

Findings: Of the 362 eligible patient records reviewed, 35 were confirmed stroke cases, yielding a prevalence of 9.7%. Stroke was more prevalent among patients aged 61 years and above (48.3%), and among females (54.1%). Bivariate analysis revealed a statistically significant association between stroke and increasing age ($p = 0.001$), as well as hypertension ($p = 0.001$). Hypertension was the most prominent comorbidity, present in 97.1% of stroke cases. Other factors, including gender and cardiac conditions, showed no statistically significant associations.

Unique Contribution to Theory, Practice and Policy: This study was informed by the Health Belief Model (HBM), which posits that individuals are more likely to engage in health-promoting behaviors such as hypertension screening and management when they perceive a high risk of a serious condition like stroke and believe in the benefits of preventive action. The findings demonstrate a high burden of stroke in this setting, with age and hypertension identified as the primary associated factors. Based on these results, it is recommended that policymakers strengthen national strategies for non-communicable disease (NCD) control, particularly by integrating routine hypertension screening, awareness campaigns, and accessible treatment at all levels of healthcare. Targeted public health interventions can significantly reduce stroke-related morbidity and mortality in Rwanda.

Keywords: Stroke, Prevalence, Risk Factors, Emergency Department, Hypertension

JEL Codes: I10, I12, I18

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INTRODUCTION

Stroke is a critical global health concern, ranking as the second leading cause of death and the third in terms of disability-adjusted life years. Traditionally defined by the World Health Organization (WHO) as a sudden onset of focal or global neurological impairment lasting more than 24 hours or leading to death due to vascular causes, this definition is now considered outdated. The American Heart Association and American Stroke Association have since adopted broader definitions incorporating clinical and imaging-based evidence of irreversible tissue injury in the brain, spinal cord, or retina. Stroke is generally categorized into ischemic and hemorrhagic types, with ischemic strokes accounting for approximately 80% of global cases. However, in Africa, hemorrhagic strokes are more common, reflecting variations in risk profiles and healthcare access across regions.

Global and Regional Context

Globally, an estimated 15 million people suffer strokes annually, with 5 million deaths and another 5 million left permanently disabled. Notably, 85% of these events occur in low-and middle-income countries (LMICs), where the burden of stroke is exacerbated by rising cardiovascular risk factors, epidemiological transitions, and limited access to preventive care. Sub-Saharan Africa experiences the highest stroke burden, with incidence rates of approximately 316 per 100,000 people. In this region, strokes often occur in younger adults, are more severe, and result in greater socioeconomic and personal costs due to unmanaged risk factors and delayed healthcare access. This continental trend is also reflected at the national level, with Rwanda increasingly facing a growing burden of stroke, driven by similar risk factors and health system challenges.

Rwandan Context and Study Rationale

In Rwanda, stroke remains a significant yet under-researched public health issue, accounting for approximately 2.1% of emergency admissions. However, public awareness of stroke symptoms and risk factors is low, largely due to limited health literacy, inadequate community-based health education, and restricted access to timely and accurate information through public health campaigns. These challenges are further exacerbated by disparities in healthcare infrastructure, particularly in rural areas where stroke prevention and early detection services are scarce. Consequently, delays in seeking care are common, driven by poor awareness, limited healthcare access, and weak referral systems in underserved communities. According to the Global Burden of Disease Study (2016), nearly 88% of stroke-related disability-adjusted life years are linked to modifiable risk factors. Despite the significant burden, data on stroke prevalence and associated factors in Rwanda remain limited. This study aims to fill that gap by assessing the prevalence and key determinants of stroke among patients presenting to the emergency department at the University Teaching Hospital of Butare. The findings will inform public health interventions, strengthen stroke prevention strategies, and support health system planning in Rwanda.

Problem Statement

Stroke remains a major global health burden, with approximately 90% of cases attributable to modifiable risk factors such as hypertension, diabetes, smoking, and physical inactivity. Low-and middle-income countries (LMICs), including Rwanda, bear the greatest share of this burden, accounting for 86% of all stroke cases worldwide. In Africa, the dual burden of communicable and non-communicable diseases is intensifying, with stroke incidence rising particularly among young adults. Despite its preventability, stroke in Rwanda is associated with

high fatality and disability rates, ranking third in mortality and ninth in disability according to GBD 2019. National statistics reveal that over half of hypertensive patients remain untreated, and awareness of stroke-related conditions is alarmingly low. Additionally, a large proportion of Rwandans engage in high-risk behaviors such as alcohol consumption and tobacco use, while fruit and vegetable intake remains insufficient. Poor detection and management of conditions like diabetes and hypertension, which significantly contribute to stroke incidence, compound these challenges. Given the scarcity of local data, this study aims to assess the prevalence of stroke and its associated risk factors among patients presenting to the emergency department at the University Teaching Hospital of Butare, to inform targeted public health strategies and improve stroke prevention in Rwanda.

Research Objectives

The objectives of this study are:

- i. To determine the prevalence of stroke among patients who presented to the emergency department at the University Teaching Hospital of Butare, Rwanda.
- ii. To identify the factors associated with stroke among patients attending the emergency department at the University Teaching Hospital of Butare, Rwanda.

LITERATURE REVIEW

Theoretical Review

Stroke is traditionally defined as the rapid onset of clinical signs of focal (or global) cerebral dysfunction lasting more than 24 hours or resulting in death, with no apparent cause other than vascular origin (Coupland et al., 2017; Sacco et al., 2013). Although this definition, introduced by the World Health Organization over 40 years ago, remains foundational, advances in medical science and diagnostic technology have refined stroke diagnosis. Contemporary practice emphasizes the critical role of neuroimaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI), which are essential for confirming stroke diagnosis, differentiating between ischemic and hemorrhagic subtypes, and guiding timely management (Campbell et al., 2019a). Stroke is classified primarily into two types: ischemic stroke, accounting for approximately 80% of cases worldwide with a higher prevalence in high-income countries (91%) compared to low-income countries (66%) and hemorrhagic stroke, which comprises about 20% of cases globally but is relatively more common in low-income settings (34%) than in high-income countries (9%) (Donkor, 2018).

Thromboembolic diseases typically cause ischemic stroke, which involves infarction of the brain, spinal cord, or retina. Common causes of embolism include large artery atherosclerosis and heart diseases, particularly atrial fibrillation. Another cause of ischemic stroke is small artery disease, which is associated with high blood pressure and diabetes mellitus. Though rarer, causes such as vasculitis, patent foramen ovale, and arterial dissection are more common in younger individuals (Campbell et al., 2019a). The rupture of blood vessels causes hemorrhagic stroke, also known as non-traumatic intracerebral hemorrhage. It is subdivided into subarachnoid hemorrhage and intracerebral hemorrhage (Montaño et al., 2021; Unnithan et al., 2024). Subarachnoid hemorrhage involves bleeding into the subarachnoid space, whereas intracerebral hemorrhage refers to bleeding within the brain parenchyma. Hemorrhagic stroke is associated with a high mortality rate and significant morbidity (Montaño et al., 2021; Unnithan et al., 2024).

Physiopathology of Stroke

Ischemic stroke results from vascular blockage caused by thromboembolic illness, leading to acute ischemia. Ischemia causes cellular adenosine triphosphate (ATP) depletion and hypoxia, triggering cytotoxic edema due to sodium and calcium ion influx and passive water movement. ATP is essential for maintaining ionic gradients across cell membranes, and its depletion causes cell depolarization (Feske, 2021; Jauch, 2023). Conversely, hemorrhagic stroke occurs due to the rupture of blood vessels. Common sites of bleeding include the basal ganglia (50% of cases), cerebral lobes (10-20%), thalamus (15%), pons and brain stem (10%), and cerebellum (10%). The hematoma compresses brain tissue, causing initial damage and raising intracranial pressure (ICP). Secondary damage is caused by inflammation, disruption of the blood-brain barrier (BBB), edema, and excessive production of reactive oxygen species (Unnithan et al., 2024).

Patients presenting with sudden-onset neurological deficits such as hemiparesis, hemisensory loss, facial drooping, ataxia, visual disturbances, speech difficulty, diplopia, dysarthria, or altered consciousness should be promptly evaluated for possible stroke (Jauch, 2023). Although clinical history and physical examination are critical initial steps, they are often insufficient for definitive diagnosis, as stroke-like symptoms can also result from conditions such as seizures, migraines, vestibular disorders, and metabolic disturbances (Campbell et al., 2019b). Neuroimaging is therefore essential for both confirming the diagnosis and distinguishing between ischemic and hemorrhagic strokes, which differ significantly in management and prognosis (Campbell et al., 2019b; Jauch, 2023). Non-contrast computed tomography (CT) remains the most commonly used imaging modality worldwide due to its rapid availability and diagnostic utility, especially for identifying hemorrhagic strokes. Magnetic resonance imaging (MRI), while more sensitive, is typically limited to well-resourced centers (Campbell et al., 2019b). In Rwanda, CT scans are routinely used for stroke diagnosis in referral hospitals such as the University Teaching Hospital of Butare, aligning with current global standards for acute stroke evaluation (Ministry of Health Rwanda, 2022).

Empirical Review

Prevalence and Incidence of Stroke

Globally, stroke accounted for 11.6% of all fatalities in 2019, making it the second leading cause of death. The prevalence of ischemic stroke has increased from 4.07 million cases in 1990 to 7.86 million in 2020, with projections reaching 9.62 million by 2030 (Pu et al., 2023). A study by Ekker et al. found that young adults (18-50 years) in Europe experience 7-8 ischemic strokes per 100,000 person-years, while in sub-Saharan Africa, the rate exceeds 100 per 100,000 person-years, highlighting significant geographical disparities (Ekker et al., 2019). Furthermore, global stroke incidence has increased by 40% over the past decade (Ekker et al., 2019). In Tanzania, ischemic stroke occurs more frequently than hemorrhagic stroke, with studies showing ischemic strokes accounting for 11.3% of all medical admissions, of which 39.2% are attributed to large artery blockage, and an 80% one-year mortality rate (Matuja, 2022). Another Tanzanian study reported crude yearly incidences of 94.5 per 100,000 in rural areas and 107.9 per 100,000 in urban areas, with males more frequently affected than females (Walker et al., 2010). Additionally, Akinyemi et al. (2021a) reported that in Africa, there are 316 new stroke cases and 1,460 cases per 100,000 people, with a three-year mortality rate exceeding 80%, particularly affecting individuals in their 4th to 5th decades of life.

In Rwanda, a 2017 study by Nkusi et al. found a stroke prevalence of 2,100 per 100,000 population, which was the first study to highlight the extent of stroke in the country. The study revealed poor awareness of risk factors among the patients and found a higher incidence of hemorrhagic stroke compared to ischemic stroke, with 63.5% of the patients suffering from hemorrhagic stroke (Nkusi et al., 2017). A 2019 study by Dushimiyimana et al. revealed that stroke caused 2,915 deaths in Rwanda, accounting for approximately 5% of total deaths, making it the third leading cause of death. According to World Life Expectancy data, stroke was the leading cause of death in Rwanda in 2020, with 5,060 deaths, representing 8.2% of all deaths. However, Rwanda lacks separate data on ischemic and hemorrhagic strokes. These findings emphasize the urgent need for better awareness and healthcare strategies to address the growing burden of stroke in the region.

Stroke-Associated Factors

According to the Interstroke Study, 90% of strokes are attributable to ten modifiable risk factors: hypercholesterolemia, hypertension, alcohol use, tobacco use, diabetes, stress, obesity, heart disease, lack of exercise, and poor nutrition (Donkor, 2018). O'Donnell et al. (2016), based on the Interstroke study, found that smoking and diabetes mellitus were significant risk factors for ischemic stroke, but not for intracerebral hemorrhage. Additionally, hypertension was more strongly associated with hemorrhagic stroke than ischemic stroke.

This study is informed by the Health Belief Model (HBM), which posits that individuals are more likely to engage in preventive health behaviors such as blood pressure control, smoking cessation, or increased physical activity when they perceive themselves to be at risk of a serious condition, believe in the effectiveness of preventive actions, and recognize few barriers to taking action. Within this framework, stroke risk factors are classified as modifiable and non-modifiable. Modifiable factors include hypertension, atrial fibrillation, smoking, diabetes mellitus, high cholesterol, sedentary lifestyle, and cardiovascular diseases, while non-modifiable factors include age, sex, and genetic predisposition (Donkor, 2018). According to Campbell et al. (2019b), approximately 91.5% of stroke cases are attributed to modifiable risk factors such as poor diet, obesity, smoking, excessive alcohol intake, and underlying cardiac conditions. By applying the HBM, this study emphasizes the potential for prevention through targeted public health interventions and behavioral change strategies focused on modifiable risk factors. This theoretical approach contributes to the study by guiding the identification of intervention points and informing recommendations aimed at reducing the stroke burden in Rwanda.

METHODOLOGY

Research Design

This study employed a retrospective cross-sectional research design, which is particularly suitable for estimating the prevalence of medical conditions and identifying associated risk factors within a defined population. The design allowed for the analysis of existing clinical records, making it both cost-effective and efficient for examining historical patient data. Specifically, the study involved reviewing archived patient files from the Emergency Department of Butare University Teaching Hospital (CHUB) to identify cases of stroke and assess the presence of potential risk factors. The retrospective nature of the design enabled the researchers to systematically gather and analyze quantitative data over a fixed period without the need for direct patient contact, thereby reducing recall bias and logistical constraints commonly encountered in prospective studies.

Study Context

The study was conducted at Butare University Teaching Hospital (CHUB), located in Mamba Village, Butare Cell, Ngoma Sector, Huye District, Southern Province, Rwanda. CHUB is a national referral and teaching hospital founded in 1928. Its Emergency Department plays a critical role in the diagnosis and immediate management of acute stroke cases prior to patient transfer for definitive care.

Data Collection

Data were collected using a structured checklist developed by the researcher, which captured socio-demographic information as well as clinical and lifestyle-related variables associated with stroke. The checklist was prepared in English, consistent with the language used in medical records at CHUB. After obtaining the necessary institutional approvals, a trained research team retrieved data from patient files archived between January 1st, 2022, and December 31st, 2023. The collected data were first entered into Microsoft Excel and subsequently imported into SPSS for statistical analysis.

Sampling Technique

A systematic random sampling method was employed. From a total population of 3,830 patients admitted to the Emergency Department during the study period, the final sample size of 383 patient files was determined using Yamane's formula. The sampling interval ($k = N/n$) was calculated as approximately 10. Every 10th file was selected from the archive after choosing a random starting point by coin toss, ensuring a representative and unbiased sample.

Data Analysis

Collected data were cleaned and analyzed using SPSS software. Descriptive statistics, including frequencies and percentages, were used to summarize demographic and clinical characteristics of the study population. To assess associations between stroke and various independent variables, chi-square tests were conducted. Variables that showed statistical significance at $p < 0.05$ in the bivariate analysis were further examined using multivariate logistic regression to identify independent predictors of stroke, with results reported as odds ratios (ORs) and 95% confidence intervals (CIs). The final results were presented in tables and graphs to enhance clarity and interpretation.

Ethical Considerations

Ethical approval for the study was obtained from the Mount Kenya University Institute of Postgraduate Studies and the CHUB Ethics Committee. Patient confidentiality was strictly maintained by anonymizing data and securing all retrieved files. The collected data were used solely for academic purposes, and no personal identifiers were disclosed.

RESULTS

The presentation of findings in this study is structured around the primary research objective, which was to determine the prevalence of stroke and identify its associated risk factors among patients who attended the Emergency Department of the University Teaching Hospital of Butare (CHUB). The results are organized to align with this objective, providing a comprehensive analysis of the frequency of stroke cases and the demographic, clinical, and lifestyle variables potentially linked to stroke occurrence within the study population.

The Prevalence of stroke

Table 1: Overall Prevalence of Stroke among Study Participants

Category	Frequency	Percent
With Stroke	35	9.7%
Without Stroke	327	90.3%
Total	362	100.0%

Table 1 above presents the prevalence of stroke among study participants. Among the 362 patients who attended the emergency department at Butare University Teaching Hospital, the overall prevalence of stroke was 9.7%, with 35 patients diagnosed with stroke. The remaining 327 patients (90.3%) did not present with stroke symptoms. This indicates that nearly 1 in 10 patients in this emergency setting were diagnosed with stroke, highlighting the substantial burden of stroke in this patient population.

This prevalence data offers a critical perspective on the magnitude of stroke cases within the emergency department. It underscores the need for targeted strategies to manage and prevent stroke, within both hospital settings and the broader community. Such strategies are essential to address the growing stroke burden and improve outcomes for affected individuals.

Analysis of Factors Associated With Stroke

The analysis process of the associated factors with stroke were done, through SPSS 22. Firstly, the frequency distribution of all variables were done, secondary cross tabulation for each independent variable and outcome variable (presence of stroke) was done, after that bivariate analysis with a 2x2 tables was done and demonstrated those factors with or without association.

Association between Sociodemographic Factors and Stroke

Table 2: Distribution of Stroke Status in Study Respondents Based on Fundamental Factors

Variable	Category	With Stroke (n = 35)	Without Stroke (n = 327)	P-Value
Residence	Urban	12	131	0.507
	Rural	23	196	
Age Category	< 30 years	1	58	0.001*
	31–60 years	5	123	
	≥ 61 years	29	146	
Gender	Male	14	152	0.464
	Female	21	175	
Occupation	Employed	11	90	0.839
	Self-employed	22	212	
	Civil Servant	2	25	
Marital Status	Married	26	206	0.054
	Single	0	55	
	Widowed	8	45	
	Divorced	0	9	
	Not Recorded	1	12	
Insurance	Yes	27	269	0.139
	No	7	57	
	Not Recorded	1	1	

Note: P-values calculated using Chi-square test.

*Statistically significant at $p < 0.05$.

Table 2 presents the distribution of stroke cases in relation to key demographic and socio-economic variables among patients at the Emergency Department of the University Teaching Hospital of Butare. The majority of stroke cases (29 out of 35) occurred in individuals aged 61 and above, and age was significantly associated with stroke occurrence ($p = 0.001$), indicating that older adults are at a higher risk. Residence was not a significant factor, as most stroke patients were from rural areas (23 out of 35), similar to the non-stroke group, with no statistically significant association ($p = 0.507$). Gender also showed no significant difference ($p = 0.464$), with 14 males and 21 females among stroke patients. Occupational status did not influence stroke prevalence, with self-employment being the most common category in both stroke (22 out of 35) and non-stroke groups (212 out of 327), and no significant association observed ($p = 0.839$). Marital status showed a borderline association ($p = 0.054$), with married individuals accounting for most stroke cases (26 out of 35), suggesting a potential trend warranting further investigation. Insurance status did not significantly influence stroke occurrence ($p = 0.139$), as the majority of both stroke (27 out of 35) and non-stroke participants (269 out of 327) had insurance. Overall, the analysis highlights age as the most significant factor associated with stroke, while other socio-demographic variables did not show strong statistical associations in this study. These findings underscore the need to prioritize older populations in stroke prevention strategies and suggest that further research is needed to explore the potential influence of marital status and other socio-economic factors on stroke risk.

Table 3: Distribution of Stroke Status among Study Respondents Based on Underlying Factors

Variable	Category	With Stroke (n = 35)	Without Stroke (n = 327)	P-Value
Comorbidity	Hypertensive	16	57	0.001*
	Cardiac	14	121	
	Diabetes	4	75	
	Others (e.g., Hyperlipidemia, Obesity)	1	74	
Type of Stroke	Ischemic	19	5	0.001*
	Hemorrhagic	16	4	
	None	0	318	
Hypertension (HTN)	Yes	34	269	0.023*
	No	1	58	
Smoking	Yes	2	50	0.305
	No	27	224	
	Not recorded	6	53	
Alcohol Consumption	Yes	30	147	0.001*
	No	5	135	
	Not recorded	0	45	
Atrial Fibrillation	Yes	3	10	0.001*
	No	12	225	
	Not recorded	20	92	
Lipids Profile	Yes	23	294	0.001*
	No	2	5	
	Not recorded	10	28	
Obesity	Yes	0	9	0.001*
	No	26	295	
	Not recorded	9	23	
HIV Status	Yes	3	17	0.001*
	No	23	287	
	Not recorded	9	23	
Atherosclerosis	Yes	0	1	0.497
	No	29	291	
	Not recorded	6	35	

Note: P-values were calculated using the Chi-square test.

***P < 0.05 indicates statistical significance**

Table 3 presents the relationship between stroke occurrence and various health conditions and behavioral factors among patients at the Emergency Department of Butare University Teaching Hospital. The analysis revealed significant associations between stroke and several variables, including hypertension, alcohol consumption, atrial fibrillation (AF), lipid profiles, HIV status, and type of stroke, while smoking, obesity, and atherosclerosis showed no significant links. Hypertension emerged as the most critical factor, with 34 out of 35 stroke patients being hypertensive ($p = 0.001$), emphasizing its role in vascular damage that predisposes individuals to both ischemic and hemorrhagic strokes. Alcohol consumption was also significantly

associated with stroke ($p = 0.001$), with 30 stroke patients reporting alcohol use, highlighting excessive alcohol intake as a key modifiable risk factor. Atrial fibrillation, though identified in only three stroke patients, showed a strong statistical association ($p = 0.001$), underscoring its role in thromboembolic stroke development. Dyslipidemia was prevalent in 23 stroke patients ($p = 0.001$), pointing to the importance of managing lipid levels to prevent artery blockages leading to ischemic stroke. HIV-positive status was also significantly associated with stroke ($p = 0.001$), suggesting a possible vascular impact of HIV infection through chronic inflammation. The type of stroke was significantly divided between ischemic and hemorrhagic forms, with ischemic strokes being more common (19 out of 35), aligning with global trends. In contrast, smoking ($p = 0.305$), obesity ($p = 0.001$, but with no obese stroke cases), and atherosclerosis ($p = 0.497$) did not show significant associations in this cohort. The limited number of cases in these categories may have influenced the results, and further research is warranted. Overall, the findings highlight the dominant role of hypertension and other modifiable factors in stroke development, calling for targeted prevention strategies focused on blood pressure control, lipid management, and alcohol reduction. This comprehensive analysis provides valuable insights into stroke risk factors within the Rwandan context and underscores the need for early identification and management of high-risk individuals to reduce stroke incidence and improve outcomes.

Multivariate Logistic Regression Analysis of Factors Associated with Stroke among Study Participants

Table 4: Multivariate Logistic Regression Analysis of Factors Associated with Stroke among Study Participants

Variable	Category	With Stroke	Without Stroke	(AOR)	95% C.I.	P-value
Age Category	Less than 30	1	58	0.737	0.179 - 3.037	0.673
	Between 31 and 60	5	123			
	61 and above	29	146			
Comorbidity	Hypertensive	16	57	10.028	1.270 - 79.160	0.029
	Cardiac	14	121	2.501	0.245 - 25.572	0.440
	Diabetes	4	75	38.443	0.068 - 21694.103	0.259
	Others (Hyperlipidemia, Obesity)	1	74			
Type of Stroke	Ischemic	19	5	80.442	16.806 - 385.046	0.000
	Haemorrhagic	16	4			
Hypertension (HTN)	Yes	34	269	39.772	0.497 - 3182.058	0.099
	No	1	58			
Alcohol	Yes	30	147	0.000		0.997
	No	5	135	0.000		0.997
	Not recorded	0	45			
Atrial Fibrillation	Yes	3	10	23.780	0.513 - 1102.592	0.105
	No	12	225	46.874	1.851 - 1186.717	0.020
Lipids Profile	Not recorded	20	92			
	Yes	23	294	2.257	0.070 - 72.717	0.646
	No	2	5	0.635	0.004 - 114.052	0.864
Obesity	Not recorded	10	28			
	Yes	0	9	2475280.199		0.999
	No	26	295	4.388	0.137 - 140.981	0.403
HIV Status	Not recorded	9	23			
	Yes	3	17	2.010	0.026 - 157.334	0.754
	No	23	287	2.977	0.080 - 110.510	0.554
	Not recorded	9	23			

Table 4 presents multivariate analysis findings on the factors associated with stroke among patients at Butare University Teaching Hospital, adjusting for potential confounders. While age appeared to influence stroke prevalence, particularly in patients aged 61 and above, the adjusted odds ratios (AOR) for younger age groups (<30 years: AOR = 0.737, $p = 0.673$; 31–60 years: not significant) did not reach statistical significance. Hypertension emerged as a major risk factor, with an AOR of 10.028 (95% CI: 1.270–79.160, $p = 0.029$), indicating that hypertensive patients were significantly more likely to experience a stroke. Other comorbidities, such as cardiac conditions (AOR = 2.501, $p = 0.440$) and diabetes (AOR = 38.443, $p = 0.259$), showed elevated odds but were not statistically significant due to wide confidence intervals. Ischemic stroke was highly associated with stroke status (AOR = 80.442, $p < 0.001$), underscoring its dominant contribution to overall stroke cases. Hypertension remained a notable factor (AOR = 39.772, $p = 0.099$) though not statistically significant in this adjustment. Alcohol consumption did not show a significant association (AOR = 0.000, $p = 0.997$), while atrial fibrillation demonstrated potential significance, particularly for patients without AF (AOR = 46.874, $p = 0.020$), suggesting a possible underdiagnosis of AF among stroke cases. Lipid profiles

(abnormal AOR = 2.257, $p = 0.646$) and obesity (non-obese AOR = 4.388, $p = 0.403$) did not reveal significant associations. Extreme results for obesity (AOR = 2,475,280.199, $p = 0.999$) reflect the lack of obese stroke cases in this sample. HIV status also showed no significant impact (HIV-positive AOR = 2.010, $p = 0.754$). In summary, hypertension, ischemic stroke, and atrial fibrillation were the most strongly associated factors with stroke occurrence, while age, alcohol use, lipid levels, obesity, and HIV status showed no statistically significant relationships in this study.

Table 5: Model Summary, Hosmer, and Lemeshow Test

Model Summary and Fit Test	Value
-2 Log Likelihood	51.378
Cox & Snell R Square	0.390
Nagelkerke R Square	0.828
Hosmer and Lemeshow Chi-square	0.842
Degrees of Freedom (df)	8
Hosmer and Lemeshow Significance (Sig.)	0.999

Table 5 summarizes the logistic regression model's performance in assessing stroke risk factors. The model's -2 Log Likelihood value of 51.378 suggests a reasonable fit. The Cox & Snell R Square of 0.390 and the Nagelkerke R Square of 0.828 indicate that the model explains approximately 83% of the variance in stroke occurrence, demonstrating strong predictive power. The Hosmer and Lemeshow goodness-of-fit test yielded a Chi-square of 0.842 ($df = 8$, $p = 0.999$), confirming that the model's predictions closely align with observed outcomes, as the p-value well exceeds the 0.05 threshold. This suggests no significant deviation between expected and actual values, further validating the model's fit. Collectively, these results indicate that the logistic regression model is robust and reliable for identifying significant predictors of stroke in the study population.

Discussion

This study reports a stroke prevalence of 9.7% among emergency department patients at Butare University Teaching Hospital in Rwanda, aligning with the increasing stroke incidence observed across Sub-Saharan Africa, driven by hypertension, diabetes, and socioeconomic factors. The study highlights a significant rise in stroke risk with age, particularly in individuals aged 61 and above, which is consistent with global findings on aging and stroke risk (Chukwuma & Duru, 2023; Mremi et al., 2023). Hypertension emerged as a critical risk factor, with an Adjusted Odds Ratio (AOR) of 10.028, echoing research from Owolabi and Saka (2022) on its prevalence in low- and middle-income countries. Diabetes was also strongly associated with stroke (AOR 38.443), supporting earlier studies such as Awori et al. (2022), which linked chronic conditions to poor stroke outcomes in Sub-Saharan Africa. The predominance of ischemic strokes, with an AOR of 80.442, mirrors findings by Khamis et al. (2021), indicating the need for targeted interventions addressing ischemic stroke risk factors. Atrial fibrillation was another significant risk factor (AOR 23.780), supporting previous studies (Radebe & Mokoena, 2022) on its role in stroke prevalence. Furthermore, socioeconomic disparities in healthcare access were highlighted, consistent with the findings of Peters and Woodward (2023), underlining the necessity for equitable healthcare interventions. The study emphasizes the need for public health initiatives focusing on the prevention and management of hypertension, diabetes, atrial fibrillation, and socioeconomic inequalities in Sub-Saharan Africa to mitigate the growing stroke burden.

CONCLUSION AND RECOMMENDATIONS

This study reveals a substantial prevalence of stroke among patients at Butare University Teaching Hospital, reinforcing the urgent need for context-specific public health interventions. The significant associations between stroke and modifiable risk factors particularly hypertension, diabetes, and atrial fibrillation highlight the potential for prevention through early detection and effective risk management. Community-based screening and routine check-ups represent practical strategies for identifying high-risk individuals, especially in underserved populations.

Grounded in the Health Belief Model (HBM), the study emphasizes how perceptions of susceptibility, severity, and benefits of action influence health behaviour. The findings contribute to theoretical discourse by demonstrating how targeted health education and awareness can drive behaviour change and reduce stroke incidence in low-resource settings.

Given the increasing stroke burden in sub-Saharan Africa, future policy should prioritize the integration of evidence-based preventive strategies into national health systems. Strengthening awareness, accessibility, and equity in stroke prevention is essential to improving outcomes and alleviating pressure on already constrained healthcare infrastructure.

Conflict of Interest

We declare that we have no conflict of interest.

Authors' Contribution

ID and AH designed the study, led the data collection, and performed data cleaning, analysis, and interpretation. ID and AH also contributed to the conception and development of the manuscript, addressing reviewers' comments throughout the revision process until its publication.

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