



**Outcomes and Associated Factors of Stroke at Addis Ababa burn emergency and trauma hospital and St. Paul's Hospital Millennium Medical College Emergency Department**

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**Outcomes and Associated Factors of Stroke in Addis Ababa burn emergency and Trauma Hospital and St. Paul's Hospital Millennium Medical College Emergency Department, Addis Ababa, Ethiopia.**

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|                                    |                                                                                                                                                                                                                   |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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## **Abstract**

**Introduction:** - Stroke is the leading cause of disability worldwide and the second leading cause of death and disability adjusted life years and is a public health problem in Ethiopia. Despite the high prevalence of stroke in Ethiopia, there is a scarcity of published data on factors that are associated with treatment outcome of stroke in Ethiopia. This study therefore aimed to assess outcomes and associated factors of stroke patients which will help as alarming signals to do national wide research so that important data will be extracted to influence policy makers to change course of their intervention.

**Methods:** - An institution based cross-sectional study was conducted at AaBET and SPHMMC hospitals emergency department, Addis Ababa, Ethiopia. The study included patients admitted to emergency department with the diagnosis of stroke during the study period of January 1, 2020 to December 30, 2022. Data was collected with structured questionnaire from patient's chart and analyzed by SPSS version 25.0. Bivariable and multivariable binary logistic regression analyses was used to identify factors significantly associated with stroke outcome.

**Results:** - A total of 237 patients with median age of 58 years were included. 54% of the patients were male. 38.4% patients arrived with ambulance and only 17.5% of patients arrived within 4.5 hours of symptom of onset. With. The most common presentation complaint was body weakness (79.7%). Hemorrhagic stroke was the most common type of stroke accounting for 53.6% of cases. The most commonly identified risk factors were Hypertension (97.6%), Hypercholesterolemia (13%), Structural heart disease (12.1%), Diabetes mellitus (12.1%) and atrial fibrillation (4.8%). The emergency department mortality rate was 13.5%.

**Conclusion:** - In this study, hemorrhagic stroke was the commonest stroke. GCS<8 and development of complication were associated with emergency department mortality.

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## **List of Acronyms and Abbreviations**

|               |                                               |
|---------------|-----------------------------------------------|
| <b>AaBET</b>  | Addis Ababa Burn and Trauma Center            |
| <b>ASA</b>    | American Stroke Association                   |
| <b>CNS</b>    | Central Nervous System                        |
| <b>CT</b>     | Computed Tomography                           |
| <b>CXR</b>    | Chest X-Ray                                   |
| <b>DALYS</b>  | Disability adjusted life years                |
| <b>ED</b>     | Emergency Department                          |
| <b>ECG</b>    | Electrocardiography                           |
| <b>GBD</b>    | Global burden of disease                      |
| <b>GCS</b>    | Glasgow Coma Scale                            |
| <b>GSD</b>    | Global Sustainable Development                |
| <b>HAI</b>    | Hospital Acquired Infection                   |
| <b>HAP</b>    | Hospital Acquired Pneumonia                   |
| <b>HIV</b>    | Human Immune-Deficiency Virus                 |
| <b>HS</b>     | Hemorrhagic stroke                            |
| <b>ICH</b>    | Intracranial Hemorrhage                       |
| <b>IRB</b>    | Institutional Review Board                    |
| <b>IS</b>     | Ischemic stroke                               |
| <b>LMIC</b>   | Low and Middle Income Countries               |
| <b>LT</b>     | Left                                          |
| <b>MRS</b>    | Modified Rankin Scale                         |
| <b>NCDS</b>   | Non Communicable diseases                     |
| <b>Rt</b>     | Right                                         |
| <b>SAH</b>    | Subarachnoid Hemorrhage                       |
| <b>SPHMMC</b> | St.Paul's hospital millennium medical college |
| <b>SPSS</b>   | Statistical Package Forth Social Science      |
| <b>SSR</b>    | Sub-Saharan Africa                            |
| <b>TIA</b>    | Transient Ischemic Attack                     |
| <b>USD</b>    | United States Dollar                          |
| <b>WHO</b>    | World Health Organization                     |

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## **1. Introduction**

### **1.1 Background**

The first recorded use of ‘stroke’ as a lay term was in 1599, attributing the sudden onset of symptoms to a ‘stroke of God’s hand’ and Hippocrates called it apoplexy(1). The word ‘stroke’ is related to the Greek word ‘apoplexia’ which implies being struck with a deadly blow (2).

World Health Organization (WHO) defines stroke more than 40 years ago as “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin (3). American stroke association(ASA) defines stroke as central nervous system(CNS) infarction in brain, spinal cord, or retinal cell death attributable to ischemia, based on either pathological, imaging, or other objective evidence of cerebral, spinal cord, or retinal focal ischemic injury in a defined vascular distribution; or clinical evidence of cerebral, spinal cord, or retinal focal ischemic injury based on symptoms persisting  $\geq 24$  hours or until death, and other etiologies excluded (4). Stroke can be classified into brain ischemia due to thrombosis, embolism, or systemic hypoperfusion and brain hemorrhage due to intracerebral hemorrhage (ICH) or subarachnoid hemorrhage (SAH)(4).

Stroke remains the second-leading cause of death and the third-leading cause of both death and disability combined in the world, and its cost reaches 0.66% of world gross domestic product (GDP) with the bulk of the global stroke burden increased residing in lower-income and lower-middle-income countries (LMIC) (5). According to WHO, 2019 report on Global burden of disease (GBD) the vast majority 87.8% of deaths in high income countries (HICs) in 2019 was due to Non-communicable disease (NCDs), with heart disease, dementia and strokes the leading causes(6). The life expectancy of the world population increasing and increasing prevalence of major risk factors such as hypertension and obesity, stroke is predicted to continuously increase worldwide (7). The WHO has estimated that 15 million people suffer from stroke each year (8). Globally with African countries accounting for 86% of the stroke deaths. According to the WHO data published in 2014, stroke accounted for 28,320 (4.71 %) of total deaths in Ethiopia (9).

In United states the associated factors for increasing mortality of Stroke was advanced age and Stroke mortality rates have substantially declined for ischemic than hemorrhagic(10). Among

characteristics associated with neurologic disability and mortality were larger log intracranial hemorrhage (ICH) volume, older age, pre-intracranial hemorrhage modified Rankin scale(mRS) score lobar location, and presence of infection (11). In another study in United states, older age, female sex, dyslipidemia, hypertension, coronary heart disease, and smoking are not only recognized risk factors for ischemic stroke, but also risk factors associated with an unfavorable prognosis following stroke (12). Study done in Africa, north western Nigeria factors the associated with death in stroke were GCS < 8, seizures, abnormal pupillary size, hemorrhagic stroke, aspiration pneumonitis were independent predictors of mortality (8). In a research done at Sierra Leoneans the independent predictors for stroke mortality were: hypertension, previous stroke clinical diagnosis in the absence of imaging, hemorrhagic stroke, and aspiration pneumonia, Women (13) similarly in a research done in democratic republic of Congo among factors that increase mortality are hemorrhagic stroke, delayed presentation (late than 24h) poor compliance to medication, recurrent stroke, and the advanced age >75 years (14).

In Ethiopia the magnitude of in hospital stroke mortality is around 14%. Hemorrhagic stroke accounts higher odd ratio of overall stroke mortality. There is no significant sex difference in stroke mortality while admission GCS and mental status are strong predictors of mortality(15).

## **1.2 Statement of the Problem**

Globally, stroke remained the second-leading cause of death and the third-leading cause of death and disability combined of total DALYs in 2019 (16). Even though a research done in USA from 1975-2019 on Epidemiology and trends of stroke mortality shows Age-standardized declined with average annual decline -2.78%, advanced age found to increase mortality sharply and the decline was more for ischemic than hemorrhagic stroke (10).

A study done north western Nigeria and in Sierra Leoneans in 2007-2010 and 2020 showed the commonest risk factors were hypertension. Ischemic stroke was the most common sub type and in-hospital mortality was around 35%. The commonest factor associated with mortality were hypertension, previous stroke, GCS < 8, clinical diagnosis in the absence of imaging, hemorrhagic stroke, and aspiration pneumonia (8),(13).

Many Africans have a stroke with in the fourth to sixth decades of life, with serious implications for the individual, their family and society. As strokes in younger people tend to result in a greater

loss of self-worth and socioeconomic productivity than in older individuals. Emerging insights from research into stroke epidemiology, genetics, prevention, care and outcomes offer great prospects for tackling the growing burden of stroke on the continent (17). While significant progress has been made in stroke care in high-income countries, stroke care in sub-Saharan is disjointed with glaring gaps in all areas of the stroke care continuum (18).

So the objective of this study is to assess treatment outcome and associated factors of stroke as there is no published data on this topic that was studied in both AaBET and SPHMMC hospitals ED.

### **1.3 Significance of the Study**

This study will help to fill the knowledge gap of how common and magnitude of disability caused by stroke in our hospital. It also helps to describe associated factors so that it raw data for designing and implementing intervention before occurrence and management guide line once it occurred. Finally, it put basis for further study as a baseline data since previously done research in this country in general and specifically in our hospital, did not include intervention and mortality in the emergency department as well as patients which get discharged directly from the ED paving a way for under reporting.

## **2. Literature Review**

### **2.1. Treatment Outcome of Stroke**

According to the 2013 global disease burden study, 6.5 million people died due to stroke. Among these 51% died from IS. Of all 113 million DALYs due to stroke, 42% is due to HS. Over the 1990–2013 period, there was a significant increase in the absolute number of DALYs due to IS, and of deaths from IS and HS, survivors and incident events for both IS and HS. The preponderance of the burden of stroke continued to reside in developing countries, comprising 75.2% of deaths from stroke and 81.0% of stroke-related DALYs (16).

According to American journal of medicine 2014 on trends in stroke rates, risk, and outcomes in the United States, from 1988 to 2008 Stroke was a major cause of morbidity and mortality ischemic stroke incidence decreased from 927 per 100,000 in 1988 to 545 per 100,000 in 2008, and

hemorrhagic stroke decreased from 112 per 100,000 to 94 per 100,000. Risk-adjusted 30-day mortality decreased from 15.9% in 1988 to 12.7% in 2008 for ischemic stroke and from 44.7% to 39.3% for hemorrhagic stroke. Although observed stroke rates decreased, the Framingham stroke model actually predicted increased stroke risk (mean stroke score 8.3% in 1988-1994, 8.8% in 2005-2008). Statin use in the general population increased (4.0% in 1992, 41.4% in 2008), as did antihypertensive use (53.0% in 1992, 73.5% in 2008). They conclude that incident strokes in the Medicare population aged  $\geq 65$  years decreased by approximately 40% over the last 2 decades, a decline greater than expected on the basis of the population's stroke risk factors. Case fatality from stroke also declined. Although causality cannot be proven, declining stroke rates paralleled increased use of statins and antihypertensive medications (19).

In a retrospective analysis of patients with stroke who were admitted over a 3.5-years period to the neurocritical care unit of a tertiary care hospital in Nur Sultan, Kazakhstan. The in-hospital mortality rate was similar in patients with ischemic (36%) and hemorrhagic (39%) stroke (HR 0.88, 95%CI 0.48–1.60). Median survival was 38 days (range: 1–89 days) in patients with ischemic stroke and 39 days (range: 1–63 days) in patients with hemorrhagic stroke (20).

In a prospective study of consecutive patients with acute stroke who were admitted to tertiary hospitals in northwestern Nigeria. A single observer, using pre-defined diagnostic criteria research on Factors associated with death and predictors of one-month mortality from stroke in Kano, Northwestern Nigeria 63.7% had ischemic stroke while 36.3% had hemorrhagic stroke one-month mortality was 37%, and the majority was patients with hemorrhagic stroke (69.6%). About two-third (74.5%) of the mortalities occurred during the first week of the event (8).

In a retrospective cohort study on risk factors, clinical outcomes and predictors of stroke mortality in Sierra Leoneans in 2018. The in-hospital mortality was 34.8% and at discharge, mean modified Rankin Score (mRS) was  $3.89 \pm 1.62$  and women had poorer outcome than men.

In a retrospective one-year study on Clinical characteristics and outcomes of patients with stroke admitted to three tertiary hospitals in Zimbabwe: In-hospital mortality was 24.9%, 95% CI (20.9; 29.0%). Mortality was associated with place of admission ( $p < 0.001$ ). Gender and side of stroke were significantly associated ( $p < 0.001$ )(21) .

In Ethiopia, SPHMMC hospital a retrospective hospital based research done in 2016 and in hospital case fatality rate was 30.1% and a significant number (45.4%) of patients was discharged with neurologic deficit and the median duration of hospital stay was 11.14 days (22).

In a systematic review research in Ethiopia in 2020 showed the overall in-hospital mortality of stroke in Ethiopia was 18% (95%:14–22). The highest magnitude of in-hospital mortality of stroke was observed in SNNPR and the lowest was noted in Tigray region. In addition, the magnitude of the in-hospital mortality rate of stroke was 15.1% (95%CI: 11.3–19.4), and 19.6%(95%CI: 14.1–25.7), among studies published before and after 2016, respectively (23)

In Retrospective cross sectional study on clinical characteristics and treatment outcomes among stroke patients hospitalized to Nekemte referral hospital, Overall, 65.4% of patients had poor outcome while 34.6% of patients had good out comes (improved). Being illiterate/ unable to read and write (AOR = 3.94, 95% CI: 1.31–11.76, P = 0.01), attending secondary school (AOR = 3.6, 95% CI: 1.4–9.17, P = 0.007) and length of hospital stay >5 days (AOR = 2, 95% CI: 1.04–3.86, P = 0.037) were independent predictors of poor treatment outcome (24).

## **2.2 Factor Associated With Treatment Outcome of Stroke Patients**

In a research done in US published on JAMA in 2021 on risk factors associated With mortality and neurologic disability after intracerebral hemorrhage in a racially and ethnically diverse cohort showed us among characteristics associated with neurologic disability and mortality were larger log ICH volume (OR, 2.74; 95% CI, 2.36-3.19; P < .001), older age (OR per 1-year increase, 1.04; 95% CI, 1.02-1.05; P < .001), pre-ICH mRS score (OR, 1.62; 95% CI, 1.41-1.87; P < .001), lobar location (OR, 0.22; 95% CI, 0.16-0.30; P < .001), and presence of infection (OR, 1.85; 95% CI, 1.42-2.41; P < .001) (11).

According to American journal of emergency medicine 2021, volume 45 report on does prolonged emergency department length of stay (EDLOS) affect the outcomes of acute ischemic stroke patients? A shorter EDLOS was significantly associated with an increased risk of stroke progression (P = 0.007). Patients with the lowest EDLOS ( $\leq 1.35$  h) were 2–3 fold more likely to have stroke progression, compared with those with the highest EDLOS ( $> 6.93$  h) (OR, 2.52; 95%

CI, 1.29–4.93;  $P = 0.043$ ). However, no significant association between EDLOS and stroke prognosis was revealed (25).

In a research done on risk factors for death by acute ischemic stroke in patients from West-Pomerania, Poland showed that compared to ischemic stroke patients who survived, the group of ischemic stroke patients who died included a higher number of patients who smoked cigarettes (OR = 6.08 in univariable model; OR = 6.22 in adjusted model), had hypertension (OR = 2.57; OR = 1.85), had a history of previous stroke (OR = 2.63; OR = 2.14), had coronary heart disease (OR = 1.78; OR = 1.36), and were older (OR = 1.06; OR = 1.05). For all these factors, p-value was lower than 0.001. Females had a higher risk of death (OR = 1.48,  $p < 0.001$ ; OR = 1.35,  $p = 0.01$ ). For dyslipidemia, only univariable model was statistically significant (OR = 1.38,  $p < 0.001$ ) with the conclusion of older age, female sex, dyslipidemia, hypertension, coronary heart disease, and smoking are not only recognized risk factors for ischemic stroke, but also risk factors associated with an unfavorable prognosis following stroke (12).

According to GBD ,2017 showed Socioeconomic status (SES) is associated with stroke incidence and mortality despite a growth in crude number of stroke events from 1990 to 2017, there has been an 11.3% decrease in age standardized stroke incidence rate worldwide (150.5, 95% uncertainty interval [UI] 140.3–161.8 per 100,000 in 2017). This has been accompanied by an overall 3.1% increase in age-standardized stroke prevalence rate (1300.6, UI 1229.0–1374.7 per 100,000 in 2017) and a 33.4% decrease in age standardized stroke mortality rate (80.5, UI 78.9– 82.6 per 100,000 in 2017) over the same time period. The rising trends in age-standardized stroke prevalence have been observed only in middle-income countries, despite declining trends in age-standardized stroke incidence and mortality in all income categories since 2005. Further, there has been almost a 34% reduction in stroke death rate (67.8, UI 64.1–71.1 per 100,000 in 2017) attributable to modifiable risk factors, more prominently in wealthier countries (26).

In a prospective research done on Stroke outcomes in Malawi, a country with high prevalence of HIV follow-up study Poor outcome was related to stroke severity and female gender but not to presence of HIV-infection. HIV-seropositive patients were younger and had less often common risk factors for stroke. They suffer more often ischemic stroke than HIV-seronegative patients. Conclusions: Mild stroke and male gender were associated with favorable outcome. HIV-infection

is common in stroke patients in Malawi but does not worsen the outcome of stroke. However, it may be a risk factor for ischemic stroke for young people, who do not have the common stroke risk factors. Our results are significant, because stroke outcome in HIV-seropositive patients has not been studied before in a setting such as ours, with very limited resources and a high prevalence of HIV (27).

Retrospective analysis of patients with stroke who were admitted neurocritical care unit of a tertiary care hospital in Nur-Sultan, Kazakhstan. Outcome predictors of stroke mortality in the neurocritical care unit critically ill patients were univariable analysis found that patients who had a lower Glasgow Coma Scale, were in coma and who had cerebral edema were more likely to die in-hospital ( $P = 0.04, 0.02, <0.01$ , respectively) (20).

In a retrospective series study on risk factors of mortality among patients with stroke in eastern region of the Democratic Republic of Congo showed us the factors found to be positively associated with mortality are hemorrhagic stroke (AOR 21.21, 6.2-61.3), reaching hospital (late than 24h AOR 33.8, 16.65-66.6), poor compliance to anti-diabetic medication (AOR 8.46, 3.0-4.3), recurrent stroke (AOR 5.81, 2.0-13.8) poor compliance to antihypertensive (AOR 4.46, 1.4-8.0), and the advanced age  $>75$  years (AOR 6.50, 1.96-21.50) and the factor negatively associated with mortality includes being a male (AOR: 0.98, 0.41-2.31) (28).

In a research on Factors associated with death and predictors of one-month mortality from stroke in Kano, Northwestern Nigeria with logistic regression showed that severe systolic blood pressure, severe diastolic pressure, second or more episode of stroke, severe GCS, seizures, abnormal pupillary size, hemorrhagic stroke type, presence of aspiration pneumonitis, RBS  $> 200$  mg/dl were independent predictors of mortality in stroke (8).

In Ethiopia, shasahemene ischemic stroke was the most common type of stroke (65.8%) Hypertension (52.05%) was the common comorbid condition. More than half (54.79%) of the stroke patients improved on treatment. Age, sex, type of stroke, and type of comorbidity were not significant factors of stroke treatment outcome. Approximately 50% of hospitalized stroke patients had good treatment outcome and none of the investigated variables were significantly associated with the treatment outcomes (9).

Another retrospective study done by SPHMMC on assessment and treatment outcome of stroke. Hemorrhagic stroke was the most common type of stroke accounting for 61.3% of cases and the most commonly identified risk factors were; Hypertension (60.7%), structural heart disease (18.4%), atrial fibrillation (14.7%) and diabetes mellitus (11%). In hospital case fatality rate was 30.1% and a significant number (45.4%) of patients was discharged with neurologic deficit and the median duration of hospital stay was 11.14 days (22).

Another Prospective assessment of patients with stroke in Tikur Anbessa Specialized Hospital, which was a cross sectional study in 2016 in an urban tertiary care center in Addis Ababa, Ethiopia and the mean age was 53years, and 56% were male. Only 30% of patients arrived using an ambulance service. The most common presenting symptoms were altered mental status (48%), hemi paresis (47%), facial palsy (45%), hemiplegia (29%), and aphasia (25%).Hypertension was the most common risk factor (49%), followed by cardiovascular disease (20.2%) and diabetes mellitus (11%). The majority of strokes were hemorrhagic in an etiology (56%). The median arrival time to the emergency center was 24h after symptoms onset; only 15% presented within three hours. Patients with hypertension, or presented with loss of consciousness were significantly more likely to have hemorrhagic stroke ( $p < .001$  and  $p=.01$  respectively). The only risk factor robustly associated with ischemic stroke was cardiac illness (odds ratio 3.99,  $p=.01$ ) (29).

A two-year hospital-based retrospective cross-sectional study was employed to analyze the medical records of patients admitted with stroke to stroke unit of Jimma University Medical Centre from February 1st, 2016 to March 30th, 2018. Of 220 patients with stroke admitted to the Jimma University, 67.30% were male. Nearly two thirds (63.18%) of them had poor treatment outcomes. Dyslipidimics were administered to 60% of the patients, and the most popular antiplatelet used was aspirin, which was prescribed to 67.3% the patients. Age  $\geq 65$  adjusted odd ratio ((AOR): 2.56; 95% CI: 1.95-9.86,  $P = 0.001$ ), presence of comorbidity (AOR: 5.25; 95% CI: 1.08-17.69,  $P < 0.001$ ), admission with hemorrhagic stroke (AOR: 18.99; 95% CI: 7.05-42.07,  $P < 0.001$ ), and admission to the hospital after 24 hour of stroke onset (AOR: 4.98; 95% CI: 1.09-21.91,  $P = 0.03$ ) were independent predictors of poor treatment outcomes (30).

### **3. Objective**

#### **3.1 General Objective**

To assess outcomes and associated factors of stroke at AaBET and SPHMMC hospital ED from January 1, 2019 to December 30, 2022.

#### **3.2 Specific Objectives**

To describe the demographic distribution of stroke patients.

To describe clinical presentation of stroke patients to AaBET and SPHMMC hospitals ED.

To evaluate emergency department treatment of stroke in AaBET and SPHMMC hospitals ED.

To identify outcome of stroke patients in AaBET and SPHMMC hospitals ED.

To determine associated factors of stroke among patients admitted to AaBET and SPHMMC hospitals ED

### **4. Methods and Materials**

#### **4.1 Study Setting and Period**

Institution based cross sectional study was conducted from January 1, 2020 to December 30, 2022. The study was conducted in Emergency department of SPHMMC and AaBET hospital located in Addis Ababa; Ethiopia. SPMMC is one of two national referral medical centers. It was established through a decree of the council of Ministers in 2010, although the medical school opened in 2007 and the hospital was established in 1968 by the late Emperor Haile Selassie. It's governed by a board under Federal Ministry of Health. The college-initiated Ethiopia's first integrated modular and hybrid problem-based curriculum for its undergraduate medical education and diversifying post graduates programs. The college has more than 2800 clinical, academic and administrative and support staffs that provide medical specialty service to patients who are referred from all over the country. The inpatient capacity is more than 700 beds and an average of 1200 emergency and outpatient clients are seen daily in the hospital.

AaBET Hospital (Addis Ababa Burn, emergency and trauma centre) is a part of St. Paul millennium medical college; it is the first and the only trauma centre; founded in Ethiopia established 4 years back. It has an Emergency department, ICU, departments of Orthopedic and Traumatology, Neurosurgery, General surgery and Plastic surgery. At full capacity it serves as 250

beds patient load equivalent. The emergency department has Red zone with 5 beds, Orange zone with 12 beds and Yellow Green zone with 40 beds. The ICU has a total of 11beds. Both the Emergency and ICU are run by the Emergency and Critical care specialists. It provides 24 hours 7 days a week service with a comprehensive laboratory and radiography units. The later providing ultrasound, Xray and CT scan service.

## **4.2 Source and Study Population**

### **4.2.1 Source Population**

All patients admitted to AaBET and SPHMMC hospitals ED during study period.

### **4.2.2 Study Population**

All patients admitted to AaBET and SPMMC hospitals ED with the diagnosis of stroke fulfilling the inclusion criteria during the study period.

### **4.2.3 Inclusion Criteria**

Age greater than 18 years and CT scan and clinically diagnosed stroke

### **4.2.3 Exclusion Criteria**

Those patients with incomplete medical records (incomplete documentation on demographic status, clinical condition and progress, CT scan or other brain imaging, treatment, outcome and final disposition of the patient.)

## **4.3 Study Design**

Institution based cross-sectional study design was used to analyse the medical records of all stroke patients admitted to AaBET and SPHMMC hospitals ED from January1, 2020 to December 30, 2022.

## **4.4 Sample Size**

With the assumption of 95% confidence interval, a study in SPHMMC, Addis Ababa, on the Assessment of Risk Factors and Outcome of Stroke, 22% of patients had good treatment outcome, and 5% margin of error.(22)

The total sample size required was calculated as follows:-

$$n = \frac{Z_{\alpha/2}^2 p(1-p)}{d^2}$$

Where;- n = minimum sample size

P= Proportion of prevalence

d = margin of error = 5%

$Z_{\alpha/2}$  = critical value for normal distribution at 95% confidence interval= 1.96 ( $\alpha = 0.05$ ).

$$n = (1.96)^2 (0.22) (1-0.22) / 0.05^2 = 263$$

by adding 10% to none response  $263 + 26 = 289$

So the calculated final sample size is 289

#### 4.5 Sampling Technique

Simple random sampling technique was used. The medical records of all patients that fulfil the inclusion criteria and admitted to AaBET and SPHMCC hospitals ED from January 1, 2020 to December 30, 2022 was obtained. The medical record numbers was coded from 1 to the end in order. Then random numbers table was generated by a computer. From the generated random number, the first sample was marked by pencil anywhere in the table by looking away or closing eye. Subsequent sample was selected by going down the column and continuing on to the next column in the table until the 289 sample was obtained.

#### 4.6 Study Variables

##### 4.6.1 Dependent Variables

Outcomes of stroke (death and alive (discharged improved, discharged the same, transferred to other places, left against medical advice).

##### 4.6.2 Independent Variables

- ✓ Age
- ✓ Sex
- ✓ Address

- ✓ Family history(genetics)
- ✓ Atrial fibrillation
- ✓ Current Smoking
- ✓ diabetes mellitus
- ✓ Hypercholesterolemia
- ✓ Hypertension
- ✓ HIV
- ✓ Structural heart disease
- ✓ GCS
- ✓ Type of stroke
- ✓ ICH Score
- ✓ Time of presentation
- ✓ Duration of stay
- ✓ Development of complications

#### **4.7 Data Collection Procedure**

A Structured questionnaire was prepared in English language adopted from previous literatures. It contains 47 questions divided in to eight components that are demographic characteristics, conditions of the patient during referral, clinical characteristics, stroke types, vascular risk factors, ED treatment, complications and treatments and final patient disposition. Patient chart was traced and collected after getting patient card number and information from HMIS Data and the questionnaire was filled by 2 selected emergency department year one residents who was given instruction session on how to fill the data from the patient charts.

#### **4.8 Operational Definition**

**Stroke:** Either CT confirmed or clinician diagnosis, rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours.(1)

**First ever stroke;** - defined as stroke occurring in a person who never had a stroke before.(31)

**Recurrent stroke:** A new stroke event occurring at least 28 days after the incident event.(31)

**Poor follow up:** Patients who don't have follow up for identified risk factor and who discontinued follow up.

**Outcome:** conditions of patients written on patients chart at disposition from emergency department (alive and death).

**Alive:** If the patient is discharged, transferred to other ward and discharged against medical advice.

#### **4.9 Data Quality Control**

The overall activity was controlled by the investigators of the study. The data collection team was trained on data collection process for 02 hrs. Data quality was controlled by designing the proper data collection materials and through continuous supervision. The medical chart number of the patient was checked whether clinically matched (stroke patient) or not. Completeness, accuracy and consistency of data collection was checked on each day of the data collection period, before using the filled questionnaires. All completed data collection form was examined for completeness and consistency during data storage and analysis.

#### **4.10 Data Processing and Analysis**

The collected data was checked manually for incompleteness and inconsistencies. Data was entered into Google form and analyzed by SPSS version 25.0. Bivariable and multivariable binary logistic regression analyses was used to identify factors significantly associated with stroke outcome. Adjusted Odds Ratio (95% CI) and  $P \leq 0.05$  was used to measure the association.

#### **4.11 Ethical consideration**

Ethical clearance and approval to conduct the research was obtained from St. Paul Hospital Millennium Medical College and department of emergency medicine and critical care, Addis Ababa. Study holds no harm to study population and the confidentiality will be guaranteed.

#### **4.12 Dissemination of the results**

The result of the study will be communicated to St Paul hospital millennium medical college, Department of emergency medicine and critical care. Finally, it will be published on reputable journal.

## 5. Results

A total of 289 medical record numbers were randomly selected and only 251 retrieved from record room, the remaining 38 lost. 237 cases fulfilling inclusion criteria were selected for analysis. 14 patients card were excluded due to incomplete data.

### 5.1 Socio demographic characteristics

The mean (SD) age of patients was 57.73 (13.01) years. Almost half of the patients were between 35-60 years. 128 (54.0%) were male. Most of the patients reside in Oromia and Addis Ababa region. Most patients arrive to the emergency department either with public taxi or ambulance. (*Table 1*)

Table 1 Socio demographic characteristics of the stroke patients, SPHMMC from January 1, 2020 to December 30, 2022

| Variables                  | Frequency | Percentage |
|----------------------------|-----------|------------|
| <b>Patient's age group</b> |           |            |
| <35 years                  | 7         | 3.0%       |
| 35-60 years                | 134       | 56.5%      |
| >60                        | 96        | 40.5%      |
| <b>Gender</b>              |           |            |
| Male                       | 128       | 54.0       |
| Female                     | 109       | 46.0       |
| <b>Residency region</b>    |           |            |
| Oromia                     | 133       | 56.1       |
| Addis Ababa                | 96        | 40.5       |
| Amhara                     | 4         | 1.7        |
| SNNPR                      | 3         | 1.3        |
| Somali                     | 1         | 0.4        |
| <b>Mode of arrival</b>     |           |            |
| Public taxi                | 93        | 39.2       |
| Ambulance                  | 91        | 38.4       |
| Private car                | 53        | 22.4       |

### 5.2 Referral Condition

Only one-fourth of the patients were self-referral. Imaging and better management were the most commonly documented reasons for referral among referred cases. 61 (34.9%) and 60 (34.3%) of the patients were referred from a health center and primary hospital respectively. (*Table 2*)

Table 2 Referral condition of the stroke patients, SPHMMC from January 1, 2020 to December 30, 2022

| Variables                | Frequency | Percentage |
|--------------------------|-----------|------------|
| <b>Was self-referral</b> |           |            |
| No                       | 174       | 73.4       |

|                                         |     |       |
|-----------------------------------------|-----|-------|
| Yes                                     | 63  | 26.6  |
| <b>Reason for referral (n=174)</b>      |     |       |
| Better management                       | 174 | 100.0 |
| For imaging                             | 172 | 98.9  |
| Patient request                         | 2   | 1.1   |
| <b>Referring facility level (n=174)</b> |     |       |
| Health center                           | 61  | 34.9  |
| Primary hospital                        | 60  | 34.3  |
| General hospital                        | 31  | 17.7  |
| Private health facility                 | 17  | 9.7   |
| Referral hospital                       | 6   | 3.4   |

### 5.3 Clinical Characteristics

The median (IQR) duration of time to hospital presentation was 24 (8-48) hours. Most patients presented 12 hours after symptom onset. Only 17.3% patients present within 4.5 hours of symptom onset which made difficult the practice of emergency standard treatment less likely especially for ischemic stroke. Most patients' (79.7%) presenting complaint was body weakness followed by loss of consciousness (15.6%). (*Table 3*)

Table 3 Clinical characteristics of the stroke patients, SPHMMC from January 1, 2020 to December 30, 2022

| Variable                                      | Frequency | Percentage |
|-----------------------------------------------|-----------|------------|
| <b>Duration of presentation</b>               |           |            |
| Less than 3 hours                             | 19        | 8.0        |
| 3-4.5 hours                                   | 22        | 9.3        |
| 4.6-12 hours                                  | 41        | 17.3       |
| 12-24 hours                                   | 80        | 33.8       |
| After 24 hours                                | 75        | 31.6       |
| <b>Initial GCS</b>                            |           |            |
| 3-8                                           | 29        | 12.2       |
| 9-12                                          | 36        | 15.2       |
| 13-15                                         | 172       | 72.6       |
| <b>Main presenting complaints</b>             |           |            |
| Body weakness                                 | 189       | 79.7       |
| Loss of consciousness                         | 37        | 15.6       |
| Headache                                      | 5         | 2.1        |
| Speech abnormality                            | 4         | 1.7        |
| Visual abnormality                            | 1         | 0.4        |
| Abnormal body movement                        | 1         | 0.4        |
| <b>Body side affected by weakness (n=187)</b> |           |            |
| Right                                         | 101       | 54.0       |
| Left                                          | 86        | 46.0       |

#### 5.4 Stroke subtypes

Hemorrhagic stroke was the leading cause of stroke carrying 53.6% (127) of stroke burden from total patients of 237. All of hemorrhagic stroke patients were with ICH. Most of the hemorrhagic stroke patients had ICH score of 1 and 0.8 %( 2) people had recurrent stroke. (*Table 4, Figure 1*)

Table 4 Risk factors of the stroke patients, SPHMMC from January 1, 2020 to December 30, 2022

| Variable              | Frequency | Percentage |
|-----------------------|-----------|------------|
| <b>Stroke type</b>    |           |            |
| Ischemic              | 110       | 46.4       |
| ICH                   | 127       | 53.6       |
| <b>Stroke episode</b> |           |            |
| First                 | 235       | 99.2       |
| Repeat episode        | 2         | 0.8        |

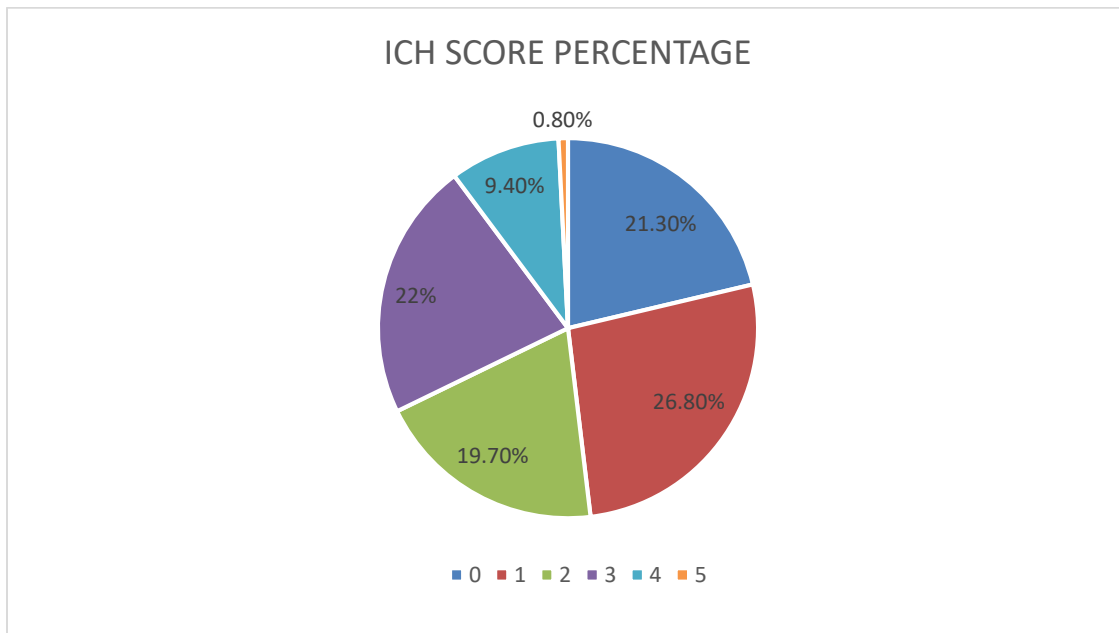


Figure 1 ICH score of hemorrhagic stroke patients, SPHMMC from January 1, 2020 to December 30, 2022

## 5.5 Diagnostic Imaging

CT scan was done for all the patients. But proper radiologist comment was attached in only 70% of patients. Out of those most of the patients have abnormal CT findings. MCA territory was the most commonly affected territory among patients with ischemic stroke. ECG Was done in 58.2% of patients. In more than half of the patients ECG abnormality was identified and LVH was the most common ECG abnormality followed by atrial fibrillation. Most patients have abnormal echocardiography results and LVH was the most common abnormality. (*Table 5* )

Table 5 Diagnostic imaging of the stroke patients, SPHMMC from January 1, 2020 to December 30, 2022

| Variable                             | Frequency | Percentage |
|--------------------------------------|-----------|------------|
| <b>Diagnostic investigation done</b> |           |            |
| CT scan                              | 237       | 100        |
| ECG                                  | 138       | 58.2       |
| Echocardiography                     | 26        | 11.0       |
| Doppler ultrasound                   | 5         | 2.1        |
| MRI                                  | 3         | 1.3        |
| <b>CT findings(n=165)</b>            |           |            |
| Normal                               | 5         | 3.0        |
| Abnormal                             | 160       |            |
| <b>Ischemic territory(n=72)</b>      |           |            |
| ACA                                  | 1         | 1.4        |
| MCA                                  | 52        | 72.2       |
| PCA                                  | 5         | 6.9        |
| MCA and ACA                          | 4         | 5.6        |
| MCA and PCA                          | 2         | 2.8        |
| lacunar infarction                   | 8         | 11.1       |
| <b>ICH location(n=88)</b>            |           |            |
| Basal ganglia                        | 54        | 61.4       |
| Pontine                              | 17        | 19.3       |
| Lobar                                | 8         | 9.1        |
| Thalamic                             | 6         | 6.8        |
| Cerebellar                           | 3         | 3.4        |
| <b>Any ECG abnormality(n=138)</b>    |           |            |
| No                                   | 64        | 46.0       |
| Yes                                  | 74        | 54.0       |
| <b>ECG abnormalities (n=74)</b>      |           |            |
| LVH                                  | 51        | 68.9       |

|                                            |    |       |
|--------------------------------------------|----|-------|
| Atrial fibrillation                        | 11 | 14.7  |
| RBBB                                       | 5  | 6.8   |
| STEMI                                      | 3  | 4.1   |
| LBBS                                       | 2  | 2.7   |
| Other findings                             | 11 | 14.9  |
| <b>MRI finding(n=3)</b>                    |    |       |
| Abnormal                                   | 3  | 100.0 |
| <b>Carotid ultrasound findings(n=6)</b>    |    |       |
| Normal                                     | 4  | 80.0  |
| Plaque                                     | 2  | 20.0  |
| <b>Echocardiography findings(n=27)</b>     |    |       |
| Normal                                     | 5  | 18.5  |
| Abnormal                                   | 22 | 81.5  |
| <b>Main Echocardiography abnormalities</b> |    |       |
| LVH                                        | 9  | 40.9  |
| DVHD                                       | 7  | 31.8  |
| CRVHD                                      | 3  | 13.6  |
| IHD                                        | 3  | 13.6  |

## 5.6 Risk Factors

Hypertension was found to be the most common identified risk factor in 97.6 %( 202) patients, followed by hypercholesterolemia in 13 %( 27) patients. Diabetes mellitus was identified in 25 patients. 12.7 %( 30) patients didn't have any identified risk factors. One fourth of the patients do not know having any RF and 45 (21.7%) of the patients know they have risk factor but do not have any follow-up for the identified RFs. (*Table 6, Table 7, Figure 2*)

Table 6 Risk factors of the stroke patients, SPHMMC from January 1, 2020 to December 30, 2022

| Variable                 | Frequency | Percentage |
|--------------------------|-----------|------------|
| <b>Have any RF</b>       |           |            |
| No                       | 30        | 12.7       |
| Yes                      | 207       | 87.3       |
| <b>RFs (n=207)</b>       |           |            |
| Hypertension             | 202       | 97.6       |
| Hypercholesterolemia     | 27        | 13.0       |
| Diabetes mellitus        | 25        | 12.1       |
| Structural heart disease | 25        | 12.1       |
| Atrial fibrillation      | 10        | 4.8        |
| Smoking                  | 5         | 2.4        |
| HIV                      | 4         | 1.9        |

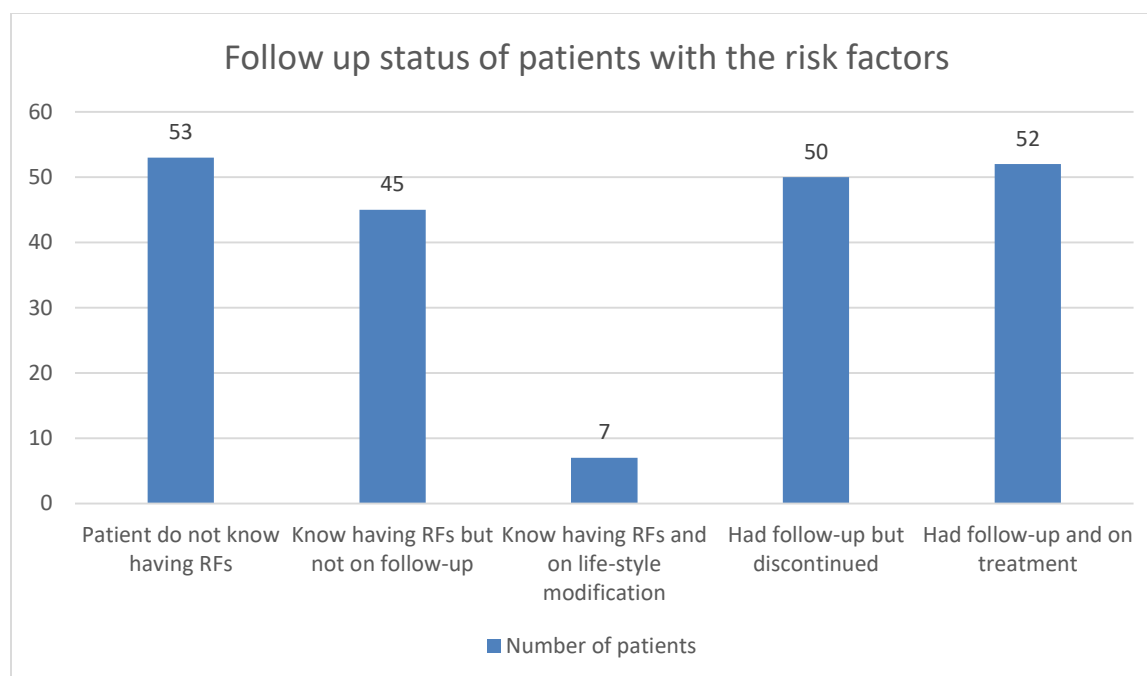


Figure 2 Follow up status of patients with the risk factors, SPHMMC from January 1, 2020 to December 30, 2022

Table 7 Risk factors for each type of stroke, SPHMMC from January 1, 2020 to December 30, 2022

| Variables                | Hemorrhagic stroke | Ischemic stroke |
|--------------------------|--------------------|-----------------|
| <b>Age</b>               |                    |                 |
| <35 years                | 3(43.8%)           | 4 (56.2%)       |
| 35-60 years              | 79 (58.9%)         | 55 (41.1%)      |
| >60 years                | 45 (46.9%)         | 51 (53.1%)      |
| <b>Gender</b>            |                    |                 |
| Male                     | 74 (57.8%)         | 54 (42.2%)      |
| Female                   | 53 (48.6%)         | 56 (51.4%)      |
| <b>RFs</b>               |                    |                 |
| Hypertension             | 117 (57.9%)        | 85 (42.1%)      |
| Dyslipidemia             | 12 (44.4%)         | 15 (55.6%)      |
| Diabetes mellitus        | 9 (36.0%)          | 16 (64.0%)      |
| Atrial fibrillation      | 1 (10.0%)          | 9 (90.0%)       |
| Structural heart disease | 8(32.0%)           | 17(68.0%)       |
| Smoking                  | 3(60.0%)           | 2(40.0%)        |
| HIV                      | 3(75.0%)           | 1(25.0%)        |

## 5.7 Emergency department treatment of stroke and Complications

All of the patients with ischemic stroke received medical treatment with Aspirin and statin and none of them received iv thrombolysis. Most patients with ICH given antihypertensive for hypertensive emergency and Nifedipine was the most commonly used drug to lower blood pressure. (*Table 8*)

169(71.3%) of the patients didn't develop any complication in the ED while 68 (28.7%) of the patients developed complications in the ED. Increased ICP followed by aspiration pneumonia were the most common complications. Only 6 (2.5%) of the patients developed seizure and phenytoin was used in all of them. Only 5 (2.1%) of the patients were intubated and airway protection was the most common indication for intubation. Medical management of increased ICP was attempted to all of the patients and only 3 patients was taken to OR for neurosurgical intervention of the ICP. (*Table 8*)

Table 8 Complications and treatment in the emergency department, SPHMMC from January 1, 2020 to December 30, 2022

| Variable                                    | Frequency | Percentage |
|---------------------------------------------|-----------|------------|
| <b>Treatment for hypertensive emergency</b> |           |            |
| Nifedipine                                  | 83        | 73.5       |
| Labetalol                                   | 59        | 52.2       |
| Other medication                            | 4         | 3.5        |
| <b>Developed any complication in the ED</b> |           |            |
| No                                          | 169       | 71.3       |
| Yes                                         | 68        | 28.7       |
| <b>Complications in the ED (n=68)</b>       |           |            |
| ICP                                         | 52        | 76.5       |
| Aspiration pneumonia                        | 32        | 47.1       |
| Electrolyte disturbance                     | 9         | 13.2       |
| Other                                       | 11        | 16.2       |
| <b>ICP management (n=52)</b>                |           |            |
| Medical                                     | 52        | 100.0      |
| Decompression craniotomy                    | 2         | 3.8        |
| EVD insertion                               | 1         | 1.9        |
| <b>Had seizure</b>                          |           |            |
| No                                          | 231       | 97.5       |
| Yes                                         | 6         | 2.5        |
| <b>Anti-seizure medication (n=6)</b>        |           |            |
| Diazepam                                    | 5         | 83.3       |
| Phenytoin                                   | 6         | 100.0      |
| <b>Patient was intubated</b>                |           |            |
| No                                          | 232       | 97.9       |
| Yes                                         | 5         | 2.1        |
| <b>Indication for intubation (n=5)</b>      |           |            |
| Air way protection                          | 4         | 80.0       |

### 5.8 Outcome and Possible causes of death

93 (45.4%) of the patients were discharged home with improvement while 32 (13.5%) died. The median (IQR) Ed stay was 2 (1-3.5) days. Over three fourth of the patients stayed more than 1 day at the ED. Among survived patients 14 (6.8%) and 3 (1.5%) were admitted to inpatient ward and ICU respectively. Brain herniation was the most common cause of death. The median duration from development of stroke and death was 3 (2-4) days and in 71.9% of the patients the duration from development of stroke to death was 2-7 days. (Table 9, Figure 3)

Table 9 Outcome and possible cause of death in the emergency department, SPHMMC from January 1, 2020 to December 30, 2022

| Variable                                               | Frequency | Percentage |
|--------------------------------------------------------|-----------|------------|
| <b>Patients survival status at time of disposition</b> |           |            |
| Alive                                                  | 205       | 86.5       |
| Death                                                  | 32        | 13.5       |
| <b>Duration of ED stay</b>                             |           |            |
| 1 day and less                                         | 56        | 23.6       |
| More than 1 day                                        | 181       | 76.4       |
| <b>Patient disposition</b>                             |           |            |
| Discharged to home with improvement                    | 93        | 45.4       |
| Discharged to home without improvement                 | 72        | 35.1       |
| Left against medical advices                           | 23        | 11.2       |
| Transferred to ward                                    | 14        | 6.8        |
| Transferred to ICU                                     | 3         | 1.5        |
| <b>Best possible cause of death at ED (n=32)</b>       |           |            |
| Brain herniation                                       | 30        | 93.8       |
| T1 respiratory failure                                 | 2         | 3.1        |
| <b>Duration from stroke to death(n=32)</b>             |           |            |
| 1 day and less                                         | 9         | 28.1       |
| 2-7 days                                               | 23        | 71.9       |

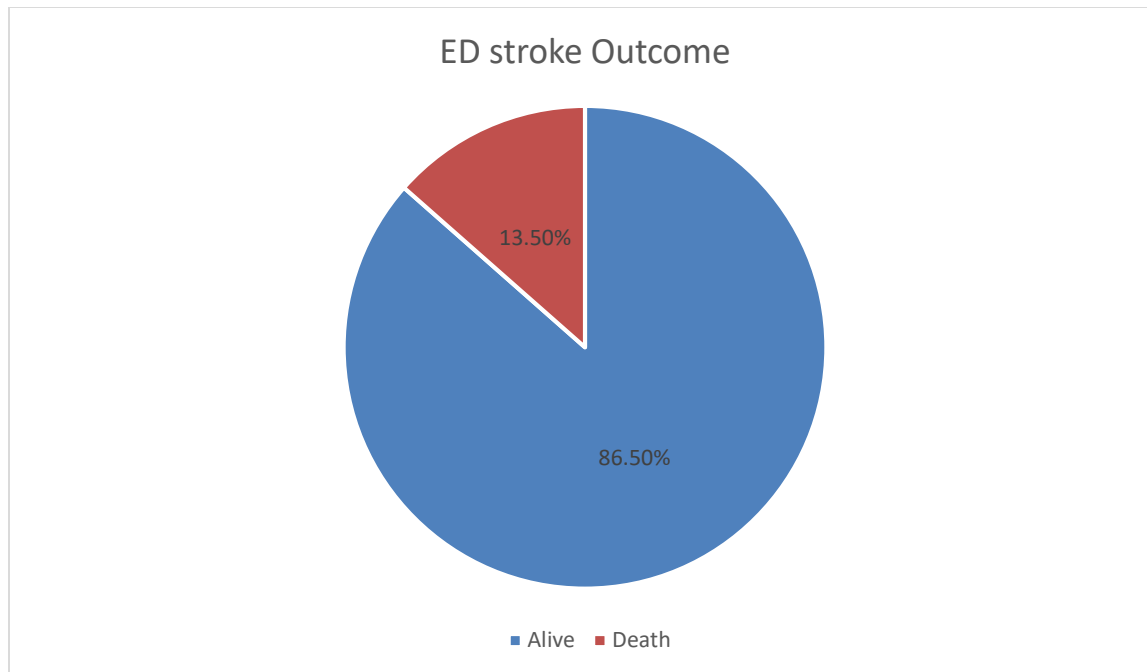


Figure 3 Emergency department stroke outcome, SPHMMC from January 1, 2020 to December 30, 2022

### 5.9 Factors associated with ED mortality

On bivariable logistic regression, patients age, sex, means of arrival to ED, risk factors and complication types were not found to have statistically significant association with mortality. On the other hand time of presentation, duration of presentation, initial GCS, ICH score, type of stroke, duration of ED and development of complication were found to have statistically significant association with mortality. As GCS score increases the likelihood of death decreases. Patients who present 12-24 hours and after 24 hours were less likely to die than patients who present before 3 hours. Patients with ICH score of above 2 were 32 times more likely to die than patients with ICH score of 0-2. Patients who stayed more than 1 day in the ED are less likely to die than patients who stayed 1 day and less at the ED. Patients who developed complications were 21 times more likely to die than patients who did not developed any complications.

On multivariable logistic regression, only GCS and development of complications were found to have statistically significant association with ED mortality. Patients with GCS 13-15 and 9-12 were less likely to die than patients with GCS 3-8. Patients who developed complication were 7 times more likely to die than patients who did not developed any complication. (*Table 10, Table 11*)

Table 10 Risk factors of stroke and association with Emergency department mortality, SPHMMC from January 1, 2020 to December 30, 2022

| Variables                   | Patient survival |             | COR (95% CI)         | p-value |
|-----------------------------|------------------|-------------|----------------------|---------|
|                             | Death            | Alive       |                      |         |
| <b>Age category</b>         |                  |             |                      |         |
| <35 years                   | 1(14.3%)         | 6(85.7%)    | 1.00                 |         |
| 35-60 years                 | 18 (13.4%)       | 116 (86.6%) | 0.931 (0.106, 8.191) | .949    |
| >60                         | 13(13.5%)        | 83(86.5%)   | 0.940(0.105, 8.450)  | .956    |
| <b>Sex</b>                  |                  |             |                      |         |
| Male                        | 22(17.2%)        | 106 (82.8%) | 1.00                 |         |
| Female                      | 10 (9.2%)        | 99 (90.8%)  | 0.487 (0.220,1.079)  | .361    |
| <b>Hypertension</b>         |                  |             |                      |         |
| No                          | 4 (11.4%)        | 31 (88.6%)  | 1.00                 |         |
| Yes                         | 28 (13.9%)       | 174 (86.1%) | 1.247 (0.409,3.804)  | .698    |
| <b>Atrial fibrillation</b>  |                  |             |                      |         |
| No                          | 31 (13.7%)       | 196 (86.3%) | 1.00                 |         |
| Yes                         | 1 (10.0%)        | 9 (90.0%)   | 0.703 (0.086,5.739)  | .742    |
| <b>DM</b>                   |                  |             |                      |         |
| No                          | 27 (12.7%)       | 185 (87.3%) | 1.00                 |         |
| Yes                         | 5 (20.0%)        | 20 (80.0%)  | 1.713 (0.594,4.944)  | .320    |
| <b>Hypercholesterolemia</b> |                  |             |                      |         |
| No                          | 31 (14.8%)       | 179 (85.2%) | 1.00                 |         |
| Yes                         | 1 (3.7%)         | 26 (96.3%)  | 0.222 (0.029,1.697)  | .347    |
| <b>Smoking</b>              |                  |             |                      |         |
| No                          | 32 (13.8%)       | 200 (86.2%) | 1.00                 |         |
| Yes                         | 0 (0.0%)         | 5 (100.0%)  | 0.000                | .999    |

Table 11 Conditions associated with emergency mortality, SPHMMC from January 1, 2020 to December 30, 2022

| Variables                    | Patient survival |             | COR (95% CI)           | p-value | AOR (95% CI)         | p-value     |
|------------------------------|------------------|-------------|------------------------|---------|----------------------|-------------|
|                              | Death            | Alive       |                        |         |                      |             |
| <b>GCS</b>                   |                  |             |                        |         |                      |             |
| 3-8                          | 22 (75.9%)       | 7 (24.1%)   | 1.00                   |         |                      |             |
| 9-12                         | 6 (16.7%)        | 30 (83.3%)  | 0.064 (0.019,0.216)    | .000    | 0.027 (0.005,0.147)  | <b>.000</b> |
| 13-15                        | 4 (2.3%)         | 168 (97.7%) | 0.008 (0.002,0.028)    | .000    | 0.010 (0.002,0.054)) | <b>.000</b> |
| <b>Stroke</b>                |                  |             |                        |         |                      |             |
| Ischemic stroke              | 7 (6.4%)         | 103 (93.6%) | 1.00                   |         |                      |             |
| ICH                          | 25 (19.7%)       | 102 (80.3%) | 3.606 (1.493,8.710)    | .004    | 0.788 (0.187,3.319)  | .746        |
| <b>ICH score</b>             |                  |             |                        |         |                      |             |
| 0-2                          | 3 (3.5%)         | 83 (96.5%)  | 1.00                   |         | 1.00                 |             |
| 3-5                          | 22 (53.7%)       | 19 (46.3%)  | 32.035 (8.685,118.160) | .000    | 8.381 (0.743,94.471) | .085        |
| <b>Time of presentations</b> |                  |             |                        |         |                      |             |
| < 3 hours                    | 7 (36.8%)        | 12 (63.2%)  | 1.00                   |         |                      |             |
| 3-4.5 hours                  | 5 (22.7%)        | 17 (77.3%)  | 0.325 (0.129,1.974)    | .325    | 1.853 (0.180,19.041) | .604        |
| 4.6-12 hours                 | 10 (24.4%)       | 31 (75.6%)  | 0.553 (0.171,1.788)    | .322    | 2.176 (0.286,16.562) | .453        |

|                                    |            |             |                        |      |                      |             |
|------------------------------------|------------|-------------|------------------------|------|----------------------|-------------|
| 12-24 hours                        | 7 (8.8%)   | 73 (91.3%)  | 0.164 (0.049,0.553)    | .004 | 0.568 (0.075,4.292)  | .583        |
| After 24 hours                     | 3 (4.0%)   | 72 (96.0%)  | 0.071 (0.016,0.315)    | .000 | 0.296 (0.034,2.580)  | .270        |
| <b>Duration of stay</b>            |            |             |                        |      |                      |             |
| 1 day and less                     | 15 (26.8%) | 41 (73.2%)  | 1.00                   |      | 1.00                 |             |
| > 1 day                            | 17 (9.4%)  | 164 (90.6%) | 0.283 (0.131,0.614)    | .001 | 0.201 (0.039,1.042)  | .056        |
| <b>Developed any complications</b> |            |             |                        |      |                      |             |
| No                                 | 5 (3.0%)   | 164 (97.0%) | 1.00                   |      | 1.00                 |             |
| Yes                                | 27 (39.7%) | 41 (60.3%)  | 21.600 (7.838,59.528)) | .000 | 7.059 (1.610,30.953) | <b>.010</b> |

## 6. Discussion

This study included 237 stroke patients admitted to both AaBET and SPHMMC hospitals' emergency department. The socio-demographic factors, clinical presentation, risk factors, types of stroke and emergency department outcome were identified.

In this study most of the patients were in the age group of 35-60(56.5%) followed by the age group of >60 (40.5%) which is similar to the study that was done in Tikur Anbesa hospital in Addis Ababa, in Jimma hospital and the previous study(22,29,32). The mean age of stroke patients in this study was  $57.3 \pm 13.01$  which is similar to the previous study in this hospital and with the study that was done in Jimma hospital but it higher from the study done in Tikur Anbesa hospital which was  $53 \pm 17$  and it is lower than study that was done in Gonder and in some sub-Saharan countries (8,11,22,29,33). This significant variation in age of the stroke patients could be due to liability of hospital based studies to selection bias of demographic differences. Males were higher than females with ratio of 1.17:1 in this study which is similar to other studies that was done in this country, Sub-Saharan and western countries (8,10,12,22,23,28–36).

Most of the patients arrive to the Emergency with public taxi and 38.4% patients arrive with ambulance which is slightly higher than the study that was done in Tikur Anbesa hospital (30%)(29). This is maybe due to the improved Ambulance service of the referral system which yet requires further changes and improvement. The median of hospital presentation was 24 hours from the symptom of onset. Around two third of the patients arrived after 12 hours of symptom of onset and only 17.3% of patients arrived within 4.5 hours of symptom of onset. This finding is similar with the study that was done in Tikur Anbesa hospital and in Gonder hospital(29,33). The delay in presentation could probably be due to a delay in the referral system and community level of attention to the condition unless it didn't become worst. This can make the standard practice of thrombolysis medication to ischemic stroke patients with the currently available anti-thrombolytic

drugs in the city very difficult. The most common presenting complaint was body weakness (79.7%), in which in 54% patients it was right side, followed by loss of consciousness in 15.6% patients. This finding is consistent to study done in Gonder hospital where body weakness accounts for 85.5% of presenting complaints(33). On the other hand this finding is different from the study that was done in Tikur Anbesa and Jimma hospitals in which altered mental status (48%) and headache (75%) were the most common clinical presentations respectively(29,32). The difference may be due to the nature of the study where the data is collected from what is documented in the medical record which could be influenced by treating physicians' history taking bias.

The commonest type of stroke identified in this study was hemorrhagic stroke followed by ischemic stroke with ratio of 1.16:1. Even though the commonest type of stroke in USA, westerns and other African countries is ischemic stroke(4-8,12-16,28,34,37) in the previous study in this hospital, in the study that was done in Tikur Anbesa hospital and most other referral hospital studies in this country was hemorrhagic stroke(22,29-34). This could be due to two reasons, the first one is all of the hemorrhagic stroke patients were hypertensive at the time of presentation but more than half of patients were not on proper follow up and treatment. The second reason is, since this is tertiary hospital were patients with major neurologic deficit treated, those patients with ischemic stroke and minor neurologic deficit may be managed in primary and general hospitals.

In this study hypertension was found to be the commonest identified modifiable risk factor for both hemorrhagic and ischemic stroke. This finding is consistent with the previous study in this hospital and other studies in this country and in other African and outside the continent (8,9,12,16,17,22,24,28-36). The percentage of hypertension in this study is higher compared to the previous study, while the percentage of DM was comparable in both(22). Atrial fibrillation percentage was very low in this study compared with the previous study. This is probably due to the retrospective nature of the data collected the traced ECG done was only in 58.2% of patients and it was done only once in most patients where paroxysmal atrial fibrillation could be missed. Similar to the other studies(8,22,28-36), the proportion of smoking and HIV was low. Since the data was obtained from medical record charts information on alcohol, sedentary life style and obesity couldn't be collected which make it difficult to associate their effect on the outcome of stroke. Most of the stroke patients have poor follow up for the identified risk factors (25.6% of patients don't know that they have the risk factor, 21.7% patients know they have the risk factor but not on follow up and 24.2% patients discontinued treatment and follow up). This finding is

consistent to the study that was done in Jimma hospital(32). The discontinuation and not having follow up for the risk factors may be due to lack of adequate information or ignorance of the risk factors, even though they understand and misconception of taking medication for hypertension could adapt and worsen the condition. This result shows importance of community screening protocol and social awareness gap on the risk factor follow up and management.

The emergency department mortality rate in this study was 13.5% which is lower than the previous study in this hospital and other studies in Sub-Saharan countries (8,13,22,28,34). This result is similar with finding from a systematic review of pooled mortality rate in Ethiopia which was 14.03%(15). The difference with the studies may be due to the difference in baseline clinical characteristics of the patients where 72.6% of patients had admission GCS of 13-15 in this study. In this study case fatality rate was higher in hemorrhagic stroke(21.3%) than ischemic stroke(6.4%) similar to the previous study and other studies in the country and sub-Saharan countries (8,9,22,28,29,32). Age, sex and other risk factors were not associated with mortality which is consistent with the previous study done in this hospital and systematic review of pooled mortality rate in Ethiopia (15,22). GCS<8 and presence of complications were associated with mortality in the emergency department. This finding is consistent with the systematic review of pooled predictors of in-hospital mortality in Ethiopia(15).

## **7. Conclusion**

In this study, hemorrhagic stroke was the commonest stroke. Hypertension was the most common risk factor identified. More than half of patients have poor follow up for the identified risk factor. Most of the patients were discharged from the emergency department with improvement. GCS<8 and development of complication were associated with emergency department mortality of stroke while age, sex and risk factors like hypertension, DM, Atrial fibrillation, structural heart disease and smoking were not associated with mortality.

## **8. Strengths and Limitations of the study**

As to our knowledge there is no published study of stroke that was done in both AaBET and SPHMMC hospitals emergency department. This study has several limitations. It is a tertiary hospital based study rather than longitudinal community based study. So the findings of this study may not be representative of all cases of stroke occurring in the community for two reasons. First

this study may be subjected to referral bias as most of the cases are referred from fixed catchment areas of this tertiary hospital. Second most patients presented with mild neurological symptoms may not be referred to this hospital and managed in the nearby primary or general hospitals. The other limitation is the study was based on retrospective chart review, the data obtained was not adequate on some important risk factors and on objective assessment of neurological outcome and functional limitation during discharge or transfer.

## **9. Recommendation**

Based on the results of this study we recommend

1. The Federal Ministry of Health and other regional health Bureau should consider
  - Preparing Strategies for screening of each risk factors
  - Community health education should be promoted to create awareness on importance of screening, drug adherence and having follow up
2. To SPHMMC
  - Advancement and Improvement of the emergency set up for early identification and management of stroke related emergency department
3. To Emergency and critical care department
  - Developing protocols on the emergency management of stroke and their complications
4. To Researchers
  - A prospective hospital based study at each hospital and community based stroke incidence and prevalence studies are required to define the true socio demographic characteristics of stroke, outcomes and associated factors in our population

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## 11. ANNEXS

### ANNEX 1: Questionnaires

Questionnaire's identification number \_\_\_\_\_

#### I. Demographic Characteristics

1. MRN: \_\_\_\_\_
2. Sex     A. Female                      B. Male
3. Age - \_\_\_\_\_
4. Address   A. Addis Ababa   B. Oromia   C. Amhara  
                    D. SNNP              E. Sidama   E. Others, specify \_\_\_\_\_
5. Mode of arrival to ED   A. Ambulance   B. Private Car   C. Public taxi   D. Others  
specify \_\_\_\_\_

#### II. Condition of the patient during referral

6. Was the patient self-referral     A. Yes     B. No
- If the answer for above question no answer the following question accordingly (questions 6-8)
7. Diagnosis of referral paper \_\_\_\_\_
    - A. Body weakness secondary to? IS
    - B. Body weakness secondary to? HS
    - C. R/o stroke
    - D. Coma secondary to? HS
    - E. Coma secondary to? IS
    - F. Aphasia secondary to? IS
    - G. Aphasia secondary to? HS
    - H. Other (specify)
  8. Reason for referral \_\_\_\_\_
    - A. imaging and further management     B. patient preference for better management
    - C. neurosurgical evaluation   D. other specify
  9. Level of referring health institution
    - A. general hospital   B. primary hospital   C. referral hospital   D. health center   E. private health facility

### III. Clinical Characteristics

10. Duration from last normal time to hospital presentation; \_\_\_\_\_
11. ED Triage category;    A. Red   B. Orange   C. Yellow   D. Green
12. HR during initial ED presentation \_\_\_\_\_
13. Blood pressure during initial ED presentation \_\_\_\_\_
14. Respiratory rate during initial ED presentation \_\_\_\_\_
15. Oxygen saturation during initial ED presentation \_\_\_\_\_
16. Initial GCS \_\_\_\_\_
17. Initial RBS \_\_\_\_\_
18. Pupillary exam   A. normal   B. anisocoric   C. both dilated and non-reactive   D. pin point
19. Main patients presenting complaint   A. Rt body weakness   B. Lt Body weakness   C. Headache  
D. Loss of consciousness   E. Abnormal body movement   F. Rt Facial deviation   G. Lt facial deviation  
H. Speech abnormality   I. Visual abnormality   J. Others specify \_\_\_\_\_
20. If coagulation profile was done, INR\_\_\_\_   APTT\_\_\_\_\_
21. What was serum creatinine? (If it was done) \_\_\_\_\_
22. If lipid profile was done, Total cholesterol\_\_\_\_\_, LDL\_\_\_\_\_, HDL \_\_\_\_\_  
Triglyceride\_\_\_\_\_

### IV. Stroke types

23. What was the type of the stroke?  
A. Ischemic stroke   B. Intra cerebral hemorrhage  
C. Subarachnoid hemorrhage   D. Unspecified type
24. What was type of the patient stroke event during ED Presentation?  
A. First ever   B. Recurrent
25. If the stroke type was intracerebral hemorrhage what was the ICH Score  
A.0 B.1 C.2 D.3 E.4 F.5
26. Which of the following diagnostic examinations were performed?  
A. CT scanning   B. CT angiography   C. Electrocardiogram  
D. Lumbar puncture   E. Medical autopsy   F. MRI scanning

G. Angiography   H. Carotid Ultrasound   I. Fundoscopy

J. Other\_\_\_\_\_

27. What was the result of each investigation if it was done at all?

A. CT scanning \_\_\_\_\_

B. CT angiography \_\_\_\_\_

C. Electrocardiogram \_\_\_\_\_

D. Lumbar puncture \_\_\_\_\_

E. Medical autopsy \_\_\_\_\_

F. MRI scanning \_\_\_\_\_

G. Angiography \_\_\_\_\_

H. Carotid Ultrasound \_\_\_\_\_

I. Fundoscopy \_\_\_\_\_

J. Other\_\_\_\_\_

#### **V. Vascular risk factors**

28. Which of the following vascular risk factors were noted for the patient (choosing more than one option is possible)?

A. Atrial fibrillation\_\_\_\_\_

B. current Smoking \_\_\_\_\_

C. Diabetes mellitus \_\_\_\_\_

D. Hypercholesterolemia \_\_\_\_\_

E. Hypertension\_\_\_\_\_

F. Transient ischemic attack \_\_\_\_\_

H. Structural heart disease \_\_\_\_\_

I. Family history (genetics) \_\_\_\_\_

J. Sedentary life style \_\_\_\_\_

K. Obesity \_\_\_\_\_

L. Anticoagulation \_\_\_\_\_

M. HIV \_\_\_\_\_

N. Unknown \_\_\_\_\_

O. Others (specify) \_\_\_\_\_

29. Was the patient on follow up for identified risk factor?

- A. No, S /He didn't know whether he had identified risk factor
- B. No, S/He know that he had the risk factor but not on follow up
- C. Yes, S/He had the follow up and life style modification
- D. Yes, S/He had the follow up and treatment
- E. Yes, S/He had the follow up but discontinued the medication for awhile
- F. No identified risk factor

#### VI. ED Treatment

30. If the stroke type was ischemic stroke what specific medical therapy was given? (More than one answer is possible)

- A. Aspirin B. Statins C. IV thrombolysis D. Others (specify) \_\_\_\_\_

31. If the patient had hemorrhagic stroke and was in hypertensive emergency with which antihypertensive was the blood pressure controlled? (More than one answer is possible)

- A. Labetalol B. Nifedipine C. Esmolol D. Others specify \_\_\_\_\_

#### VII. Complications and Treatment in ED

32. Did the patient develop any complication during ED stay? A. Yes B. No

33. If yes is the answer to the above question what complications did the pt develop? (More than one answer is possible)

- A. Aspiration pneumonia B. Myocardial infarction C. Electrolyte disturbance D. Seizure disorder E. increased ICP G. Other, specify \_\_\_\_\_

34. If the patient developed seizure what drugs are used to control seizure? (More than one answer is possible)

- A. Diazepam B. Phenytoin C. Phenobarbital D. Carbamazepine E. Valproic acid F. Others (specify) \_\_\_\_\_

35. If the patient is intubated what was the indication for intubation

- A. Airway protection B. T1 Respiratory failure C. T2 Respiratory failure D. Mixed Respiratory failure

36. If the patient developed increased ICP, how was it managed?

A. Only medically B. Both medically and decompressive craniectomy C. Both medically and EVD insertion

### **VIII. Final Patient Disposition**

37. For how long did patient stayed at ED before discharge/death/transfer \_\_\_\_\_

38. Was the patient alive at discharge/transfer? A. Yes B. No

39. If patient alive at discharge, what was the discharge destination of the patient?

A. Other hospital/ ward B. Community facility C. Home after getting linked to neurologic clinic D. home against medical advice

41. If patient alive at discharge/transfer, what was clinical condition of the patient during discharge/ transfer? (Clinically/functional outcome)

A. Discharged improved \_\_\_\_\_

B. Discharged the same \_\_\_\_\_

C. Transfer to other place improved \_\_\_\_\_

D. Transferred to other place the same \_\_\_\_\_

E. Left against medical advice \_\_\_\_\_

F. Transferred to other place deteriorated

41. If the patient was transferred to other places/admitted, where was it? A. Ward B. ICU

If the patient died at ED, Answer question number 42 & 43

42. What was possible cause of death?

A. Type 1 respiratory failure secondary to AP

B. Brain herniation secondary to increased ICP

C. Other Specify \_\_\_\_\_

43. For how long did the patient stayed after developing stroke to death \_\_\_\_\_

44. Patient final diagnosis \_\_\_\_\_

A. Coma secondary to HS B. Coma secondary to IS C. Hemiparesis secondary to IS

D. Hemiparesis secondary to HS E. Speech Disturbance Secondary To IS F. Speech

Secondary To HS G. Facial palsy secondary to IS

H. facial secondary to HS I. OTHER (SPECIFY) \_\_\_\_\_

## **ANNEX 2: Assurance of Principal Investigator**

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## **Approval of the Primary Advisor**

Name of the primary advisor: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## **Approval of the Co-Advisor**

Name of the primary advisor: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_