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BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCE

SCHOOL OF MEDICINE DEPARTMENT OF INTERNAL MEDICINE

In Hospital Mortality And Its Predictors Amonge Acute Ischemic Stroke Patients In Tibebe Ghion Specialized Hospital, Bahir Dar, Ethiopia

A RESEARCH THESIS TO BE SUBMITTED TO THE DEPARTMENT OF INTERNAL MEDICINE, COLLEGE OF MEDICINE AND HEALTH SCIENCE, BAHIR DAR UNIVERSITY, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR SPECIALITY IN INTERNAL MEDICINE

BY: DR. Agumas Kiros (MD, INTERNAL MEDICINE RESIDENT)

JANUARY, 2026

BAHIR DAR UNIVERSITY,ETHIOPIA

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TITLE	IN-HOSPITAL MORTALIT AND ITS PREDICTORS AMONG ACUTE ISCHEMIC STROKE PATIENTS ADMITTED IN TIBEBE GHION SPECIALIZED HOSPITAL, 2026
STUDY PERIOD	JANUARY 1, 2023 TO DECEMBER 30, 2026
TOTAL BUDGET	21,945ETB

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ABSTRACT

Background: Stroke is the second leading cause of death and third leading cause of death and disability combined in the world. The mortality of ischemic stroke is not known in TGSH despite it is one of a tertiary hospital in the region where most of stroke patients are referred from other tertiary, general and primary hospitals for further investigation and management. So, the aim of this study was to assess the magnitude of in-hospital mortality and its predictors.

Objective: To assess in-hospital mortality and its predictors among adult acute ischemic stroke patients in TGSH, Bahir Dar, Northwest Ethiopia, 2026.

Methods: Institution-based cross-sectional study was conducted from December 1-30, 2025 by reviewing medical records of ischemic stroke patients admitted from January 1, 2023 to December 30, 2025. The sample size was 244 and the sampling technique was simple random sampling. The data was collected from patient's medical record by using kobo collect software, having pre-developed data collection check list through smartphone, then it was transferred to SPSS version 27 for analysis. Bi-variable and multi-variable logistic regression analysis was used to identify the predictors of ischemic stroke mortality.

Results: In-hospital mortality of ischemic stroke was 13.8% (95% CI,9.5-18.1). Those patients who had aspiration pneumonia have 3.80 times higher risk ofmortality (AOR=3.80, 95% CI (1.46-10.15)). Patients who had increased intracranial pressure have 5.61 times higher risk of mortality (AOR=5.61, 95% CI (2.28-16.83)). Patients who had associated MI at the same admission have 3.68 times higher risk of mortality (AOR=3.68, 95% CI (1.01-13.48)).

Conclusion: In-hospital mortality of ischemic stroke was relatively high. The presence of Aspiration pneumonia, associated MI and increased ICP at time of admission were found to be significant predictors of in-hospital mortality for ischemic stroke patients. Early identification and treatment of complications and other co-morbidities along with strict follow-upin the hospital are required to reduce in-hospital ischemic stroke mortality and long-term disability.

Key words: Ischemic stroke, in-hospital mortality, predictors, Bahir Dar, Ethiopia

Acronyms & abbreviations

AHR……..Adjusted Hazard Ratio
CT…… ComputedTomography Scan
CVD……Cardiovascular Diseases
DALYs……Disability-Adjusted Life-Years
ERB…….....Ethical Review Board
GBD…… Global Burden of Diseases
LMIC……Low- & Middle-Income Country
MD…… Medical Doctor
MOH…….....Ministry of Health
MRI…….....Magnetic Resonance Imaging
NCD……Non-Communicable Diseases
PhD ……Doctor of Philosophy
SPSS…….....Statistical Package for Social Science
SSA…….....Sub-Saharan Africa
TIA…… Transient Ischemic Attack
TGSH……TibebeGhion Specialized Hospital
WHO…….....World Health Organization
t-PA……..... Tissue Plasminogen Activator

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1. INTRODUCTION:

1.1 Background

Recently, cardiovascular disease (CVD) is the world's main cause of death (17.9 million deaths annually(4). Stroke is the leading cause of cardiovascular disease, followed by coronary heart disease and diabetes(5).

According to the definition proposed by the World Health Organization (WHO) in 1970, "stroke is rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer, or leading to death, with no apparent cause other than of vascular origin"(6).

Stroke is a leading cause of disability, dementia and mortality worldwide and is associated with substantial economic costs. Globally, an average of 1 in 4 adults will have a stroke during their lifetime(7). Even though stroke is preventable through the prevention of modifiable risk factors, it is one of the leading causes of death and disability worldwide(8). The economic costs of post-stroke care are enormous(9). As of now, approximately 34% of the global total healthcare expenditure is spent on stroke. The average healthcare cost of stroke per person, including inpatient care, rehabilitation, and follow-up care, is estimated at USD 140,048 in the United States(10).

According to the 2022 world stroke organization report about 6.5 million people die annually in the world due to all stroke types combined, and among this around3.3 million people aredue to ischemic stroke with crude rate per 100,000 per year of 42.56%(11).

According to a study in 2020, the worldwide 1-month case fatality of ischemic stroke was 13.5% (95% CI 12.3% to 14.7%). The case-fatality was 10.8% in Asia, 14.2% in Europe, 14.0% in South America and Caribbean, 14.0%in North America and 12.5% in Australia and New Zealand(12).

The results of population-based studies suggest that the overall mortality after ischemic stroke in Africawasranging from 5.5% to 11%(7).

The in-hospital mortality particularly from ischemic stroke is variable in Ethiopia as seen in a study at three different hospitals but the mortality from any type of stroke is about 14.03% on average, ranging from 6.04% to 37.37%(13).

1.2 Statement of the problem

According to the Global Burden of Disease (GBD) 2019 stroke burden estimates showed that it remains the second leading cause of death and the third leading cause of death and disability combined (as expressed by disability-adjusted life-years lost—DALYs) in the world. From 1990 to 2019, the burden (in terms of the absolute number of cases) increased substantially (70.0% increase in incident strokes, 43.0% deaths from stroke, 102.0% prevalent strokes, and 143.0% DALYs), with the bulk of the global stroke burden (86.0% of deathsand 89.0% of DALYs) residing in lower income and lower–middle income countries (LMIC)(11).

There were large geographical differences in age-standardized stroke incidence (six-fold), mortality (15-fold), prevalence (four-fold) and DALYs (20-fold) rates, with the highest rates in LMIC (particularly in Eastern Europe, Asia, and Sub-Saharan Africa)(11).

According to 2017 USA nationwide inpatient database, the incidence of acute ischemic stroke was 243 per 100,000 Americans among males and 229 per 100,000 Americans among females. 20,995 deaths were reported with an overall mortality rate of 3.1%. The mean length of stay was 4.91 days while the mean hospital charges were $60,002.50. The total hospital charges for acute ischemic stroke patients were $31,252,598,673(14)

Based on the 2023 China stroke surveillance report, in-hospital mortality of ischemic stroke was 3%(15).Another study in Sri Lanka showed that in-hospital mortality of ischemic stroke was 5.28%(16).According to a prospective single center study in Spain, overall, in- hospital mortality rate of ischemic stroke was 7.13%(17)

In recent systematic analyses by the global burden of neurological diseases investigators, stroke was foremost along with migraine and meningitis in terms of disability- adjusted life years (DALYs) in northern, central, western, eastern and southern Africa(18). According to a systematic review in sub-Saharan Africa, in-hospital mortality of ischemic stroke was reported as 14%(19).

According to a study in Ghana the in-hospital mortality of ischemic stroke was 17.5%(1). A similar study done in Namibia also showed that in-hospital mortality of ischemic stroke was 20.4% (20). Another study in Somalia shows that in-hospital mortality of acute ischemic stroke was reported as 13.4%(21).Reports showed that the future trend of stroke in SSA revealed that stroke burden will increase over the coming years owing to poor healthcare seeking behavior, and poor neurologic interventions(22).

Chronic diseases become major global public health problems, mainly, in developing countries. Therefore, as a developing country, Ethiopia faces the unenviable threat of a triple burden of disease: infectious diseases, Non- Communicable Diseases (NCDs), and injuries(23).

According to WHO data published in 2017, the magnitude of stroke-related deaths in Ethiopia is 6.23% out of total deaths, and the age-adjusted death rate of stroke in the country is 89.82 per 100 000 of the population(24).

Based on recent institution-based retrospective follow-up study conducted on adult stroke patients who were admitted to Debre Markos, northwest Ethiopia, the in-hospital mortality rate of ischemic stroke was 6.3%and, the median time to mortality was 8 days and similar study done in Gondar university hospital shows that in-hospital mortality of ischemic stroke was 12.5%(25, 26).

A study in Ambo university hospital, west Ethiopia, the overall in-hospital case-fatality rate of ischemic stroke was 13.5%(27).

In-hospital mortality is a good indicator to assess the efficacy of stroke care. Identifying the Predictors of in-hospital mortality are important to advance the stroke outcome and plan the future strategies of stroke management. Evidence on stroke mortality can be used to monitor disease trends and design appropriate public health interventions. So, knowing the extent of in-hospital mortality, predictors of mortality and stroke outcomes in general in TibebeGhion specialized hospital helps to design a policy to apply targeted therapy to the predictors of mortality, to prioritize the prevention/control strategies and improve quality of care for stroke patients in the hospital.

1.3 Significance of the Study

Knowing the magnitude and predictors of ischemic stroke mortality in TGSH will have greater input to physicians and for health educators to create awareness about the impact of stroke in the community's health care system.

It has also valuable contribution for the academic community and for service providers as a source of information. Therefore, this study provides a basic clue for the prevention of stroke by creating awareness about the burden of ischemic stroke and advise on risk reduction and early detection and treatment of the diseases, to lower morbidity and mortality and helps to prioritize patients who need ICU care based on the predictors of mortality that will be identified in this study.

2. LITERATURE REVIEW:

2.1 Magnitude of mortality of ischemic stroke:

The prevalence of stroke is increasing in alarming rate globally especially in low- and middle-income countries with high burden of mortality and having long term disability. According to the findings of the Global Burden of Disease (GBD) 2019 study, stroke is the second most lethal disease and the third leading cause of an increase in total disability-adjusted life years (DALYs) globally. Ischemic stroke accounts for 62.4% of all stroke cases and it accounts about 3.3 million deaths annually among 6.5 million deaths from all types of strokes (11).

2.2 Factors associated with in-hospital ischemic stroke mortality:

2.2.1 Sociodemographic factors

According to study done in USA, aging is the most robust non-modifiable risk factor for incident stroke, which doubles every 10 years after age 55 years. Approximately three-quarters of all strokes occur in age ≥65 years(28) and the mortality rate according to age group was 13.16% for patients up to 59 years old, 12.34% for patients 60 to 69 years old, 14.06% for patients 70 to 79 years old, and 18.33% for patients above 79 years old(29, 30).

Women face a disproportionate burden of stroke mortality and morbidity. In the United States in 2019, stroke was the third leading cause of death in women as compared with fifth in men(31) and according to Greater Cincinnati Northern Kentucky Stroke Study, stroke case fatality in women exceeded that of men even after adjustment for age(32, 33) and the overall in-hospital mortality rate for female was 7.13%(95% CI, 5.31%-9.35%).

Based on the 2017 USA nationwide ischemic stroke data, females admitted with acute ischemic stroke had a higher mortality rate (53.8%) than males (46.2%) with ($p < 0.01$). 68.5% of all AIS cases were reported among Whites, who also had a higher mortality rate (73.2%) with ($p < 0.01$)(14).

Based on study in Spain in 2019, in-hospital mortality of ischemic stroke among men was 6.16% (3.90%-9.18%) and in women it was 8.23% (95% CI, 5.45%-11.82%)(17).

According to study done in Denmark regarding the effect of ethnic differences on mortality of stroke, compared with Danish born men, all-cause 1-year mortality hazard for Non-western men was (HR, 1.61; 95% CI, 1.13-2.29) while for Western men was (HR, 1.07; 95% CI, 0.90-1.29) among ischemic stroke patients. women had reduced all cause 1-year mortali-

ty hazard in Non-western (HR, 0.32; 95% CI, 0.13-0.80) for hemorrhagic stroke whereas no difference in mortality hazard was observed for ischemic stroke(34).

A retrospective cohort study in Sierra Leonean shows that in-hospital mortality of ischemic stroke was 34.8% and at discharge, mean modified Rankin Score(mRS) was 3.89 ± 1.62 and women had poorer outcome than men(35).

2.2.2 Health seeking behavior and facility related factors

According to a study in Japan, longer road-distance to a primary care facility has higher relative risk of death from stroke for both men (1.019: 95% CI 1.005-1.032) and women (1.019: 95% CI 1.006-1.033)(36).

The accessibility of timely brain imaging and presence of medication like t-PA for acute ischemic stroke had significant impact on in-hospital mortality and morbidity of acute ischemic stroke. As compared with patients given placebo, patients treated with t-PA were at least 30 % more likely to have minimal or no disability at three months post-stroke and mortality at three months was 17 % in the t-PA group and 21 % in the placebo group (P = 0.30)(37).

The client's perception about stroke and associated health seeking behavior also increases the in-hospital mortality of ischemic stroke and also related with low socioeconomic status($p<0.001$) as evidenced in a study done in Tanzania(38).

A study in Thailand also shows among 181 patients with acute ischemic stroke only 89 came in the golden time for t-PA administration due to difference in health seeking behavior despite similar mode of transportation, health insurance, day interval of onset and good knowledge of stroke warning signs(39).

Involvement of nursing and physician specialists in acute stroke care have a direct impact on health outcomes(40). In a population of patients treated at 42 academic medical centers in the University Health Systems Consortium, in-hospital deaths were less frequent at hospitals with a vascular neurologist (odds ratio [OR] 0.51; 95% CI, 0.36 to 0.74; P<0.0001) and at those who limited tPA administration to neurologists (OR, 0.65; 95% CI, 0.49 to 0.88; P=0.004)(41). In a comparison of in- hospital outcomes in patients in the Veterans Affairs Stroke Study treated by either a neurologist or a non- neurologist, patients treated by a neurologist were 37% less likely to be dead or dependent at discharge, regardless of event severity or differences in comorbidity burden(42).

2.2.3Diseases related conditions

According to study in Nur-Sultan, Kazakhstan, the in-hospital mortality rate of patients with ischemic stroke is 36%and the severity of stroke which is assessed by the presence of low GCS score (<9), higher NIHSS score (>14), were in coma and having cerebral edema during admission have increased risk of in-hospital mortality (p=0.05, 0.02, <0.01 respectively)(43).

According to retrospective studies in Germany, increased intracranial pressure and respiratory infections have highest attributable proportion of all predicators of ischemic stroke mortality, accounting for 94% (95% CI, 93.9-94.1%) and 31.2% (95% CI, 30.9%-31.5%) respectively(44).

The presence of acute kidney injury is also have increased incidence of both overall in-hospital mortality (50% vs 3.4%;p<0.001) and also in a time -to-event manner observing a HR of 15.2(95% CI,1.87-124.24, p=0.011) in Romania(45) and the 30-day mortality is higher in those having AKI (35% vs 6.2%,p<0.001) in Brazil(46) and it is also observed in USA having increased in-hospital mortality with OR 3.08, 95% CI(1.49-6.35)(47).

Based on relatively a large population study (0.5 million) for about 9 years in China, after combining both short-term (≤28 days) and long-term (>28 days) risks, the cumulative mortality after a first stroke was 15% at 1 year (ischemic stroke 7%, intracerebral hemorrhage 53%) and 26% at 5 years (ischemic stroke 19%, intracerebral hemorrhage 62%)(48).

According to study done in Spain, among those patients with a length of stay > 7 days, only those with respiratory infection showed a higher mortality risk (59.57% with p value 0.01), while, prior atrial fibrillation, previous strokes, and cardiovascular complications were associated to mortality in those patients with shorter stays (<7 days)(17).

A study on Burkina Faso showed that the mortality of ischemic stroke was associated with length of stay and having 31% within 7 days and 39.3% within 14 days, respectively(49).

A study in Debre Markose, northwest Ethiopia, the presence of low Glasgow coma scale (3–8) (AHR = 2.38, 95% CI(1.01, 5.67)), aspiration pneumonia (AHR=3.51, 95% CI(1.86, 6.61)and increased intracranial pressure (AHR = 2.12, 95% CI(1.10, 4.07)) were statistically significant predictors for in-hospital mortality(25).

According to study in Ambo university hospital, west Ethiopia, the presence of substance abuse (COR=2.341, P=0.040), being civil servant from occupational status (COR=7.246, P=0.004), having severe stroke type (COR=4.533, P=0.001), having complication during admission (COR=2.393, P=0.05) and having no any medication for stroke treatment during ad-

mission (COR=11.05, P≤0.001) were the independent factors that increase the likely hood of poor treatment outcome(27).

2.2.4 Family history

A study done in Lebanon shows that family history of stroke has strong association with stroke with OR of 2.06(50).

Another study done in Finland and in peoples of African ancestry, the family history of a premature stroke is an independent risk factor for stroke inheritance and for the occurrence stroke in the young (25-49 years)(51-54).

A nationwide follow-up study to evaluate familial mortality risks of ischemic stroke among 1380 Swedish sibling pairs (2760 cases) shows that short sibling survival (i.e., <3 or <4 years) after ischemic stroke was associated with an adjusted familial hazard ratio (FHR) of 1.29(95% CI, 1.05-1.58) and 1.24(95% CI,1.02-1.51), respectively for overall mortality after ischemic stroke. stratified analysis showed that short sibling survival (i.e., <2-<5 years) was stronger and significant only among younger individuals (<62 years) and males. Highest FHR for short sibling survival (<4 years) was 1.42(95% CI, 1.08-1.88) for younger individuals and 1.50(95% CI, 1.21-187) for males(55).

2.2.5 Comorbid conditions

There are different well-established comorbidities that increase the risk of stroke and increase the mortality of ischemic stroke like hypertension, diabetes, cardiac diseases, and renal failure.

According to study done in Toronto, Hypertension was associated with six- to eight-fold increases in the odds of IHD (OR 5.9, 99% CI 5.6–6.2) and stroke mortality (7.9, 7.4–8.5) and diabetes was associated with double the odds (1.9, 1.7–2.0) of IHD mortality and increased odds of stroke mortality (1.6, 1.4–1.7)(56).

Based on study in Korea ischemic stroke mortality increased with diabetes mellitus by 30.5%, p-value < 0.01, with CKD by 31.6%, p-value< 0.01 and with Dyslipidemia by 27.9%, p-value< 0.01(57) and another study in Germany shows that the strongest predictors of in-hospital stroke mortality were, cancer (AOR = 2.11, 2.06–2.16; p < 0.001), congestive heart failure (AOR = 1.70, 1.67–1.73; p < 0.001), and lower extremity arterial disease (AOR = 1.76, 1.67–1.84; p < 0.001)(58).

According to study in Burkina Faso, the predictors of death were history of heart disease (p = 0:048), fever (p = 0:01), hyperglycemia (p = 0:002), anemia (p = 0:038), post stroke pneumonia ($p \leq 0{:}001$), and urinary tract infection ($p \leq 0{:}001$)(49).

According to study in Sierra Leonean, the presence of vascular risk factors have significant association with ischemic stroke mortality; hypertension [(AOR = 2.2; C.I 95%: (1.32–3.80), p = 0.001], diabetes mellitus [(AOR = 1.41; C.I 95%: (0.73–2.70), p = 0.0001], previous stroke [(AOR = 2.31; C.I 95%: (1.43–5.74), p = 0.001], and seizure [COR = 1.02; C.I 95%: (1.43–7.94), p = 0.03](35).

According to study in Debre Markos, northwest Ethiopia, those stroke patients with a history of hypertension at admission were at a twofold (AHR = 2.01 (95% CI = 1.08, 3.74)) higher risk of mortality compared to non-hypertensive stroke patients(25), similarly a study in Gondar university hospital, northwest Ethiopia, revealed that only a decrease in renal function, particularly elevated serum creatinine (AHR=8.848, 95% CI: 1.616-67.437), was associated with a statistically significant increase of in-hospital mortality of ischemic stroke(26).

2.3. Conceptual framework:

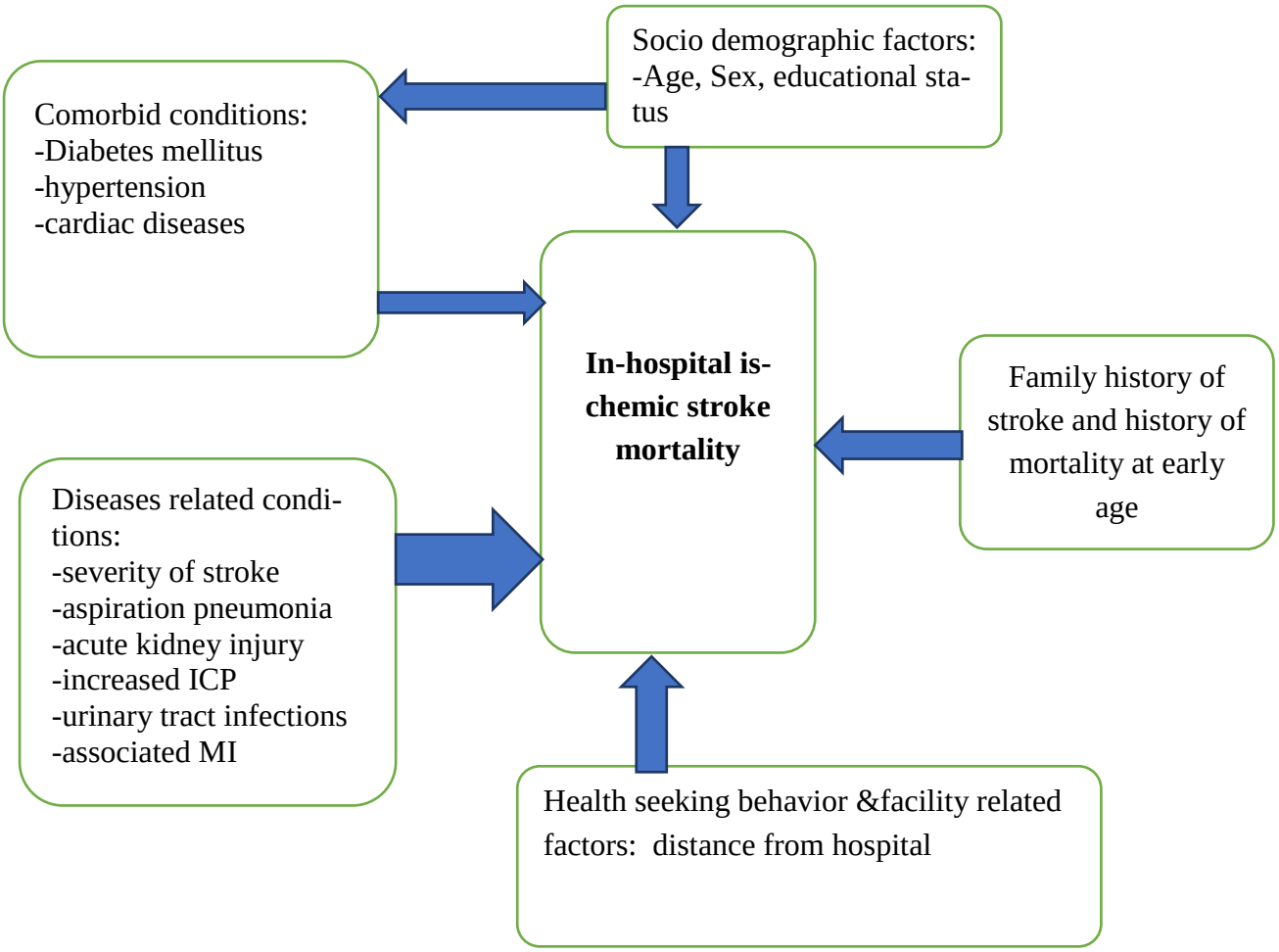


Figure 1 conceptual frame work for predictors of ischemic stroke mortality adopted from reviewingdifferent literatures(1-3)

3. OBJECTIVEIVE:

General objective:

To assess in-hospital mortality and its predictors among adult acute ischemic stroke patients in TGSH, Bahir Dar city, Northwest Ethiopia, 2023-2025.

Specific objective:

To estimate in-hospital mortalityamong adult acute ischemic stroke patients in TGSH, Bahir Dar city, Northwest Ethiopia, 2023-2025

To identify predictors of mortality from acuteischemic stroke patients admitted to TGSH, Bahir Dar city, Northwest Ethiopia, 2023-2025

4. METHODS AND MATERIALS:

4.1. Study design:

Institution-based cross-sectional studywas used.

4.2. Study area and period:

The study was conducted at Tibebe Ghion Comprehensive Specialized Hospital located in Bahir Dar city, Amhara Regional State, Ethiopia. Tibebe Ghion Specialized Hospital is situated in Sebatamit, en route to Abet town, approximately 570 kilometers to northwest of the capital city of Ethiopia, Addis Ababa and with 1840 meters (6036 feet above sea level) on the southern coast of Lake Tana. TGSH is a referral hospital serving as a teaching hospital for college of Medicine and Health science of Bahir Dar University and patients with a catchment population of more than five million people who are referred from the region and abuttal regions. The hospital offered a wide range of medical services, including Internal Medicine, Pediatrics, Gynecology/Obstetrics,Surgery,Dentistry,Otolaryngology,Psychiatry, Ophthalmology, Radiology, Dermatology, and Head and Neck Surgery. Each department comprised emergency, inpatient, and outpatient units.Internal Medicine department is divided into specialized units such as Cardiology, Gastroenterology, Pulmonology, Neurology, Nephrology, Infectious Diseases, and Endocrinology

The neurology Unit was particularly relevant to this study which is a stoke unit. The medical care teams consisted of nurses, residents working under supervision of 3 neurologists serving an average of 20 patients per month.

Acute stroke patients almost always pass through emergency and dispose to stroke unit in the medical ward.The studywas conducted fromDecember 1–30,2025 by reviewing patient cards who were admitted with a diagnosis of acute ischemic stroke from January 1,2023-December30,2025(59).

4.3. Source population:

The source population was all ischemic stroke patients who were admitted to TibebeGhion specialized hospital.

4.4. Study population:

All ischemic stroke patients who were admitted to TibebeGhion specialized hospitalfrom January 1, 2023-December 30, 2025.

4.5. Study unit:

The study unit was alladult ischemic stroke patients that fulfill the inclusion criteria and was admitted to TibebeGhion specialized hospital from January 1, 2023-December 30, 2025 and those selected by simple random sampling method.

4.6. Sample size & sampling procedure:

Sample size was determined for both objectives separately. For first objective sample size was calculated using single population proportion formula based on the following assumptions; taking p value from another similar study conducted, p= 17.5%(1) level of significance 5% (a=0.05), margin of error 5% (d=0.05).

n = (Za/2) 2 p (1-p)/d2,

Where

n = sample size.

Z = 95% confidence limit (1.96)

p = prevalence of ischemic stroke mortality 17.5%

d = margin of error or degree of accuracy desired (0.05)

n= (1.96)2x (0.175) (1-0.175)/ (0.05) 2 = 3.8416 x0.144375/0.0025=222

Adding a 10% non-response rate the sample size was**244**.

For the second objective "Epi info version 7" software for the determination of sample size was used(3).

Table 1:- sample size determination using double population formula

Variable	Death			% of outcome	COR	Ratio (present: absent)	Power	Sample size
		Yes	No					
Pneumonia	Yes	24	35	40.7	4.87	5.5	80	100
	No	25	298	7.7				
ICP	Yes	21	35	37.5	4.08	5.8	80	131
	No	28	298	8.6				

The final sample size was determined by taking the largest calculated sample size.

The required sample size(244) was drawn from a total of 602 ischemic stroke patients admitted in TGSH in three years' period by using a simple random sampling technique. The pa-

tients MRN list was used as the sampling frame, the serial number was assigned from 1 to N, and a computer-generated random number (Open Epi version 3) was used to select samples randomly. The number was generated in 10 rows.

4.7. Inclusion & exclusion criteria:

4.7.1 Inclusion criteria

All adult ischemic stroke patients whose diagnosis confirmed by brain imaging with either CT-scan or MRIand admitted to internal medicine wing of TGSH from January 1/2023- December 30/2025.

4.7.2 Exclusion criteria

Ischemic stroke patients having incomplete clinical information (like unknown final outcome of the patient, other relevant information) or missed chartswere excluded.

4.8. Variables of the study:

4.8.1 Dependent variable**:**

In-hospital mortality of ischemic stroke/yes/no.

5.8.2 Independent variables

Sociodemographic variables: Age, Sex, religion and residency

Family history: family history of ischemic stroke and family history of death due to ischemic stroke at early age.

Disease's related conditions: severity of ischemic stroke(measured by GCS), aspiration pneumonia, acute kidney injury, increased ICP, urinary tract infections and associated MI

Comorbid conditions: hypertension, diabetes mellitus, cardiac diseases and previous stroke,

4.9. Operational/ term definition:

In-hospital mortality: in-hospital mortality is defined in this research as death which occurs after 24 hours of admission to the hospital. The outcome of the patient can be taken asdeathwhen there is death certificate confirmed by a physician and documented on the patient's chart and can be categorized as either yes or no.

Glasgow coma scale: it is a measure of level of consciousness and graded as mild (13-15), moderate (9-12) and severe (3-8)(60). It is measured by adding together the scores from eye opening, verbal response and motor response and these give

you an overall score out of the maximum of 15 and graded as mild, moderate and severe.

Increased ICP: Acute intracranial hypertension is defined as sustained ICPgreater than 20 mmHgfor greater than 5-10 minutes in a patientthat is notbeing stimulated(61).It is measured by inserting a catheter in to the ventricle of brain but since this isn't available in our hospital it can be suspected based on sign and symptoms like vomiting, headache, decrease in mentation and papilledema.

Acute kidney injury: AKI is defined as; increase in serum creatinine by 0.3 mg/dl within 48 hours or increase in serum creatinine to 1.5 times from baseline, which is known or presumed to have occurred within the prior 7 days or Urine volume<0.5 ml/kg/h for 6 hours(62).

4.10. Data collection procedure

Prepared questionnaires in English language that contain measurable language were utilized. The patient's medical record was accessed after asking the concerned official through a letter. The data related to the type ofstroke, diseases related conditions, comorbid conditions and socio-demographic information's was collected from the patients' medical record by using kobo collect software through smartphone by 2 trained data collectors (interns) from December 1-30, 2025to include those patients who was admitted in this month. Since data collectors are familiar (physicians) to the information in the checklist& can read and write English well, the tool will not be translated to local language.

4.11. Data quality control

The data was collected by trained data collectors (2 intern physicians). Training was given for data collectors for one day on method of extracting the needed information, how to fill the information to the **kobo collect**software. Pretest was done using 10% of sample size to asses understandability of the questioners. The data was collected with close supervision by the principal investigator (PI) to check its consistency and for any ambiguousness of the checklist.

4.12. Data processing and analysis

The data was checked for its completeness every day by principal investigator and then it was exported to Statistical Package for Social Science version 27 (SPSS-27) for analysis. Descriptive statistics (mean, standard deviation, median, frequency & percentages) was computed depending on the nature of the variable and results were presented as graphs &tables.Bivariable binary logistic regression and multi-variable logistic regression analysis was used to

identify the predictors of ischemic stroke mortality. Before performing multivariable analysis, multicollinearity among independent variables was assessed using the variance inflation factor(VIF) and a pairwise correlation matrix. Results showed a low risk of collinearity with VIF values less than 1.3 and correlation coefficient less than 0.6, and Hosmer-Lemeshow test and variable who are not significant are considered for analysis. Finally, variables with P- value <0.05 at confidence interval (CI) of 95% in multi-variable analysis with a corresponding odds ratio was used to declare the variable as having strong association with ischemic stroke mortality.

4.13. Ethical consideration:

Ethical approval was obtained from the Institutional Review Board (IRB) of Bahir Dar University, College of Medicine and Health Sciences, and Permission was also secured from Tibebe Ghion Specialized Hospital prior to data collection. Since the study was conducted using secondary data from patient medical records, informed consent was exempted by the IRB. Confidentiality of patient information was strictly maintained. No personal identifiers like name of patients, medical record number, and phone number were recorded, and data were collected in coded form to ensure privacy.The information obtained from the charts of the patients kept confidential and used only for the purpose of this study, stored securely, and accessed only by the principal investigator.

5. RESULTS

5.1 Socio-demographic characteristics:

A total of 244 medical records of patients with ischemic stroke were identified in the study period. Of these, 10 medical records of patients were either incomplete or lost. 232 ischemic stroke patient's medical record was analyzed which accounts 95% response rate. The medi-anagewas 65 years andmajorities weremales122(52.6%). The majority 200(86.4%) of patients were Orthodox religion followersand175(75.4%) of patients were rural residents.

Table 2:- Socio-demographic characteristics of acute ischemic stroke patients in TGSH, from 2023-2025(N=232)

Variables	Category	Frequency	Percentage (%)
Sex	Female	110	47.4
	Male	122	52.6
Age	Under 45 years	15	6.5
	45-54 years	24	10.3
	55-64 years	51	22
	65-74 years	85	36.6
	75 years and older	57	24.6
Place of residence	Urban	57	24.6
	Rural	175	75.4
Marital status	Married	172	74.1
	Single	2	0.9
	Widowed	48	20.7
	Divorced	10	4.3

5.2Familial mortality risks:

Among the total study units, 14(6%) of them had family history of stroke and of this 6(2.6%) were died and from this only one(0.4%) of them was died at age below 45 years old(table 3).

Table 3:- Familial mortality risk characteristics of acute ischemic stroke patients in TGSH, from 2023-2025(N=232)

Variable	Category	Frequency	Percentage (%)
Family history of stroke	Yes	14	6
	No	67	28.9
	Unknown	151	65.1
Family history of	Yes	6	2.6

death due to stroke	No	8	3.4
Age of death	45 years and below	1	0.4
	46 years and above	5	2.2

5.3Comorbid conditions:

From a total of study units, 111(47.8%) of them had hypertension, 24(10.3%) of them had previous history of stroke, 62(26.7%) had diabetes mellitus and 79(34.1%) of them had cardiac diseases as concomitant comorbidities (Table 4)

Table 4:- Comorbid conditions of acute ischemic stroke patients in TGSH, from2025-2025(N=232).

Variable	Category	Frequency	Percentage (%)
History of hypertension	Yes	111	47.8
	No	121	52.2
History of previous stroke	Yes	24	10.3
	No	208	89.7
History of diabetes mellitus	Yes	62	26.7
	No	170	73.3
History of confirmed cardiac disease	Yes	79	34.1
	No	153	65.9

5.4 Diseases related conditions:

From a total of study units, in terms of stroke severity,66(28.4%) had severe GCS(3-8). Among the total study units, 97(41.8%) had aspiration pneumonia, 105(45.3%) had increased ICP, 26(11.2%) had acute kidney injury, 98(42.2%) had urinary or fecal incontinence, 24(10.3) had associated MI, 108(46.6%) had difficulty of swallowing and 100(43.1%) of them stayed in the hospital for 6 days and above (Table 5).

Table 5:- Diseases related conditions of acute ischemic stroke patients in TGSH, from2023-2025(N=232).

Variable	Category	Frequency	Percentage (%)
Severity of stroke (GCS)	Mild (13-15)	142	61.2
	Moderate (9-12)	24	10.3
	Sever (3-8)	66	28.4
Aspiration pneumonia	Yes	97	41.8
	No	135	58.2
Increased ICP	Yes	105	45.3
	No	127	54.7
Urinary and fecal in-	Yes	98	42.2

continence	No	134	57.8
Associated MI	Yes	24	10.3
	No	208	89.7
Swallowing difficulty	Yes	108	46.6
	No	121	82.2
	Unknown	3	1.3
AKI	Yes	26	11.2
	No	176	75.9
	Unknown	30	12.9
Length of hospital stay	6 days and below	122	55.6
	7 days and above	100	44.4

5.5 In-hospital mortality of ischemic stroke patients:

In this study, out of 232 patients, 32 of them died in the hospital,resulting in ischemic stroke mortality of 13.8%(95%CI 9.5-18.1) (figure 2).

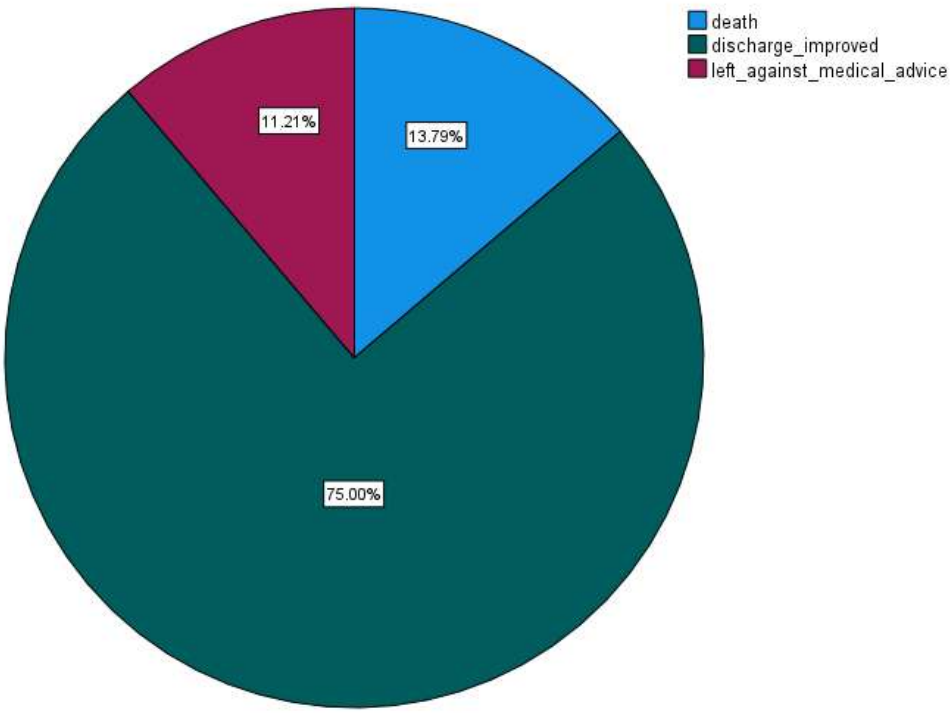


Figure 2:- In-hospital mortality of acute ischemic stroke patients in TGSH, from 2023-2026

Among those who were died, majority were above 65 years,11 (4.7%) were between 65 and 74 age group and 10(4.3) were in the age groups of 75 years and older, 18(7.8%) of them were males, 17 (55.6%) of them stayed in the hospital for 6 days and below, 23 (71.9%) of

them had aspiration pneumonia, majority 26(81.3) had increased ICP, 21(65.6%) had swallowing difficulty, 1(37.5%)had associated MI at admission and only 6(18.8%) of them had history of previous stroke (table 6)

Table 6:- Outcome distribution of patients admitted in TGSH, from 2023-2026(N=232)

Variables	Category	Outcome			
		Category			
		Death		No death	
		Frequency	Percentage	Frequency	Percentage
Sex	Female	14	6	96	44.1
	Male	18	7.8	104	44.8
Age	<=44	2	0.9	13	5.6
	45-54	2	0.9	22	9.5
	55-64	7	3	44	19
	65-74	11	4.7	74	31.9
	>=75	10	4.3	47	24.6
Residency	Rural	23	9.9	152	65.5
	Urban	9	3.9	48	20.7
GCS	Mild	14	6	128	55.2
	Moderate	8	3.4	16	6.9
	Sever	10	4.4	56	24.1
Aspiration pneumonia	Yes	23	9.9	74	31.9
	No	9	3.9	126	54.3
AKI	Yes	4	1.7	22	9.5
	No	23	9.9	153	65.9
	Unknown	5	2.2	25	10.8
Swallowing difficulty	Yes	21	9.1	87	37.1
	No	11	4.7	113	48.7
	Unknown	0	0	3	1.3
UTI	Yes	0	0	15	6.5
	No	32	13.8	185	79.7
Urinary and fecal incontinence	Yes	17	7.3	81	34.9
	No	15	6.5	119	51.3
Increased ICP	Yes	26	11.2	79	34.1
	No	6	2.6	121	52.2
Associated	Yes	8	3.4	17	7.3

MI	No	24	10.3	183	78.9
HTN	Yes	22	9.5	89	38.4
	No	10	4.3	111	47.8
Cardiac disease	Yes	15	6.5	62	26.7
	No	17	7.3	138	59.5
DM	Yes	10	4.3	52	22.4
	No	22	9.5	148	63.8
Previous stroke	Yes	7	3	17	7.3
	No	25	10.8	183	78.9
Hospital stay	<=6 days	19	8	106	47.5
	>= 7days	13	5.8	94	38.7

5.6: Factors associated with in-hospital mortality of ischemic stroke:

Bi-variate and multivariate logistic regression was undertaken to select significant factors associated with in-hospital mortality of ischemic stroke. Bi-variate logistic regression analysis revealed that presence of aspiration pneumonia, having increased ICP, having swallowing difficulty, history of previous stroke,history of hypertension, having urinary and fecal incontinenceand having associated MI at the same admission were all significantly related with in-hospital mortality of ischemic stroke.Bi-variables with p-value < 0.25 were a candidate for multivariable analysis. In the multivariable analysis aspiration pneumonia, increased ICPand having associated MI at the same admission were significantly associated with in-hospital mortality of ischemic stroke with p value of <0.05.Those patients who had aspiration pneumonia have3.80 times higher risk of in-hospital mortality than those without aspiration pneumonia (AOR=3.80, 95% CI (1.46-9.86)). Patients who had increased intracranial pressure have 5.61 times higher risk of mortality than those who did not have increased ICP (AOR=5.61, 95% CI(2.06-15.29)). And patients who had associated MI at the same admission have 3.68times higher risk of mortality as compared to patients who did not have associated MI at the same admission (AOR=3.68, 95% CI (1.01-13.48))(Table 7).

Table 7:- Bivariate and multivariate regression analysis to identify factors associated with in-hospital mortality of acute ischemic stroke patients inTGSH,from 2023-2025(N=232)

Variable name	Category	Death		COR (95% CI)	p-value	AOR	95% CI	**P**-value
		Yes	No					
Aspiration pneumonia	Yes	23	74	4.35(1.91-9.90)	<0.001	3.80	1.46-9.86	**0.006**
	No	9	126	1		1		

Associated MI	Yes	8	17	3.58(1.40-9.02)	0.008	3.68	1.01-13.48	**0.008**
	No	24	183	1		1		
Urinary and fecal incontinence	Yes	17	81	1.66(0.78-3.52)	0.182	1.86	0.76-4.60	0.175
	No	15	119	1		1		
History of confirmed cardiac disease	Yes	15	62	1.96(0.92-4.18)	0.08	2.28	0.91-5.72	0.08
	No	17	138	1		1		
History of hypertension	Yes	22	89	2.74(1.24-6.09)	0.013	2.41	0.92-6.32	0.075
	No	10	111	1		1		
History of previous stroke	Yes	7	17	3.01(1.35-7.97)	0.023	3.20	1.001-10.24	0.05
	No	25	183	1		1		
History of increased ICP	Yes	26	79	6.64(2.61-16.85)	<0.001	5.61	2.06-15.30	<**0.001**
	No	6	121	1				
Swallowing difficulty	Yes	21	87	2.48(1.14-5.42)	0.23	1.53	0.59-3.96	0.380
	No	11	113	1	1			

6. DISCUSSION

The study was conducted to assess the prevalence of mortality and its predictors among ischemic stroke patients admitted to stroke unit of TGSH, 2026.

From this study, the prevalence of in-hospital mortality of ischemic stroke was 13.8% [CI 95%, 9.5-18.1]and the presence of aspiration pneumonia, increased ICP and associated MI-were the factors associated with in-hospital mortality of ischemic stroke.

The in-hospital mortality of ischemic stroke in this study was in-line with studies conducted in Gondar university hospital 12.5%(26), Ambo university hospital13.5%(27),Somalia 13.4%(21), sub-Saharan country 14%(19), worldwide 1-month case fatality of ischemic stroke 13.5%(12).

But the in-hospital mortality of ischemic stroke in this study were higher than studies done in Debre-Markos hospital 6.3%(25), this may be due to the fact that as reported in the study in Debre-Markos hospital, 16.2% of patients were referred to higher level hospitals(including TGSH) for further investigation and management and this may underestimate in-hospital mortality of ischemic stroke in their hospital. Other reason may be due to difference in terms of sociodemographic characteristics (e.g. age) and short time of arrival to the hospital. The result of this study also higher than similar studies done in countries like,China 3%(15), USA 3.1%(14), Sri Lanka 5.28%(16) andSpain 7.13%(17). These differences might be due to the variation in socioeconomic status, health seeking behavior of patients, time of arrival to the hospital,difference in adherence to treatment and follow up for possible stroke risk factors and accesses to different treatment modalities ofischemic stroke (like thrombolytic agents), which is easily available in developed countries but not in ours.Intravenous thrombolysis with recombinant tissue plasminogen activator (rtPA) remains a corner stone to improve patient outcomes in acute ischemic stroke (63).It helps for clot dissolution and timely restoration of the blood flow to the ischemic brain tissue and thus prevent death of neurons and lead to clinical improvement.

However, the findings of this study were lower than the study conducted in Gahanna 17.5(1), Namibia 20.4%(20), and this may be due to difference in sociodemographic status of patients(e.g. older age in their study, ethnicity), accesses to different treatment modalities, study period, and sample size.

In this study, as shown in the multivariate analysis, those patients who develop aspiration pneumonia had higher risk of mortality as compared to patients without aspiration pneumonia. This is consistent with studies conducted in Debre-Markos hospital, Spain and

Germany(17, 25, 44).Thereason may be, since patients with an impaired swallowing mechanism due to neurological injury like ischemic stroke are at high risk foraspirating gastrointestinal contents in to the airways and then resulting in infection (i.e. pneumonia) and finally leads to type 1 respiratory failure and then contributing for increasing in-hospital mortality of stroke patients.

The second predictors of mortality in this study were the presence of increased ICP. Other studies also show increased risk of mortality in the presence of increased ICP(25, 43, 44). The reason is due to the fact that patients with increased ICP are at risk of brain herniation which results cardiorespiratory compromise and fasten the mortality of the patient and also since such type of patients have depressed mental status and have depressed immunity, they are prone to develop other complication like infection at any site, long term immobilization having risk of deep venous thrombosis and pulmonary embolism and further worsen mortality.

The third associated factor with in hospital mortality of ischemic stroke in this study was the presence of associated MI during the same admission. This may be due to trigger of sympathetic over activity due to ischemic stroke that may cause myocardial injury even with or without coronary occlusion. This finally leads to decreased ejection fraction which results in hypotensionthat leads to secondary cerebral ischemia(64).

Limitations of the Study:

This study tries to address possible predictors of ischemic stroke mortality and it uses random sampling technique from the three-year ischemic stroke patient's data.This study had the following limitations:

1. Reliance on medical records as the secondary data my result in the omission of crucial variables such as social, economic and behavioral factors.
2. Itsinstitution-based nature of the study may limit the generalization of our findings to the broader community.

7. CONCLUSION AND RECOMMENDATION:

In this study, in-hospital mortality of ischemic stroke was relatively high as compared to that of developed countries. The presence of aspiration pneumonia, increased ICP and having MI at time of admission were found to be significant predictors of in-hospital mortality for ischemic stroke patients. Early identification and prevention of possible complications, treatment of complicationsand other co-morbidities along with strict follow-up, in the hospital are required to reduce in-hospital ischemic stroke mortality and long-term disability.

Recommendation:

The following recommendations were made based on the findings of this study:

For Bahir Dar university, TGSH administrators and managers:

- ✓ Taking appropriate policy strategies to have Portable X-ray Machine to diagnose and manage aspiration pneumonia early.

For the Ministry of Health, Regional health bureau, Zonal administrations:

- ✓ Improving the knowledge and awareness of the community regarding controlling modifiable risk factors for ischemic stroke,
- ✓ To avail thrombolytic agents to decrease mortality.
- ✓ To avail medications to manage increased ICP, like hypertonic saline.

For researchers:

- ❖ It is better to do both institution and community-based prospective studies with a large sample size to estimate the exact burden of ischemic stroke mortality and to explore other important predictors of mortality which was found to be associated factor in other studies but not in this study.

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9. Annexes:

Annex I: Information sheet for those who work in patient's medical record room

Good morning/afternoon

My name is Dr. Agumas Kiros, a 3rd year internal medicine resident at Bahir Dar University, College of Medicine &Health Sciences.

Now I am conducting a study on the title of in-hospital mortality and its predictors among acute ischemic stroke patients admitted at TGSH .

Name of investigator: Dr. Agumas Kiros (third year internal medicine resident)

Name of organization: Bahir Dar University College of medicine and health sciences, school of medicine, Department of internal medicine.

Purpose of the study: To assess in-hospital mortality and its predictors among adult ischemic stroke patients admitted to TGSH.

Data collection time: December 1-30, 2025.

Study unit: Acute ischemic stroke Patients who was admitted to TGHS from January1, 2023 to December 30, 2025.

Risks: Since all data will be taken from medical chart, there is no any harm to the patient and the name or any identification will not be recorded in the checklist. The confidentiality of all information taken from the chart will be maintained.

Benefits: There are no direct benefits for those subjects whose documents reviewed. However, results will be used for policy makers and decision makers for designing appropriate measures to decrease burden of ischemic stroke mortality.

Annex-II: Consent form for the head of the hospital

As I mentioned above, I am working a thesis proposal submitted to Bahir Dar University, college of medicine and health sciences, school of medicine, and department of internal medicine. I believe that the result of this study will be used as an evidence for decision making and reviewing approach of heart failure patients. Necessary information for the study will be taken from medical registration card and with patient. It will not harm the patient as well as confidentiality will be kept. No name and other identification will be written in the checklist.

The information collected from patients' medical chart of patients will be useful for the study. But, you have full right not to let the information to be used for this study. You may communicate advisors or principal investigator if you have any questions about this study.

Principal Investigator: Dr. Agumas Kiros (Internal Medicine resident)

Advisors:

Dr. Wudie Gedefaw (MD, neurologist)

Dr. Girum Meseret (MPH and PHD candidate)

Annex III: English version checklist

Checklist for data collection to assessin-hospital mortality and its predictors among adult ischemic stroke patients admitted to TGSH, Bahir Dar town, Northwest Ethiopia from January 1/2023-December 30/2025.

Part I: Socio-demographic characteristics:

S. No	**Checklists**	**Answers**
101	Age	_____ years
102	Sex	1. Male 2. Female
103	Place of residence?	1. Rural2. Urban
104	Religion	1. Orthodox Christian 2. Muslim 3. Other, please specify--------

Part II. Check list for diseases related conditions

	A. severity of ischemic stroke		**Skip**
201	**A. GCS at admission**	1. mild: 13-15 2. moderate: 9-12 3. severe: 3-8	
202	**B. Aspiration pneumonia**	1.Yes 2. No 3. Unknown	
203	**C. increased ICP**	1.Yes 2. No 3. Unknown	

204	**D. Acute kidney injury**	1.Yes 2. No 3. Unknown	
205	**E. length of hospital stay in days**	1_____	
206	**F. urinary & fecal incontinence**	1.Yes 2. No 3. Unknown	
207	**G. Swallowing difficulty**	1. Yes 2. No 3. Unknown	
208	**H. Associated MI**	1.Yes 2.No	

Part III. Check list forfamilial mortality risk of ischemic stroke

S.NO	Questions concerning family history	Response
301	Is their family history of stroke? (Grandfather, Father, Grandmother, mother, sister, brother)	1. Yes 2. No 3. Unknown
302	If yes, is there death due to stroke	1. Yes 2. No
303	If yes, at what age does he/she died	____(years)

Part IV: Check list for comorbid conditions associated with stroke

S.no	Questions	Response	Skip
401	History of hypertension	1. Yes 2. No	
402	History of previous stroke	1. Yes 2. No	
403	History of diabetes mellitus	1. Yes 2. No	
404	History of confirmed cardiac disease	1. Yes 2. No	

Part v: Checklist for final outcome of the patient

501	**Final outcome of the patient**	1.Death 2.Discharged improved 3.Going against medical advice	

Annex iv:-Declaration

This is to certify that the entitled "in- hospital mortality and its predictors among ischemic stroke patients admitted in Tibebe Ghion specialized hospital" submitted in partial fulfillment of the requirements for specialty in internal medicine department of internal medicine Bahir dare university is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificate. The assistance and help I received during the course of this investigation have been duly acknowledged.

Investigator:

Dr. Agumas Kiros (MD, year III internal medicine resident)

Signature _____

Date ... 28/7/18 E.C .....

This thesis is will be submitted with the approval of the following advisors

Name	signature
Dr. Wudie Gedefaw (MD, Neurologist)	.....
Mr Girum Meseret (MPH, PHD candidate)	.....