Received: 5 September 2023 | Revised: 12 May 2024 | Accepted: 30 May 2024

DOI: 10.1002/hsr2.2198

ORIGINAL RESEARCH

Health Science Reports Open Access WILEY

Predictors of 30-day mortality following the first episode of stroke among patients admitted at referral hospitals in Dodoma, central Tanzania: A prospective longitudinal observational study

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Abstract

Background and Aims: Stroke is the leading cause of disability and the second most common cause of death after ischemic heart disease worldwide. Understanding predictors of early poststroke mortality provides opportunities for interventions and favorable outcomes. This study aimed to determine the incidence and predictors of 30-day mortality among patients admitted with the first stroke at referral hospitals in Dodoma.

Methods: A prospective longitudinal observational design enrolled patients with acute stroke confirmed by CT scan or MRI admitted at referral hospitals in Dodoma. The National Institute of Health Stroke Scale was used to assess stroke severity at baseline. A comparison of risk factors, clinical profiles, and mortality was done using the Chi-square test. A logistic regression model was used to determine the predictors of 30-day mortality in patients with the stroke while the 30-day probability of survival was estimated using Kaplan–Meier analysis.

Results: Out of 226 patients with first-ever stroke, 121(54%) were males, and the population mean age was 63(15) years. The 140(62%) had Ischemic stroke, and 154(68%) survived at the 30th day. Patients with a history of smoking 2.4 [95% confidence interval (CI) (1.0–5.6), $p = 0.048$], loss of consciousness 2.7 [95% CI (1.2–6.4; $p = 0.019$] and unequal pupil size 13.7 [95% CI (4.1–58.1, $p < 0.001$ were significantly more associated with mortality within 30 days. The median survival was 7 (3–9) days, whereas alcohol drinkers and those aged above 60 years had a shorter time to mortality compared to non-alcohol drinkers and those aged <60 years.

Conclusion: The study showed a high incidence of mortality within 30 days after the first stroke episode, with the highest proportion dying within 7 days of being

hospitalized. Advanced age of ≥60 years, smoking, alcohol use, and severe stroke at admission warrant special attention.

KEYWORDS
30-days, Dodoma, first-stroke, mortality, post-stroke

1 | INTRODUCTION

Stroke remains the most catastrophic and disabling condition, with profound residual impairment and a high fatality rate, which significantly strain community health expenditures and patients and their families.[1–3] Globally, stroke is the second leading cause of mortality after ischemic heart disease, accounting for 11.8% of total deaths.[4] Most stroke-related deaths occur in developing countries, accounting for about 87% of stroke deaths.[5] Worldwide, one out of six persons will experience a stroke in their lifetime, with 5% to 10% of all stroke victims under 50.[6] In a 2004–2006 Tanzanian population-based study, the crude stroke incidence was 107.9 per 100,000 for urban and 94.5 per 100,000 for rural areas, and 315.9 and 108.6 per 100,000 for rural and urban respectively, following age standardization;[7] interestingly, the study highlighted the higher incidence of stroke in urban Tanzania comparable to developed countries.[7]

The most common conventional risk factors for stroke in Africa are hypertension, diabetes, smoking, a sedentary lifestyle, sickle cell disease, African race, an increasingly aging population, and alcohol abuse.[8] Meanwhile, over 80% of published studies in Sub-Saharan Africa (SSA) identify hypertension as the most frequently identified risk factor.[9] The rapid rise of hypertension and poor blood pressure control in Africa contribute to an increase in hemorrhagic stroke, which has a worse outcome than ischemic stroke.[10,11]

Thirty-day stroke mortality ranges between 3.1% and 9.7% in high-income countries[12-14]; however, it remains higher in SSA with a mortality rate of 27% and 46%.[7,15-17] Given the lack of specialized facilities like stroke units, low and middle-income countries have a greater stroke death rate than industrialized nations.[18] Other predictors include premorbid conditions such as diabetes mellitus (DM), advanced age, stroke severity on admission, hemorrhagic type of stroke, and infections.[5,19,20] Two previous studies done in Tanzania reported 33.3% and 61.3% in-hospital stroke fatality rates, with septicemia, age above 45 years, and aspiration pneumonia being significant predictors of high mortality rate.[21]

Despite the high global prevalence of stroke, there is limited information on the epidemiology, prevention, treatment, and outcome of stroke in African settings and other lower middle income countries,[3,22] limiting the baseline evidence for designing interventions to reduce this burden in developing countries.[23] Consequently, this study aimed to determine predictors of early mortality among adult patients admitted with the first episode of stroke in referral hospitals in Dodoma.

2 | METHODS

2.1 | Study design and setting

This was a prospective longitudinal observational study done at the referral hospitals in Dodoma, the capital of Tanzania. Dodoma Referral Regional Hospital and Benjamin Mkapa Hospital (BMH) receive 20 and 30 patients, respectively, with first-ever stroke every month. Both are accredited teaching hospitals for the University of Dodoma's undergraduate and residency medical training programs. The Benjamin Mkapa Hospital is equipped with neuroimaging services, such as CT scans and MRIs, in case of need.

2.2 | Inclusion/exclusion criteria

Adult patients aged 18 years and above with first-ever stroke confirmed stroke by CT scan/MRI who were admitted at Dodoma tertiary hospitals were eligible for the study. Patients with Transient ischemic stroke and those with recurrent stroke were excluded from the study.

2.3 | Variables and data source/measurement

Direct interview with patients or guardians to inquire about socio-demographic, cardiovascular risk factors, predictors of stroke outcomes, and medication history. Laboratory tests: radiological results were obtained and recorded in the structured questionnaires.

All adult patients of ≥18 years who met the inclusion criteria were enrolled after receiving detailed information about the study. Personal data (including sex, age, marital, and occupation), past medical history (like hypertension, DM, previous cardiovascular disease, and stroke), and lifestyle, including alcohol drinking and smoking, were collected. Current smoking/alcohol use, defined as those who smoke or take alcohol within the last 12 months from the presentation, was collected through direct interviews with the patient and/or immediate guardian.[24] The National Institute of Health Stroke Scale (NIHSS) was used to assess the severity of stroke based on symptoms and physical examination using specific scores[25]; a score of 1–4 was categorized as minor stroke, 5–15 as moderate stroke, 15–20 as moderately severe stroke and 21–42 as severe stroke. Blood Pressure was measured using a brand AD Medical Inc. digital BP machine by placing the cuff on the arm at the level of the heart. Three measurements were taken 2 min apart from the unaffected arm to minimize the effects of changes in tone from the hemiplegic arm.[26] Hypertension is defined as systolic blood pressure ≥ 140 mmHG or

TABLE 1 Predictors of 30-day mortality in patients with stroke.

		Unadjusted		Adjusted	
Variables	**Category**	**OR (95% CI)**	***p*-Value**	**OR (95% CI)**	***p*-Value**
Age in years	<60	Ref	0.002	Ref	0.44
	≥60	2.6 (1.4–4.8)		1.4 (0.6–3.4)	
Smoking	No	Ref	0.05	Ref	0.009
	Yes	1.9 (1.0–3.5)		3.2 (1.3–7.9)	
Diabetes	Yes	1.1 (0.5–2.3)	0.73	1.6 (0.5–4.8)	0.39
	No	Ref		Ref	
Hypertension	No	Ref	0.28	Ref	0.66
	Yes	1.6 (0.7–3.7)		1.3 (0.4–5.4)	
Stroke type per CT scan	Hemorrhagic	Ref	0.19	Ref	0.25
	Ischemic	1.5 (0.8–2.7)		1.6 (0.7–3.8)	
Aphasia	Yes	11.3 (5.0–30.5)	<0.001	1.8 (0.5–8.2)	0.39
	No	Ref		Ref	
Loss of consciousness	Yes	8.8 (4.7–17.1)	<0.001	2.7 (1.2–6.4)	0.019
	No	Ref		Ref	
NIHSS score	<15	Ref	<0.001	Ref	0.15
	≥15	2.7 (1.5–4.8)		1.7 (0.8–3.7)	
Focal neurologic deficit	Yes	1.4 (0.2–28.8)	0.77	0.5 (0.0–12.5)	0.61
	No	Ref		Ref	
Dysarthria	Yes	0.1 (0.0–0.2)	<0.001	0.3 (0.0–1.4)	0.13
	No	Ref		Ref	
Seizure	Yes	2.7 (1.4 - 5.2)	0.003	1.6 (0.7–3.9)	0.29
	No	Ref		Ref	
Pupils examination	Normal	Ref	<0.001	Ref	<0.001
	Abnormal	12.3 (4.7–38.3)		12.1 (3.4–53.6)	
Aspiration pneumonia	No	Ref	<0.001	Ref	<0.001
	Yes	9.4 (4.9–18.6)		5.2 (2.2–12.6)	

Abbreviations: CI, confidence interval; OR, odds ratio.

diastolic bood pressure ≥ 90 mmHg or those with a known history of hypertension or on antihypertensive drugs.[26,27] An examination of the radial pulse was done on the unaffected limb for the rate and rhythm in 1 min to detect the presence of an arrhythmia; a pulse deficit of 10 or more was regarded as atrial fibrillation.[28] Waist and hip circumference were measured using a tape measure and recorded in centimeters. Central obesity was defined as a waist-hip ratio that reached ≥0.90 in men and ≥0.85 in females.[29]

Blood glucose was measured using a Glucometer Accucheck Active Roche. A diagnosis of DM was made when the random blood glucose level was ≥11.1 mmol/l and confirmed by fasting blood glucose ≥ 7.0 mmol/l or glycosylated hemoglobin ≥ 6.5%. Blood samples of about 10 mL were collected aseptically: 5 mL were analyzed for complete blood count (CBS) using an Automated Hematological analyzer CD-RUBY,[30] and a total white cell count >11.6,000 was considered as leucocytosis, 5 mL analyzed for lipid profile using Automated chemistry analyzer Erba XL-180,[31] and the results were out within 24 h postadmission and total cholesterol of more than 6.2 mmol/l (>240 mg/dl) termed as hyperlipidemia. HIV rapid testing was done using the standard deviation (SD) Bio line. If the SD Bio line turns positive, then a confirmation test using a rapid test Unigold was done.

The principal investigator performed a 12-lead electrocardiogram using the BIONET machine to look for arrhythmias. The consultant cardiologist performed echocardiography using GE LOGIQC5 Premium, and the result was interpreted based on the American Society of Echocardiography guidelines.[32]

Non-contrast brain computed tomography using (SOMATOM Definition Flash) or magnetic resonance imaging was performed on all cases with sudden onset of the neurological deficit as a high suspicion of stroke within 7 days; patients were transferred to BMH using either a hospital ambulance with the escort nurse and the results were interpreted by a consultant radiologist.[33] Stroke outcome was assessed using a modified Rankin Scale[34] at 24 h, 7 days, 14 days, and 30 days from admission.

2.4 | Sample size and sampling procedure

A formula for proportion in a prospective cohort study was used,[31,35] and a minimum sample size of 142 was required. Over the 19 months, 226 samples were collected from March 2020 to October 2021. Participants who were readily accessible, willing to participate, and met the inclusion criteria were recruited until the required sample size was attained.

2.5 | Data analysis

For statistical analysis, data were entered on a Microsoft Excel sheet and then converted to IBM SPSS PC version 26. During preliminary analysis, some of the continuous variables including age and NIHSS score, were collapsed into categorical data. The study population characteristics were summarized as mean and SD, median and interquartile range for continuous variables, while categorical variables were summarized as frequencies and proportions. The chi-square test was used to assess the baseline characteristics of stroke patients and the association with 30-day mortality. Binary logistic regression was used to compute the predictors of 30-day mortality; only variables that met a 20% statistical significance at the univariate level were selected for multivariable Logistic regression analysis to determine independent predictors for 30-day stroke mortality. Data was summarized as adjusted odds ratio and 95% confidence interval. Time to mortality by associated factors using log-rank test. Tests were two-tailed, and statistical significance was set at a p-value less than 0.05. (Table 1).

2.6 | Ethical considerations

The University of Dodoma Institutional Review Board provided ethical clearance under the Directorate of Research and Publications (reference number MA.84/261/02). The administrative departments of Benjamin Mkapa and Dodoma Regional Referral Hospitals approved data collection with reference numbers AC.83/119/01/89 and PB.22/130/02/04, respectively. Participants or next of kin were informed that their participation was entirely optional and that they may opt out without interfering with the standard routine care. Participants were asked to provide written or verbal informed consent under the witness of a close relative. For those who could not provide informed consent, a custodian who had to be a close family member or guardian provided the assent on behalf.

3 | RESULTS

3.1 | Baseline demographic and clinical characteristics and the distribution of death and survival after stroke

Of all 242 patients presented with stroke, 226 (93.4%) met the criteria for first-ever stroke and could provide informed consent, refer to Figure 1 for the reasons of excluding 16. Of these 226 patients, 121 (54%) were male, the mean (SD) age was 63 (15) years, and the median NIHSS Interquartile range (IQR) was 14 (11–20). A total of 140 (62%) patients had an ischemic stroke, 54(24%) were cigarette smokers, 189 (84%) had hypertension, 38 (17%) had diabetes, just 7 (3%) patients were living with HIV/AIDS and on regular use of medications (see Table 2).

3.2 | Time to mortality by clinical patterns and associated risks

The overall mortality in 226 patients presenting with the first stroke episode was 72 (32%). Their median (IQR) time to mortality was 7 (3–9) days. Alcohol drinkers and those aged above 60 years had a shorter time to mortality compared to non-alcohol drinkers and those aged <60 years (Figure 2D,F, $p \leq 0.041$). There were no significant

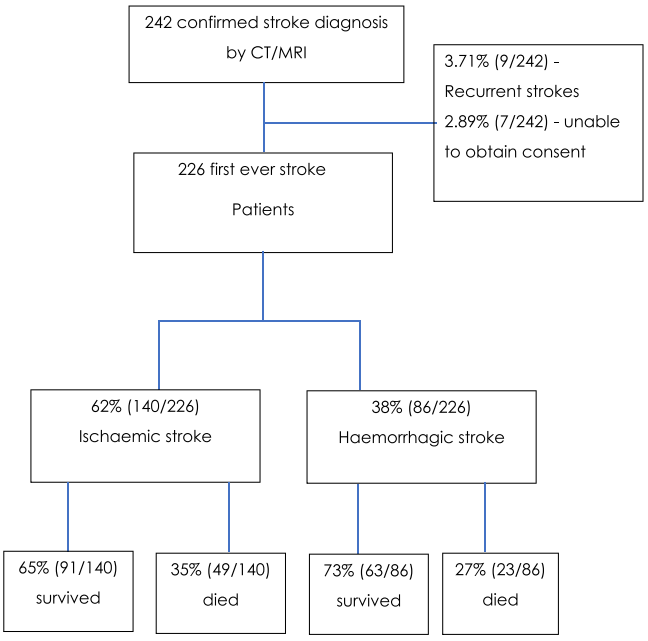

FIGURE 1 Recruitment and clinical outcome of patients with stroke.

TABLE 2 Baseline demographic and clinical characteristics and the distribution of death and survival after stroke.

Variables	Category	All (*N* = 226)	Survived (*n* = 154)	Died (72)	*p*-Value
Gender, *n* (%)	Female	105 (46)	71 (46)	34 (47)	0.99
	Male	121 (54)	83 (54)	38 (53)	
mean age, (SD)	Mean	63 (15)	61 (13)	69 (96)	<0.001
HIV	Positive	7	6	1	0.43
	Negative	137	90	47	
Marriage	Single	25	14	11	0.31
	Married	119	82	37	
Education	No formal	48 (21)	24 (16)	24 (33)	0.02
	Primary	107 (47)	77 (50)	30 (42)	
	Secondary	38 (17)	26 (17)	12 (17)	
	Tertiary	33 (15)	27 (17)	6 (8)	
Occupation	Dependent	23	10	13	0.009
	Employee	22	19	3	
	Peasant	99	67	32	
Smoking	Yes	54 (24)	31 (20)	23 (32)	0.08
	No	172 (76)	123 (80)	49 (68)	
Alcohol drink	Yes	91 (40)	58 (38)	33 (46)	0.31
	No	135 (60)	96 (62)	39 (54)	
Hypertension	Yes	189 (84)	126 (82)	63 (88)	0.38
	No	37 (16)	28 (18)	9 (12)	
Diabetes mellitus	Yes	38 (17)	25 (16)	13 (18)	0.88
	No	188 (83)	129 (84)	59 (82)	
Hyperglycemia	Yes	52 (23)	31 (20)	21 (29)	0.18
	No	174 (77)	123 (80)	51 (71)	
Aspiration pneumonia	Yes	62 (27)	42	20	<0.001
	No	164 (73)	134	30	
Stroke type	Hemorrhagic	86 (38)	63 (41)	23 (32)	0.25
	Ischemic	140 (62)	91 (59)	49 (68)	
Headache	Yes	124 (55)	81 (53)	43 (60)	0.25
	No	102 (45)	73 (47)	29 (40)	
Aphasia	Yes	142 (63%)	76 (49)	66 (92)	<0.001
	No	84 (37%)	78 (51)	6 (8)	
Vomiting	Yes	48 (21)	29 (19)	19 (26)	0.26
	No	178 (79)	125 (81)	53 (74)	
Loss of consciousness	Yes	87 (38)	35 (23)	52 (72)	<0.001
	No	139 (62)	119 (77)	20 (28)	
Median NIHSS (IQR)	Median	14 (11–20)	13 (9–17)	19 (12–23)	<0.001
Focal neurologic deficit	Yes	222 (98)	151 (98)	71 (99)	>0.99
	No	4 (2)	3 (2)	1 (1)	

(Continues)

TABLE 2 (Continued)

Variables	Category	All (*N* = 226)	Survived (*n* = 154)	Died (72)	*p*-Value
Dysarthria	Yes	73 (32)	69 (45)	4 (6)	<0.001
	No	153 (68)	85 (55)	68 (94)	
Seizure	Yes	48 (21)	24 (16)	24 (33)	0.004
	No	178 (79)	130 (84)	48 (67)	
Pupils examination	Normal	200 (89)	149 (97)	51 (71)	<0.001
	Anisocoria	14 (6)	3 (2)	11 (15)	
	Pinpoint	12 (5)	2 (1)	10 (14)	
median RBG (IQR)		6.9 (6.1–8.9)	6.8 (6.0–8.1)	7.5 (6.4–10.1)	0.011
Mean/medial cholesterol		5.2 (4.5–6.5)	5.2 (4.3–6.5)	5.4 (4.7–6.3)	0.34
Mean/medial LDL		2.2 (1.8–2.9)	2.2 (1.8–2.9)	2.3 (1.9–3.1)	0.12
Mean/medial triglyceride		1.5 (1.1–2.1)	1.4 (1.1–2.1)	1.7 (1.2–2.1)	0.13

Abbreviations: IQR, Interquartile range; LDL, low density lipoprotein; NIHSS, national institute of stroke scale; RBG, random blood glucose; SD, standard deviation,

differences in time to mortality among those with or without hypertension, smoking, ischemic and hemorrhagic stroke (Figure 2A–C, $p > 0.05$). The details of time to stroke-related mortality among patients by risk factors and clinical presentations on admission are in Figures 2A–F and 3.

4 | DISCUSSION

This study found ischemic stroke is a more prevalent type (62%); this is similar to a ratio of 60:40 observed at Muhimbili National Hospital in Tanzania for ischemic stroke and hemorrhagic stroke, respectively.[10,36] Considering the variability in the ischemic-to-hemorrhagic stroke ratio, ischemic stroke remains prevalent in developed and underdeveloped countries.[11,37] While the higher risk of intracerebral hemorrhage in low-income and upper-middle-income nations may be attributable to the increased risk of uncontrolled hypertension in these countries,[38] our study also shows that 84% of participants were hypertensive with poor blood pressure control. This is consistent with previous findings showing that 52% of Americans (a developed country) have their hypertension under control, compared to 5%–10% in the African population.[39] The lack of awareness, access to care, and adherence to implementable hypertension management recommendations in low and middle-income countries may significantly contribute to this difference.[40]

The 30-day mortality rate in this study was 32%, comparable to previous reports from Uganda[41] and Ghana,[42] where the mortality rates were 43.8% and 43%, respectively. The relatively higher mortality rate (61.3%) in a previous study conducted in Dar es salaam-Tanzania[36] might be attributed to the inclusion of more than half of the participants with severe stroke (median NIHSS was 19) despite the mean age of the study populations being nearly identical to our study population. Our findings also showed the 30-day mortality rate to be 15% higher than in industrialized countries,[11,43,44] owing to a lack of knowledge about stroke signs and symptoms resulting in late hospital presentation,[45] about which the mean duration of the patient presented to the hospital since the onset of stroke was 3 days in a previous study done in Tanzania[46] closer to the observed mean duration for this study. Furthermore, low and middle-income countries have poor neurosurgical outcomes of stroke, with few studies reporting up to 55% mortality rate[47] owing to a lack of access to advanced neurosurgical procedures compared to developed nations.

We found that current smoking status, loss of consciousness, unequal pupil size at presentation, and poststroke aspiration pneumonia were independent determinants of stroke mortality at 30 days. The impact of smoking on stroke outcomes is consistently reported[48] in diverse settings, including the United States and China[49–51]; however, the association between smoking and stroke-related mortality is not always delineated, given the disparity in access to advanced stroke units that offer standard and timely stroke management in the acute setting in developed countries. For example, unlike the resource-limited settings, thrombolytic agents are generally provided, which may improve their stroke severity score at baseline and hence improve outcomes in the advanced units of the developed world.[52] Given that smokers tend to have higher NIHSS scores at admission,[53] they are more likely to have hypertension, abdominal obesity, dyslipidemia, atrial fibrillation, and diabetes.[54] The difference in improvement may mainly be observed among smokers who receive thrombolytic agents compared to those who do not. It is hypothesized that smoking reduces the release of endogenous tissue-type plasminogen activator, leading to an increase in

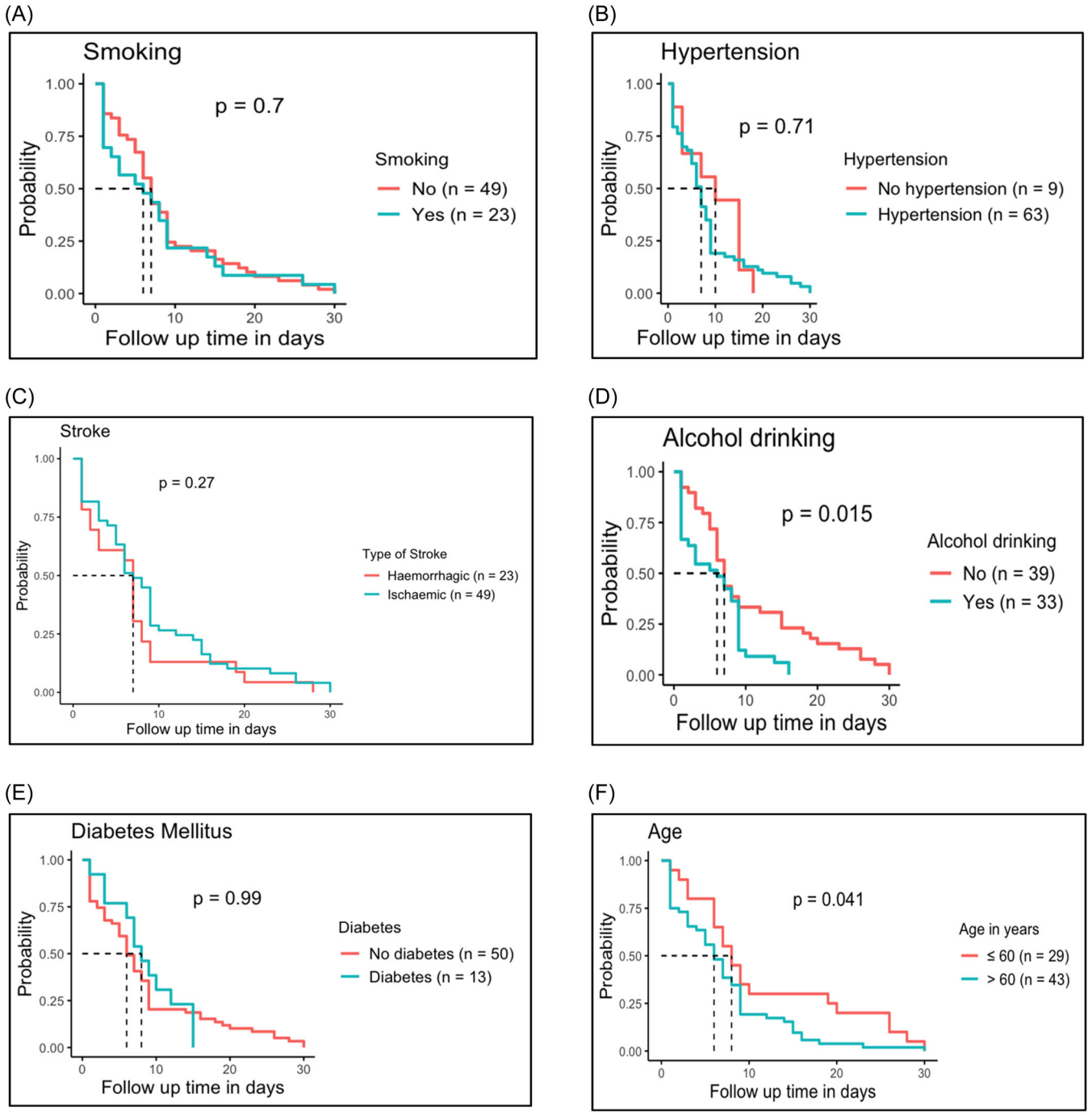

FIGURE 2 (A–F) Baseline variables for time to stroke-related death in patients at risk ($n = 72$).

fibrinogen levels and an increase in fibrin-rich thrombi, thereby increasing susceptibility to exogenous tissue-type plasminogen activator therapy.[55] Furthermore, the risk of vascular events such as heart attacks and strokes appears to be amplified when these risk factors coexist.[56] Loss of consciousness is a good proxy for the severity of a stroke, and both are associated with an increased risk of stroke mortality in the early stages.[57] A previous study in the United States showed that less severe types of stroke were linked to an 80% drop in stroke-related deaths, which supports the findings elsewhere.[58] We found that stroke patients with loss of consciousness at presentation had three times higher odds of dying within 30 days. Similar to a previous study conducted in Nigeria, patients with a Glasgow coma scale < 10 and NIHSS ≥ 16 were more likely to die within 30 days, and other studies in Africa and Western countries also show the severity of stroke predicts a high mortality rate.[59,60]

As previously observed, unequal pupil size/anisocoria on admission predicted death within 30 days compared to normal pupils.[57,61] Unequal pupil size is a common presentation of stroke in vertebral-

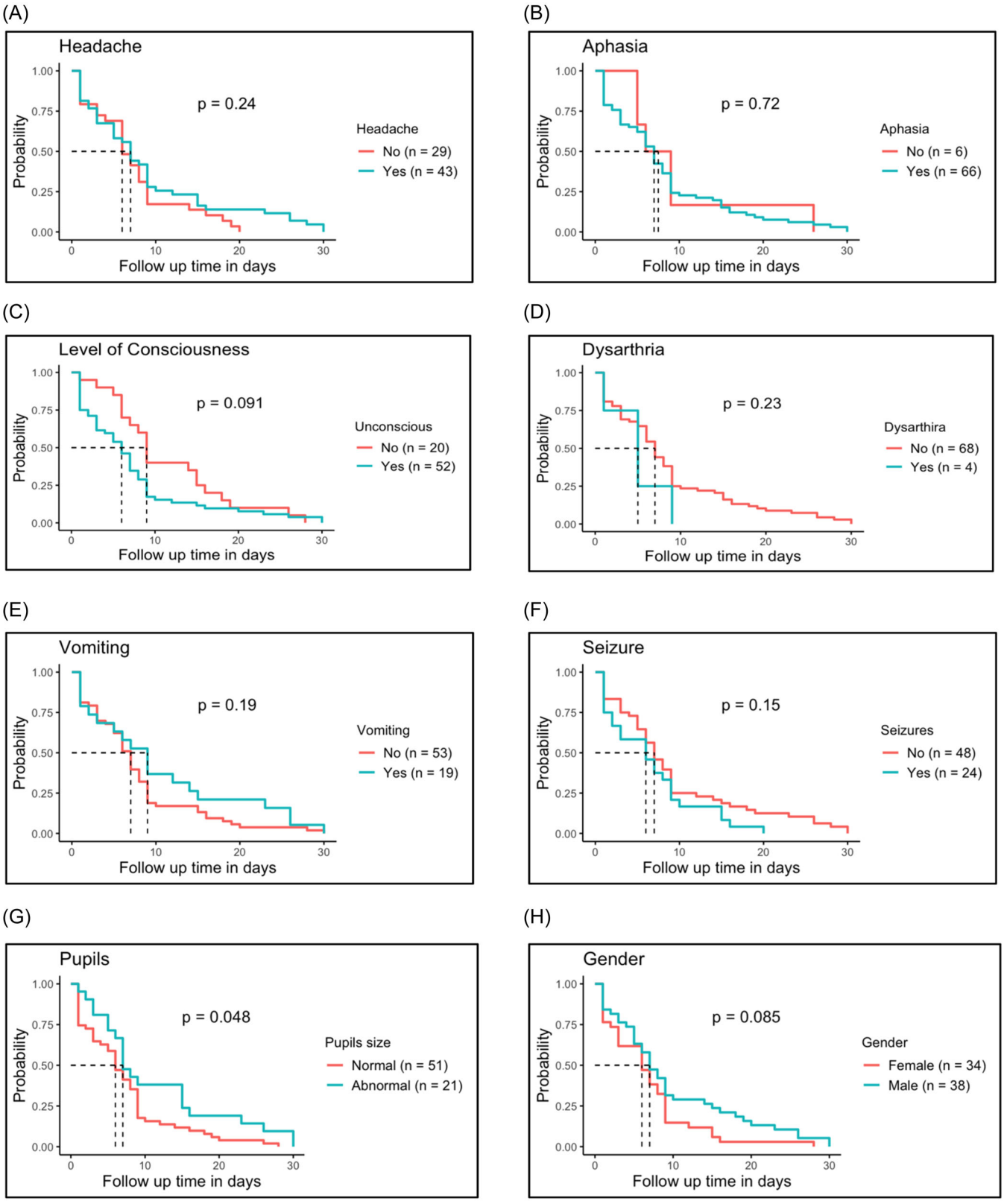

FIGURE 3 (A–H) Baseline factors associated with time to stroke-related mortality among patients at risk ($n = 72$).

basilar circulation mostly due to an expanding aneurysm of the posterior communicating artery that compresses externally located pupil fibers of the oculomotor nerve.[62] With a mortality of 85%, vertebral basilar stroke carries a higher risk of mortality compared to stroke in anterior circulation; a few things may explain this phenomenon: vertebral-basilar stroke presents with symptoms that resemble non-stroke symptoms such as vertigo or nausea and thus delaying timely-dependent interventions.[61,62] Because of the

involvement of the brain stem and cerebellum, vestibular-cerebellar strokes are also associated with severe disabilities, including hemiplegia or quadriplegia, dysarthria, dysphagia, gaze abnormalities, and cranial neuropathies secondary due to multisystem involvement.[62] Although variables such as higher presenting NIHSS scores are typically associated with poorer functional outcomes and are more common in anterior circulation stroke than in posterior circulation stroke,[63] the NIHSS detects posterior circulation deficits with less sensitivity than anterior circulation deficits[64]; therefore, its utility in predicting poor outcome posterior circulation stroke is somewhat limited.

We found that aspiration pneumonia after stroke was common (27%) and an independent predictor of early stroke mortality. Our findings are consistent with previous studies conducted in SSA; published evidence from this region indicates that its incidence ranges from 13% to 34% and may be responsible for up to 45% of in-patient stroke-related mortality.[21,65,66] In the United States, post-stroke aspiration pneumonia accounts for up to 13% of cases and up to 10% of stroke deaths.[67] Stroke patients frequently develop aspiration pneumonia due to dysphagia and decreased mental status.[67] Post-stroke aspiration pneumonia lengthens hospital stays, induces fevers and systemic inflammation, and can develop into sepsis and acute respiratory failure.[68,69] In-patient stroke centers in the United States and other high-resourced settings use protocols to reduce the risk of post-stroke aspiration pneumonia, such as early swallow screening, nil per os, and nasogastric tube (NGT) feeding in patients with prohibitive dysphagia, but resource-limited settings often lack adequate human resource for close nursing care and swallowing therapists to ensure safe nutrition after an acute neurologic insult that impairs mental status or oropharyngeal coordination.[70,71] In SSA, limited access to NGTs, parenteral feeding formulae, food texture change, difficulty in elevating the (head-of-bed) HOB in many hospitals, and vigorous oral feeding by bedside family caregivers may increase the risk of aspiration.

The majority of hospitalized stroke patients died within 7 days, which was found to be comparable with the 7 days in a study done at Debre Markos Comprehensive Specialized Hospital, Northwest Ethiopia,[72] 4.5 days at Hawassa University Referral Hospital, South Ethiopia,[73] and 4 days at Ayder Comprehensive Specialized Hospital, Northern Ethiopia.[74] Early stroke deaths within the first week of stroke onset were primarily influenced by neurological dysfunction,[8] initial stroke severity, and early neurological deterioration.[20]

The study had several limitations. First, this was a hospital-based study, which may not accurately reflect the reality given the lack of access to hospitals for many critically ill patients who might have died before reaching a hospital. In addition, the hospital-based study is susceptible to referral bias because the majority of acute stroke patients who visit our hospital are from the health facilities proximal to the hospitals. The Joanna Briggs Institute critical appraisal tool, with 11 criteria, was used to assess the risk of bias in the cohort study. The first three criteria were not applicable to this study, so they were not graded. The remaining eight criteria were met in this study: the participants were free of outcome (death) at the start of the study, and the method for measuring outcome was valid and reliable because contacts were made with family members of deceased participants. Additionally, death records were confirmed using hospital mortality data. Furthermore, participant follow-up was complete throughout the study period, with no loss of follow-up, and appropriate statistical analysis methods were used.

5 | CONCLUSION

In central Tanzania, the 30-day mortality rate after stroke is high, and most patients die within 7 days of being hospitalized. Stroke patients older than 60 years old, smokers, alcoholic drinkers, and patients who arrive at the hospital with loss of consciousness need special attention.

6 | RECOMMENDATIONS

Our recommendation is for early patient evaluation, identification, and complication management to prevent early stroke-related mortality and disability, it is imperative that specialized stroke units be established in Tanzanian referral hospitals for emergency care of acute stroke. In addition, attention needs to be focused on treating stroke patients with considerably higher mortality risk such as those with loss of consciousness, smokers, alcoholics, older people and those at risk of aspiration pneumonia.

AUTHOR CONTRIBUTIONS

Anna M. Chongolo: Conceptualization; data curation; investigation; methodology; writing—original draft. **Baraka Alphonce**: Writing—review and editing. **Peter M. Mbelele**: Formal analysis; writing—review and editing. **John Meda**: Conceptualization; methodology; supervision; writing—review and editing. **Azan Nyundo**: Conceptualization; formal analysis; methodology; writing—original draft; writing—review and editing.

ACKNOWLEDGMENTS

We thank all the study participants and the internal Medicine team from Dodoma Referral Regional Hospital and Benjamin Mkapa Hospital for their support during data collection.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restriction. Data are available upon request from the corresponding author. The author had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis

TRANSPARENCY STATEMENT

The lead author Azan Nyundo affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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How to cite this article: Chongolo AM, Alphonce B, Mbelele PM, Meda J, Nyundo A. Predictors of 30-day mortality following the first episode of stroke among patients admitted at referral hospitals in Dodoma, central Tanzania: a prospective longitudinal observational study. *Health Sci Rep*. 2024;7:e2198. doi:10.1002/hsr2.2198