A QUALITY AUDIT ON THE MANAGEMENT OF ACUTE ISCHAEMIC STROKE AT KENYATTA NATIONAL HOSPITAL

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Declaration

I, Dr Gloria Omondi, declare that this is my original work and that to the best of my knowledge it has not been presented before for a degree or any other academic award at this or any other university.

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Thank You Almighty Lord for bringing me this far. It is all by your grace.

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List of Abbreviations and Acronyms

AF	:	Atrial fibrillation
ASA	:	American stroke association
A&E	:	Accident and emergency
CCC	:	Comprehensive Care Unit
CDC	:	Communicable Disease Control
CT	:	Computed Tomography
DALYs	:	Disability adjusted life years
DW MRI	:	Diffusion weighted MRI
GWTG	:	Get With The Guidelines.
HDL	:	High Density Lipoproteins
HICs	:	High Income Countries
ICD	:	International disease code
INR	:	International normalised ratio
KNH	:	Kenyatta National hospital
LMICs	:	Low and Middle Income Countries
MRI	:	Magnetic Resonance Imaging
NGT	:	Nasogastric tube
NHIF	:	National Hospital Insurance Fund
VTE	:	Venous thromboembolism
NCCT	:	Non Contrast CT scan
NIHSS	:	National Institute of Health Stroke Scale
NNRTI	:	Non-Nucleoside Reverse Transcriptase Inhibitors
NQT	:	National Quality Forum

OAC	:	Oral anticoagulant
OR	:	Odds Ratio
rtPA	:	recombinant Tissue Plasminogen Activator
SCD	:	Sickle cell disease
SSA	:	sub Saharan Africa
TJC	:	The Joint Commission
UK	:	United Kingdom
US	:	United States
VLDL	:	Very Low Density Lipoproteins
WHO	:	World Health Organisation

ABSTRACT

Background

Stroke mortality is high and rising in developing countries including Kenya. Eighty four percent of stroke victims in these countries die within 3 years of diagnosis compared to16% of those living in high income countries. This disparity is largely attributable to the care given in the acute setting after onset of stroke. Though stroke is now considered a treatable medical emergency, the care of stroke patients is still suboptimal in much of SSA. This is due to wide gaps between evidence based guideline recommendations and actual clinical practice as affected not only by availability of resources but also inertia and inefficiency in health service provision. In view of this, professional neurological societies developed quality assessment tools that can be used to monitor and improve the care given to stroke patients. Institutions that carry out regular audits have been shown to have consistent improvements in the outcome of their stroke patients.

Objectives

Primary objective

1. To assess the management of acute ischaemic stroke and determine the proportion of stroke patients receiving the recommended stroke care according to the American Stroke Association quality indicators.

Secondary objectives

1. To evaluate knowledge on standard stroke care among health care providers in KNH.

2. To assess the main barriers to providing recommended stroke care interventions.

Methods

The study design was mixed. First, there was a retrospective file audit of patients admitted with acute ischaemic stroke over a period of one year (2018). Secondly, we employed a quantitative cross sectional design to assess health care provider's knowledge on stroke care. Lastly, we carried out a qualitative cross sectional assessment of the main barriers to quality stroke care.

The ASA-GWTG audit tool was used to document the extent to which stroke care processes approximated recommended guidelines. The score for each process was calculated as a percentage of patients documented to have received the care process (quality indicator) versus the total number eligible.

Knowledge on stroke among health care providers was assessed quantitatively using questionnaires and the scores expressed as a percentage of correct answers by the respondents. Barriers to stroke care were assessed using semi structured voice recorded interviews of key informants and thematic analysis was done for the data obtained.

Results

A total of 160 files records were reviewed. We found low and variable adherence to stroke quality indicators. Eighty three percent of the patients had brain imaging done by day one but none of them had thrombolysis. Dysphagia screening was considered done in 7%. Antiplatelets administration by day 2 was met in 48% of the patients. Venous thromboembolism prophylaxis was documented in 65% while 78% of the patients in atrial fibrillation had anticoagulation therapy. Fifty eight percent of the patients had physiotherapy done. Less than 1% of the patients were documented to have been educated stroke. There was no documentation of advice against

smoking to any of the active smokers. Seventy five percent of the patients were discharged on an antiplatelet and 59% went home on a cholesterol lowering agent.

On assessment of knowledge of health care workers on stroke, most internal medicine residents had sufficient knowledge on acute stroke care. Their mean score 73%, but the mean score for the medical officers was 55%. The nurses had a low mean score at 39%.

We found eight key barriers to standard stroke care. At the patient level, there were delays in presentation, financial constraints and low level of awareness on stroke. At the hospital level, there was lack of stroke care protocols, low awareness among lower cadre providers, inadequate staff, insufficient equipment and limited funding from the national government.

Conclusion

KNH had overall low and variable scores across the stroke performance measures.

Health care workers demonstrated a wide variability in their stroke knowledge on stroke.

There were multiple barriers to optimal stroke care at the patient level, hospital level and national level.

CHAPTER ONE

1 INTRODUCTION

Stroke is second commonest cause of mortality globally. It is also leading cause of serious long term acquired disability in the world (1). While the incidence of stroke is dropping in high income countries (HIC), the contrary is true in developing countries including Kenya. Low and middle income counties (LMIC) currently bear more than 75% of the total stroke deaths (1). Almost half (48%) of the stroke deaths are premature, more so in Sub-Saharan Africa (SSA) where the people affected are on average 15 years younger compared to those from HIC (2).

Stroke poses substantial economic burden both to the individual and the society. Apart from the direct medical expenses, the survivors grapple with major protracted indirect costs due to long-term disability, lost productivity and even mental and psychosocial disturbances.

The quality of care provided in the acute phase of stroke is a major determinant of stroke outcome. Better quality care is associated with fewer complications and reduced mortality in the acute phase of stroke. Better care is also associated with less disability and higher likelihood of independence after stroke (3).

Historically, stroke management was only conservative. Recently though, there have been major advances in research that have revolutionised acute stroke into a treatable condition that should be managed actively as an emergency. In this regard, updated evidence based guidelines are readily available for application. However their uptake into practice lags behind especially in

LMIC. As a result, the quality of care and outcome of stroke remains suboptimal in much of these areas. The 28 day inpatient stroke mortality at KNH for example was 26.7% in 2016 (4).

In view of poor outcomes and wide guideline- practice gaps, professional neurologic societies developed performance measures to allow audit of stroke care. The assessment provides objective evidence to identify deficits in stroke care and provide a framework for developing quality improvement plans. Teams that carry out regular audits have been shown to have consistent improvement in outcomes of their stroke patients (5).

The main objective of this study was to document the quality of acute ischaemic stroke care and determine the main barriers to adherence to recommended guidelines at KNH. In subsequent sections, we examine the literature on epidemiology of stroke and Stroke care. We also describe the methods applied and present the results.

CHAPTER TWO

2 BACKGROUND AND LITERATURE REVIEW

2.1 Definitions

Stroke is as an abrupt neurological deficit that is caused by interruption of blood supply to part of the brain. Globally, about 80% of stroke is due to occlusion of a blood vessel, causing ischaemia. The remaining 20% is due to haemorrhage into the brain tissue.

2.2 Epidemiology of stroke

Stroke is a disease of major public health concern. In 2013, 6.5 million people died of stroke, making it still the second leading cause of death globally (1). Developing countries bear more than 75% of this mortality burden (1). In addition, the population affected in LMIC is on average 15 years younger (6). Moreover, up to 84% of stroke victims in LMIC die within 3 years of diagnosis versus 16% of those living in high income countries (2).

Stroke incidence in LMIC has risen by over 100% in the past two decades (7). This is largely due to rapid urbanization with associated increased exposure to risk factors such as obesity, hypertension and diabetes, coupled with poor or absent primary prevention. There has been limited accurate data on incidence and prevalence from stroke in Africa as a whole. Most of the available data is hospital based. A systematic review estimated stroke prevalence in Africa at 317/100,000 (8). In South Africa, stroke is the third leading cause of death in adults after HIV/AIDS and ischaemic heart disease. The age-standardised mortality is at 125 per 100 000. In Tanzania the crude incidence of stroke is estimated at 94.5-107/100000 (9) with more cases occurring in the urban areas. Mortality due to stroke is at 5.5% (10).

In Kenya, the WHO ranked stroke the 4th leading cause of death immediately after HIV/AIDS. An estimated, 11,976 people died of stroke in 2017, accounting for 4.25% of total deaths. The age adjusted death rate was at 66.90 per 100,000(1). A 2016 prospective study of stroke in Kenya's referral hospitals showed a peak age of 50-69 years with 28 day mortality at 27.6% (4). One of the main factors blamed for the poor stroke outcomes in our setting is the suboptimal early care (11).

2.3 Economic burden of stroke

Stroke is a costly disease. It is associated with high direct costs of providing medical care and even higher protracted indirect costs due to lost productivity and long term disability. In the US the individual lifetime cost of ischemic stroke is approximately $140,000 (12). The total annual cost of stroke in the USA is estimated to exceed $180 billion by 2030(13). In the United Kingdom (UK), stroke alone costs the health sector more than 5% of its total annual budget (14). In South Africa, the total direct cost of stroke was estimated at US$283,500–US$485,000. This is more than 3% of the sub-district health expenditure(15). A study in Togo revealed that the direct cost of stroke was 19 times more than the minimum salary of a civil servant in the country (15). In Kenya, the inpatient cost of stroke is one of the highest among non-communicable diseases (16).

The high cost of care of stroke is out of reach for many patients in the developing world. However better quality of stroke care has been associated with significant reduction in overall cost of stroke. This is by reducing not only the length of hospital stay but also the level of disability hence tremendous alleviation of long term care costs and lost productivity.

2.4 Risk factors for stroke

Modifiable risk factors

Hypertension is the commonest risk factor for stroke. Adequate blood pressure (BP) control can reduce the incidence of stroke by up to fifty percent. According to the 2015 countrywide STEP survey, the prevalence on hypertension in Kenya is 24%. Of more concern is that only 8% of those with hypertension are on treatment and only 3% of those with hypertension are well controlled on medication (17).

Diabetes is also an important growing risk factor for stroke. The STEPS survey found the found the prevalence of raised blood sugar at 2%. It was commoner in the urban population and among the wealthy (17). In 2018, the WHO estimated the prevalence of diabetes in Kenya at 4% (1).

Atrial fibrillation (AF) is the most important treatable cardiac cause of stroke. Traditionally, most of the atrial fibrillation in Africa was as a result of valvular heart disease. However, non valvular atrial fibrillation is becoming more common. Yonga et al found that valvular heart disease contributed to 12% of AF in AKUH (18). In KNH, Nduiga et al found 53% of AF was non valvular and stroke was the second commonest complication at 47% of the patients (19). Up to 40% of patients with rheumatic heart disease (RHD) have AF. Just like hypertension, AF in sub-Saharan Africa is underdiagnosed and undertreated and thus further contributing to the high incidence of stroke in this population (20).

Dyslipidaemia particularly elevated low density lipoproteins (LDL) increase the risk of stroke. The Interstroke study showed that elevated Apo lipoprotein B increased risk of stroke by 1.12 (21). High HDL is protective against ischaemic stroke. In Kenya low HDL is the more prevalent

type of dyslipidaemia (22). More than 10% of Kenyan adults have total cholesterol of more than 10% and it is c commoner in females (17).

Smoking is a well-established risk factor for stroke. The Framingham study, revealed that smoking doubles the risk of stroke and smoking cessation reduced the risk of stroke by 50% (23). The prevalence of smoking in Kenya 13.9% (1). It is commoner among the poor and in males (1).

HIV increases the risk of stroke by various mechanisms including vasculitis. The risk of stroke is proportional to viral load levels. Kenya has one of the highest burden of HIV in Africa. There are over 1.6 million people living with HIV in Kenya. The hazard ratio of stroke in HIV is 1.4 (24).

Sickle cell disease (SCD) is the commonest cause of stroke in children. Western Kenya and parts of coastal Kenya lie in the sickle cell belt. Sickle cell is associated with an increased incidence of stroke due to endothelial inflammation and increased coagulability. The prevalence of SCD in western Kenya is more than 25% (25).

Non Modifiable risk factors

The risk of stroke doubles with every decade after the age of 65 years. The incidence is more if one has a first degree relative with stroke. Globally stroke occurs more in males than females in a ratio of approximately 1.5 to 2.

2.5 Evolution of stroke care

Until the late 20th century, there was no specific treatment for stroke and management was conservative. The landmark NINDs study in 1996 revolutionised stroke into a treatable disease. NINDS demonstrated significant improvements in functional outcomes if thrombolysis was

given within 3 hours. These results were confirmed in the ATLANTIS A trial. Subsequently, the ECASS III trial demonstrated benefit of alteplase beyond 3hours and effectively extended the thrombolysis window to 4.5 hours (26) . Thrombolytic therapy reduces death and dependency with no statistically significant increase in intracranial haemorrhage (27).

Further advances in stroke therapy now encompass the use of endovascular devices. These are suitable for large vessel occlusions and can be attempted even after failed intravenous thrombolysis (28). Studies are currently on going on the performance of different devices being developed.

Improvement in stroke care has not been uniform globally. Developing countries are lagging behind in implementation of most of the initiatives. A systematic review in 2017 showed that stroke in Africa is still mostly managed supportively (11) .

2.6 Quality of care

The US institute of Medicine defines quality of health care as the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge (29). High quality care is safe, effective, timely, efficient, equitable and patient centred.

Performance measures (quality indicators) can be used to assess quality of care. Performance measures are initially selected from clinical guidelines supported by the highest level of evidence available. They are rigorously reviewed, rated and finally selected in multi professional panels or through the Delphi method. Clinical evidence shows that when applied, performance indicators enhance the patients' life and when omitted are likely to result in suboptimal outcomes (30).

Performance measures can also be used to compare institutions. In the United States, they are used to reward well performing institutions.

2.7 Quality indicators in stroke

Quality indicators used for stroke vary with individual hospitals, countries or even regions. This is because they are often tailor-made to capture practicability, and the needs or deficits in particular institutions. They are also dynamic as they are revised as new evidence becomes available. Nonetheless, they all focus on four main domains in stroke care: acute treatment of stroke, organisation of stroke care, prevention of stroke complications and secondary prevention of stroke.

In a cross sectional study that reviewed the variation of stroke performance measures across Europe, there were 123 quality indicators in total. Majority (91) were process measures while 24 were outcome and 8 structural measures. The number of implemented quality indicators ranged from 10 (Scotland) to 43 indicators (Catalonia, Spain). Brain imaging time and anticoagulants for patients with AF was assessed in all the 6 audits. Five indicators: stroke unit care, swallowing test, antiplatelet/antithrombotic therapy at discharge, discharge on lipid-lowering therapy, thrombolytic therapy were assessed in all but 1 audit. Early aspirin or antiplatelet therapy, assessment for rehabilitation, and discharge on blood-pressure-lowering therapy was checked in 4 out of the 6 audits. The least commonly used indicator was an outcome indicator; death in hospital which was only used in Germany and Sweden. The table below summaries the quality indicators used in the different audits in Europe (31) and USA.

Table 1 Variation in stroke quality indicators use in Europe(31)

Performance measures	**Belgium**	**Germany**	**Scotland**	**Spain**	**Sweden**	**UK**	**USA**
Stroke unit care	+	+	+		+	+	
Brain MRI or Ct scan	+	+	+	+	+	+	
Carotid Doppler imaging.	+	+			+	+	
Swallowing test		+	+	+	+	+	+
Thrombolytic therapy	+	+	+		+	+	+
ECG done	+			+			
Antiplatelets administered		+	+	+		+	+
Early mobilisation		+		+			
Assessed for rehabilitation		+		+		+	+
Mood disorders				+	+	+	
Lipid lowering therapy	+		+	+	+	+	+
Discharge on antiplatelet	+		+	+	+		+
Antihypertensive given			+	+	+	+	
Anticoagulants for AF	+	+	+	+	+	+	+
Death in hospital		+		+	+		

+ means indicator is used in the given country.

In the USA stroke performance measures have been developed by the CDC, ASA/AHA and the joint commission (TJC). The Stroke Performance Measure Consensus Group, with representatives from the three organisations harmonised the indicators into 10 common items. There were thrombolysis, dysphagia screening, antiplatelet by day two, VTE prophylaxis, anticoagulation in AF, evaluation for rehabilitation, discharge on antiplatelets, discharge on statins, smoking cessation advice and patient education. The measures were submitted to the USA national quality forum and it endorsed 8 of the 10 measures. Smoking cessation was not endorsed as a separate stroke measure because the NQF already endorsed a global smoking measure that applies to all hospitalized patients, and dysphagia screening was not endorsed due

to debatable evidence that the measure improves outcomes and concerns over the validity of the screening tools.

2.8 Effect of the quality indicators in stroke

2.8.1 Stroke unit care

A stroke unit is an organized in-hospital facility that is entirely (or next to entirely) devoted to care for patients with stroke. It is staffed by a multidisciplinary team with special knowledge in stroke care. Stroke unit care started as soon as possible after stroke is associated with a higher likelihood of effective treatment that reduces long term damage to the brain, disability and overall healthcare costs. In a Cochrane review of 28 randomised clinical trials in 2013, patients with stroke who were managed in stroke units were more likely to be alive, independent, and living at home one year after a stroke compared to patients managed in regular wards (32). The reductions in the odds of death at one year was 0.87 (95% CI 0.69 to 0.94; P = 0.005). The odds of death or dependency was 0.79(95% CI 0.68 to 0.90; P = 0.0007).

2.8.2 Antiplatelets in stroke

Antiplatelet therapy is useful both in acute management and secondary prevention of stroke. Given early, aspirin substantially reduces the severity of acute stroke. It reduces the 6 week risk of stroke recurrence by 60% and risk of disabling or fatal stroke by 70% (33). In the long term, aspirin reduces the recurrence of stroke by 13% (3).

The CAPRIE trial randomised over 19,000 patients and sought to evaluate clopidogrel versus aspirin in secondary prevention of CV event. It reported that patients treated with clopidogrel had lower risk of composite vascular events (ischemic stroke, AMI, or death)

than aspirin (5.32% vs 5.83%), with a relative risk reduction (RRR) of 8.7% in favour of clopidogrel (95% CI = 0.3–16.5, p 0.043).

2.8.3 Imaging in stroke

The current ASA guidelines recommend non-contrast CT (NCCT) scan as the modality of choice in acute stroke. It should be done within 20 minutes of a patient arriving in hospital (34). CT scans are relatively available and the images can be acquired easily and fast. Although CT scan sensitivity for ischaemic changes is low, at 26%, the main aim is to exclude parenchymal haemorrhage and other lesions such as tumours that preclude thrombolysis. The sensitivity of MRI scans is much higher (86%) for acute stroke (35). Diffusion weighted MRI is the most sensitive sequence and can detect a stroke even within 3 minutes of occurrence. MRI is also more sensitive in detecting posterior fossa and deep in the cortex strokes. However, they take on average 4 times longer duration to acquire images compared to CT scans. This is constraining in view of the short thrombolysis window in stroke. MRIs also require full patient cooperation, which may not be possible if the patient is confused.

2.8.4 Thrombolysis

Intravenous thrombolysis was approved for treatment of stroke after the land mark NINDS study in 1996 (27). At 3 months the alteplase group had less neurological deficits (higher GCS scores), and were more independent when graded in the Barthel index score compared to the placebo arm (OR 1.75%). In 2008 the ECASS III trial in Europe extended the therapeutic window for alteplase to 4.5hours. In this trial, patients who received alteplase were 28% more

likely to return to an independent lifestyle compared to the placebo group (26).

Alteplase is recommended for all eligible patients with ischaemic stroke. The main drawback of thrombolysis is the risk of intracranial bleeding at 6.4% versus 0.2 % in the initial NINDS study.

2.8.5 Dysphagia screening

Dysphagia in stroke is due to is due to weak, poorly coordinated muscle movements and impaired sensation in the throat muscles. It is a common yet often overlooked complication that affects up to 78% of the stroke patients (36). In a referral hospital in Kenya (MTRH) for example, dysphagia screening was only performed in 3% of admitted stroke patients (37).

The bed side swallow test is simple and recommended before administration of anything orally. Patients who fail a dysphagia test should have a feeding tube inserted to enable adequate nutrition and prevent aspiration pneumonia until return of normal swallowing. Failing a dysphagia test is associated with poor outcomes even in patients with mild stroke (38).

2.8.6 Anticoagulants for atrial fibrillation

AF is a potent risk factor for ischaemic stroke. The odds of developing a cardioembolic stroke in AF is 3.17(21). Anticoagulant therapy is effective in reducing the risk of systemic embolization in patients with AF. A meta-analysis of 29 trials involving over 29000 patients showed that warfarin in AF reduced stroke by 64% (39). Warfarin also reduces mortality from

stroke and the severity of ischaemic stroke in patients with AF. The main drawback of warfarin is intracranial haemorrhage but it is small and occurred more in patients who have INR of more than 3 (40).

Non vitamin K oral anticoagulants (NOACS) are now the preferred agents over VKA if there is no contraindication. The 2011 ARISTOTLE trial of Apixaban in AF randomized 18,201 patients with non valvular AF to apixaban or warfarin. With a median follow-up of 1.8 years, apixaban was superior to warfarin in rates of stroke or systemic embolism (annual incidence 1.27% vs. 1.60%). It was also associated with less major bleeding (annual incidence 2.13% vs. 3.09%). Similarly subsequent trials and met analysis of the other NOACS; dabigatran(RE-LY), and rivaroxaban (ROCKET-AF) proved NOACS were non-inferior to VKA yet associated with a large reduction of intracranial haemorrhage (apixaban HR, 0.45; dabigatran HR, 0.42; rivaroxaban HR, 0.64. (41). The main drawback of NOACS is their high cost and this is constraining especially in resource limited settings. They have also not been validated for use in atrial fibrillation due to valvular heart disease however a multicentre study that includes Kenya is currently on going on the same.

2.8.7 Smoking cessation advice

Cigarette smoking is an established independent risk factor for stroke. Smoking doubles the risk of stroke. Smoking cessation reduces the risk of stroke by half (23). Health care providers are pivotal in delivering smoking cessation advice to patients and should encourage patients to quit at every available opportunity.

2.8.8 Lipid lowering therapy

Apart from lipid lowering, statins also have vasodilatory, antithrombotic, antioxidant and other anti-inflammatory properties that are beneficial in acute thrombotic events. They are recommended not only in secondary prevention but also in primary prevention of ischemic stroke in patients estimated to have a high 10-year risk for cardiovascular events.

The SPARCL study, published in 2006, was the first trial to show the benefits of statin therapy in preventing recurrent stroke. It randomised 4700 patients with prior stroke to high dose statin (80mg) or placebo. Atorvastatin reduced the recurrence of stroke 16% and reduced fatal stroke by 43% at 5 years, when compared to placebo (42).

One meta-analysis of 26 trials that included over 90000 patients found that statins reduced the risk of first strokes in high risk patients by 21% (95% CI, 15–27) (43). The beneficial effects are proportional to the degree of lipid lowering. For each 10% reduction in LDL cholesterol, the risk of strokes was estimated to decrease by 15.6% (95% CI, 6.7–23.6).

2.8.9 Patient education

Poor knowledge on stroke is often associated with suboptimal control of the risk factor leading to higher rates of secondary stroke and stroke complications. Thus the emphasis on patient and or relative education. A cross sectional study in Uganda showed that post stroke patients were more likely to have good blood pressure control and had poorer hypertension related knowledge compared to controls (44).

2.9 Review of stroke audits

2.9.1 Stroke audits in the United States

Until the 1990s, there was low adherence to published stroke guidelines in the USA. Alteplase for example was underutilised for thrombolysis despite having been approved by the FDA as well (45). In 2003, the ASA launched the '*get with the guidelines'* (GWTG) program. GWTG is a voluntary registry and a quality improvement initiative that collects data on patient characteristics, hospital adherence to guidelines and inpatient outcomes. They use a tool that serves as an online case report. It has 10 performance measures that emphasise revascularisation therapy and other acute stroke treatment, prevention of stroke complications and prevention of secondary stroke. Analysis of the first 1 million GWTG-Stroke patients showed improvement from 44% to 84% in adherence to all performance measures. Overall there was a 9.4-fold increase in odds of receiving guideline-recommended care (46). A prospective study carried out 4 years after its initiation showed stroke mortality had reduced by 25%. The chart below shows consistent improvement in each performance measure. The trend continues.

Figure 1 Trend in adherence to the stroke performance measures

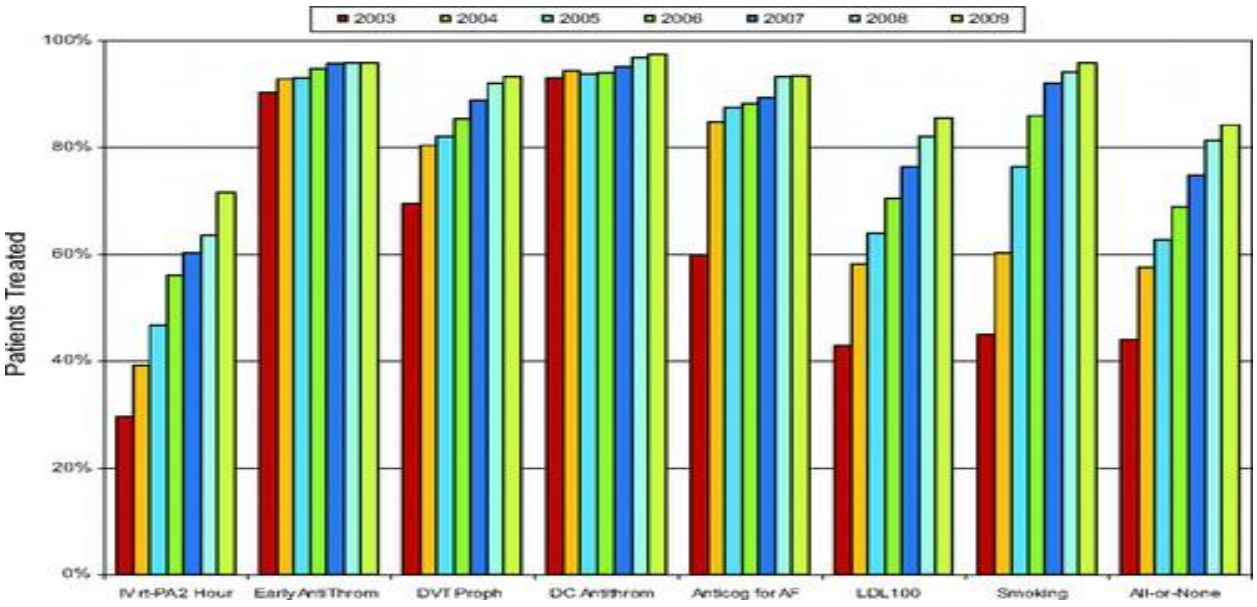


Figure 2 Adherence to stroke performance measures in the US-GWTG program 2012-2013

Acute performance measure	Percentage score
Thrombolysis	87.9%
Early antithrombotics	97.7%
DVT prophylaxis	97.8%
Discharge on antithrombotics	98.4%
Anticoagulation for atrial fibrillation	95.3%
Smoking cessation	98.3%
Dysphagia screening	85.1%
Rehabilitation assessment	96.7%
Discharge on a statin	95.2%
Educated on stroke	93%

2.9.2 Stroke audits in the United Kingdom

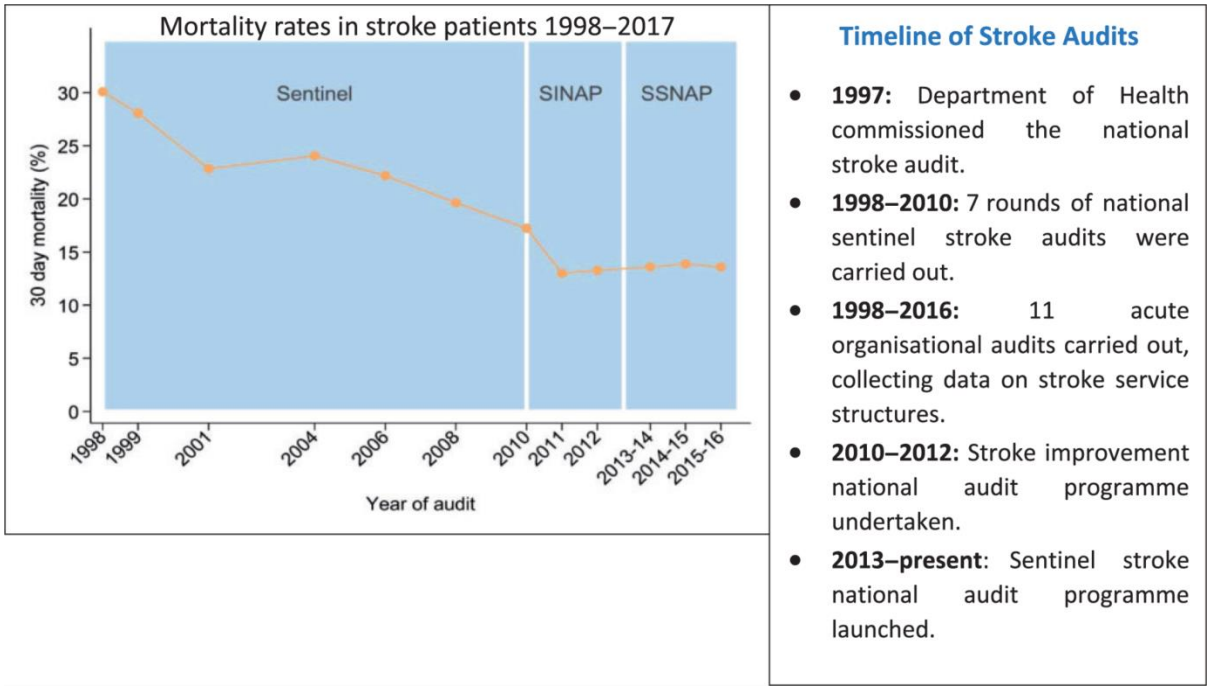
(Sentinel Stroke National Audit Program)

The first stroke audits in the UK were done in 1998(47). They were retrospective studies of few individual (sentinel) institutions. As a result of the improvements made from these audits more and more institutions were interested and joined voluntarily. Currently, stroke audit program, though still called sentinel, covers all hospitals in the UK. In fact the NHS made the audits mandatory in all UK stroke hospitals due to impressive results from the participating hospitals.

Similar to the US, a web tool (SSNAP) is used an online case report. It captures high quality data almost real time. It has 44 performance measures that emphasize multidisciplinary stroke team care, timeliness of interventions, and adequate duration of therapies such as physiotherapy and speech therapy and occupational therapy. The tool also captures outcomes of patients up to 6 months after discharge.

The UK has also seen dramatic improvements in stroke care since its inception and the trend continues. Their 30 day mortality has since reduced by over 15%. The length of hospital stay has significantly shortened. Level of disability is also significantly lower. The charts below illustrate this (47).

Figure 3 Trend of 30 day stroke mortality between 1998 and 2016 in the UK



The following table compares adherence to stroke performance measures in 2014 and 2017 according to the 2017 UK stroke audit report (47).

Table 2 Adherence to stroke performance measures in the UK

Quality indicator	**2014(%)**	**2017(%)**
Stroke unit care	57	87
CT scan within 1 hr.	41	51
Dysphagia screening	78	87
Thrombolysis	74.3	86.9
Physiotherapy	54	79
Occupational therapy	54	83
Antiplatelet therapy	65	92
Speech therapy	25	49
DVT(pneumatic stockings)	8	20
Thrombolysis	1%(2004)	88% of eligible(11% total)
Discharge on anticoagulation AF	92	97
Assessment for mood disorders	78	91
Thrombectomy	-	535 patients;
Discharged alive	76	95

2.9.3 Stroke audits in Africa.

Studies on stroke care in Africa are not uniformly structured. Most of the available stroke data are hospital series and they assess single interventions such as thrombolysis therapy, rehabilitation in stroke patients as opposed to a block of performance measures to evaluate a wider scope in stroke care. The rate of thrombolysis in Africa remains low compared to developed countries. Morocco is one of the most advanced in acute stroke care in Africa. In a systematic review of thrombolysis reports in Morocco, the proportion of thrombolysed patients ranged from 1.8% to 2.9% (48). In Uganda there were large treatment gaps. Most patients

arrived days after stroke. Brain CT scans were financially out of reach for most of the patients. There was no thrombolytics. ECG was not readily available and the physiotherapy facilities were limited and outstretched. Expectedly, outcomes were poor (49).

Though stroke audits are sparse, Kenya is in the process of developing a stroke registry. A retrospective file audit was carried out in MTRH using the TJC tool (37). It has 10 performance measures similar to the ASA tool. The results were low and variable as summarised in the table below.

Table 3 Adherence to performance measure in Moi Teaching and referral Hospital(22)

Performance measure	Percentage of eligible patient given care
Anticoagulation for atrial fibrillation	100
GCS documented	92
CT scan by day 1 of hospital	84
Antithrombotic by day2	73
Antithrombotic at discharge	64
Early ambulation	33
Rehabilitation consultation	61
Lipid management	33
Smoking counselling cessation	25
Dysphagia screening	24
DVT prophylaxis	3
Thrombolysis given	0

2.10 Study tool

We opted for the American Stroke Association (ASA-GWTG) tool. It is a questionnaire in form of a check list with the 10 stroke quality indicators integrated in it. The quality indicators

are an emphasis on rapid diagnosis and treatment of stroke, prevention of stroke complications, screening and management of stroke risk factors and secondary prevention of stroke. It has similar performance measures as The Joint commission and the CDC.

The tool was developed in the year 2000 and is regularly updated. The last update was in 2018 June. It was validated and found applicable for use in both small and large institutions and even teaching hospitals. It was also found to have a positive impact on patients' outcomes (50). The tool is regularly used by most hospitals in the USA that take care of stroke patients.

This tool was selected over the one used in UK (SSNAP) and other areas in Europe because its indicators are applicable and measurable at KNH. Though it is more elaborate with 44 performance measures, some of the variables may not be available in our setting such as the timelines of different interventions such as physiotherapy, counselling. The same quality indicators were used in audit of quality of stroke care at Moi teaching and referral hospital in 2014. Permission was sought from the ASA to use their tool and it was granted.

2.11 Barriers to quality stroke care

The WHO notes that knowledge-clinical practice gap remains a global challenge (51) and translation of an evidence-based health intervention into routine clinical practice can take up to 17 years (52). In the USA and Europe, only about 30% to 50% of patients receive evidence-based interventions in clinical settings (53). Uptake even is slower in developing countries yet the burden of stroke is much higher there.

It is therefore essential to identify barriers that underpin the slow uptake of recommended care in our setting. Numerous barriers have been identified in other settings. Some of these barriers

include inadequate medical facilities, inadequate knowledge and skills of stroke care providers and low awareness of current acute stroke care recommendations. There are also barriers at the patient level which include delays in seeking emergency care due to lack of awareness of early stroke symptoms or financial constraints.

In a recent cross sectional survey in rural and urban Uganda, up to 76% of the patients did not recognise stroke as a brain disorder. In Nigeria, the mean presentation time for CT imaging was 70 hours and patient presented within the thrombolysis window of 4.5 hours (54).

The table below table summarises some of the key barriers to optimal stroke care identified in the different studies.

Table 4 Summary of studies on Barriers to quality stroke care

Author	Year	Participants	Type of study	Main findings
Kristabel et al (55)	France 2014 (SCP)	44 health care workers	Qualitative	- lack of resources - poor coordination of stroke care - suboptimal professional practises - inadequate public education about strok
Badachi, Mathew, Prabhu et.al (56).	Tertiary care centres, South India 2015	100 consecutive acute ischaemic stroke patients	Descriptive prospective design	Failure of patients to recognize stroke symptoms of patient's relative to recognize stroke, failure of lack of neuroimaging & thrombolysis facility in 1
Leonard et a (57)	2017 Ghana	40 neurologists, emergency physicians, doctors, nurses, physiotherapists	Qualitative	financial constraints, patient delays, sociocultural or religious practices, discharge against medical advice, denial of stroke

2.12 Problem statement

Stroke is a silent epidemic that is underappreciated in our setting. Stroke outcomes in SSA are poor, with high mortality (4). Inpatient stroke mortality in Kenya's referral hospitals is 26.7% with 18.4 % of the patients dying within the first 10 days (4).

2.13 Study justification

Quality of care, particularly in the acute setting significantly impacts on the outcome of stroke patients. Unfortunately there exists a wide gap between guidelines and actual care provided, more so in LMIC. This curtails patient outcomes. Therefore, there is need for attention on the quality of care provided.

This audit will raise awareness on our current practice and clearly identify areas that need improvement. It will provide data that can be used in evidence based decision making. Many institutions have seen impressive results after stroke audits.

2.14 Research question

What is the quality of care of acute ischaemic stroke patients at Kenyatta National Hospital?

2.15 Study objectives

2.15.1 Primary objective

1. To assess the management of acute ischaemic stroke and determine the proportion of stroke patients receiving the recommended stroke care according to the ASA quality indicators.

2.15.2 Secondary objectives

1. To evaluate the knowledge on standard stroke care among health care workers in KNH.

2. To assess the main barriers to providing recommended stroke care interventions.

CHAPTER THREE

3 METHODOLOGY

3.1 Study site

The study site was Kenyatta National Hospital (KNH). This is a national referral hospital in Nairobi, the capital city of Kenya. It has a bed capacity of over 1800. The main catchment areas are Nairobi, Central and surrounding Eastern parts of Kenya. KNH is also a teaching institution for both undergraduate and postgraduate medical students and various other disciplines in health. The main study areas were the main records department, medical wards and accident and emergency (A&E) department.

3.2 Study Design

The study design was mixed. First there was a descriptive retrospective audit of files of patients admitted with a diagnosis of acute ischaemic stroke. Secondly, we used a quantitative cross sectional design to assess health care provider's knowledge on stroke. Lastly, we employed a qualitative cross sectional design to assess the main barriers to quality stroke care using interviews.

3.3 Study population

3.3.1 File records audit

3.3.1.1 Case definition of study files

We adapted the WHO definition of stroke: "the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin". The cases needed to have a

supporting brain imaging finding. This was defined as a hypodense lesion on CT brain, a normal early CT scan or a hypointense lesion on T1 Weighted MRI scan that best fits the radiologic description of an ischaemic stroke.

3.3.1.2 Recruitment of patient files

We targeted all the files of patients admitted with a diagnosis of acute ischaemic stroke over a one year period, from 1st January to 31st December 2018.The patients included were 13 years and older and needed to have documentation of brain imaging supporting a diagnosis of ischaemic stroke. We excluded patients with imaging findings not in keeping with ischaemic stroke. Incomplete and missing file records were also excluded.

3.3.2 Medical personnel

3.3.2.1 Case definition (Medical personnel)

Medical personnel assessed for their knowledge on stroke were internal medicine registrars, medical officers and registered nursing officers who were working in the study areas at the time of the study.

3.3.2.2 Sample size and sampling method (Medical personnel)

There were approximately 70 internal medicine registrars, 60 nurses in the medical wards and 40 medical officers in A&E. Using the finite population formula we computed a sample size of 119. This was proportionally allocated to each cadre giving a sample size of 42 nurses, 27 medial officers and 54 internal medicine residents as shown below.

n = Nz^2pq (E^2(N-1)+ z^2pq) Where;

N = size of the target population = 200

Z = Z statistic for 95% level of confidence = 1.96

P = Estimated proportion of health workers with knowledge on management of stroke= 50%

d = margin of error = 5%

n=119

Non probability purposive sampling method was used to recruit the health care workers.

3.3.3 Key informants:

3.3.3.1 Case definition (of key informants)

The key informants were experienced staff with advanced professional knowledge in their respective fields. The profile included neurologists, senior medical registrars, physiotherapists, nutritionists, senior nursing officers and senior pharmacists.

3.3.3.2 Sample size and sampling method (Key informants)

Purposive sampling was used to recruit key informants. Suitable respondents were directly identified by the principal investigator from the continuum of care of stroke patients. The number of participants was determined by data saturation. Fourteen key informants were included.

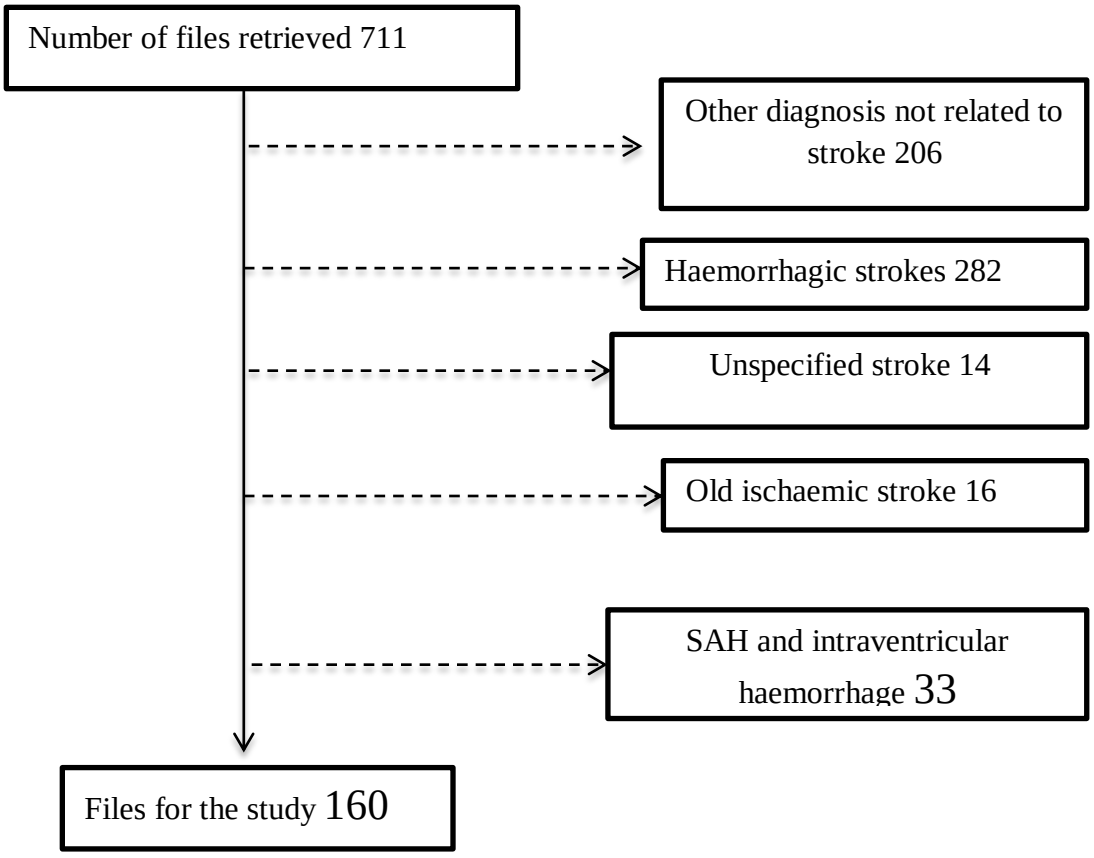
3.4 Data collection

3.4.1 Data collection (File audits)

The study was carried out between 26th March and 21st June 2019 at KNH. The KNH statistics database was searched for files of patients admitted with a diagnosis of stroke between 1st

January 2018 and 31st December 2018. KNH uses the ICD10 version 10 coding system. The codes used for the search were I60 to I69. The records search yielded 793 files. The file numbers were then used to retrieve the physical files from KNH main records store. Manageable batches of files were retrieved and reviewed every weekday until the list was exhausted. A total of 711 of the files were found. Each file was carefully perused for exclusion or inclusion into the study as per the research protocol. Two hundred and six files were misclassified as they had diagnosis not related to stroke, such as head injury, malignancies, multiple sclerosis, epilepsy and others. Two hundred and eighty two files were excluded because of haemorrhagic stroke. Subarachnoid haemorrhages were 33. Sixteen of the patients had old ischaemic strokes and had been admitted with a different diagnosis. In 14 files, stroke was not was specified as ischaemic or haemorrhagic After exclusion of duplicates, we had a total of 160 files for analysis.

Figure 4 Flow chart showing recruitment of files into the study:



Study tool

We used the ASA study tool to collect data. It is a comprehensive tool with the inpatient stroke quality indicators integrated in it. We modified the tool by adding an entry for brain imaging done within the first 24 hours of admission since it is relevant in our setting. We also used the GCS score instead of the NIHSS as the GCS is routinely used at KNH. The unit for laboratory measurements was also changed from milligrams/decilitre to millimoles/litre as these are the default settings at KNH laboratories.

3.4.1.1 Study variables (file audits)

Independent variables

The independent variables that were obtained from the file records were the patient's demographic data, the time to presentation at KNH from the onset of symptoms, the risk factors for stroke, the patient's GCS at admission, the duration of hospital stay and whether the patient had medical insurance.

Dependent variables

Our independent variables were the 10 ASA stroke quality indicators. We assessed for brain imaging done by the end of day one, thrombolysis administered or a reason for exclusion and dysphagia screening. Dysphagia screening was considered done if the patient had a bedside water swallow test before being given anything by mouth. In instances where the patient's consciousness was too low to have a swallow test, insertion of a feeding tube upfront was considered dysphagia screening.

The other dependent variables were administration of antiplatelet by the end of day two, initiation of intensive dose statin, anticoagulation for the patients with atrial fibrillation, venous thromboembolism prophylaxis and discharge on an antiplatelet. Further, we documented whether rehabilitation measures were initiated, education to the patient on secondary prevention of stroke and smoking cessation advice to the patient who had been smoking.

3.4.2 Data collection (Health workers' knowledge)

We assessed the knowledge of doctors on stroke using a questionnaire that was adapted from a similar study in Pakistan. The questionnaire contained 15 multiple choice questions with a single best answer. Knowledge assessed covered acute diagnosis, treatment of stroke, management of stroke complication and secondary prevention of stroke. Ninety three questionnaires were issued to doctors during tea breaks and informal meetings. Eighty one questionnaires were returned giving a response rate of 87%. Twenty eight were medical officers at A&E and 54 internal medicine residents.

The questionnaire used for nurses was adapted from a study that assessed knowledge of nurses on stroke in MTRH in 2016 (58). It was closed ended, with 10 questions and multiple choice answers.

The questionnaires were hand delivered to the participants during breaks and casual meetings within the institution.

3.4.3 Data collection (Barriers to stroke care)

We assessed barriers to stroke care qualitatively using semi structured in-depth interviews. The interviews were carried over a period of 6 weeks from May to June 2018. The initial contact with the proposed participants was at their place of work to obtain consent and schedule the date, time and place for interview. The participants were assured of confidentiality. Consent was explained and then obtained in written. The interviews were carried out in the corresponding departmental office for each of the specialists and in the doctors' rooms within the wards for the rest of the staff.

Qualitative semi structured interviews were employed in order to gain a rich and in-depth understanding of barriers faced by the healthcare providers. The interview guide used was adapted from a similar study that assessed the barriers to evidence based stroke care in Ghana in 2016 (59).

The interviews were face to face and voice recorded using a digital Sony voice recorder. The voice records were then transcribed by a professional transcriber. Half of the transcripts were shared with the respondents to cross check and verify that the information was accurate before the data was used for analysis.

3.5 Data analysis

3.5.1 Data analysis (File audits)

Data from excel was exported to STATA version 15 for statistical analysis. The study population was described using demographic and clinical characteristics. Categorical data was summarized in percentages. Continuous data was expressed as means or medians as appropriate. For each performance measure, the score was calculated by dividing the number of patients documented

to have received the intervention and the total number of patients who were eligible for the indicator and expressed as a percentage. Interventions not documented were considered not done.

3.5.2 Data analysis (Health workers knowledge)

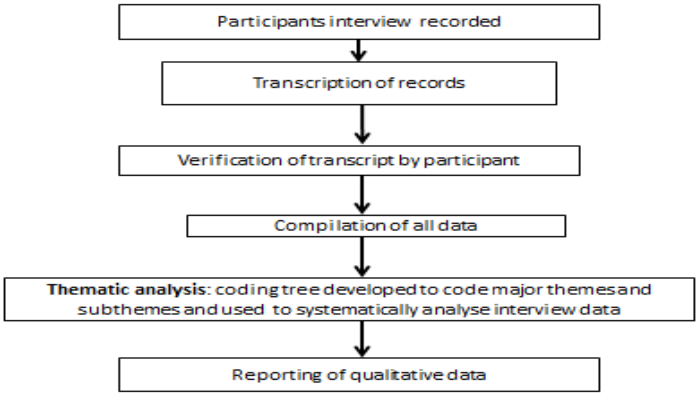
The age, gender, cadre, and duration of practise was summarised using frequencies and percentages. For each question, the outcome was the percentage of respondents who were aware of the correct answer. Blank answers were considered wrong on assumption that participants most likely were unaware of the right response. Student T test was run to determine the difference in knowledge between the internal medicine residents and medical officers.

The p -values were adjusted using Bonferroni method for multiple comparisons to control for the probability of finding one or more type I error. The threshold for assessing the statistical significance of the tests was set to a = 0.05. All analyses were performed using STATA version 15.

3.5.3 Data analysis (Barriers to quality stroke care)

This was done qualitatively. Once all the transcripts were compiled, line to line reading was done to identify themes. A coding tree was then developed from which subthemes were identified. Thematic data analysis (60) was carried out and results reported.

Figure 5 Flow chart showing analysis of qualitative data



3.6 Quality Assurance

The principal investigator together with one trained research assistant collected all the data for the study.

In the assessment of health workers, the questionnaires administered were reviewed by senior content specialists (neurologists) and verified to be appropriate for assessment of stroke knowledge among the corresponding health care cadres.

Barriers to stroke care were assessed quantitatively in interviews. The interviews were all voice recorded and then transcribed to reduce reporting bias. Half of the transcripts were shared with the respondents to cross check and verify that the information was accurate before analysis.

3.7 Ethical considerations

Study was conducted after approval by the Kenyatta National Hospital and University of Nairobi Ethical Review Committee. The data collected from the files was kept private and confidential with access controlled by the principal investigator.

Consent was clearly explained to all the study participants and then obtained in written before their inclusion into the study. Information gathered from the study participants was kept confidential. The study did not interfere with any care operations.

CHAPTER FOUR

4 STUDY RESULTS

4.1 Baseline characteristics

The mean age of the patients was 61 years and the median was also 61 years. The youngest patient was 15 years and the oldest 95 years. Majority of the patients were in the age group 55 to 74 years. There was no significant difference between the genders and the females accounted for 51.9%.

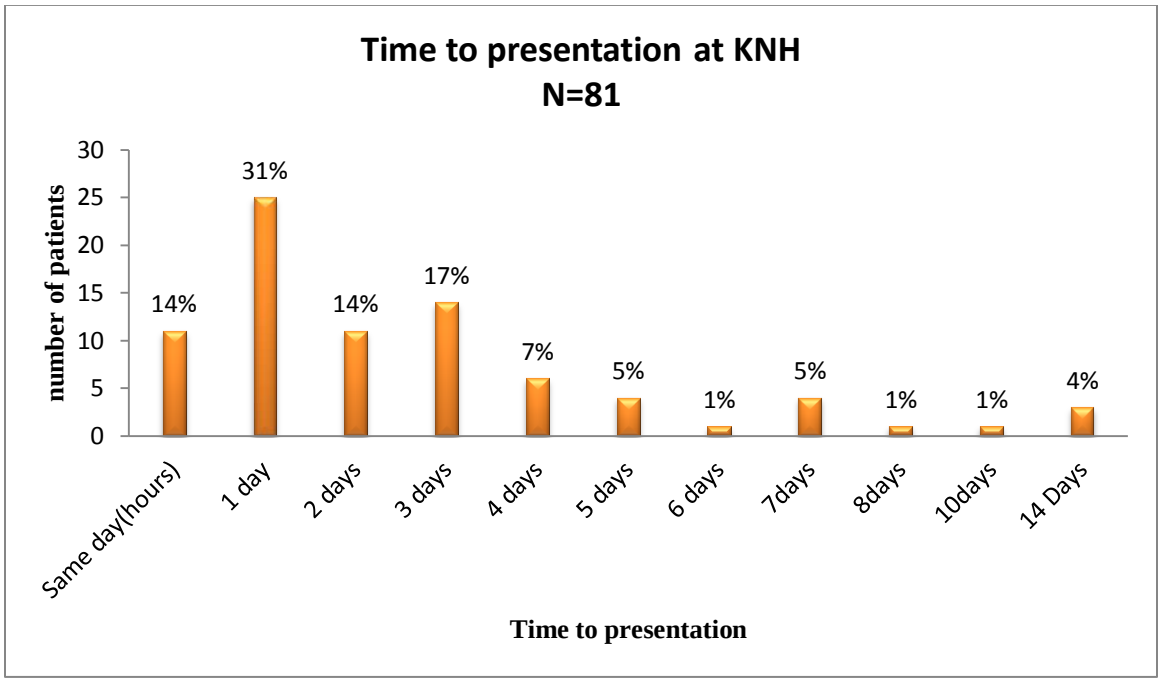
Fifty nine percent of the patients were from Nairobi County while the rest came from the neighbouring counties. More than a quarter of the patients (26%) had been referred from other institutions. Twenty four percent of those referred were documented to have arrived in an ambulance.

Time from onset of symptoms to presentation at KNH was documented in 50% (81) of the patients. In eleven of those patients, time was documented in hours while in the remaining 70 it was documented in days. The two earliest patients arrived at 4 and 5 hours respectively after symptom onset. The latest patient presented in KNH at 2 weeks after initial stroke symptoms. Of note is that 26% of the patients had been to other institutions before being referred to KNH. However the precise time that the patients reported to the other institutions was not documented in the few referral letters that were available.

Table 5 Baseline characteristics

Variable	Frequency(percentage)	Mean(SD)	median(median IQR)
Age		61(18.27)	61(45-71)
<34	14(9%)		
35-44	18(12%)		
45-54	23(15%)		
55-64	33(21%)		
65-74	35(22%)		
75-84	20(13%)		
>85	13(8%)		
Gender(female)	83(51.9%)		
Time to presentation at KNH (days)		2.8(9.2)	2(1-3)
Days hospitalized in KNH		12.34(18.61)	5.5(3-13)
Admission GCS		12.0(3.1)	13(10-15)
Patients with medical cover (NHIF)	63(41%)		
Referrals from other hospitals	41(26%)		
Residence			
Nairobi	**94(59%)**		
Outside Nairobi	**66(41%)**		

Figure 6 Time to presentation at KNH after stroke symptom onset.



The average days of hospitalisation was 12.34(SD 18.61) with a median of 5.5 days (median IQR 4 to 14). Seventy four percent (119) of the patients had their GCS documented. The average GCS on admission was 12.01 with a median of 13. Forty one per cent of the patients had medical cover in form of NHIF.

4.2 Risk factors for stroke

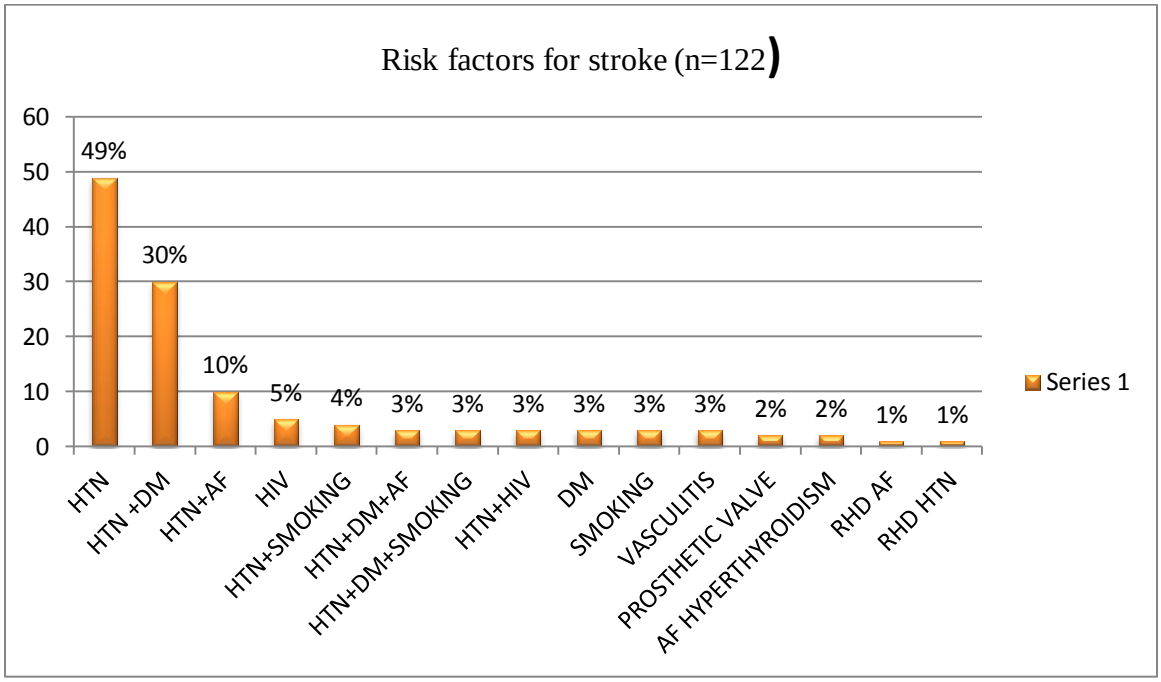
Seventy six percent of the patients (122) had at least one risk factor for stroke documented. About half (45%) of the patients had more than one risk factor for stroke. Hypertension was the leading risk factor for stroke and was present in 81% of the patients. Forty percent of the patients had hypertension alone as an identified risk factor. Diabetes in conjunction with hypertension was found in 30% of the patients, though diabetes alone was only in 3% of the patients. Atrial fibrillation was the third commonest risk of stroke (19%). Nine percent of the patients had HIV. Out of those with HIV, a third of them had no other identified risk factor for stroke. The other

risk factors were rheumatic heart disease, sickle cell disease and vasculitis as summarised in the table below.

Table 6 Prevalence of the stroke risk factors

Risk factor	Percentage	Absolute numbers
Hypertension	81%	99
Diabetes mellitus	30%	37
Atrial fibrillation	19%	23
Smoking	12%	15
HIV	9%	14
Rheumatic heart disease/prosthetic valves)	2%	2
Sickle cell disease	<1%	1

Figure 7 Risk factors for stroke in the study population



others* = prosthetic valve, AF hyperthyroidism, RHD AF, RHD HTN, HTN AF and hyperthyroidism

Lipid profile results were available for 61% of the study participants. Thirty eight percent of the patients had elevated total cholesterol. The predominant lipid abnormality was high LDL at 62% followed by a low HDL 59%. The lipid profile results are summarised in the table below.

Table 7 baseline lipid profiles of the patients

	Total cholesterol	**LDL**	**HDL**
N	97	97	97
Average(SD)	4.6(1.9)	1.2(0.4)	2.7(1.3)
Cut off	>5.18	>2.6	<1.3
n	37	61	58
percentage	38%	62%	59%

4.3 Adherence to stroke performance measures at KNH

The stroke quality indicators had variable pass rates. Brain imaging done on day had the highest score at 84% while thrombolysis, patient education and advice against smoking scored 0%.

The following table summarises adherence to the performance measures.

Table 8 Adherence to stroke performance measures at KNH

Performance measure	Denominator eligible	Frequency	Percent
Brain imaging by day 1	160	132	83%
Anticoagulant in atrial fibrillation	23	18	78%
Discharged on antiplatelet	89	67	75%
VTE prophylaxis	142	92	65%
Discharged on cholesterol reducing medication	107	63	59%
Rehabilitation services offered	160	94	58%
Antithrombotic given by day 2	156	75	48%
Dysphagia screening before anything by mouth	160	12	7%
Antismoking advice	15	0	0%
Stroke education	160	1	0%

Brain imaging done by day one of KNH

Majority of the patients (83%) had their CT scan done by end of day one of arrival at KNH. This includes 23% (37) patients who had their imaging done at different institutions.

Thrombolysis

One patient arrived within the thrombolysis time window. None of patients was screened for thrombolysis. None of them had thrombolysis.

Dysphagia screening

Seven percent (12) of the patients were considered to have dysphagia screening done. All the seven had a low GCS and NG tube was inserted upfront without need for a swallow test. There was no documentation of any form of bed side swallow tests. Twenty one percent of the patients had NGT inserted in the course of their admission nonetheless.

Antithrombotic agent administered by day two

One hundred and fifty six patients were eligible for antiplatelet administration by day two as 4 patients had died before then. Seventy five percent (117) of the patients had an antiplatelet prescribed by day two. Of these, 48% (75 patients) had an antiplatelet administered by day 2.

Discharged on an antiplatelet

Eighty nine patients were eligible for discharge on an antiplatelet. This is after exclusion of 53 patients who had died and another 18 patients who were already on an anticoagulant. Seventy five percent (67 patients) were documented to have been discharged on an antiplatelet.

Discharged on a statin

Fifty three patients died before discharge leaving 107 patients eligible for discharge on a statin. Out of these, 59% (67patients) had documentation of discharge on a statin.

Venous thromboembolism prophylaxis

Sixty five percent (92 patients) had VTE prophylaxis in the form of anticoagulants. One patient had a pneumatic compression stocking prescribed but it could not be verified whether this was done.

There was no documented reason for not giving VTE prophylaxis in any of the patients in whom this intervention was not met.

Anticoagulation in Atrial Fibrillation.

Twenty three patients were noted to have AF. However the rate of screening for AF clinically was low as only 21% (33patients) had pulse documented as either regular or irregular. Patients who had an irregular rhythm were more likely to have an ECG done. In total, 16% (27 patients) had an ECG done by the end of their hospital stay. None of the patients had longer durations of

screening for atrial fibrillation such as holter monitoring. Seventy eight percent (18 out of 23) of the patients who had AF had documentation of anticoagulant initiation.

The commonest anticoagulant used was warfarin at 74% of the patients. Sixteen percent were on Rivaroxaban and 10% were on Dabigatran.

Rehabilitation services

The commonest form of rehabilitation service was physiotherapy. This was clearly documented as physiotherapy notes. Sixty five percent (105) patients had physiotherapy services prescribed as part of the treatment. However, just over half (58%) of the patients received physiotherapy at least once during their hospital stay. There was no documentation of any other form of rehabilitation such as speech therapy or occupational therapy or psychotherapy.

Stroke education

There was scarce documentation of education on stroke. The study assessed education on four main domains. Education on risk factor reduction, stroke warning signs, need for follow up after stroke and adherence to prescription. None of the patients was documented to have been educated on all the four domains of stroke. The 4 patients who had clear documentation on adherence counselling and need for follow up were all HIV positive and had been counselled by a CCC counsellor. The only other patient was in CCU and relatives were counselled extensively on the diagnosis and prognosis and the way forward. Eighty seven percent of those discharged were sent through medical outpatient clinics for followup.

Table 9 Domains in education of stroke patients

Education domain	Patient educated(n)	Percentage educated
Stroke warning signs	0	0
Activation/need for emergency services in stroke	0	0
Risk factor reduction	2	<1%
Adherence to prescription	0	0
Need for follow up	93	87%

Advice against smoking

There was a mention of smoking history in 60% (96) of the files. Out of these, 9% (15 patients) were noted to have a history of smoking. There was no documentation of advice or counselling against smoking to any of the smoking patients.

4.4 Doctors' knowledge on stroke.

Demographic characteristics of doctors

Majority of the doctors were aged between 20 and 34 years. The female respondents at casualty were fewer at 29% whereas they were the majority of the registrars at 64%. Majority (60%) of the doctors had experience of between 5 and 10 years.

Table 10 Demographic characteristic of doctors

Characteristics	Medical officers		Registrars	
	Frequency (n=28)	Percent	Frequency (n=53)	Percent
Age				
20-34 years	24	85.7%	46	88.5%
35-44 years	4	14.3%	6	11.5%
Sex				
Female	8	29%	34	64.2%
Years of experience				
<5 years	0	0.0%	11	36.7%
5 to 10 years	15	60.0%	18	60.0%
11 to 15 years	10	40.0%	1	3.3%
>15 years	0	0.0%	0	0.0%

Table 11 Percentage correct score for individual questionnaire items for doctors

Knowledge domain	Medical officers		Registrars	
	Frequency (n=28)	Percent	Frequency (n=53)	Percent
Non contrast CT scan as first investigation of choice	24	85.7%	46	86.8%
Knowledge of DWMRI as the accurate test for IS	7	25.0%	29	54.7%
Knowledge on door to imaging time of 20 minutes	4	14.3%	11	22.5%
Knowledge on best initial therapy for IS	10	35.7%	38	72%
Oral medicines administered 24-48 hours after stroke onset	18	64.3%	46	86.8%
Correct dose of aspirin in ischaemic stroke	7	25.0%	20	37.7%
Knowledge of conditions when statins should be prescribed for stroke due to atherosclerosis	18	64.3%	47	88.7%
Correct dose of atorvastatin in acute ischaemic stroke	11	39.3%	37	69.8%
Knowledge of 4.5hrs as current for thrombolysis window	7	25.0%	25	47.2%

Knowledge of addition of clopidogrel to aspirin mild IS	14	50.0%	33	62.3%
How to reduce stroke recurrence	21	75.0%	51	96.2%
Intracranial haemorrhage as an absolute contraindication to thrombolytic therapy	26	92.9%	52	98.1%
Concern of VTE for immobilized patients due to stroke	25	89.3%	52	98.1%
Contraindication to anticoagulant	26	92.9%	51	96.2%
Prescription OAC for atrial fibrillation in stroke	14	50.0%	40	75.5%
Range			27-80%	60-93%
N		28		53
Mean		50.5		72.8
Standard deviation		15.5		13
t				-8.6
Df				79
P value				<0.0001

The lowest score by the registrars was 60% while the highest score was 93%. Their mean score was 73%. The medical officers' score ranged from 27 to 83% with a mean of 55%.

An independent student t-test was conducted to compare knowledge among medical officers and knowledge among registrars. There was a significant difference in the stroke knowledge scores for medical officers (m=15.31, SD=7.5) and registrars (m=36.88, SD=14.4); t (30) = 5.32, $p < 0.00001$. These results suggest that being a registrar is associated with more knowledge on ischemic stroke management.

4.5 Nurses' knowledge on stroke

Sixty questionnaires were issued to nurses . Out of these, 43 were returned giving a response rate of 71%. More than half of the nurses were aged between 20 and 34 years. There was a slight female preponderance at 60%. There was a balance between the junior and the senior nurses.

Table 12: Base line characteristics of nurses

Characteristics	Frequency (n=43)	Percent
Age		
20-34y	22	51.2%
35-44y	12	27.9%
>44y	9	20.9%
Sex		
Female	24	60%
Appointment type		
Junior nursing officer	17	53%
Senior nursing officer	15	47%
Years of experience		
<5 years	16	42.1%
5 to 10 years	6	15.8%
11 to 15 years	3	7.9%
>15 years	13	34.2%
Number of stroke patients taken care of per month		
1 to 5	6	14.6%
6 to 10	16	39.0%
11 to 20	18	43.9%
>20	1	2.4%

Knowledge domain	Nurses knowledge	
	Frequency (n=43)	Percent
Proportion aware of stroke scales	16	39.0%
Correct knowledge of brain imaging within 20 minutes	11	26.2%
Correct knowledge on timing of emergency treatment for stroke	6	14.0%
Correct knowledge of always obtaining brain CT prior to anticoagulant therapy	28	65.1%
Correct knowledge of CT brain as the common type of imaging for stroke patients	30	71.4%
Correct knowledge of stroke unit as where stroke patients should be admitted	9	20.9%
Correct knowledge of always administering venous thromboembolism prophylaxis for stroke patients	17	39.5%
Correct knowledge of always ordering dysphagia screening for stroke patients before giving anything by mouth	18	41.9%
Range		12.5-62%

The knowledge of nurses on stroke was generally low. The average score for the nurses was 39.8%. The highest was 62% and the lowest was 12%. There was low awareness that acute stroke is actually an emergency. Only 14% of the nurses were aware of the correct door to CT scan time for stroke of 20 minutes. More than 40% indicated 12 hours. Only 11% of the nurses were aware of the thrombolysis window of 4.5hours. Most nurses were also not aware of the

need for dysphagia screening to prevent aspiration pneumonia and ensure adequate nutrition. Only 14.5% of them would assess the patient's swallowing before giving anything by mouth.

4.6 **Barriers to stroke care**

Characteristics of the respondents

Fourteen key informants were interviewed. They included both men and women of varied professional disciplines: three neurologists, two internal medicine registrars, two medical officers, two nurses, two nutritionists and two physiotherapists and one pharmacist.

Table 13 Characteristics of interview participants

Category	**Number interviewed (N)**
Neurologists	3
Doctors	4
Nurses	2
Physiotherapists	2
Nutritionists	2
Pharmacists	1
Total	14

The median year of experience was 10 years, with a minimum of 5 and a maximum of 34 years.

In the analysis of the transcripts, four main themes and 8 subthemes emerged from these interviews as elaborated below.

4.6.1 **Patient factors**

All the respondents interviewed brought up different challenges in stroke care attributable to the patient. Under this category we identified three subthemes: patient delays, financial constraints and low awareness on stroke.

4.6.1.1 Patient delays

Patient late arrival to hospital was mentioned as a barrier to optimum stroke care by all the doctors. Most of the patients arrive way beyond the thrombolysis window for instance. The respondents suggested that the delays could be attributed to low awareness on stroke amongst the patients and their relatives. They do not understand the gravity of the symptoms nor the importance of coming to hospital early. Some patients first wait to see if they would improve and only come after they realize the symptoms have persisted or worsened.

Financial constrains was also blamed for delays. Patients often went to the cheaper, lower level health facilities for that unfortunately did not have the recommended capacity for acute stroke care. They would later be referred to KNH having lost considerable time there.

4.6.1.2 Financial constraints

Financial constraint was a barrier that was uniformly raised by all the study respondents. Due to lack of funds, many patients did not have means of coming to hospital, let alone covering the cost of brain imaging, blood investigations and medication. As a result, a number of the patients presented late. And even within the hospital, stroke care interventions were slowed down as relatives try to raise funds required. An excerpt form a respondent emphasises this:

"…..KNH hospital serves the lower social economic level of society who may not necessarily have funds or insurance at their disposal….. ….most of the patients, if you tell them to go for the CT scan they have to first go and look for the funds to come and do the CT scan….."Nr3

4.6.2 Hospital level factors

At the hospital level, the subthemes identified were lack of stroke management protocols, lack of a stroke unit, inadequate staff and lack of equipment.

4.6.2.1 Lack of stroke management protocols.

13 out of 14 respondents reiterated that there were not aware of readily displayed hospital tailored stroke protocols for their use. Some respondents referred to existing international guidelines or protocol books in computers but they hardly looked at them. The closest were nutritionists who had a manual for managing critically ill patients but it was not specific to stroke management. It was mentioned that absence of a protocol often left them uncertain on how to manage a stroke patient. Most of the respondents seemed to agree that stroke protocol would help improve stroke care management.

4.6.2.2 Lack of a dedicated stroke unit

Five out of 14 respondents agreed that KNH does not have a stroke unit. The care of stroke patients was not streamlined thus causing delays. Registration had to be done before the patient could get any intervention. This consumed significant time especially when it is busy. In case the patient is unable to pay for the services, waiver process is instituted, and this further causes delay. It was mentioned that there was need for reorganisation of the A&E department into an efficient system that can triage, investigate and treat stroke patients like an emergency that it is.

'…we should have like a special facility be it a stroke unit or a section in the ward just dedicated to stroke patients as this might improve their outcome and might help us have more timely interventions….nrl3

4.6.2.3 Inadequate staff

All the cadres interviewed complained about few staff numbers against many patient numbers that are often overwhelming.

"…nursing care … is really a problem here just because of the numbers so the two hourly turning will not take place and actually even when they get better most of them have bed sores which increase their hospital stay and increase their [stroke patients] problems" (r2)

The doctors at casualty mentioned that A&E department is often flooded with patients against three or four doctors working per shift. Giving immediate attention to a stroke patient was not practical because there were more pressing emergencies.

For some of the cadres like nutrition, it was possible for stroke patients to be discharged without nutritional review as the hospital was not covered by this cadre all the time. The main concern raised was coverage over the weekend when only one nutritionist was allocated to cover the whole hospital, including critical care unit.

"…[when i] have more than 40 patients sometimes you end up missing some and sometimes the time they come in we are not available so you find they are discharged without getting any nutritional review…" (n1)

4.6.2.4 Insufficient equipment

8 out of 15 respondents complained of insufficient equipment. Brain imaging was not always readily available at KNH. Of note, there was only one functional CT scanner available for imaging for the entire hospital for all departments serving both inpatient imaging needs, acute trauma and medical outpatients. The machine broke down frequently necessitating patients to source for emergency brain imaging at peripheral centres. Several physiotherapy devices were not available and most of the time they had make do with improvised devises as relatives could not afford them.

"…we don't have walking frames so I have to send them to buy and in most cases they don't have the money to buy immediately so they go home without even learning how to ambulate" (p1)

4.6.3 Individual health professional factors

There was variable knowledge and attitude amongst the health care providers. While the residents seemed updated on the required stroke care he medical officers seemed uncertain. The nurses were surprised and even argued that stroke could be an emergency, citing more serious emergencies. None of them was aware that stroke should be treated as an emergency. There were also complaints of laxity when managing the stroke patients:

"…realize sometimes doctors don't examine the patients so they come to the wards without the CT scan and sometimes they are missed completely and sent to the ward" (r1)

4.6.4 National level factors

KNH hospital is designed to be a national referral hospital and often patients do not come here directly. It would be optimum if the other institutions could manage stroke adequately but they end up referring to KNH. By the time they arrive, often it is past the thrombolysis window.

There is also limited financial support from the national government and its resources are stretched.

"……*right now the budgetary allocation of KNH is very low we don't even have sufficient money to employ extra nurses*….."

5 Results discussion

This audit was set out to document the care of acute ischaemic stroke patients at KNH against the ASA performance measures. We went ahead and assessed the knowledge of the caregivers on stroke as well as the barriers to standard stroke care practices.

In the audit, 160 files of patients admitted with diagnosis of acute ischaemic stroke were reviewed. There was no significant gender difference; the females were 51.9%. The average age at stroke was 61years. This is comparable with other hospital based stroke studies done in SSA with an average of 59 to 64 years (61) (62). Stroke occurs much later in developed countries though, with a peak up to 76 years (63) .This could be attributed to better control of the traditional stroke risk factors such as hypertentsion.

The risk factors identified were comparable to the global picture. Hypertension remained the single largest contributor followed by diabetes together with hypertension. HIV had a significant contribution at 9% with a third of these patients having HIV as the only identified risk factor for stroke. HIV is an emerging risk factor for stroke and our scores were higher compared to other regional studies. In Cameroon for example, the prevalence of HIV among stroke patients was 6.6% (64). This could be explained by Kenya having one of the highest incidences of HIV in Africa and also the evolving picture of HIV infection showing NCDs as the main cause of morbidity and mortality.

The mean time of presentation to KNH was long, at 2.8 days with a median of 1-3 days. Of note is that 26% of the patients had visited other institutions prior to coming to KNH and precise data on the time to presentation at the previous institutions was not available. Therefore this time is an

exaggeration of patient delay in presentation at KNH. However it is essential that the initial centre a stroke patient reports to has the capacity for emergency acute care services.

Adherence to stroke performance measures

Overall, we found low adherence to stroke performance measures.

CT scan done by day one was the highest performance measure at 83%. This reflects accurate diagnosis of the CVS events hence patients can be started on appropriate management. However, the scans in our study included those done at peripheral centres and we could not have objective assessment of our door to imaging timelines. Door to CT scan time should to be tracked in minutes with a target of less than 20 minutes as per stipulated stroke guidelines to facilitate emergency revascularization therapy for eligible patients. It is of note that 17% of patients had no imaging by end of day 1. Late imaging leads to late diagnosis with subsequent exclusion of treatment options specifically thrombolysis. None of the patients received revascularisation therapy. This failure could be a reflection of healthcare provider knowledge and attitude toward stroke. It could also be heavily influenced by patient factors chiefly being late presentation. Only one patient arrived within the thrombolysis window of 4.5 hours. The mean duration from symptom onset to presentation at KNH was 2.8 days. However it is noted that duration of symptoms to presentation was not documented in 50% of the patients. Common reasons for late presentation were lack of finances to get to hospital, and lack of awareness on the importance of early arrival (65). KNH is also a referral hospital and 24% of the patients had initially presented to a lower level hospital. Apart from the late presentation, thrombolysis hasn't been extensively practiced in SSA especially in public hospitals. In MTRH for example, no thrombolysis had been

done over a period of 4 years (37). Agha Khan Hospital had the highest thrombolysis rates at 8% according to a study by Mithi et al. In Egypt overall rate of thrombolysis is 1% (66).

Availability of alteplase is another main drawback to thrombolysis. The high cost of thrombolytics is also out of reach of many public institutions. In our case, alteplase is available at KNH but many of the clinicians were not aware of this.

Dysphagia screening was low at 7%. Dysphagia screening is commonly forgotten especially in mild stroke as it was in our case. In 2003 when stroke audits began in the USA, dysphagia screening was at less than 40%. With clearly outlined stroke protocols and regular audits this has risen to over 85%. This is an opportunity to carry out regular stroke audits to improve stroke care.

Seventy eight percent of the patients in AF were discharged on anticoagulation. Seventy five percent were discharged on aspirin. However, aspirin by day 2 was much lower (48%) even compared to local studies (74%) (37).There was noted a delay in administration of the medicines to the patient commonly documented as 'order' from pharmacy. This could be a system inefficiency. The finding of low rates of discharge on a statin could be attributed documentation failure though the patient could have actually been discharged with the medication. No copy of discharge prescription leaflet was filed and a majority of the discharge summaries, though mentioned the medication in the ward, did not specify the medication that the patient was discharged on.

Patient education on stroke was hardly documented. The poor performance in this study was in all the four aspects of stroke education: awareness of stroke symptoms, need for emergency arrival in hospital, need for follow up and how to prevent a secondary stroke. No smoking patient

was advised against smoking. There are hardly studies on education of stroke patients in SSA. The GWTG program educates up to 95% of their patients. These high scores are achievable because of they are part of their stroke care protocols and in addition, provide both hard and soft copy materials to enhance their patients' knowledge on stroke.

Our results compared dismally with similar audits in with developed countries. The USA, using the same tool, in an audit of 720,247 patients, had their highest score at 98.4 (discharge on aspirin and patient education) and the lowest at 87.9% (thrombolysis)(50) . Most of the centres involved in this audit have excellent coordination of stroke care in stroke units. They also have ready access to resources required for optimal stroke care compared to our setting and this could explain these impressive results. However, GWTG audit is optional and lower performing hospitals could shy away from these audits, exaggerating their good overall performance. Some centres in China also used the same tool. Their pest performance was discharge on aspirin (90%) while their lowest score was thrombolysis at 18% of the patients. MTRH in Kenya used the same performance measures to audit 74 patients. Anticoagulation in AF was achieved in 100% of the patients. On the contrary, VTE prophylaxis was low at 3% and none of their patients had thrombolysis just like in our study (37).

A major limitation encountered in this study was missing documentation. There was scare recording of intervention time. This study assumed that what was not documented was not done. This could have contributed to the overall low performance. Poor documentation is a known challenge in retrospective studies, particularly in LMIC. A cross sectional study in Tanzania audited the completeness of inpatient records in 2016. Only 8% of the files had complete information in terms of time, procedures done, investigations, treatment offered, and diagnosis made (67) . HIC on the other hand have high quality, real time, computer based data records.

Data from the US GWTG program, whose tool is used for this study, has an overall composite accuracy rate of 96.1% and over 99% completeness. This could contribute to their exceptional performance and is also an opportunity to upgrade our documentation.

Knowledge on stroke care.

The Internal medicine residents had sufficient knowledge on stroke with a mean score of 79% however this was not fully reflected in the audit as we found low levels of screening for atrial fibrillation and poor prescribing practices. We found medical officers had insufficient knowledge on diagnosis of stroke, the recommended emergency therapy, prevention of stroke complications and secondary prevention of stroke, their mean score was 54%. The nurses also had overall low knowledge on acute stroke care with an average score of 39%. This is concerning because the emergency care for stroke is initiated at the A&E department by a team of medical officers and nurses. The first contact providers set in motion a cascade of events that greatly influence the quality of care a patient receives. This same questionnaire was used amongst final year medical students in Pakistan (68).Though still suboptimal, majority had knowledge about timely thrombolysis (67.4%), the use of aspirin (75.7%), and the risk of DVT in immobilized patients (85.4%) unlike our findings. Knowledge on stroke needs to be disseminated regularly amongst all cadres of health care particularly those involved in acute stroke care.

Barriers to standard stroke care

The barriers to stroke care identified in these interviews were largely similar to those raised in studies done in other parts of SSA. The frequently mentioned barriers revolved around lack of resources, lack of stroke care protocols, and patient delays in arriving in hospital. Of note, there

was only one functional CT scanner available for imaging for the entire hospital for all departments serving both inpatient imaging needs, acute trauma and medical outpatients. The machine broke down frequently necessitating patients to source for emergency brain imaging at peripheral centres. This meant more time lost. Furthermore, imaging outside KNH costs more leaving more patients out of this vital investigation. Unlike our findings, in west Africa, sociocultural beliefs came out as a strong barrier to optimal stroke care (57). A number of the patients believed that stroke was a spiritual disease that did not require medical management. The study interviewed over forty staff. Direct patient interviews could have brought out more patient factors but that was beyond the scope of our study.

5.1 Conclusion

KNH had overall low and variable scores across the performance measures.

Although Internal Medicine residents had sufficient knowledge on various aspect of acute stroke care, the nurses and the medical officers at A&E had insufficient knowledge on the acute stroke care interventions.

There were multiple barriers to optimal stroke care at the patient level, hospital level and national level.

5.2 Strengths of the study

This is the first audit on stroke care at KNH. The study has highlighted some strengths and deficiencies in stroke care most of which can be addressed. KNH is a learning institution and most of the participants are available for update on recommended stroke care.

5.3 Study limitations

Being a retrospective study, missing files and incomplete information was a limitation; however, the retrospective design was appropriate as it negates the possibility of influencing the care given.

5.4 Recommendations

1. Public awareness campaign on stroke and the need for rapid identification and early presentation of stroke patients in hospitals that can manage stroke.
2. Develop and implement a hospital specific stroke care protocol.
3. Organise regular education fora on acute stroke care interventions to the entire team that is involved in the care of stroke patients in order to update knowledge on stroke and adherence to recommended guidelines.
4. Schedule regular audits with clear performance indicators as this will improve adherence to the stipulated guidelines.
5. Improve documentation.
6. Establishment of a stroke unit at KNH.

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6 Appendices

6.1 Patient case report form

PATIENT ID_____

GENDER ☐ MALE ☐FEMALE ☐UNKNOWN

DATE OF BIRTH __/__/____ (DD/MM/YYYY)

AGE ____ (YRS)

RACE ☐AFRICAN/BLACK ☐WHITE ☐ASIAN

RESIDENCE ☐NAIROBI ☐OUTSIDE NAIROBI ☐HOMELESS

HEALTH INSURANCE STATUS ☐PRIVATE INSURANCE ☐NHIF ☐SELF PAY/NONE

Final clinical diagnosis related to stroke

☐Transient ischaemic attack(<24HRS)		☐Stroke not otherwise specified
☐Ischaemic stroke	☐Elective carotid intervention only	☐No stroke related diagnosis
☐Haemorrhagic stroke	☐Subarachnoid haemorrhage	

If no stroke related diagnosis:

☐Migraine	☐Electrolyte or metabolic disturbance	☐other
☐Seizure	☐Functional disorder	☐Uncertain
☐Delirium		

Was the stroke aetiology documented in the patient's records?	☐YES ☐NO

Select documented stroke aetiology	☐Large-artery atherosclerosis (e.g., carotid or basilar stenosis) ☐Cardio embolism (e.g., atrial fibrillation/flutter, prosthetic heart valve, recent MI) ☐Small-vessel occlusion (e.g., subcortical or brain stem lacunar infarction (<1.5 cm) ☐Stroke of other determined aetiology (e.g., dissection, vasculopathy, hypercoagulable or hematologic disorders. ○ Dissection ○ Hypercoagulability ○ Other ☐Cryptogenic stroke (stroke of undetermined aetiology) ☐Multiple potential aetiologies identified ☐Stroke of undetermined aetiology ☐Unspecified

ARRIVAL DAY/DATE	__/__/____ (DD/MM/YYYY)	
ARRIVAL TIME	__/__(24HR)	
ADMISSION		
☐YES PATIENT ADMITTED AS INPATIENT ☐PATIENT NOT ADMITTED	REASON NOT ADMITTED	☐Transferred from your ED to another hospital ☐Discharged directly from ED to home or other location that is not an acute care Hospital ☐Left from ED against medical advice ☐Died in ED ☐Discharged from observation status without an inpatient admission ☐Other ☐N/A

If patient transferred from your ED to another hospital, specify hospital name	☐Private hospital ☐Public hospital ☐Hospital not documented
Select reason(s) for why patient was transferred	☐Evaluation for IV rtPA up to 4.5 hours ☐Post Management of IV rtPA (e.g. Drip and Ship) ☐Evaluation for Endovascular thrombectomy Advanced stroke care (e.g., Neurocritical care, surgical or other time critical therapy) ☐Patient/family request ☐Other advanced care (not stroke related) ☐Not documented

DATE OF DISCHARGE	__/__/____ __:__ (DD/MM/YYYY	
TIME OF DISCHARGE	__/__24HR TIME	
What was the patient's discharge disposition on the day of discharge?	☐Home ☐ Home-Physiotherapy ☐Hospice – Health Care facility ☐Acute Care Facility	☐Other Health Care facility ☐Died ☐Left Against Medical Advise/AMA ☐ND or Unable to Determine (UTD)
If Other Health Care Facility	☐Inpatient Rehabilitation Facility (IRF) ☐Skilled Nursing Facility (SNF) ☐Intermediate Care facility (ICF) ☐Other ☐Long Term Care Hospital (LTCH	

DIAGNOSIS CODE	
ICD-9-CM or ICD-10-CM Principal Diagnosis Code	_____

ICD-9-CM or ICD-10-CM Other Diagnosis Codes	
ICD-9-CM Discharge Diagnosis Related to Stroke: ICD-10-CM Discharge Diagnosis Related to Stroke:	_____
ICD-9-CM Discharge Diagnosis Related to Stroke: ICD-10-CM Discharge Diagnosis Related to Stroke:	_____
No Stroke or TIA Related ICD-9-CM Code Present: No Stroke or TIA Related ICD-10-CM Code Present:	☐ ☐

ARRIVAL AND ADMISSION INFORMATION		
Was this patient admitted for the sole purpose of performance of elective carotid intervention?		☐YES ☐NO
Patient location when stroke symptoms discovered	☐Not in a healthcare setting e.g home ☐Outpatient healthcare setting ☐Another acute care facility ☐Stroke occurred after hospital arrival (in ED/Obs/inpatient) ☐Chronic health care facility ☐ND or Cannot be determined	
How patient arrived at your hospital	☐EMS from home/scene ☐Mobile Stroke Unit ☐Private transportation/taxi/other from home/scene ☐Transfer from another hospital ☐ND or Unknown	
Referring hospital discharge Date/ Time	__/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND	
If transferred from another	☐Private	

hospital, specify hospital		☐public ☐level IV ☐level III ☐level II ☐level I
Referring hospital arrival date/ time		__/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND
If patient transferred to your hospital, select transfer reason(s)		☐Evaluation for IV rtPA up to 4.5 hours ☐Post Management of IV rtPA (e.g. Drip and Ship) Evaluation for ☐ Endovascular thrombectomy Advanced stroke care (e.g., Neurocritical care, surgical or other time critical therapy) Patient/family request ☐Other advanced care (not stroke related) ☐For imaging ☐Unspecified reason "For further management" ☐Not documented
Where patient first received care at your hospital	☐Emergency ☐Department/ Urgent Care ☐Direct Admit, not through ED	☐Imaging suite ☐ND or Cannot be determined
Advanced Notification by EMS (Traditional Responder or Mobile Stroke Unit)?		☐YES ☐NO/CANNOT BE DETERMINED ☐N/A
Where was the patient cared for and by whom? Check all that apply.	☐Neuro admit ☐Other services ☐Stroke consult ☐No stroke consult	☐In stroke unit ☐Not in stroke unit ☐Medical ward ☐Surgical ward
Physician/provider		☐Medical officer ☐registrar ☐consultant

MEDICAL HISTORY	

Previously known medical history of:	☐None ☐Atrial Fib/flutter ☐CAD/Prior MI ☐Carotid stenosis ☐Current pregnancy or pueperium ☐Depression ☐Diabetes Mellitus ☐Dyslipidaemia	☐Drugs/alcohol abuse ☐Family history of stroke ☐HF ☐Hypertension ☐Migraine ☐Overweight/obesity ☐Sickle cell ☐Smoker	☐Previous stroke ☐Previous TIA ☐Prosthetic heart valve ☐PVD ☐Renal insufficiency- ☐chronic sleep apnoea ☐ND
Ambulatory status prior to current event	☐Able to ambulate independently (no help from another person) w/ or w/o ☐device ☐With assistance (from person) ☐Unable to ambulate ☐ND		

DIAGNOSIS AND EVALUATION		
Symptom Duration if diagnosis of Transient Ischemic Attack (< 24 hours)	☐Less than 10 minutes ☐10-59 minutes ☐ > 60 minutes ☐ ND	
Had stroke symptoms resolved at time of presentation?	☐Yes ☐ No ☐ND	
Initial GCS score documented	☐Yes ☐ No	
If yes what was the value at admission	__/15 ☐ND	
Initial exam findings (Select all that apply)	☐Weakness/Paresis ☐Altered Level of Consciousness ☐Disturbance Aphasia/Language	☐Other neurological signs/symptoms ☐No neurological signs/symptoms ☐ND

Ambulatory status on admission	☐Able to ambulate independently (no help from another person) w/ or w/o device ☐With assistance (from person)	☐Unable to ambulate ☐ND

MEDICATIONS PRIOR TO ADMISSION			
Not on any medication ☐NO not on medication ☐Yes on medication			
Antiplatelet or anticoagulant		Yes NO	
If yes:	Antiplatelets ☐Aspirin ☐Clopidogrel ☐Ticlopidine ☐other	Anticoagulants ☐Warfarin ☐Unfractionated ☐ heparins ☐LMW Heparins	☐Dabigatran ☐Fondaparinux ☐ Rivaroxaban(xarelto) ☐other
Antihypertensive		☐YES ☐NO/ND	
Antidiabetic medication		☐YES ☐NO/ND	
Cholesterol reducer		☐YES ☐NO/ND	
Antidepressant		☐YES ☐NO/ND	

SYMPTOM TIMELINE	
Date/Time patient last known to be well?	__/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND
Time of Discovery same as Last known well ☐YES ☐NO	__/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND
Date/Time of discovery of stroke symptoms?	__/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND

COMMENT	

BRAIN IMAGING	
Brain imaging completed at your hospital for this episode of care?	☒YES ☐NO ☐NC
Date/Time Brain imaging ordered	__/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND
Date/Time Brain Imaging interpreted/recorded	__/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND

THROMBOLYTIC THERAPY	
IV t-PA initiated at this hospital? ☐YES ☐ NO	Date and time in rtPA initiated: __/__/____ __:__ (DD/MM/YYYY) ☐ND __/__ (24HR TIME) ☐ND
Documented exclusions (Contraindications or Warnings) for not initiating IV thrombolytic in the 0-3hr treatment window?	☐YES ☐ NO ☐ND

OTHER IN HOSPITAL TREATMENT AND SCREENING			
Dysphagia Screening			
Patient NPO throughout the entire hospital stay?	☐YES	☐ NO	☐ND
Was patient screened for dysphagia prior to any oral intake including water or	☐YES	☐NO	☐NC

medications?		
If yes, Dysphagia screening results:	☐PASS ☐ FAIL ☐ ND	
Did the patient have an NG tube inserted Date NG tube inserted	☐YES ☐ NO __/__/____ __:__ (DD/MM/YYYY) __:__ 24HR TIME ☐UNKNOWN/ND	
Treatment for Hospital-Acquired Pneumonia	☐YES ☐NO	
VTE interventions	☐Low molecular weight heparin (LMWH) ☐Low dose unfractionated heparin ☐Aspirin ☐Factor Xa Inhibitor ☐Warfarin ☐Rivaroxaban	☐Venous foot pumps (VFP) ☐Oral Factor Xa Inhibitor ☐Intermittent pneumatic compression devices ☐Graduated compression stockings ☐None of the above or ND ☐Dabigatran
What date was the initial VTE prophylaxis administered after hospital admission?	__/__/____ __:__ (DD/MM/YYYY) ☐UNKNOWN/ND	
Is there physician/APN/PA or pharmacist documentation why VTE prophylaxis was not administered at hospital admission?	☐YES ☐NO	
Was DVT or PE documented?		
Was antithrombotic therapy administered by the end of hospital day 2?	☐YES ☐NO/ND ☐NC	
If yes, select all that apply	☐Antiplatelet ☐Anticoagulant	

MEASUREMENTS	

Blood pressure _____mmHg(initial) ☐ ND Heart rate _____(Beats per minute) Pulse rhythm documented ☐ YES ☐NO If documented ☐Regular ☐Irregular Weight _____kg ☐ND Height _____cm ☐ND BMI _____ ☐ND	LIPIDS ☐ND ☐ NCs TCHOL (Mmol/L) TGS (Mmol/L) HDL(Mmol/L) ☐ND LDL(Mmol/L) ☐ND RBS (MMOL/L) ☐ND HBA1C ☐ND INR ☐ND

DISCHARGE INFORMATION		
Modified Rankin Scale at Discharge		☐YES ☐NO
If yes, actual score		__/40
Ambulatory status at discharge	☐Able to ambulate independently (no help from another person) w/ or w/o device ☐ With assistance (from person) ☐Unable to ambulate ☐ND	
Discharge Blood Pressure (Measurement closest to discharge)		_____/_____ mmHg(Systolic/Diastolic) ☐ND

DISCHARGE MEDICATION			
Prescribed?	☐YES ☐ NO		
Antithrombotic Therapy approved in stroke	Antiplatelet ☐Aspirin ☐Dipyridamole	Anticoagulant apixaban (Eliquis) ☐Dabigatran (Pradaxa) ☐	☐full dose LMW heparin ☐Rivaroxaban (Xarelto)

	☐Clopidogrel ☐Ticlopidine	Fondaparinux (Arixtra)	☐Unfractionated heparin IV ☐warfarin

	Dosage Frequency 1. 2. 3. 4.

If NC, documented contraindications	☐ Allergy to or complications r/t ☐Serious side effect to medication ☐Terminal illness/Comfort measures only ☐ Patient refused ☐Risk for bleeding or discontinued due to Other bleeding

Persistent or Paroxysmal Atrial Fibrillation/Flutter	☐YES	☐ NO	☐ND
If atrial fib/flutter or history of PAF documented, was patient discharged on anticoagulation?	☐YES	☐NO/ND	☐NC

If NC, documented reasons for no anticoagulation	☐Allergy to or complication r/t warfarin or heparins ☐Mental status ☐Patient refused ☐ Risk for bleeding or discontinued due to bleeding	☐Risk for falls ☐ Serious side effect to medication ☐Terminal illness/Comfort Measures Only

Antihypertensive Tx (Select all that apply)	☐Non prescribed/ND ☐None - contraindicated ☐ACE Inhibitors ☐ ARB	☐ Beta Blockers ☐ Ca++ Channel Blockers ☐ Diuretics ☐Other anti-hypertensives

Cholesterol-Reducing Treatment	☐YES ☐NO	
Medication prescribed	☐Statin Total daily dose of statin_____mg ☐Ezetimibe ☐Other	
Documented reason for not prescribing a statin medication at discharge?	☐YES ☐NO	
Intensive Statin Therapy	☐YES ☐NO ☐NC	
New Diagnosis of Diabetes?	☐YES ☐ NO ☐ND	
Basis for new diagnosis of diabetes (Select all that apply):	☐ HbA1c ☐Fasting ☐Blood Sugar	☐Oral Glucose Tolerance Test Other
Diabetic Tx (Select all that apply):	☐N/A ☐None prescribed/ND ☐NC	☐Insulin ☐Oral agents
Anti-Smoking Tx	☐YES ☐NO/ND ☐NC	
Any antidepressant Rx at discharge?	☐Yes, SSRI ☐Yes, other antidepressant ☐ND	

OTHER LIFESTYLE INTERVENTIONS			
Reducing weight and/or increasing activity recommendations	☐YES	☐NO/ND	☐NC
TLC Diet or Equivalent	☐YES	☐NO/ND	☐NC
Antihypertensive Diet	☐YES	☐NO/ND	☐NC
Was diabetes teaching provided?	☐YES	☐NO/ND	☐NC

STROKE EDUCATION		
Patient and/or caregiver received education and/or resource materials regarding all the following:		
Check all as yes	☐	
Risk factors for stoke	☐YES	☐NO
Stroke warning signs and symptoms	☐YES	☐NO
How to activate EMS for stroke	☐YES	☐NO
Their prescribed medication	☐YES	☐NO
Need for follow up after discharge	☐YES	☐NO

STROKE REHABILITATION		
Patient assessed for and/or received rehabilitation services during this hospitalization?	☐YES	☐NO
Check all rehab services that patient received or was assessed for:	☐Patient received rehabilitation services during hospitalization ☐ Patient transferred to rehabilitation facility ☐Patient referred to rehabilitation services following discharge ☐ Patient ineligible to receive rehabilitation services because symptoms resolved ☐Patient ineligible to receive rehabilitation services due to impairment (i.e. poor prognosis, patient unable to tolerate rehabilitation therapeutic regimen)	

STROKE DIAGNOSTIC TESTS AND INTERVENTIONS	
Cardiac ultrasound/echocardiography	☐Performed during this admission or prior 3 months ☐Planned post discharge ☐Not performed or planned
Carotid Imaging	☐Performed during this admission or prior 3 months

	☐Planned post discharge ☐Not performed or planned
Carotid revascularization	☐Performed during this admission or prior 3 months ☐Planned post discharge ☐Not performed or planned
Extended surface cardiac rhythm monitoring > 7 days	☐Performed during this admission or prior 3 months ☐Planned post discharge ☐Not performed or planned
ECG	☐Performed during this admission or prior 3 months ☐Planned post discharge ☐Not performed or planned
Hypercoagulability Testing	☐Performed during this admission or prior 3 months ☐Planned post discharge ☐Not performed or planned
Intracranial Vascular Imaging	☐Performed during this admission or prior 3 months ☐Planned post discharge ☐Not performed or planned
Short-Term Cardiac Rhythm Monitoring ≤ 7 days	☐Performed during this admission or prior 3 months ☐Planned post discharge ☐Not performed or planned

6.2 Study Proforma

To be filled by Healthcare workers (Medical officers and Registrars and Nurses)

Date of assessment _____

Age (yrs.): 20-34 ☐ 35-44 ☐ >44 ☐

Sex: Male ☐ Female ☐

Speciality: Doctor ☐ Nurse ☐

Appointment: Medical officer ☐

Senior house officer Part 1 ☐ Part 2A ☐ Part 2B ☐

Junior nursing officer ☐ Senior nursing officer ☐

Years of clinical experience: <5 ☐ 5-10 ☐ 11-15 ☐ >15 ☐

6.3 Questionnaire to assess Nurses' knowledge on stroke

To be filled by nurses.

i)Do you look after patients with stroke? ☐YES ☐NO

ii)Approximately how many stroke patients have you seen in the last month?

☐1-5 ☐ 5-10 ☐10-20 ☐ >20

1) Do you utilise stroke scales (GCS scale) to quantify the severity of stroke?

A) Never B) Sometimes C)Always D) I don't know

2) How often do you utilise a stroke scale in the initial evaluation of a patient?

A) Never B) Sometimes C)Always D) I don't know

3) What is the time period after onset of ischaemic stroke within which emergency treatment for stroke (thrombolysis) is beneficial.

A)2.5hrs D)4.5hrs C)6hrs D) 12hrs

4)Because thrombolytic therapy is not available at KNH, can you give a substitute therapy such as streptokinase, heparin for the treatment of stroke?

A)Never B) Sometimes C)Always D) I don't know

5) Is it necessary obtain a brain imaging such as a CT scan prior to the administration of anticoagulant therapy?

A)Never B) Sometimes C)Always D) I don't know

6) What is the most common type of imaging recommended for stroke patients?

A) Skull Xray B) CT Brain C)MRI brain D)All the above

7) Where should stroke patients be admitted?

A)General medical ward B)Cardiac care Unit C) Intensive care unit D) Stroke unit

8) Should stroke patients receive venous thromboembolism?

A)Never B) Sometimes C)Always D) I don't know

9) In a patient with stroke, would you perform or order a dysphagia screening test before giving anything by mouth?

A) Never B) Sometimes C)Always D) I don't know

6.4 Questionnaire to assess Doctors' knowledge on stroke.

To be filled by Medical officers and Registrars

Question	**Stem A**	**Stem B**	**Stem C**	**Stem D**
1)Stroke is a focal deficit of brain function, most commonly hemiplegia, with or without signs of focal higher cerebral dysfunction, lasting:	>3 hours after onset of symptoms	>4.5 hrs of onset of symptoms	>12 hrs of onset of symptoms	>24 hrs of onset of symptoms
2)The first Investigation of choice in a patient suspected of having an acute stroke is?	CT scan	MRI scan	Xray head	Lumbar puncture
3)The initial diagnostic test of choice in a case of stroke helps in:	Distinguish between haemorrhagic and ischaemic stroke	Identification of posterior stroke	Localising and assessing extent of stroke	Preventing further haemorrhage

4) The most accurate diagnostic test for detecting ischemic stroke?	Non diffusion weighted MRI	Diffusion weighted MRI	Contrast CT scan	Non contrast CT scan
5) The best initial therapy for a non-haemorrhagic stroke patient presenting within 4.5hrs from start of symptoms is:	Aspirin	High dose statin	Warfarin	Alteplase
6) The first step of management in a patient with haemorrhagic stroke should include which of the following?	Lower blood pressure	Give statins	Warfarin	Give intravenous 5000 units of heparin
7) Which of the following oral medicines should be administered within 24-48 hours of the onset of stroke?	prednisolone	Gabapentin	Aspirin	Fluoxetin
8) What is the dose of aspirin to be given in ischaemic stroke?	75mg OD	300mg STAT	300mg STAT then 75mg daily	300mg stat then 300mg daily
9) Statins should be prescribed to a patient with stroke if the serum total cholesterol is	More than 2.5mmol/l	More than 3.5mmol/L	More than 4mmol/L	More than 5 mmol/L
10) Thrombolysis in ischaemic stroke is most effective when administered	Within 4.5hrs from symptom onset	After 4.5 hrs symptom onset	Within 12 hrs symptom onset	After 12hrs symptom onset
11) A 40-year-old patient presenting with acute stroke is taking aspirin. What medicine should be	streptokinase	Vi B12	propranolol	clopidogrel

added to his/her prescription?				
12) The risk of stroke recurrence can be significantly reduced by:	Good sleep	Regular exercises	Subcutaneous heparin	Controlling BP
13) Which of the following is an absolute contraindication to thrombolytic therapy?	Intracranial haemorrhage	Pregnancy	Age >50years	Major surgery within last 1year
14) The development of what serious condition would you be concerned about the most in patients immobilized due to acute stroke?	depression	dementia	Urinary tract infection	Venous thromboembolism
15) The most important contraindication to anticoagulation is	Epilepsy	Haemorrhagic stroke	Deep vein thrombosis	pregnancy

6.5 Consent forms

6.5.1 Consent explanation for key informants to be interviewed

I am a registrar at the University of Nairobi Department of Internal Medicine. I am carrying out a study titled "A quality audit on acute ischaemic stroke care at KNH for my dissertation.

The purpose of the study is to compare the quality of care given to acute stroke patients to guidelines and assess the barriers that prevent standard care. The barriers to quality stroke care will be assesses using in depth face to face and recorded interviews . The records will be deidentified and your name will not be recorded anywhere. All the information provided will be held absolutely confidential and cannot be used against you. Participation is absolutely voluntary. You may withdraw your consent at any time without any consequences to you. There are no risks involved with this study.

The information obtained will be useful in making evidence based decisions to improve care of stroke patients.

I kindly request you to take part in this study as it will provide important information in improving stroke care at Kenyatta National Hospital.

Dr Gloria Omondi,

Gloria.omondi@gmail.com

073631981.

Consent form for interviewees

I_____ have read and understood the information regarding this study. I hereby consent to be take part in a face to face recorded interview for the purposes of this study.

Signed …… Thumb Print …… Date ……..

Witness …….. (PI/Assistant) Date ……..

For further information, you may contact

Dr Gloria Omondi,

P.O Box 24255, 00100,

Nairobi.

Email: **Gloria.omondi@gmail.com**

Cell phone: 0736 319831

6.5.2 Consent explanation for healthcare workers to fill questionnaire

I am a registrar at the University of Nairobi, Department of Internal Medicine. I am carrying out a study titled "A quality audit on acute ischaemic stroke care at KNH for my dissertation.

The purpose of the study is to compare the quality of care given to acute stroke patients to guidelines and assess the knowledge of health care workers on standard stroke care. The knowledge will be assesses using best response multiple choice questionnaires. Your name will not be recorded anywhere. All the information provided will be held

absolutely confidential and cannot be used against you. Participation is absolutely voluntary. You may withdraw your consent at any time without any consequences. There are no risks involved with this study.

The information obtained will be useful in making evidence based decisions to improve care of stroke patients.

I kindly request you to take part in this study as it will provide important information in improving stroke care at Kenyatta National Hospital.

Thank you,

Dr Gloria Omondi,

P.O.BOX 24255-00100

Nairobi.

Gloria.omondi@gmail.com

073631981.

Consent form for Healthcare workers

I_____ have read and understood the information regarding this study. I hereby consent to be take part in filling the stroke knowledge questionnaire for the purposes of this study.

Signed …… Thumb Print …… Date ……..

Witness …….. (PI/Assistant) Date ……..

For further information, you may contact

Dr Gloria Omondi,

P.O Box 24255, 00100,

Nairobi.

Email: **Gloria.omondi@gmail.com**

Cell phone: 0736 319831

6.6 Interview Guide

For interview of key informants (senior neurologists, senior registrars, senior nurses, senior physiotherapist, senior pharmacist)

1) Let's start with a brief explanation of what you do in this hospital in terms of stroke care? Kindly explain to me what you are expected to do when a stroke patient has been transferred or report to the hospital with a stroke-like symptoms?
2) What different acute stroke care services or treatments are provided for the care of acute stroke patients in this hospital? (Probe for the awareness and use of stroke unit care, aspirin therapy or thrombolytic therapy, etc.)
3) Do you perceive the current acute stroke care services and therapies for stroke patients as helpful in providing care or there are some challenges in using them?
4) How is acute stroke care provided in this hospital? (Probe to understand if the provision of care is guided by clinical guidelines or protocols and if so, what types of guidelines or protocols are used?)
5) Do you find these guidelines helpful in providing care or face some challenges in trying to use them? Where they exist, probe on the following: (their clarity and relevance to stroke clinical care, stroke care professionals familiarity with and confidence in clinical guidelines usage, their attitudes towards clinical guidelines and the perceived barriers of these guidelines in clinical decision-making
6) Now let's discuss the current practical challenges which hinder the delivery of optimal care to stroke patients? Could you elaborate on some of the barriers you face on daily bases? Probe on the following: Guideline factors, health staff level barriers, patient factors, incentives and resources, policy decisions/contexts, national level factors, etc.

7) How do you cope or manage to provide stroke care in the midst of such barriers? What recommendations will you like to make to the hospital authorities on how to improve acute stroke care in the hospital?
8) Is there anything you will like to share, either audio-recorded or off audio recorded in relation to the issues we have just discussed?
9) I will be transcribing the recording and if you don't mind I will be happy to share the interview transcript with you to cross check to be sure what is transcribed reflects your views?
10) Thank you for your time