AWARENESS OF STROKE RISK FACTORS AND WARNING SIGNS AMONG HYPERTENSIVE PATIENTS ATTENDING GARISSA COUNTY REFERRAL HOSPITAL IN GARISSA COUNTY, KENYA

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FEBRUARY 2025

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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DEDICATION

I dedicate this thesis to my parents, my grandfather (who died of stroke) and my wife, and our lovely children (Hafsa, Ilham, Mohamed, Munir & Munira).

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DEFINITION OF OPERATIONAL TERMS

Awareness: Defined as being able to state correctly two or more risk factors or warning signs for stroke versus those who would not.

Cigarette pack years: A measure of extent of cigarette smoking exposure, it is calculated by multiplying the number of cigarette packs smoked per day by the number of years a person has smoked.

Hypertension: A documented diagnosis of hypertension (High blood pressure) on the file by a doctor or health worker and or receiving treatment for hypertension.

Risk Factors: Any characteristic, diseases, or behavior that increases the likelihood of getting a stroke**.**

Stroke: A neurological disease due to blockade of blood supply to a part of the brain or when a blood vessel in the brain bursts.

ABBREVIATIONS AND ACRONYMS

ANSA	:	American National Stroke Association
BE-FAST	:	Balance, Eye, Face, Arm, Speech and Time.
DALYS	:	Disability adjusted life years lost
FAST	:	Face Arm Speech and Time.
GBD	:	Global Burden of Disease
GDP	:	Gross Domestic Product
HIS	:	Health Information System
KNH	:	Kenyatta National Hospital
LMIC	:	Low- and Middle-Income Countries
MOPC	:	Medical Outpatient Clinic
MOPC	:	Medical Out-patient clinic
MTRH	:	Moi Teaching and Referral Hospital
NACOSTI	:	National Commission for Science, Teaching and Innovation
NINDS	:	National Institute of Neurologic Disorder and Stroke.
SPSS	:	Statistical Packages for Social Science
US	:	United States
USDs	:	United States Dollars
WHO	:	World Health Organization
WSO	:	World stroke Organization
YLD	:	Years of healthy Life lost due to disability
YLL	:	Years of Life lost prematurely

ABSTRACT

Stroke is a major global health challenge that substantially impacts individuals, families, and societies. Several risk factors contribute to the development of stroke, the majority modifiable while some are non-modifiable. Despite the high prevalence of stroke risk factors among the people of Garissa County, there are no published studies evaluating the level of awareness of hypertension on risk factors and early warning signs among hypertensive patients in Garissa. Garissa County, in the former Northeastern Province of Kenya, has overall low literacy levels, which could potentially impact patients' awareness of stroke risk factors and warning signs. Therefore, the study's objective was to determine the level of awareness of stroke risk factors and warning signs among hypertensive patients in Garissa County and the factors influencing their level of awareness. It was conducted in the medical outpatient clinic of Garissa County Referral Hospital. The study population was hypertensive patients older than 18 years. A structured questionnaire and key informant interview tool were used for quantitative and qualitative data collection. Data was analyzed in SPSS version 25. Categorical data was summarized as absolute frequencies and proportions, while continuous variables were presented as measures of central tendency. A multivariate logistic regression was used to determine the association between patients' characteristics and their level of awareness. A P-value of < 0.05 was considered significant. There were 143 respondents with a mean age of 57 years, very low literacy (18%), and a low employment rate (34%). 39% (56) of the hypertensive patients also had one or more comorbidities, mostly diabetes, kidney failure and heart failure. The hypertension control rate was also suboptimal (26%). Hypertensive patients in Garissa have very low awareness levels of both stroke risk factors and warning signs at 15% and 38%, respectively. On multivariable logistic regression analysis, level of education (aOR: 7.474, CI: 1.343-41.598, p=0.022), family history of stroke (aOR: 5.552, CI: 1.200-25.682, p=0.028), and comorbidity (aOR: 0.135, CI: 0.038-0.481, p=0.002) were significant predictors of level awareness. This study recommends that the Garissa County Public Health Department develop a health education and promotion strategy to enhance stroke awareness, reduce risk factors, and improve cardiovascular health outcomes.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

According to the World Stroke Organization, globally, stroke is the second-leading cause of death, and the third-leading cause of death and disability combined (as expressed by disability-adjusted life-years lost-DALYs). The World Stroke Organization reports that 12.2 million new stroke cases occur globally each year, equivalent to one stroke every three seconds. This significant disease burden is accompanied by substantial financial costs for prevention, treatment, and rehabilitation. The WSO estimates the global financial impact of stroke to be approximately $451 billion USD, representing 0.36% of the global GDP (World Stroke Organization (WSO), 2022).

Regionally, Sub-Saharan African countries like Kenya continue to bear the biggest brunt of stroke. Low and middle-income countries such as Kenya account for a four-fold increase in prevalence, a 15-fold increase in stroke mortality, and a 20-fold increase in DALYs globally (World Stroke Organization (WSO), 2022).This disparity is made more pronounced by the low literacy levels, poor healthcare access, socio-economic and socio-cultural factors such believes and misconceptions about stroke.

In Kenya, the exact incidence and prevalence of stroke remains unknown due to limited high quality data however hospitals-based point prevalence range between 0.6-7.1%. It accounts for 7% of hospital admissions in a study in rural Kenya (Peter Waweru & Samwel Maina Gatimu, 2021). Kaduka et al found stroke resulted in substantial disability adjusted life years (DALYS) with young adults (<45 years) bearing the biggest brunt (35.6% of total DALYS) resulting in loss of productive years. They make a call for the reinforcement of targeted prevention of stroke risk factors (Lydia Kaduka et al., 2019).

According to the World Stroke Society Globally, poorly controlled Hypertension is the leading risk factor for stroke (55.5%), followed by obesity (24.3%), poorly controlled diabetes (20.2%), ambient particulate matter pollution constitutes a

significant portion (20.1%), while smoking accounts for 17.6%(World Stroke Organization (WSO), 2022).

Ominde et al., in a study on the pattern of stroke in a rural Kenya hospital, Kangundo Hospital, found similar risk factors as the most prevalent among stroke patients. He found Hypertension (74%), alcohol use (63%), Cigarette smoking (48%), diabetes (32%), diabetes, and Hypertension comorbid (28%) as some of the most common risk factors among stroke patients (Ominde et al., 2019).

Risk factor modification or reduction is a critical component of stroke management, and patients and the community must be educated on risk factor identification and mitigation/modification measures to reduce the incidence of stroke. Poor knowledge leads to low compliance with preventive interventions.

There are several stroke warning signs and symptoms. However, the most common ones include sudden numbness or weakness, particularly on one side of the body, abrupt bewilderment, difficulty in verbal communication, sudden vision impairment, unexpected difficulty in walking, and a severe headache that arises suddenly without any identifiable reason. Some of these warning signs duped FAST (Face, Arm, Speech, Time) and have been used as a tool for public awareness campaigns on stroke knowledge (Aroor et al., 2017). FAST is a mnemonic for Facial drooping, Arm weakness, speech difficulty, and Time to call emergency as vital warning signs of stroke to reduce prehospital delay.

Nigat et al. point out that stroke can be avoided and managed by altering risk elements and promptly identifying its early signs (Nigat et al., 2021). The most critical factor in successful revascularization (reopening blocked blood vessels) in Ischemic (stroke due to blockage of blood vessel) stroke patients is timely arrival at the hospital. Guidelines recommend that individuals experiencing stroke symptoms reach the hospital within 4.5 hours from the commencement of these symptoms. Given these strict timelines for optimal revascularization therapy, educating high-risk patients like hypertensive patients on early detection of warning signs and timely arrival to the hospital is prudent.

Despite the growing burden of stroke and its leading risk factor, hypertension, research on stroke has focused on the general population with few studies focusing on the awareness of stroke risk factors and warning signs among hypertensives (Sapna et al., 2016). This is study aims to fill this gap and generate evidence for context specific interventions or public health campaigns to enhance stroke awareness.

1.2 Statement of the Problem

Garissa County Hospital is a level 5 hospital that has been recording high proportions of stroke admissions into the medical wards. In the last quarter alone, 9.3% of all medical admissions were due to stroke, and 73% of the stroke cases were hypertensive patients (Hospital HIS data). This burden of disease is higher than what was reported by others in hospitals in Nairobi (3%) in Eldoret (0.6%) but similar to a 7.5% reported in a rural Kangundo level 4 hospital (Jowi & Mativo, 2008; Ominde, Ogeng'o, Misiani, & Kariuki, 2019).

Despite many studies showing hypertension as the leading cause of stroke both locally and globally, prevention and management of hypertension has been sub-optimal with only 29.4% of hypertensive patients aware of their status, only 6.5% of them on treatment and only 12.5% of those on treatment achieving control of their blood pressure, this highlights the significant gap in hypertension care and thus stroke prevention (Supa Pengpid & Karl Peltzer, 2020).

Despite the regular follow-up at the medical outpatient clinic, many hypertensive patients still get strokes and present late to the hospital. This could be attributed to a possible lack of knowledge of risk factors and, therefore, no mitigation measures taken by the patients and the inability to detect early warning signs of stroke to ensure timely arrival to the hospital. While there are few studies on stroke in the country, there is still scanty information on extent of awareness on stroke among hypertensive patients, it is therefore prudent to evaluate the patient's knowledge of the risk factors that predispose them to stroke and the warning signs of stroke.

1.3 Study Justification

Stroke is associated with increased morbidity and death, leading to a substantial burden on healthcare systems. Stroke can be avoided, and effectively dealing with risk factors would significantly contribute to its management.

Hypertension is the leading risk factor for stroke, accounting for approximately 64% of stroke cases in Kenya; despite this huge impact, current evidence suggests that knowledge of stroke risk factors and warning signs among hypertensive patients is alarmingly low in developing countries, in Ethiopia, for instance, two-thirds (75%) of hypertensive patients could not identify any risk factors or warning signs of stroke. This poses a serious risk as it can result in delayed recognition of symptoms and poor compliance/observance of preventive measures, leading to an increasing burden of stroke. High-quality research is essential to provide a guide on policy development and improve stroke care in the country.

The ministry of Education reports a huge regional literacy rate disparity with North Eastern Counties including Garissa recording the lowest literacy levels (8%) while Nairobi recorded the highest at 87.1% ,(Ministry of Education, 2012), this together with the limited physical and financial access to healthcare, socio-cultural beliefs, gender equity issue can all negatively impact awareness level .

The findings of this study would provide invaluable insight into stroke awareness in a specific Kenyan context. This information is essential for developing targeted educational interventions, improving stroke prevention strategies in the region, and ultimately reducing the stroke burden in Kenya.

1.4 Research Questions

a) What are the characteristics of hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya?
b) What is the extent of awareness about stroke warning signs among hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya?
c) What is the awareness level on stroke risk factors among hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya?
d) How do awareness and patient characteristics correlate among hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya?

1.5 Null Hypothesis

H_0: There is no association between patient characteristics and level of awareness of stroke risk factors and warning signs among hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya.

1.6 Objectives

1.6.1. The Main Research Objective

To establish the level of awareness of stroke risk factors and warning signs among Hypertensive patients attending Garissa County referral hospital in Garissa County, Kenya.

1.6.2. Specific Objectives

a) To determine the patient characteristics of hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya
b) To determine the awareness level on stroke warning signs among hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya.
c) To evaluate the extent of awareness about stroke risk factors among hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya.
d) To determine the association between awareness of stroke risk factors and warning signs and patient characteristics among hypertensive patients attending Garissa County Referral Hospital in Garissa County, Kenya.

1.7 Significance of this Study

The results of this study will offer significant insights into the extent of knowledge about risk factors and early indicators of stroke among individuals with hypertension. Clinicians and community health workers will also use it to focus the health education sessions for hypertensive patients on stroke risk reduction measures and early warning signs to ensure prompt arrival at the nearest hospital.

1.8 Limitations

The study was limited to a single facility, and it is also limited to only patients with hypertension; hence, its findings may not be generalizable to the general population.

1.9 Conceptual Framework

Independent variables **Dependent variables**

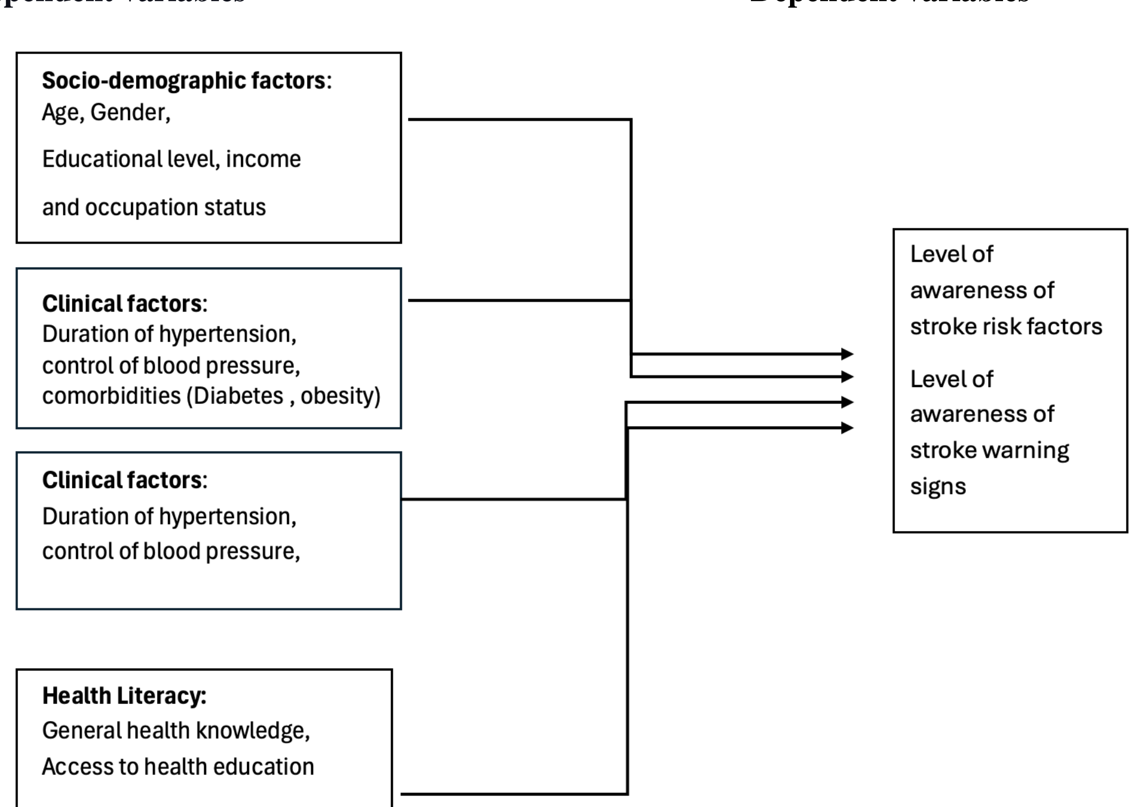


Figure 1.1: Conceptual Framework

The independent Variables included the socio-demographic characteristics of the patients, clinical characteristics, lifestyle factors and health literacy. The socio-demographic characteristics encompassed age, gender, educational level, marital status, and financial position. The clinical factors included the length of time hypertension has been present and the control of blood pressure, and presence or absence of comorbidities. Lifestyle risk factors included cigarette smoking, Alcohol use, and obesity. Health literacy include general health knowledge or access and adequacy of health education. The dependent variable in this study was awareness of stroke warning signs and risk factors among the study participants as can be seen in figure 1 above.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Stroke is an acute neurologic condition resulting from either lack of blood flow through a vessel or rupture of blood vessels within the brain. Stroke is broadly divided into ischemic or hemorrhagic strokes based on the underlying pathophysiologic process. Ischemic stroke is due to sudden occlusion of blood flow by either a clot formed locally (Thrombotic ischemic stroke), or a clot formed elsewhere and dislodged to block a vessel within the brain (Embolic ischemic stroke). Hemorrhagic stroke is on the other hand a stroke due to rupture in one of the brain arteries within the brain tissue causing bleeding into the brain tissue. Globally, ischemic stroke is responsible for more than 80-85% of strokes while hemorrhagic strokes contribute to 15-20% of the stroke burden (Akinyemi et al., 2021).

2.2 Epidemiology of Stroke

Globally, stroke ranks as the second most common contributor to mortality and the third most prevalent cause of both fatality and disability when considering individuals aged 15 and above. There are 12 million new strokes yearly meaning, one every 3 seconds. One hundred and one million people live with stroke globally, which has almost doubled in the last year (World Stroke Organization (WSO), 2022).

Over the past ten years, there has been a 70% rise in the occurrence of stroke, a 43% upsurge in fatalities attributed to stroke, a 102% growth in the prevalence of stroke cases, and a 143% surge in the number of disability-adjusted life years lost due to stroke. developing countries such as Kenya, are primarily responsible for the majority of this deteriorating worldwide condition (World Stroke Organization (WSO), 2022).
At the turn of the century, there has been an epidemiologic transition in Africa from a communicable disease burden to an increasing non-communicable disease burden. Africa today has a 2-3-fold greater risk of incidence and prevalence of stroke than Western Europe and the USA (Akinyemi et al., 2021).

The current estimates suggest that Africa experiences around 316 new cases per 100,000 individuals on a yearly basis, with a fatality rate of up to 80% within a span

of three years (Akinyemi et al., 2021). Importantly stroke in Africa affects the much younger population as early as the fourth decade of life, substantially impacting the individual, their family, and society. It results in a more significant loss of socioeconomic productivity than in other parts of the world (Akinyemi et al., 2021).

The burden of stroke in Kenya is generally unknown due to the few epidemiologic studies. The few hospital-based studies available found that stroke point prevalence ranged between 0.6% to 7% (Waweru & Gatimu, 2021). Like the rest of the world, most strokes in Kenya are ischemic (48-85%), while only 8.8% are hemorrhagic (Waweru & Gatimu, 2021).

The in-hospital mortality rate in was found to be up to 27% in public hospitals and 5% in private hospitals (Waweru & Gatimu, 2021).Waweru et al. noted that there is suboptimal stroke care in Kenya, and this he opines is due to the absence of clear and coordinated stroke prevention and management policies in the country (Waweru & Gatimu, 2021).

2.3 Pathophysiology of Stroke

Stroke is a cerebrovascular disease that results from the disruption of blood of flow/supply to the brain which deprives brain cells of oxygen and essential nutrients resulting in their death.

Stroke can be classified as either Ischemic or hemorrhagic depending on the cause. Ischemic stroke is as a result of occlusion of cerebral blood vessels by either a thrombus, atherosclerotic plaque or a cardiac embolus disrupting blood flow to the brain. It accounts for 80-87% of all strokes. Hemorrhagic stroke on the other hand is due to rupture of a cerebral blood vessel.

Decreased and/or absent cerebral circulation results in neuronal cellular injury and death, causing either temporary or permanent neurological deficit/disability depending on when and how fast blood flow is restored (Yongfang Li, Guo-Yuan Yang, 2017).

Kaduka et al. also found ischemic stroke to be the most common form of stroke in Kenyatta National Hospital (KNH), with women being the most affected (Lydia Kaduka et al., 2018).

Ominde et al. similarly found that stroke in Kenya mainly affected the elderly with a mean age of 68 years, more common in women (62%) than male (38%), and ischemic stroke was the most common form (67.4%) (B. Ominde et al., 2019).

The molecular level pathophysiology of ischemic stroke is complex and not well understood however interplay of the following mechanisms are thought to be responsible for cell death: excitotoxicity, oxidative stress, inflammation, blood brain barrier dysfunction and apoptosis (Prabal Deb et al., 2010; Yi-wang Guo et al., 2014).

The clinical presentation/signs and symptoms of strokes often include sudden weakness on one side of the body, facial drooping, speech difficulty (including loss of speech), severe headache, loss of consciousness, sudden loss of vision, and loss of balance. The Occurrence of these features should be considered a warning and trigger prompt presentation to the hospital for early intervention (Choudhary Tariq Masood et al., 2013). The body often gives subtle warning signs before a major stroke event happens. These early warning signs are often overlooked because they are not so dramatic. Recognizing these early warning signs can make a massive difference in the outcome of stroke as it can ensure timely intervention and reperfusion of the brain (Taiwo Akindahunsi et al., 2019).

2.3 Risk Factors of Stroke

The modification and treatment of risk factors remain the most effective means of curbing the ravaging burden of stroke; however, this effective strategy has remained a challenge for both the clinicians and the patients (Romero, Morris, & Pikula, 2008) Traditional modifiable risks encompass inadequately managed high blood pressure, poorly regulated diabetes mellitus, elevated blood cholesterol, smoking, obesity, atrial fibrillation, and coronary artery disease. (Boehme, Esenwa, & Elkind, 2017).

The global burden of disease (GBD) report of 2016 showed that 87.9% of ischemic stroke DALYs and 87.5% of hemorrhagic stroke DALYs were due to modifiable risk factors, therefore, the is a significant potential to reduce the impact of stroke with risk factor reduction (Collaborators, 2021). The World Health Organization (WHO) promotes the mitigation of the risks associated with hypertension, high cholesterol, diabetes mellitus, smoking, limited physical activity, an unhealthy diet, and obesity as effective strategies for preventing strokes. (Johnson, Onuma, Owolabi, & Sachdeva, 2016).

Interstroke, a large multicenter, multinational case-control study of 3000 patients with ischemic stroke (77.9%) and hemorrhagic stroke (22.1%), found the following ten modifiable risk factors to be responsible for more than 90% of risks of stroke. They included poorly controlled blood pressure, current smoking, obesity, unhealthy diet, poor physical activity, diabetes mellitus, binge alcohol consumption, psychosocial stress & depression, cardiac disease, and high Apo lipoprotein B to A1 ratio (Zeng, Deng, & Ding, 2017).

Kaduka et al., in a study in Kenyatta National Hospital (KNH) and Moi Teaching and Referral Hospital (MTRH),found the most prevalent risk factors include hypertension (77.3%), smoking (16.1%), Diabetes Mellitus (14.9%), and elevated blood cholesterol (2.8%) (Lydia Kaduka et al., 2018).

A study in Nairobi hospital had similar findings with hypertension (80%), Diabetes mellitus (33.7%), diabetes and hypertension comorbidities (28.8%) as the most common established risk factors for stroke (Jowi & Mativo, 2008).

Ominde et al. in a rural hospital in Kenya, also found hypertension (74%) to be the most common risk factor, with alcohol abuse (63%) coming second and tobacco smoking (48%), and diabetes mellitus (42%) as the other common risk factors among stroke patients attending Kangundo hospital (Ominde, Ogeng'o, Misiani, & Kariuki, 2019).

Non-communicable diseases such as hypertension and stroke are becoming more prevalent in developing countries due to increasing rural-urban migration, urbanization, increasing sedentary lifestyles, and changes in diet and behavior. The Garissa population is not an exception; Hassan Adan found a high prevalence of hypertension (12.6%). He also identified a significant occurrence of additional risk factors for cardiovascular diseases, like diabetes mellitus (3.7%), overweight (23.9%), obesity (12.6%), abdominal obesity (20.4%), smoking (5.2%), high blood cholesterol level (16.9%) and physical inactivity (8%) (Adan, 2012).

2.4 Awareness of Stroke Risk Factors

Stroke is the most preventable neurologic disorder due to the fact that a significant portion of its risk factors, like hypertension and diabetes, can be averted through either lifestyle adjustments or medical interventions (Emmanuel & Adegbenro, 2017). Risk factor modification is the cornerstone for stroke prevention, but prevention must begin with patient awareness/knowledge of these risk factors (José Rafael Romero et al., 2008). Therapeutic approaches for stroke among high-risk groups such as hypertensive patients must include awareness of stroke risk factors and education on mitigation measures (Abate, Bayu, & Mariam, 2019).

Many studies in Africa on hypertensive patients' level of knowledge on stroke risk factors have shown poor knowledge. Abate et al. in a study in Ethiopia, found the vast majority of hypertensive patients (77%) in a tertiary hospital could not identify any risk factor for stroke. He found Physical inactivity (21.6%), Obesity (20.1%), and alcohol use to be the most identified risk factors. Surprisingly, despite being a hypertensive cohort, 23.6% of them recognized Hypertension as a contributing factor for strokes (Abate et al., 2019). Poor knowledge of the risk factors leads to poor compliance to preventive strategies (Abate et al., 2019).

A large Population-Based Survey with 28 090 Participants in Berlin, German found 58% of the participants managed to identify a minimum of two stroke risk factors in an open-ended survey. Furthermore, they also ascertained that higher educational levels, a family history of stroke, and recent exposure to information regarding stroke risk factors were recognized as factors predicting awareness (Jacqueline Müller-Nordhorn et al., 2006).

In a study conducted in Ireland, Ann Hickey and her colleagues also discovered that a significant segment of the populace (71%) was unable to accurately enumerate two or more common lifestyle-related factors that increase the risk of stroke. The risk factors most commonly mentioned were smoking, which was listed by 54.6% of participants, being overweight, indicated by 40.6%, and insufficient physical activity, noted by 32.1%. (Hickey, Holly, McGee, Conroy, & Shelley, 2012).

A Research on the recognition of Stroke Risk Factors and Warning Signs among individuals with hypertension in Benin City, Nigeria, found a slightly higher level of knowledge (55.8%) on stroke risk factors than other African studies. The difference was primarily due to the difference in the definition of knowledge. This Benin city study described knowledge as the ability to enumerate one or multiple risk factors, while the other studies considered one knowledgeable if they listed two or more risk factors (Ehidiamen & Ehinwenma, 2018).

Okinyemi et al., posits that knowledge of stroke risk factors among the African population is suboptimal and is influenced by cultural and religious beliefs (Akinyemi et al., 2021).

2.5 Awareness of Warning Signs of Stroke

A stroke constitutes a medical crisis where every moment holds significance. This underscores the long-standing saying, "Time is brain," which stresses the crucial role of time in the treatment of acute strokes over the past two decades. To avert the devastating long-term effect of stroke and death, Time from symptom onset to hospital arrival must be reduced to give timely and appropriate care (Emmanuel & Adegbenro, 2017).

The signs and symptoms of stroke can be variable. Nonetheless, the typical signs include abrupt facial, arm, or leg weakness, sudden challenges with walking or balance, sudden incapacity to speak, sudden visual difficulties, a severe unexplained headache, and a loss of awareness (Greenlund et al., 2003).

The American National Stroke Association (ANSA) adopted the acronym FAST (Facial drooping, Arm weakness, Speech difficulty, and Timely referral to emergency unit) as a global campaign to create awareness of warning signs of stroke. The American Heart Association (AHA) found that FAST self-identifies up to 69-90% of strokes but misses up to 40% of posterior circulation strokes; hence recommended the adoption of BE-FAST in place of FAST. BE-FAST has additional signs of loss of Balance and Eye (sudden visual loss) (Aroor, Singh, & Goldstein, 2017).

Aroor et al. examined whether adopting the new BE-FAST for public campaigns reduced the proportion of strokes missed by FAST. They found it reduced the proportion of missed strokes by a significant 4.4% (Aroor et al., 2017).

The most common form of stroke globally (ischemic stroke) can be managed with thrombolysis to reduce mortality and long-term disability. Thrombolysis is the breakdown of blood clots within blood vessels using a drug (thrombolytic). Thrombolysis is effective if done within 4.5 hours of symptom onset to improve clinical outcomes. This narrow therapeutic window for thrombolytic administration calls for a prompt hospital arrival (Duque et al., 2015). Studies have shown that an important cause of delay in arrival in the hospital for most stroke patients is the inability to recognize stroke warning signs. A recent study in Vietnam showed delayed presentation to hospital remains a major impediment in management of stroke. It showed that the pre-hospital delay was majorly due to patients and family members lack of awareness of the stroke warning signs (Hoa Thi Truong et al., 2024). Studies examining the global comprehension of stroke alert signs reveals less than satisfactory awareness levels. Within Europe, research conducted in Portugal and Ireland uncovered that merely 46.8% and 30.7%, respectively, were able to accurately enumerate two or more early signs of a stroke. They found that slurred speech, unilateral limb weakness, severe headache, and facial drooping/weakness were the most listed warning sign of stroke (Duque et al., 2015) (Hickey et al., 2012).
In Asia, a study in Iraq found that only 42.1% of hypertensive patients could correctly name at least two warning signs of stroke. The primary signs most frequently mentioned in this study included facial, arm, or leg numbness or weakness, challenges

in speaking, a sudden and intense unexplained headache, abrupt vision difficulties, and loss of coordination (Amen, 2016).

Studies in Africa similarly found sub-optimal knowledge of stroke warning signs. Nigat et al. in Ethiopia found a paltry 15% knowledge level. Abate et al. so in Ethiopia in an urban tertiary hospital found knowledge levels of 28.3%, and Their study revealed that issues with swallowing, abrupt memory loss, and sudden speech difficulties were the most frequently recognized indicators (Nigat et al., 2021) (Abate et al., 2019).

In Nigeria, a study among hypertensive patients attending a teaching hospital found that 41.5% were knowledgeable about stroke warning signs. This study had a higher proportion than other African studies because it considered listing one stroke warning sign as the cut-off for knowledge definition, while most other studies used a cut-off of at least two signs (Ehidiamen & Ehinwenma, 2018).

2.6 Synopsis of Gaps from Literature

There are a number of studies in Kenya on stroke but there still exists gaps in literature especially on community targeted studies. Studies on population-based epidemiology of stroke and communities' knowledge on stroke. There are few published data on population awareness of risk factors predisposing them to stroke and detection of early warning signs in order to reduce the number of strokes, initial stroke severity and improve outcomes of stroke.

CHAPTER THREE: MATERIALS AND METHODS

3.1 Study Design

Analytic cross-sectional design, single institution-based study was conducted to assess participants' awareness of stroke risk factors and warning signs.

3.2 Study Variables

The independent Variables included the socio-demographic characteristics of the patients, clinical characteristics, lifestyle factors and health literacy. The socio-demographic characteristics encompassed age, gender, educational level, marital status, and financial position. The clinical factors included the length of time hypertension has been present and the control of blood pressure, and presence or absence of comorbidities. Lifestyle risk factors included cigarette smoking, Alcohol use, and obesity while health literacy include general health knowledge or access and adequacy of health education. The dependent variable in this study was awareness of stroke warning signs and risk factors among the study participants.

3.3 Study Setting

The research took place at Garissa County Referral Hospital, situated in Garissa County. Garissa County Referral Hospital is a level 5 hospital with an approximate bed capacity of 256 beds. It provides extensive medical services, including outpatient and inpatient care, surgical facilities, intensive care services, radiology provisions, and specialized clinics. It is a referral facility for both rural sub-counties of Garissa and neighboring counties of Wajir, Mandera, Tana River, and Mwingi Central of Kitui County. Its primary focus is on providing services to the low-income rural population.

The hospital has a Medical Outpatient Clinic (MOPC) run by consultant physicians and medical officers who attend to various chronic communicable and non-communicable diseases.

3.4 Study Population

The study population was patients older than 18 years with a documented diagnosis of Hypertension attending the Medical Outpatient Clinic (MOPC) at Garissa County referral hospital.

3.4.1 Inclusion Criteria

All consenting hypertensive individuals older than 18 years attending the MOPC at Garissa County referral hospital and have lived in Garissa for more than six months.

3.4.2 Exclusion Criteria

All hypertensive patients who are critically ill (such as patients with severe respiratory distress) who were not able to give information. Patients with dementia or any other disease that makes them unable to communicate.

3.5 Sampling Techniques

A simple random sampling technique was used to recruit participants with hypertension attending the MOPC clinic at Garissa County Referral Hospital. The files of patients with hypertension booked for that week were identified from the MOPC clinic. The out-patient number of those files that meet the eligibility criteria was serialized and entered into Excel. These serial numbers were then randomized in Excel using the command “=RAND ().” The randomized numbers in each cell were then sorted from smallest to largest. Every serial number that appears in the odd category was selected for possible recruitment into the study subject for consent. In a situation where a patient selected randomly declined to participate in the study, the next selected patient was approached. The sampling frame was repeated weekly for one month until the target sample size of 143 was reached.

3.6 Sample Size Determination

There are approximately 300 patients on follow-up at the medical out-patient clinic. A representative sample was drawn from this finite population, and the sample size was determined using the formula for finite populations (less than 10,000). The calculation was as follows:

$$n = \frac{NZ^2P\,(1-P)}{d^2(N-1) + Z^2P\,(1-P)}$$

Where n' = sample size with finite population correction,

N = size of the target population = 300

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

P = proportion of patients with good awareness regarding lifestyle risk factors for stroke (Abate et al.) = 18.3%

d = margin of error = 5%

$$n = \frac{300 \times 1.96^2 \times 0.183 \times 0.817}{0.05^2\,(300-1) + 1.96^2 \times 0.183 \times 0.817}$$

n = 130

10% for non-respondents will be factored in.

A minimum of 143 hypertensive patients were sampled to estimate the knowledge on risks and early signs related to stroke with a precision level of 5%.

Seven (7) key informant interviews targeting the clinic nurse in-charge, one clinic nurse, one clinic medical officer, one physician and a hospital manager were conducted to enrich the findings of the quantitative study.

3.7 Research Instruments

A structured questionnaire developed after a comprehensive review of all previous literature on awareness/knowledge of stroke risk factors and warning signs of stroke among hypertensive patients was used to collect data. The questionnaire had three sections. The first section assessed the demographic and clinical characteristics such as age, sex, level of education, occupation, income status, duration of hypertension, personal or family history of stroke, and other comorbidities.

The second section evaluated awareness regarding risk factors for stroke, while the third section assessed patient`s knowledge of warning signs of stroke. Awareness of risk factors and warning signs of a stroke was assessed using an open-ended question with no prompts. *Awareness* was defined as the ability to name/list two or more risk factors and two or more warning signs for stroke (Hickey, Holly, McGee, Conroy, &

Shelley, 2012; Kayode-Iyasere & Odiase, 2019; MO et al., 2021; Obembe, Olaogun, Bamikole, Komolafe, & Odetunde, 2014; Park et al., 2006).

A key informant interview using an interview guide was used to enrich the quantitative data collected by the questionnaire. The key informants targeted in this study were critical stakeholders involved in the care of hypertensive patients. These included the nurse in charge of the clinic, Clinic Nurse, medical officer, a consultant physician, and a representative from the hospital management team. A total of seven key informants were interviewed. The interview covered their perception of patient awareness of risk factors and warnings signs of stroke. The factors that could potentially affect patients' awareness levels, the availability of structured health education programs, and the adequacy of patient health education.

3.8 Pretesting

A pre-test study of 10% of the desired sample size was conducted at Iftin Level 4 Hospital to pre-test the study questionnaire. Iftin Level 4 Hospital is the second largest hospital in Garissa County with medical inpatient services. Patients admitted to the medical wards were selected because they were similar in characteristics to the target population. This allowed for test-retest reliability testing two days apart while they were in the wards. Once the pre-testing was done, the questionnaire's applicability, reliability, and clarity were assessed, and appropriate revision was undertaken where necessary.

3.9 Validity

There is no universally validated tool for evaluating awareness of stroke risk factors and warning signs of stroke in research settings. FAST (Face, Arm, Speech, and Time) has been validated as a global community campaign tool to raise awareness of stroke warning signs. However, the American Heart Association found it unreliable as it misses up to 40% of stroke patients (Aroor et al., 2017); we, therefore, used a questionnaire adopted from studies reviewed in the literature in a similar context for data collection on risk factors and warning signs.

3.10 Reliability

The test-retest method was employed to determine the consistency of the instruments. In the pre-testing phase, information was gathered from the same patients on two separate occasions, with a two-day interval between them. The reliability was assessed using Cronbach's alpha coefficient, where a value of 0.8 or higher was considered indicative of acceptable reliability.

3.11 Data Collection Techniques

A rapport was created, and the study was explained to the patient attending the medical clinic on the interview day. Informed written consent was obtained from the selected patients after the study had been sufficiently explained to them. After signing the consent form, a structured questionnaire was administered to collect data on the patient's socio-demographic and clinical characteristics and assess their awareness of stroke risk factors and warning signs. The questionnaire was administered during the clinic visit. After completing the administration of the study questionnaire, the participants were thanked for their time and any questions they had answered. The researcher approached the Key informants to explain the study and set up a time and place for an interview. The key informants were then interviewed after informed consent was obtained. The interviews were audio-recorded with the participant's permission, and notes were taken during the interviews.

3.12 Data Analysis

Data was assessed for completeness and entered into MS Excel. These data were then exported and analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Categorical variables such as Socio-demographic, clinical characteristics, and level of awareness of the patients were summarized as absolute frequencies (n) and proportions (%).

Continuous variables such as the duration of Hypertension were summarized using mean, median, and standard deviation. Multivariate logistic regression was used to determine the association between patient characteristics and their awareness of risk factors and warning signs for stroke. The entry criterion for multivariate analysis was a P value ≤ 0.05 on bivariate analysis.

3.13 Logistical and Ethical Considerations

Approval was obtained from and granted by Kenyatta University Graduate School, and ethical clearance to conduct the study was also obtained from Kenyatta University Ethics Review Committee. Permission to conduct the study was sought from the National Commission for Science, Technology, and Innovation (NACOSTI) and the Garissa County Referral Hospital management. Informed consent was obtained from the participants after the study's pros and cons were explained to them, and the voluntary nature of their involvement was emphasized. Absolute confidentiality of the participant's information was maintained by ensuring anonymity. Participants were identified by study number only. The principal investigator securely stored all physical copies of the data using locks and keys. The digital data is password protected. Data collected will not be used for any purpose other than the fulfillment of the objectives of this study. These data will be retained for a minimum of five years after the study, and the records will be disposed of to ensure the information cannot be reconstructed. All COVID-19 protocols were observed during data collection.

CHAPTER FOUR: RESULTS

4.1. Characteristics of the study participants

4.1.1. Respondents' Socio-Demographic

A total of 143 hypertensive patients participated in the study, giving a 100% response rate. The respondents' mean age was 57 years, with a standard deviation of 15 years. 25% of the hypertensive patients were elderly, falling in the age group of 55-64 years (n=36), followed by those aged 45-54 years at 21% (n=30). The youth and those aged above 84 years contributed the most diminutive proportions of hypertensive patients at 7% and 4%, respectively. Males are slightly more predominant at 55% (n=78), with a majority of the patients being married at 79% (n=113) (Table 4.1).

The study findings illustrate low literacy levels in Garissa County, where 117 patients (82%) reported to have no formal education, leaving the remaining 26 (18%) distributed across respondents who attained primary, secondary, and tertiary education at 10 (7%), 9(6%), and 7(5%), respectively. In line with the low rates of formal education attained among respondents, the findings illustrate low formal employment rates among respondents, where only 7 respondents (5%) were employed. The majority of the respondents, 94 (66%) were unemployed, followed by casual laborers at 38 (27%). This finding also translates to the distribution of average monthly income where the majority, 65 respondents (45%) were earning between KSh. 5,000 to KSh. 15,000 monthly. Significantly, few respondents reported earning an average of over KSh—45,000 monthly (5%) (Table 4.1).

Table 4.1: Respondents' Socio-demographic Characteristics

Variable	Frequency (n=143)	Percentage (%)
Age (Years)		
Summary	Mean (56.69)	Std Dev (15.36)
18-24	2	1.40
25-34	8	5.59
35-44	21	14.69
45-54	30	20.98
55-64	36	25.17
65-74	27	18.88
75-84	14	9.79
85-94	5	3.50
Sex		
Female	65	45.45
Male	78	54.55
Marital Status		
Married	113	79.02
Single	9	6.29
Widow/widower	9	6.29
Separated /Divorced	12	8.39
Religion		
Christian	17	11.89
Muslim	126	88.11
Education Level		
No formal education	117	81.82
Primary	10	6.99
Secondary	9	6.29
Tertiary	7	4.90
Employment Status		
Casual laborer	38	26.57
Employed	7	4.90
Self-employed	4	2.80
Unemployed	94	65.73
Average Monthly Income		
0- 5,000	19	13.29
5,001-15,000	65	45.45
15,001-25,000	21	14.69
25,001-35,000	20	13.99
35,001-45,000	10	6.99
45,001-55,000	2	1.4
Above 55,000	6	4.2

4.1.2. Clinical Characteristics of the Respondents

Most patients, 87 (61%) had no comorbidity. Of those who reported having comorbidities, the majority suffered from Diabetes 34 (23.7%), followed by 11 patients (7.7%) who suffered from both Diabetes and Kidney failure, while only three (2.1%) suffered from different types of cancer, as shown in Figure 4.1.

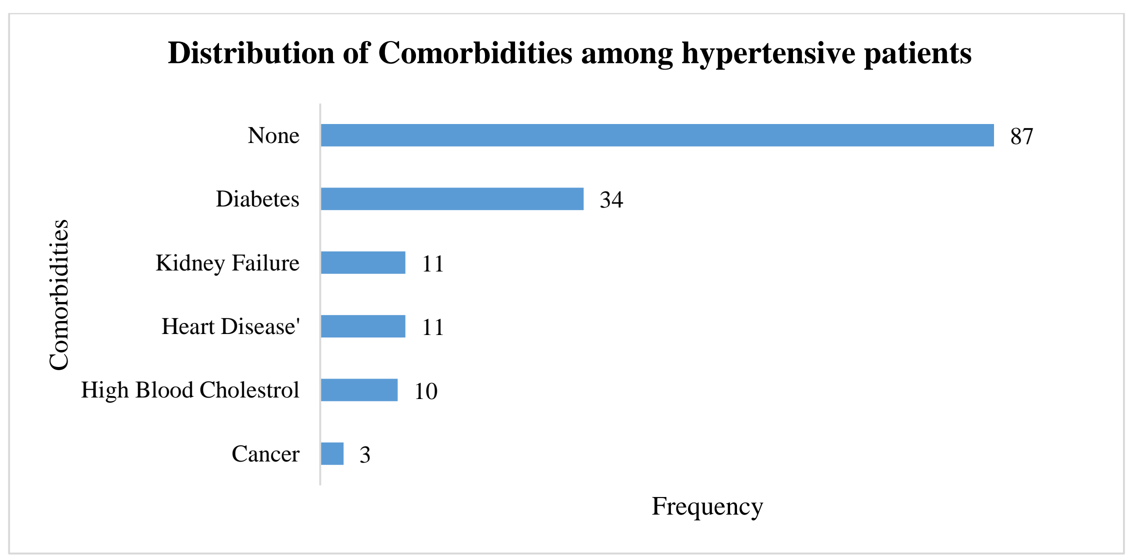


Figure4.1: Distribution of Comorbidities among hypertensive patients in Garissa County Referral Hospital.

The majority of the patients had suffered from hypertension for more than one year at the time of data collection, with 44 (34%) having suffered from hypertension for one to 5 years and 51 (36%) suffering from hypertension for more than five years. In line with this, majority of the patients,95 (66%) had been on hypertension treatment for more than six months, followed by a quarter of the patients who had been on treatment for less than six months, while 12 patients were not on hypertension treatment. Additionally, 26 patients (18%) were on the high blood cholesterol treatment, while only 12 (8%) were taking the anti-platelet treatment at the time of data collection. (Table 4.2).

Despite a majority of the patients being on hypertension treatment, the majority 106 (74%) had uncontrolled blood pressure status (>140/90). The patient's body mass index had a median of 24.61 (IQR: 22.05-29.73). Therefore, a majority, 63 (44%) of

the patients were reportedly healthy, but about 79 respondents (50%) were either overweight (27%) or obese (23%). (Table 4.2).

About 20 patients (14%) had previously been diagnosed with a mini-stroke or stroke. Additionally, about 24 (17%) patients reported to have a family history of stroke. However, a majority 97 (68%) denied having any family stroke history, while 15% did not know. In terms of substance abuse, only 20 patients (14%) admitted to using alcohol, while 127 (89%) patients had never smoked before. Of the 16 patients who had smoking history, 25% had ten-pack years of cigarette smoking. (Table 4.2).

Table 4.2: Clinical Characteristics of the respondents

Variable	Frequency (n=143)	Percentage (%)
Comorbidity		
Yes	56	39.16
No	87	60.84
Hypertension Duration		
< 6 months	31	21.68
6 - <12 months	13	9.09
>12 months - 5 years	48	33.57
> 5 years	51	35.66
Hypertension Treatment Duration		
< 6 months	36	25.17
> 6 months	95	66.43
Not on treatment	12	8.39
High Blood Cholesterol Treatment		
Yes	26	18.18
No	117	81.82
Anti-Platelet Treatment		
Yes	12	8.39
No	131	91.61
Blood Pressure Status		
Controlled (< 140/90)	37	25.87
Uncontrolled (> 140/90)	106	74.13
BMI Status		
Summary	Median (24.61)	IQR (22.05-29.73)
Underweight	9	6.29
Healthy	63	44.06
Overweight	39	27.27
Obese	32	22.38
Past Mini-Stroke Diagnosis		
Yes	20	13.99
No	123	86.01
Family Stroke History		
Yes	24	16.78
No	97	67.83
I don't know	22	15.38
Alcohol Use		
Yes	20	13.99
No	123	86.01
Smoking History		
Current Smoker	2	1.40
Ex-Smoker	14	9.79
Non-Smoker	127	88.81
Cigarette Pack Years	**n=16**	
0-5	6	37.5
6-10	6	37.5
11-15	2	12.5
Above 15	2	12.5

4.2. Level of Awareness of Stroke Warning Signs Among Hypertensive Patients Attending Garissa County Referral Hospital

The most commonly known stroke warning sign among hypertensive patients was one-sided body or limb weakness, which was mentioned among 89 patients (62.2%). This was followed by slurred speech mentioned among 24 patients (16.8%). The least identified warning signs were sudden loss of vision (n=8), sudden memory loss (n=6), and dizziness (n=3), as shown in figure 4.2 below.

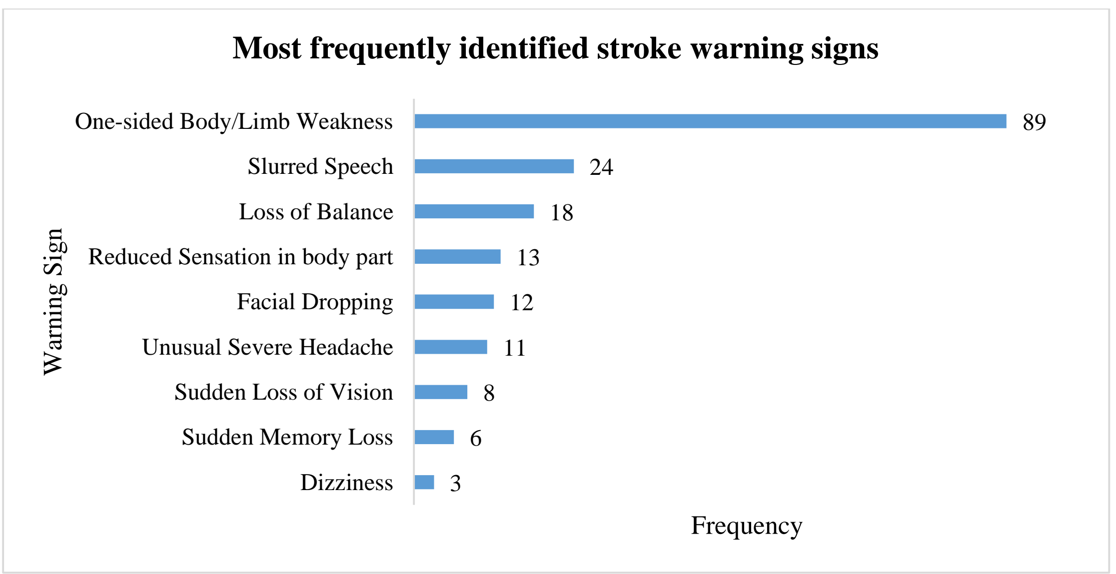


Figure 4.2.: Most frequently identified Stroke Warning Signs by hypertensive patients

Slightly over a third of the respondents (52 cases, 36.4%) did not know of any stroke warning sign, while 25.2% (36 cases) of the patients mentioned only one warning sign. The remaining 55 cases (38.5%) could list at least two or more stroke warning signs (Figure 4.3.).

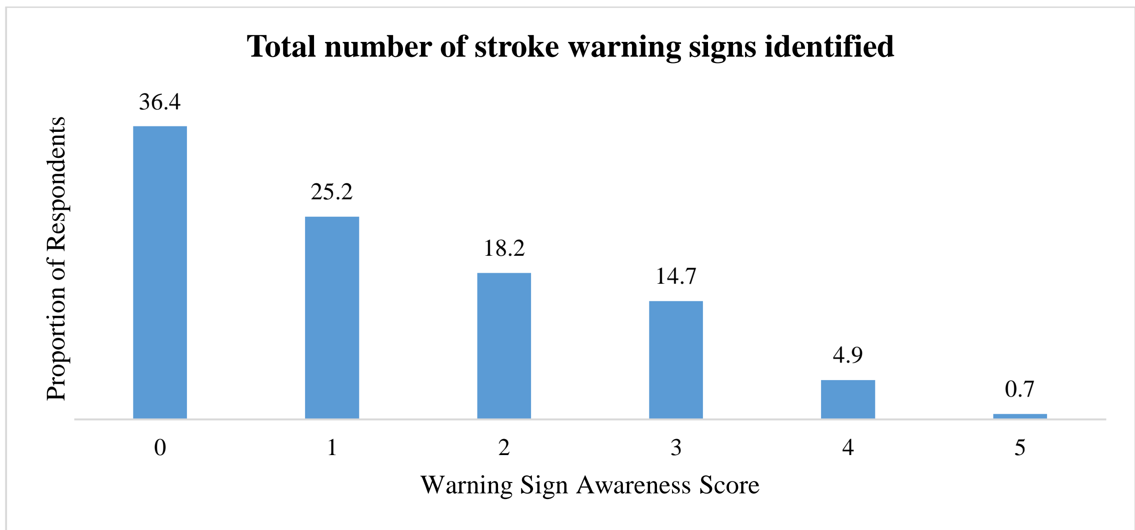


Figure 4.3: Total Number of Stroke Warning Signs identified by hypertensive patients

According to the definition of awareness of warning signs, only 55 patients (38%) of the patients were aware of stroke warning signs, i.e., mentioning at least two warning signs. See Figure 4.4 below.

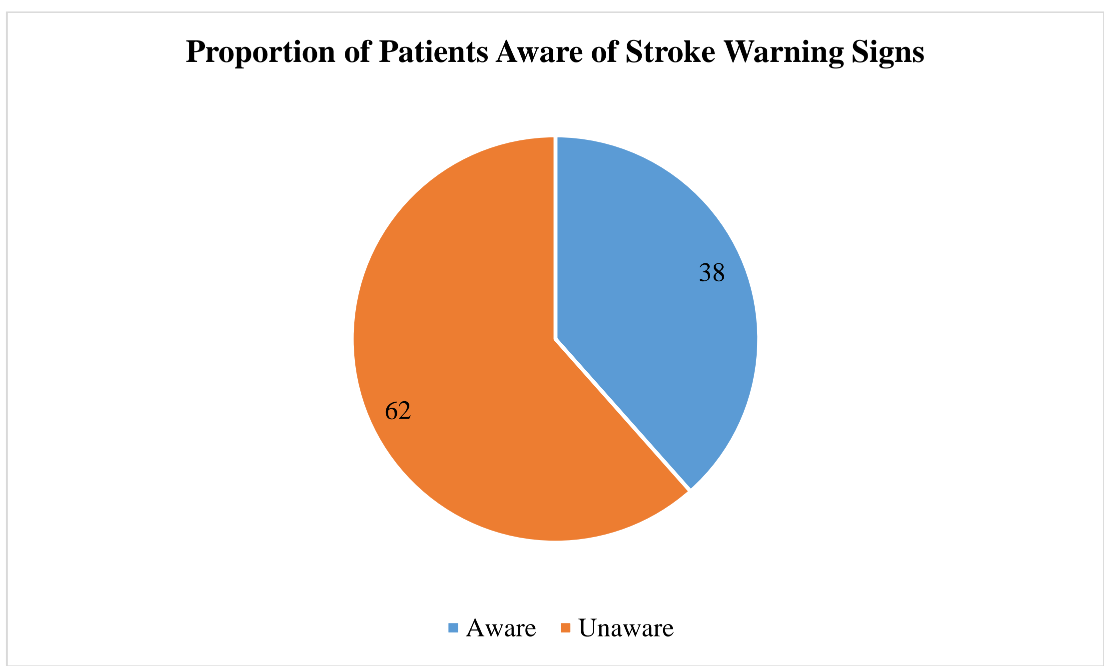


Figure 4.4: Proportion of hypertensive patients aware of stroke warning signs

The findings of the key informant interview similarly suggested a possible low awareness levels on warning signs among hypertensive patients on follow in Garissa County Referral Hospital.

"The awareness on warning signs is also very low, may be around 10% ...." **(Medical officer)**

"To my observation, I will say the level of awareness of stroke warning signs is about 20%" **(clinic nurse)**

"Awareness on warning signs is low, probably 10%, the reason I say that is because we have not been able to catch a patient who presents as soon as they get warning sign of stroke, most present with a full-blown stroke" **(hospital manager)**

"The level of awareness of stroke warning signs is very low, less than 10%, we have nearly 100% late presentation of strokes". **(physician)**

4.3. Level of Awareness of Stroke Risk Factors Among Hypertensive Patients Attending Garissa County Referral Hospital

About 68 (47.5%) patients identified hypertension as a risk factor for stroke. However, awareness of the other risk factors seemed relatively low, with diabetes following among ten patients, while the least identified risk factors were obesity (n=2), sedentary lifestyle (n=1), and heavy alcohol use (n=1). (Figure 4.5).

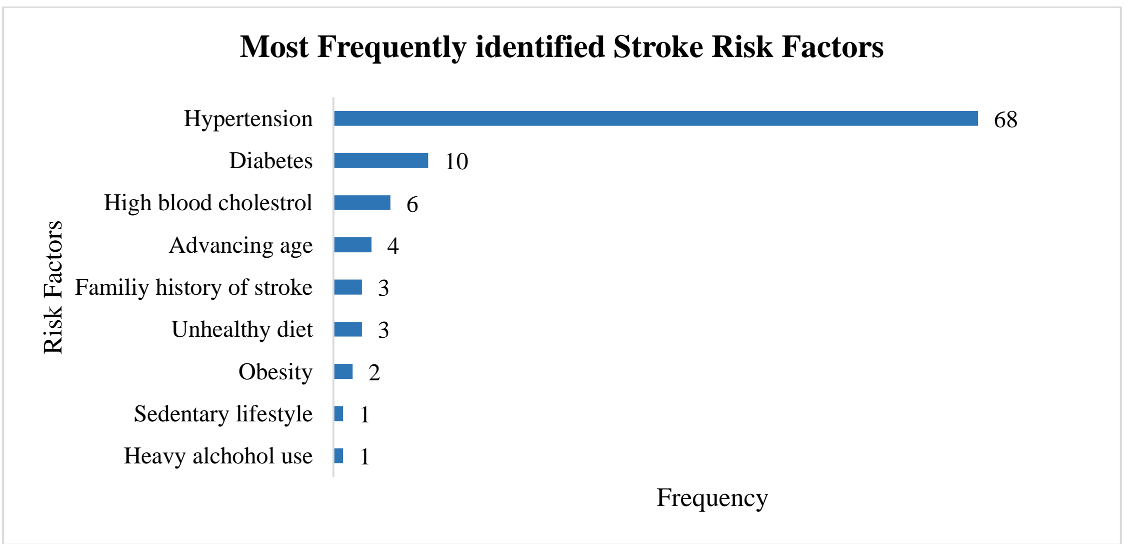


Figure 4.5: Most Frequently Identified Stroke Risk Factors Among Hypertensive Patients

Most of the patients, 73 (51%) could not identify any stroke risk factor. This was followed by 48 patients (33.6%) identifying one risk factor and 22 patients (15.4%) identifying at least two or more stroke risk factors, as shown in Figure 4.6 below.

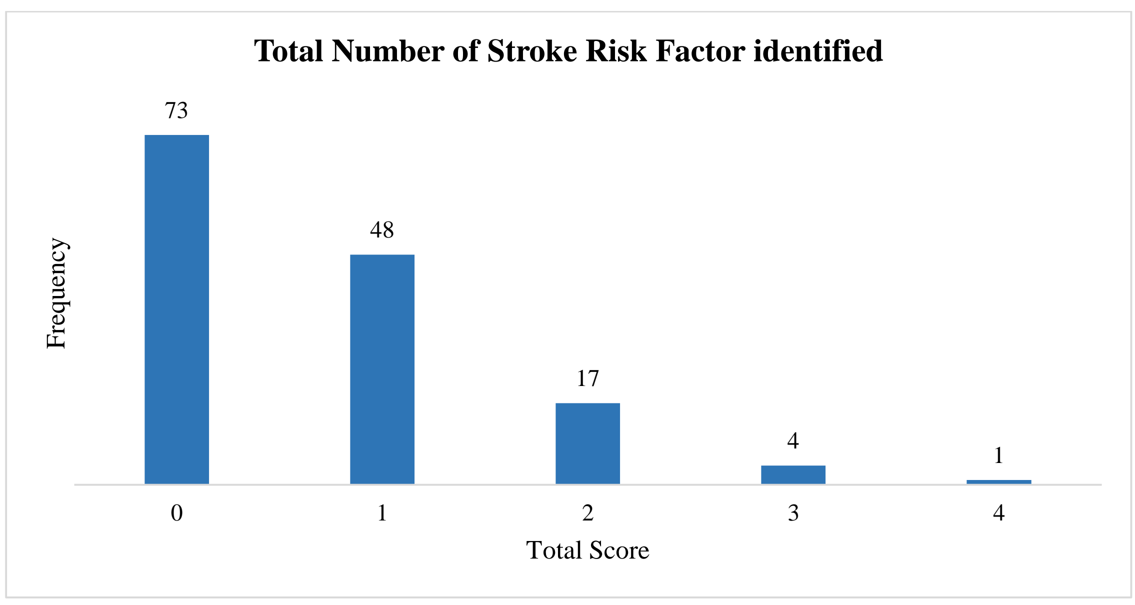


Figure 4.6: Number of Stroke Risk Factors Identified by Hypertensive Patient.

Therefore, only 22(15%) of the patients were aware of stroke risk factors, i.e. mentioning at least 2 risk factors of stroke as shown in figure 4.7 below.

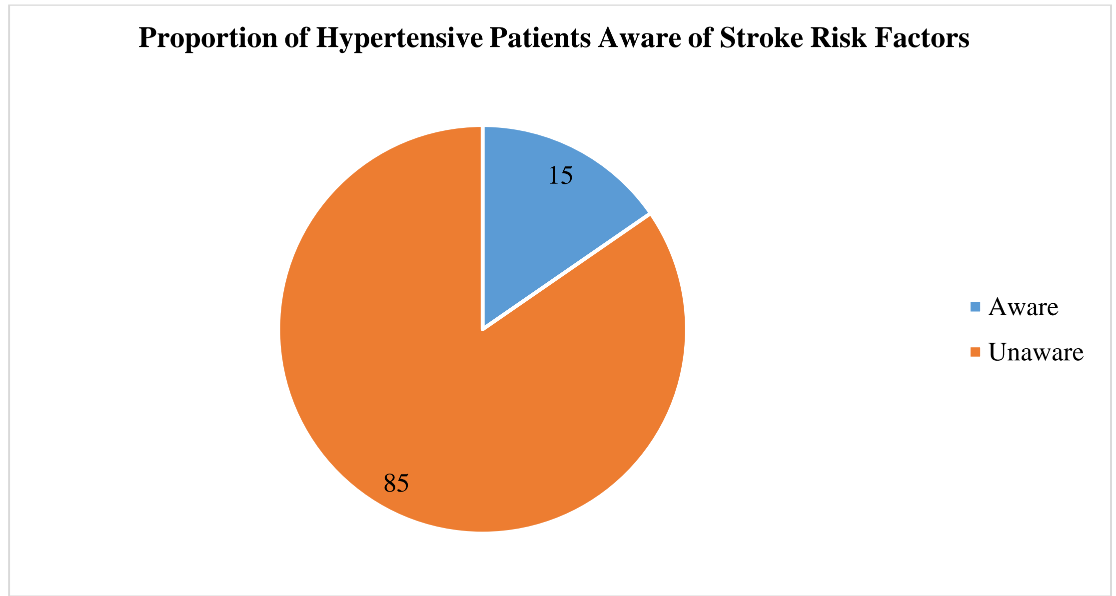


Figure 4.7: Proportion of Hypertensive Patients Aware of Stroke Risk Factor.

Key informant interviews findings also echoed similar perception of low awareness levels regarding stroke risk factors among hypertensive patients during follow-up at Garissa County Referral Hospital.

"The level of awareness of stroke risk factors is likely to be very low, may be, rate it at 20%" **(hospital manager)**

"According to how I see, I can say the level of awareness of stroke risk factors will be around 20% of the patients" **(clinic nurse in-charge)**

"*The level of awareness of risk factors I will say is moderate, say around 40% of the patients"* **(medical officer)**

"My estimation is less than a third of the patients might be knowledgeable on stroke risk factors" **(clinic nurse)**

4.4. Correlation Between Level of Awareness of Stroke Warning Signs and Patients' Socio-Demographic and Clinical Characteristics

4.4.1. Correlation Between Patient Socio-Demographic Characteristics and Level of Awareness of Stroke Warning Signs – Bivariate Regression Analysis

The study findings illustrate that the youngest patients, aged between 18 and 24 and those aged between 25 and 34 years, were the most unaware groups of stroke warning signs, while those between 35 and 64 years were reasonably aware. Above the age of 65 years, the level of unawareness increased with increase in age, where 80% of those aged 85-94 years were unaware of stroke warning signs (Table 4.3).

In terms of gender, patients of male gender were the least aware (36%) of stroke warning signs. Despite Muslims being the majority religion, the levels of awareness of stroke warning signs did not vary much across the religions since 35% of Christians and 39% of Muslims were reportedly aware of the stroke warning signs (Table 4.3).

Self-employed patients reported the most negligible levels of awareness of stroke warning signs (25%, n=1), while employed and casual laborers reported the highest awareness of warning signs at 43% and 42%, respectively. In terms of education level, the awareness of stroke warning signs increased with increased academic level. The study findings illustrate a significant association between the patient's education level and their awareness of stroke warning signs (p=0.01). Patients with no formal education reported the lowest level of awareness of stroke warning signs (32%, n=38). In comparison, those who had achieved tertiary and secondary education reported 78% and 71% awareness levels of stroke warning signs. (Table 4.3).

Table 4.3: Association between socio demographic factors and awareness of stroke warning signs-Bivariate analysis

Variable	Unaware of Stroke Warning Signs	Aware of Stroke Warning Signs	Total	p-value
	n= 88	n= 55	n=143	
Age (Years)				
18-24	2(100.00)	0(0.00)	2(100.00)	0.128
25-34	6(75.00)	2(25.00)	8(100.00)	
35-44	9(42.86)	12(57.14)	21(100.00)	
45-54	18(60.00)	12(40.00)	30(100.00)	
55-64	18(50.00)	18(50.00)	36(100.00)	
65-74	20(74.07)	7(25.93)	27(100.00)	
75-84	11(78.57)	3(21.43)	14(100.00)	
85-94	4(80.00)	1(20.00)	5(100.00)	
Sex				
Female	38(58.46)	27(41.54)	65(100.00)	0.49
Male	50(64.10)	28(35.90)	78(100.00)	
Marital Status				
Married	66(58.41)	47(41.59)	113(100.00)	0.456
Single	7(77.78)	2(22.22)	9(100.00)	
Widow/widower	7(77.78)	2(22.22)	9(100.00)	
Separated /Divorced	8(66.67)	4(33.33)	12(100.00)	
Religion				
Christian	11(64.71)	6(35.29)	17(100.00)	0.775
Muslim	77(61.11)	49(38.89)	126(100.00)	
Education Level				
No formal education	79(67.52)	38(32.48)	117(100.00)	**0.01***
Primary	5(50.00)	5(50.00)	10(100.00)	
Secondary	2(22.22)	7(77.78)	9(100.00)	
Tertiary	2(28.57)	5(71.43)	7(100.00)	
Employment Status				
Casual laborer	22(57.89)	16(42.11)	38(100.00)	0.888
Employed	4(57.14)	3(42.86)	7(100.00)	
Self-employed	3(75.00)	1(25.00)	4(100.00)	
Unemployed	59(62.77)	35(37.23)	94(100.00)	
Average Monthly Income				
0- 5,000	8(42.11)	11(57.89)	19(100.00)	0.298
5,001-15,000	42(64.62)	23(35.38)	65(100.00)	
15,001-25,000	12(61.90)	8(38.10)	21(100.00)	
25,001-35,000	11(55.00)	9(45.00)	20(100.00)	
35,001-45,000	9(90.00)	1(10.00)	10(100.00)	
45,001-55,000	1(50.00)	1(10.00)	2(100.00)	
Above 55,000	4(66.67)	2(33.33)	6(100.00)	

4.4.2. Correlation Between Patient Clinical Characteristics and Level of Awareness of Stroke Warning Signs –Bivariate Regression Analysis

The level of awareness of warning signs across hypertensive patients did not vary much by hypertension duration. In terms of hypertension treatment, patients who were on treatment the least (less than six months) reported higher rates of stroke warning signs awareness at 47%, followed by 42% of those who were not on treatment at all. Patients on treatment for more than six months reported awareness levels of 35% (n=33). Patients who were not on High blood cholesterol treatment reported higher rates of stroke warning signs' unawareness at 64% (n=75). This was consistent among patients who were not on anti-platelet medication who reported up to 62% unawareness of stroke warning signs. Higher rates of unawareness were reported among patients with uncontrolled blood pressure (63%, n=67) (Table 4.4).

On the other hand, over half of patients who had ever been diagnosed with a previous stroke or mini stroke were more aware of stroke warning signs (55%, n=11). Patients' knowledge of their family history of stroke was significantly associated with their awareness of stroke warning signs (p=0.015). Patients who knew a family member with a stroke reported higher rates of awareness of stroke warning signs at 53% (n=13). In comparison, those who did not know about their stroke family history reported the lowest rates of awareness of stroke warning signs at 13% (n=13.64). Additionally, patients' BMI status was significantly associated with their level of awareness of stroke warning signs (p=0.003). Patients who were reportedly overweight, 22 (56%) and obese, 16 (50%) reported higher rates of stroke warning sign awareness. Lower awareness of stroke warning signs was observed among healthy patients (24%, n=15) and those who were underweight (22%, n=2). Patients' comorbidity did not illustrate an association with the level of awareness of stroke warning signs, and neither did substance use. (Table 4.4).

Table 4.4: Association between patient clinical characteristics and awareness of stroke warning signs -Bivariate Analysis

Variable	Unaware of Stroke Warning Signs	Aware of Stroke Warning Signs	Total	p-value
	n= 88	n= 55	n=143	
Hypertension Duration				
< 6 months	18(58.06)	13(41.94)	31(100.00)	0.621
6 - <12 months	7(53.85)	6(46.15)	13(100.00)	
>12 months - 5 years	28(58.33)	20(41.67)	48(100.00)	
> 5 years	35(68.63)	16(31.37)	51(100.00)	
Hypertension Treatment Duration				
< 6 months	19(52.78)	17(47.22)	36(100.00)	0.411
> 6 months	62(65.26)	33(34.74)	95(100.00)	
Not on treatment	7(58.33)	5(41.67)	12(100.00)	
High Blood Cholesterol Treatment				
Yes	13(50.00)	13(50.00)	26(100.00)	0.181
No	75(64.10)	42(35.90)	117(100.00)	
Anti-Platelet Treatment				
Yes	7(58.33)	5(41.67)	12(100.00)	0.812
No	81(61.83)	50(38.17)	131(100.00)	
Blood Pressure Status				
Controlled (< 140/90)	21(56.76)	16(43.24)	37(100.00)	0.487
Uncontrolled (> 140/90)	67(63.21)	39(36.79)	106(100.00)	
BMI Status				
Underweight	7(77.78)	2(22.22)	9(100.00)	**0.003***
Healthy	48(76.19)	15(23.81)	63(100.00)	
Overweight	17(43.59)	22(56.41)	39(100.00)	
Obese	16(50.00)	16(50.00)	32(100.00)	
Past Stroke/Mini-Stroke Diagnosis				
Yes	9(45.00)	11(55.00)	20(100.00)	0.101
No	79(64.23)	44(35.77)	123(100.00)	
Family Stroke History				
Yes	11(45.83)	13(53.17)	22(100.00)	**0.015***
No	58(59.79)	39(40.21)	97(100.00)	
I don't know	19(86.36)	13(13.64)	24(100.00)	
Alcohol Use				
Yes	9(45.00)	11(55.00)	20(100.00)	0.101
No	79(64.23)	44(35.77)	123(100.00)	
Smoking History				
Current Smoker	1(50.00)	1(50.00)	2(100.00)	0.294
Ex-Smoker	6(42.86)	8(57.14)	14(100.00)	
Non-Smoker	81(63.78)	46(36.22)	127(100.00)	
Comorbidity				
Yes	37(66.07)	19(33.93)	56(100.00)	0.371
No	51(58.62)	36(41.38)	87(100.00)	
Cigarette Pack Years				
0-5	3(50.00)	3(50.00)	6(100.00)	0.620
6-10	3(50.00)	3(50.00)	6(100.00)	
11-15	1(50.00)	1(50.00)	2(100.00)	
Above 15	0(0.00)	2(100.00)	2(100.00)	

4.4.3. Correlation Between Level of Awareness of Stroke Warning Signs and Patients' Socio-Demographic and Clinical Characteristics- Multi-Variable Regression Analysis

A multivariate logistic regression was conducted, including the variables with p-values less than 0.05 in the chi-square tests. The regression was run at a 95% confidence interval, with its output reporting the adjusted odds ratios to illustrate the direction and magnitude of association, p-values, and the confidence interval. Of the three individual and clinical factors significantly associated with awareness of stroke warning signs in bivariate analysis, the patient's education level and family stroke history remained significant in multivariate analysis.

Patients who had attained a secondary education level were seven times more likely to be aware of the stroke warning signs than those with no formal education (aOR: 7.474, CI: 1.343-41.598, p=0.022). Additionally, patients with a family history of stroke were six times more likely to be aware of the stroke warning signs compared to those who did not know their family history of stroke (aOR: 5.552, CI: 1.200-25.682, p=0.028) (Table 4.5).

Table 4.5: Association between level of Awareness of Stroke Warning Signs and patients' socio-demographic and clinical characteristics- multi-variable regression Analysis

Awareness of Stroke Warning Signs	Adjusted Odds Ratio	p-value	Confidence Interval	
			Lower Limit	Upper Limit
Education Level				
No Formal Education	Ref			
Primary	1.219	0.777	0.309	4.798
Secondary	**7.474**	**0.022***	**1.343**	**41.598**
Tertiary	2.360	0.344	0.399	13.967
BMI Status				
Underweight	Ref			
Healthy	0.928	0.933	0.163	5.273
Overweight	3.564	0.160	0.606	20.951
Obese	3.010	0.229	0.499	18.146
Family Stroke History				
Yes	**5.552**	**0.028***	**1.200**	**25.682**
No	2.746	0.145	0.706	10.684
I don't Know	Ref			

Similarly, the Key informant interview highlighted that the level of education and having a family member with a history of stroke, being young patients as possible factors likely to influence the patients` level of awareness.

"The level of awareness may be influenced by their educational level; another factor may be socio-economic level of the patient" **(medical officer)**

"The level of education, the age of the patient, having relatives who had stroke or exposure to other patients with stroke before will influence their level of knowledge". **(physician)**

"Very important is education level, also the duration of hypertension and having young care giver at home. As well as where they reside, rural or urban area may influence the extent of their knowledge" **(clinic nurse)**

"I will say the age, education level, level of income, how long they had hypertension will most likely influence education level on warning signs and stroke risk factors" **(hospital manager)**

4.5. Correlation Between Level of Awareness of Stroke Risk Factors and Patients' Socio-Demographic and Clinical Characteristics.

4.5.1. Correlation Between Patient Socio Demographic Characteristics and Awareness of Stroke Risk Factors –Bivariate Analysis

The study findings illustrated that the lowest stroke risk factors awareness rates were among the youngest patients aged 18-24 years and the oldest patients over 75 years (0%). The highest level of awareness of stroke risk factors was noted among patients aged 55-64 years (19%, n=7). Awareness of risk factors by gender did not vary significantly. Findings from a Chi-square test of association illustrated a significant association between a patient's religion and their level of risk factor awareness (p=0.015). Overall, Christian patients reported a higher level of awareness of stroke risk factors (35%, n=6) compared to their Muslim counterparts (13%, n=16) (Table 4.6).

Similarly, patients' education level was significantly associated with their awareness of stroke risk factors (p=0.001). The highest level of awareness was observed among

patients who had attained tertiary education (57%), and the level of awareness dropped with a low level of education attained. Hence, patients with no formal education reported a 10% awareness of stroke risk factors (n=12). Patients' employment status was also noted to be significantly associated with the level of stroke risk factor awareness (p=0.032). Unemployed patients reported the lowest awareness levels (10%, n=9), while the highest level of awareness was observed among the employed patients (43%, n=3). The patients' income did not illustrate a significant association with their awareness level of stroke risk factors (Table 4.6).

Table 4.6: Association between Stroke risk factor awareness and patients` socio-demographic characteristics -bivariate analysis

Variable	Unaware of Stroke Risk Factors	Aware of Stroke Risk Factors	Total	p-value
	n= 121	n= 22	n=143	
Age (Years)				
18-24	2(100.00)	0(0.00)	2(100.00)	0.597
25-34	7(87.50)	1(12.50)	8(100.00)	
35-44	16(76.19)	5(23.81)	21(100.00)	
45-54	25(83.33)	5(16.67)	30(100.00)	
55-64	29(80.56)	7(19.44)	36(100.00)	
65-74	23(85.19)	4(14.81)	27(100.00)	
75-84	14(100.00)	0(0.00)	14(100.00)	
85-94	5(100.00)	0(0.00)	5(100.00)	
Sex				
Female	54(83.08)	11(16.92)	65(100.00)	0.642
Male	67(85.90)	11(14.10)	78(100.00)	
Marital Status				
Married	97(85.84)	16(14.16)	113(100.00)	0.340
Single	8(88.89)	1(11.11)	9(100.00)	
Widow/widower	8(88.89)	1(11.11)	9(100.00)	
Separated /Divorced	8(66.67)	4(33.33)	12(100.00)	
Religion				
Christian	11(64.71)	6(35.29)	17(100.00)	**0.015***
Muslim	110(87.30)	16(12.70)	126(100.00)	
Education Level				
No formal education	105(89.74)	12(10.26)	117(100.00)	**0.001***
Primary	7(70.00)	3(30.00)	10(100.00)	
Secondary	6(66.67)	3(33.33)	9(100.00)	
Tertiary	3(42.86)	4(57.14)	7(100.00)	
Employment Status				
Casual laborer	29(76.32)	9(23.68)	38(100.00)	**0.032***
Employed	4(57.14)	3(42.86)	7(100.00)	
Self-employed	3(75.00)	1(25.00)	4(100.00)	
Unemployed	85(90.43)	9(9.57)	94(100.00)	
Average Monthly Income				
0- 5,000	14(73.68)	5(26.32)	19(100.00)	0.522
5,001-15,000	57(87.69)	8(12.31)	65(100.00)	
15,001-25,000	19(90.48)	2(9.52)	21(100.00)	
25,001-35,000	16(80.00)	4(20.00)	20(100.00)	
35,001-45,000	9(90.00)	1(10.00)	10(100.00)	
45,001-55,000	2(100.00)	0(0.00)	2(100.00)	
Above 55,000	4(66.67)	2(33.33)	6(100.00)	

4.5.2. Correlation Between Level of Awareness of Stroke Risk Factors and Patients' Clinical Characteristics-Bivariate Analysis

The study findings illustrated that the majority of patients who were aware of stroke risk factors had hypertension for 6 to 12 months (23%, n=3), followed by 19% of patients who had hypertension for more than five years. Similarly, patients who were on hypertension treatment for more than six months reported higher levels of stroke risk factors awareness (16%, n=15). Over a quarter of patients who were on high blood cholesterol treatment were reportedly aware of stroke risk factors (n=7), while a quarter of those who were on anti-platelet medication were aware of stroke risk factors (n=3). The level of knowledge across patients' blood pressure control status was entirely even, with 16% awareness among those with controlled blood pressure and 15% awareness among those with uncontrolled blood pressure. Patients who had not been diagnosed with a stroke or mini stroke before were found to be more aware of stroke risk factors at 16%. Additionally, patients who confirmed not to have a family history of stroke reported higher levels of stroke risk factor awareness at 17%. (Table 4.7).

Findings from the Chi-square test of association illustrated a significant association between patients' BMI status and their awareness of stroke risk factors (p=0.009). Higher rates of stroke risk factor awareness were noted among patients who were overweight or obese at 28% and 22%, respectively. Despite smoking not illustrating a significant association with the level of stroke risk factors awareness, alcohol use was noted to be significantly associated with the patient's level of awareness of stroke risk factors (p=0.009). The majority of patients who used alcohol reported higher levels of awareness of stroke risk factors (35%, n=7). Similarly, comorbidities were found to be significantly associated with patients' stroke risk factors awareness (p=0.011). A quarter of patients who had a comorbidity were aware of stroke risk factors (n=14) compared to those who had no comorbidities (9%, n=8) (Table 4.7).

Table 4.7: Association between Awareness of Stroke Risk Factors and Patients' Clinical Characteristics – Bivariate analysis

Variable	Unaware of Stroke Risk Factors	Aware of Stroke Risk Factors	Total	P-value
	n= 121	n= 22	n=143	
Hypertension Duration				
< 6 months	28(90.32)	3(9.68)	31(100.00)	0.499
6 - 12 months	10(76.92)	3(23.08)	13(100.00)	
>12 months - 5 years	42(87.50)	6(12.50)	48(100.00)	
> 5 years	41(80.39)	10(19.61)	51(100.00)	
Hypertension Treatment Duration				
< 6 months	30(83.33)	6(16.67)	36(100.00)	0.773
> 6 months	80(84.21)	15(15.79)	95(100.00)	
Not on treatment	11(91.67)	1(8.33)	12(100.00)	
High Blood Cholesterol Treatment				
Yes	19(73.08)	7(26.92)	26(100.00)	0.181
No	102(87.18)	15(12.82)	117(100.00)	
Anti-Platelet Treatment				
Yes	9(75.00)	3(25.00)	12(100.00)	0.335
No	112(85.50)	19(14.50)	131(100.00)	
Blood Pressure Status				
Controlled (< 140/90)	31(83.78)	6(16.22)	37(100.00)	0.487
Uncontrolled (> 140/90)	90(84.91)	16(15.09)	106(100.00)	
BMI Status				
Underweight	8(88.89)	1(11.11)	9(100.00)	**0.009***
Healthy	60(95.24)	3(4.76)	63(100.00)	
Overweight	28(71.79)	11(28.21)	39(100.00)	
Obese	25(78.13)	7(21.88)	32(100.00)	
Past Mini-Stroke Diagnosis				
Yes	18(90.00)	2(10.00)	20(100.00)	0.472
No	103(83.74)	20(16.26)	123(100.00)	
Family Stroke History				
Yes	19(86.36)	4(16.67)	22(100.00)	0.308
No	80(82.47)	17(17.53)	97(100.00)	
I don't know	21(95.45)	1(4.55)	24(100.00)	
Alcohol Use				
Yes	13(65.00)	7(35.00)	20(100.00)	**0.009***
No	108(87.80)	15(12.20)	123(100.00)	
Smoking History				
Current Smoker	2(100.00)	0(0.00)	2(100.00)	0.679
Ex-Smoker	11(78.57)	3(21.43)	14(100.00)	
Non-Smoker	108(85.04)	19(14.96)	127(100.00)	
Comorbidity				
Yes	42(75.00)	14(25.00)	56(100.00)	**0.011***
No	79(90.80)	8(9.20)	87(100.00)	
Cigarette Pack Years				
0-5	6(100.00)	0(0.00)	6(100.00)	0.265
6-10	4(66.67)	2(33.33)	6(100.00)	
11-15	2(100.00)	0(0.00)	2(100.00)	
Above 15	1(50.00)	1(50.00)	2(100.00)	

4.5.3. Correlation Between Level of Awareness of Stroke Risk Factors and Patients' Socio-Demographic and Clinical Characteristics- Multivariate Analysis

A multivariate logistic regression was conducted, including the variables with p-values less than 0.05 in the chi-square tests of association. The regression was run at a 95% confidence interval, with its output reporting the adjusted odds ratios to illustrate the direction and magnitude of association, p-values, and confidence intervals. Of the six individual and clinical factors that were significantly associated with awareness of stroke risk factors on bivariate analysis, the patient's comorbidity status remained significant on multivariate analysis. Patients who reported having no comorbidity were 86% less likely to be aware of stroke risk factors compared to those who had comorbidities (aOR: 0.135, CI: 0.038-0.481, p=0.002) as shown in Table 4.8 below.

Table 4.8: Association between awareness of Stroke risk factors and patient characteristics- Multivariate analysis

Awareness of Stroke Risk Factors	Adjusted Odds Ratio	p-value	Confidence Interval	
			Lower Limit	Upper Limit
Religion				
Islam	0.568	0.449	0.132	2.451
Christianity	Ref			
Education Level				
No formal Education	Ref			
Primary	1.313	0.772	0.208	8.311
Secondary	3.639	0.146	0.637	20.781
Tertiary	6.640	0.212	0.340	129.577
Employment Status				
Employed	0.405	0.590	0.015	10.840
Self-employed	0.600	0.748	0.027	13.514
Unemployed	0.490	0.258	0.142	1.686
Casual Laborer	Ref			
BMI Status				
Underweight	Ref			
Healthy	0.355	0.418	0.029	4.349
Overweight	2.096	0.533	0.204	21.520
Obese	1.402	0.785	0.124	15.856
Alcohol Use				
Yes	1.983	0.326	0.506	7.768
No	Ref			
Comorbidity				
Yes	Ref			
No	0.135	**0.002***	0.038	0.480

A shared perception emerged in the key informants` interview as well, with a majority of participants indicating a belief that educational background, young age, duration of treatment and family history of stroke, or personal acquaintance with someone who had experienced a stroke, were factors likely to influence one's knowledge level.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Socio demographic Characteristics of the Participant

Hypertensive patients in this study were predominantly middle-aged with a mean age of 57 (SD 15), slightly more males (55%), very low literacy level with 84% of the respondents not having any formal education, very high unemployment rate (65%), with resultant low-income levels with 59% of the respondents earning less than Ksh. 15,000 (USD 100) per month.

The findings of this study were similar to what was reported in studies in Nigeria, Ethiopia, and Oman. The mean age of the hypertensive patients in these studies was between 50 and 58 years, mostly male predominance and low socioeconomic status; however, their literacy rates were between 54.3% and 95.5%) which were better than in our study(Amen, 2016; Ehidiamen & Ehinwenma, 2018; Grace Vincent-Onabajo et al., 2015; Nigat et al., 2021). This difference could potentially be explained by the settings; these studies were conducted in predominantly urban populations compared to the semi-urban/rural population in our setting.

According to the Kenya National Adult Literacy Survey (KNALS), 29.9% of youths (15-19 years) and 49% of adults (45-49 years) are illiterate (Kebathi, 2006).There is huge disparity in the literacy rates according to the Ministry of Education (Kenya) with Nairobi recording a literacy rate of 87.1% while North Eastern region recording the lowest at 8% (Ministry of Education, 2012), which is keeping with the findings of this study. Similar theme also emerged from the key informant interview with some interviewees highlighting potential low literacy level among patients on follow up in the Garissa County Referral Hospital clinic.

Samuel Oji Oti et al. found that treating a hypertensive individual in Kenya costs USD 123 a month (Oti et al., 2016). The high unemployment rate and the resulting low-income levels among our participants are likely to have far-reaching effects on financial access to hypertension care and compliance with treatment.

5.1.2 Clinical Characteristics of the Participants

The majority (70%) of the patients had hypertension for more than a year, 91.7% were on hypertension treatment, and 66% of these had been on treatment for longer than six months. Approximately 8.3% of the patients were found not to be on pharmacologic treatment; of these, seven patients (58.3%) had been having hypertension for more than one year. Additionally, 11 out of these 12 patients exhibited poorly controlled blood pressure (>140/90), indicating clinical inertia on the part of healthcare workers managing them.

Only 25.87% of the participants had their blood pressure under control (control rate). This control rate was similar to a cross-sectional study by Magoka et al. that found a blood pressure control rate of 27% (Mogaka et al., 2022) and Mutua et al. in Nyeri (33.4%) (Mutua et al., 2014). In a large cross-sectional study, Ogola et al. found a slightly higher control rate of 45.5% (Ogola et al., 2019).

The majority (61%) of the hypertensive patients did not have a comorbidity. The most common comorbidity was Diabetes Mellitus (23.8%), Kidney failure (7.7%), Heart disease (7.7%), and high blood cholesterol level (7%); this was similar to a study in Kenya in the slums that found Diabetes mellitus, stroke and heart disease (Angina) as the most common self-reported comorbidities among hypertensive patients (Hulzebosch, Vijver, Oti, Egondi, & Kyobutungi, 2015).

Personal and family histories of stroke can represent a significant risk factor for stroke and are likely to influence the patient's knowledge level due to prior exposure. In this study, 14% of participants had a documented personal history of stroke or Transient Ischemic Attack (Minor stroke), and 17% reported a familial history of stroke or minor stroke. These figures align closely with the findings of a study conducted among hypertensive patients in Nigeria, which reported a 13% prevalence (Grace Vincent-Onabajo et al., 2015). However, the observed prevalence was slightly higher compared to the 7.5% reported in a study conducted in Ethiopia (Nigat et al., 2021).

Only a minority of 14% and 11% of the participants reported to be using or have used alcohol or smoked cigarettes, respectively. A quarter of the smokers had a significant

ten-pack years of smoking. A higher number of pack years is generally associated with an increased risk of cardiovascular events such as stroke or heart attacks. The prevalence of smoking in this study was similar to findings in Ethiopia and Nigeria among hypertensive patients at 13% and 15.9%, respectively (Ehidiamen & Ehinwenma, 2018; Nigat et al., 2021).

44% of the study population had a healthy BMI (18.5 to 24.9 kg/m2), while 22% were obese (BMI 25-29.9 kg/m2), in keeping with an obesity prevalence (18%) among hypertensive patients in the Meru study (Mwenda, Njuguna, & Musa, 2017). However, this study revealed a notably higher prevalence among the urban population than a study by Adan in Garissa (Adan, 2012). The distinction lies in Adan studying the general population (both healthy and unhealthy), while our focus was specifically on hypertensive patients, a group potentially more predisposed to obesity.

5.1.3 Level of Awareness of Stroke Warning Signs

The level of awareness of stroke warning signs in this study was found to be 38%. Over a third (36%) of the participants could not name any warning signs. The most identified warning sign was unilateral body/limb weakness (62.2%), followed by slurred speech (16.8%) and loss of balance (9.1%). The least identified warning signs were sudden loss of vision (5.6%), sudden memory loss (4.2%) and dizziness (2.1%). The key informant interview also observed that awareness levels among hypertensive patients are generally low to moderate among hypertensive patients in Garissa.

Multiple studies in Africa have reported similarly low levels of awareness of stroke warning signs in Rural and semi-urban populations in Nigeria, Ethiopia, and Uganda reported low awareness levels of 16.7%, 14.4%, 15%, 15%, and 8.9% respectively (Abate et al., 2019; Ehidiamen & Ehinwenma, 2018; Nakibuuka et al., 2014; Nigat et al., 2021; Wahab, Kayode, & Musa, 2015). However, Hickey et al. and Sadighi et al. found higher levels of awareness in Ireland and America, respectively (Hickey et al., 2012; Sadighi, Groody, Wasko, Hornak, & Zand, 2018). The potential causes for this disparity may stem from the higher proportions of participants from rural communities with lower literacy rates in the African studies, where diminished income, limited access to healthcare facilities, and restricted educational opportunities are expected to be higher.

Other studies (Abate et al., 2019; Kharbach et al., 2020; Nigat et al., 2021; Saengsuwan, Suangpho, & Tiamkao, 2017) also had similar findings of sudden weakness/paralysis of one side of the body, speech difficulty, facial weakness, loss of balance, and unusually severe headaches as the most commonly identified warning signs.

5.1.4 Level of Awareness of Stroke Risk Factors

Only 15.4% of the participants met the criteria for awareness of stroke risk factors. The majority (51%) were not able to identify any risk factors of stroke despite suffering from one of the most common risk factors (Hypertension).

While most of the other studies reported suboptimal awareness of stroke risk factors, Nakibuuka et al., Ehidiamen et al., Vincet-Onabajo et al., and Obembe et al. all reported awareness levels above 50%.(Ehidiamen & Ehinwenma, 2018; Grace Vincent-Onabajo et al., 2015; Nakibuuka et al., 2014; Obembe, Olaogun, Bamikole, Komolafe, & Odetunde, 2014) The plausible reason why this study population had a much lower awareness level (15.4%) was the difference in the literacy rates. The current study population had a literacy rate of 18% compared to over 90% in the other studies.

The suboptimal knowledge level is unsurprising given that only 18% of the current study population had formal education and are likely to get access to information on stroke through print and social media platforms. Like other studies in the region, the most identified stroke risk factors were hypertension (69.4%), Diabetes mellitus (10.2%), High blood cholesterol (6.1%), and advancing age (4.1%). Similarly, Adan, in a study on the prevalence of cardiovascular risk factors in Garissa, found hypertension, diabetes mellitus, obesity, smoking, and high blood cholesterol levels as the most prevalent risk factors in Garissa (Adan, 2012).

5.1.5 Corrections Between Patients' Characteristics and Level of Awareness of Stroke Warning Signs

Three sociodemographic and clinical factors (level of education, BMI status, and family history of stroke) were significantly associated with awareness of stroke

warning signs on bivariate analysis; however, in subjecting it to multivariate analysis, only the patient's level of education and family history of stroke remained significant. Patients who attained at least a secondary level of education were seven times more likely to be aware of stroke warning signs when compared to those without formal education. This is consistent with the findings of other studies from Nigeria, Ethiopia, Uganda, and America that found higher educational levels were positive predictors of awareness level (Odiase, 2018) (Nakibuuka et al., 2014) (Sadighi et al., 2018) (Nigat et al., 2021). Attainment of higher educational levels could potentially result in improved access to information, better health literacy and comprehension of health risks, and often better socio-economic status.

We also found having a family history of stroke was a significant predictor of awareness levels when compared to those who did not know a family member with a history of stroke (aOR: 5.552, CI: 1.200-25.682, p=0.028). Sadighi et al. also found that knowing someone with a history of stroke was associated with better awareness levels among the rural population in central Pennsylvania. Prior exposure to signs of stroke potentially aids in the recall of warning signs (Sadighi et al., 2018). Ehidiamen et al. and Wahab et al. found male sex as a positive predictor of awareness level of stroke warning signs (Ehidiamen & Ehinwenma, 2018; Wahab et al., 2015); however, this was not the case in this study.

Yong age (<40 years) was also found to be an important predictor of the level of awareness in a number of studies (Abate et al., 2019; Nigat et al., 2021; Obembe et al., 2014); however, we did not establish such an association. Although prior exposure to health education on hypertension and stroke risk factors may impact patients' knowledge levels, the key informant interview revealed a lack of a structured health education program for hypertensive patients in Garissa. Minimal opportunistic health education occurs during clinic consultations and ward rounds, but a significant barrier is the heavy workload and the absence of a deliberately organized program.

5.1.6 Corrections Between Patients' Characteristics and Level of Awareness of Stroke Risk Factors

Level of education, employment status, religious inclination, BMI status, Alcohol use history, and comorbidity were found to be significantly associated with awareness of stroke risk factors on bivariate analysis; however, on subjecting the above variable to

multivariate analysis, only patients` comorbidity status remained statistically significant variable.

Patients who reported having no comorbidity were less likely to identify a risk factor for stroke. Patients with comorbidities were more likely to be aware of risk factors due to the multiple risk factors such as Diabetes mellitus, renal failure, and heart diseases that they suffer from. The presence of comorbidities also increases exposure to healthcare and health workers, hence increasing the potential for health education. Vincent-Onabajo et al. also noted hypertensive patients with diabetes mellitus comorbidity were more likely to be aware of stroke risk factors (Grace Vincent-Onabajo et al., 2015).

We did not establish any significant association between socio-demographic characteristics and patients' knowledge of stroke risk factors; similarly, Hickey et al., in a study in Ireland, did not establish any significant association between socio-demographic factors and awareness. This contrasts with findings in many other studies (Abate et al., 2019; Grace Vincent-Onabajo et al., 2015; Kharbach et al., 2020; Obembe et al., 2014; Sadighi et al., 2018); that found the level of education, age, urban residence, and income levels to be significant predictors of stroke risk factor awareness level.

5.2. Conclusion

The findings of this study led to the following key conclusions. Hypertensive patients receiving follow-up care at Garissa County Referral Hospital demonstrated a very low literacy rate of 18%, high unemployment levels at 65%, and a poor blood pressure control rate of 26%. Furthermore, the majority of these patients showed a sub-optimal awareness of stroke warning signs and risk factors, with awareness levels at 38% and 15.4%, respectively. Additionally, significant predictors of awareness regarding stroke warning signs and risk factors among hypertensive patients included the level of education, a family history of stroke, and the presence of comorbidities.

5.3. Recommendations

5.3.1. Recommendations for practice

Based on the findings of the study, the following recommendations are proposed: Garissa County's Department of Health should develop a well-structured health education strategy targeting hypertensive patients. This initiative should aim to reduce the risk and impact of stroke within the community.

The county's public health department should conduct regular health promotion campaigns to raise awareness about stroke risk factors, including hypertension, diabetes mellitus, smoking, and obesity. These campaigns will play a vital role in empowering the public with knowledge to prevent stroke. Community health workers, alongside community and religious leaders, should take a central role in these health promotion efforts. Their involvement is crucial to effectively reach older and less educated members of the community.

Lastly, the management of Garissa County Referral Hospital needs to re-evaluate its approach to the follow-up and management of hypertensive patients. Strengthening these processes will enhance overall blood pressure control rates, thereby mitigating stroke risks and improving cardiovascular outcomes for these patients.

5.3.2. Recommendations for further research

We recommend conducting further research in the following areas:
First, the impact of health education on the incidence of stroke and the timely presentation of patients to hospitals. Second, the factors contributing to the very low or poor blood pressure control rates among hypertensive patients at Garissa County Referral Hospital.

REFERENCES

Abate, A. T., Bayu, N., & Mariam, T. G. (2019). Hypertensive Patients' Knowledge of Risk Factors and Warning Signs of Stroke at Felege Hiwot Referral Hospital, Northwest Ethiopia: A Cross-Sectional Study. Neurology Research International.

Adan, A. H. (2012). *Prevalence of cardiovascular disease risk factors in urban Garissa residents*. (Master's thesis, University of Nairobi). University of Nairobi Repository.

Akinyemi, R. O., Ovbiagele, B., Adeniji, O. A., Sarfo, F. S., Abd-Allah, F., Adoukonou, T., . . . Owolabi, M. O. (2021). Stroke in Africa: profile, progress, prospects and priorities. Nature reviews: Neurology, 17, 634-656.

Amen, M. R. (2016). Assessment of hypertensive patients' knowledge about lifestyle risk factors and warning signs of stroke. Journal of Contemporary Medical Sciences, 2(5), 28-32.

Aroor, S., Singh, R., & Goldstein, L. B. (2017). BE-FAST (Balance, Eyes, Face, Arm, Speech, Time) Reducing the Proportion of Strokes Missed Using the FAST Mnemonic. Stroke, 48(2), 479–481.

Boehme, A. K., Esenwa, C., & Elkind, M. S. V. (2017). Stroke Risk Factors, Genetics, and Prevention. Circulation research, 120(3), 472-495.

Duque, A. S., Fernandes, L., Correia, A. F., Calvinho, I., Cardoso, G., Cabete, J., . . . Campos, L. (2015). Awareness of Stroke Risk Factors and Warning Signs and Attitude to Acute Stroke INTERNATIONAL ARCHIVES OF MEDICINE, 8(125).

Ehidiamen, O. F., & Ehinwenma, O. J. (2018). Awareness of Stroke Risk Factors and Warning Symptoms amongst Hypertensive Patients in Benin City. Annals of Medical and Health Sciences Research, 8, 40-44.

Emmanuel, L. R., & Adegbenro, C. A. (2017). Knowledge of Stroke Risk Factors and Warning Signs among Private Primary School Teachers from Moro Community in Ife North Local Government, Nigeria. Texila International Journal of Public Health, 5(4).

Grace Vincent-Onabajo, Mshelia, J. Y., Umar Abubakar, Majidadi, R. W., Aliyu, H. N., Gujba, F. K., . . . Masta, M. A. (2015). Knowledge of Stroke Risk Factors among Individuals Diagnosed with Hypertension and Diabetes: A Hospital-

based Survey. Journal of Advances in Medicine and Medical Research, 10(6), 1-8.

Greenlund, K. J., Neff, L. J., Zheng, Z.-J., Keenan, N. L., Giles, W. H., Ayala, C. A., . . . Mensah, G. A. (2003). Low public recognition of major stroke symptoms. American Journal of Preventive Medicine, 25(4), 315-319.

Hickey, A., Holly, D., McGee, H., Conroy, R., & Shelley, E. (2012). Knowledge of stroke risk factors and warning signs in Ireland: development and application of the Stroke Awareness Questionnaire (SAQ). International Journal of Stroke, 7(4), 298-306.

Hulzebosch, A., Vijver, S. v. d., Oti, S. O., Egondi, T., & Kyobutungi, C. (2015). Profile of people with hypertension in Nairobi's slums: a descriptive study. Global Health, 11, 26.

Johnson, W., Onuma, O., Owolabi, M., & Sachdeva, S. (2016). Stroke: a global response is needed. Bull World Health Organ, 94(9).

Jowi, J. O., & Mativo, P. M. (2008). Pathological sub-types, risk factors and outcome of stroke at the Nairobi Hospital, Kenya. East Afr Med J, 85(12), 572-581.

Kebathi, J. N. (2006). Measuring Literacy: The Kenya National Adult Literacy Survey. Education for Everyone. Worldwide. Lifelong.

Kharbach, A., Obtel, M., Achbani, A., Bouchriti, Y., Hassouni, K., Lahlou, L., & Razine, R. (2020). Level of Knowledge on Stroke and Associated Factors: A Cross-Sectional Study at Primary Health Care Centers in Morocco. Annals of Global Health, 86(1), 83.

Mogaka, J. N., Sharma, M., Temu, T., Masyuko, S., Kinuthia, J., Osoti, A., . . . Farquhar, C. (2022). Prevalence and factors associated with hypertension among adults with and without HIV in Western Kenya. PLoS ONE, 17(1).

Mutua, E. M., Gitonga, M. M., Mbuthia, B., Muiruri, N., Cheptum, J. J., & Maingi, T. (2014). Level of blood pressure control among hypertensive patients on follow-up in a Regional Referral Hospital in Central Kenya. Pan African Medical Journal, 18, 278.

Mwenda, V., Njuguna, J., & Musa, M. (2017). Prevalence of overweight and obesity among hypertensive and diabetic patients seeking care at a rural Kenyan hospital: a cross-sectional study. East and Central Africa Medical Journal, 3(1), 26-29.

Nakibuuka, J., Sajatovic, M., Katabira, E., Ddumba, E., Byakika-Tusiime, J., & Furlan, A. J. (2014). Knowledge and Perception of Stroke: A Population-Based Survey in Uganda. ISRN Stroke, 10.

Nigat, A. B., Abate, M. W., Demelash, A. T., Tibebu, N. S., Tiruneh, C. M., Emiru, T. D., . . . Yimer, Y. S. (2021). Knowledge on Stroke Warning Signs and Associated Factors Among Hypertensive Patients, Northwest Ethiopia: An Institution-Based Cross-Sectional Study. Vasc Health Risk Manag, 17, 721–728.

Obembe, A. O., Olaogun, M. O., Bamikole, A. A., Komolafe, M. A., & Odetunde, M. O. (2014). Awareness of risk factors and warning signs of stroke in a Nigeria university. J Stroke Cerebrovasc Dis, 23(4), 749-758.

Ogola, E. N., Barasa, F., Barasa, A. L., Gitura, B. M., Njunguna, B., Beaney, T., . . . Poulter, N. R. (2019). May Measurement Month 2017: the results of blood pressure screening of 14 845 individuals in Kenya—Sub-Saharan Africa. European Heart Journal Supplements, 21, 71-73.

Ominde, B. S., Ogeng'o, J. A., Misiani, M. K., & Kariuki, B. N. (2019). Pattern of stroke in a rural Kenyan hospital. Malawi Medical journal, 31(1), 50-55.

Oti, S. O., Vijver, S. v. d., Gomez, G. B., Agyemang, C., Egondi, T., Catherine Kyobutungi, & Stronks, K. (2016). Outcomes and costs of implementing a community-based intervention for hypertension in an urban slum in Kenya. Bulletin of World Health Organization, 94(7), 501-509.

Sadighi, A., Groody, A., Wasko, L., Hornak, J., & Zand, R. (2018). Recognition of Stroke Warning Signs and Risk Factors Among Rural Population in Central Pennsylvania. Journal of Vascular and Interventional Neurology, 10(2), 4-10.

Saengsuwan, J., Suangpho, P., & Tiamkao, S. (2017). Knowledge of Stroke Risk Factors and Warning Signs in Patients with Recurrent Stroke or Recurrent Transient Ischemic Attack in Thailand. Neurology Research International, 1(1).

Wahab, K. W., Kayode, O. O., & Musa, O. I. (2015). Knowledge of stroke risk factors among Nigerians at high risk. Journal of Stroke and Cerebrovascular Diseases, 24(1), 125-129.

Waweru, P., & Gatimu, S. M. (2021). Stroke Epidemiology, Care, and Outcomes in Kenya: A Scoping Review. Frontiers in Neurology, 12.

Zeng, X., Deng, A., & Ding, Y. (2017). The INTERSTROKE study on risk factors for stroke. The lancet, 389(10064), 35.

B. Ominde, J. Ogeng'o, Musa Misiani, & Brain Ngure Kariuki. (2019). Pattern of stroke in a rural Kenyan hospital. *Malawi Medical Journal*, *31*, 50–55.

Choudhary Tariq Masood, ChoudharyMaqbool Hussain, Anis Rehman, & S. Abbasi. (2013). Clinical presentation, risk factors and outcome of stroke at a district level teaching hospital. *Journal of Ayub Medical College*, *25*(1), 49–51.

Hoa Thi Truong, Sam Hoanh Nguyen, Cuong Van Le, Shinichi Tokuno, Aya Kuchiba, & Shinji Nakahara. (2024). Factors Associated with Delayed Hospital Arrival after Stroke Onset: An Observational Study in Thanh Hoa Province, Vietnam. *Cureus*, *16*(11).

Jacqueline Müller-Nordhorn, Christian H. Nolte, Karin Rossnagel, Gerhard J. Jungehülsing, Andreas Reich, Stephanie Roll, Arno Villringer, & Stefan N. Willich. (2006). Knowledge about risk factors for stroke: A population-based survey with 28,090 participants. *Stroke*, *37*(4).

José Rafael Romero, Jane Morris, & Aleksandra Pikula. (2008). Stroke prevention: Modifying risk factors. *Ther Adv Cardiovasc Dis*, *2*(4), 287–303.

Lydia Kaduka, Anne Korir, Chrispine Owuor Oduor, Judith Kwasa, Jane Mbui, Sylvanos Wabwire, Robai Gakunga, Nathan Okerosi, Yvonne Opanga, Isaac Kisiang'ani, Mercy Rotich Chepkurui, Erastus Muniu, & Scot C Remick. (2018). stroke distribution patterns and characteristics in kenya's leading public health tertiary institutions: Kenyatta National hospital and moi teaching and referral hospital. *CARDIOVASCULAR JOURNAL OF AFRICA*, *29*(2).

Lydia Kaduka, Erastus Muniu, Anne Korir, Chrispine Owuor Oduor, Judith Kwasa, Jane Mbui, Sylvanos Wabwire, Robai Gakunga, Nathan Okerosi, Yvonne Opanga, Isaac Kisiang'ani, Mercy Rotich Chepkurui, & Scot C Remick.

(2019). Disability-Adjusted Life-Years Due to Stroke in Kenya. *Neuroepidemiology*, *53*(1–2), 48–54.

Ministry of Education. (2012). *Policy Framework for Education. Aligning Education and Training to the Constitution of Kenya (2010) and Kenya Vision 2030 and beyond*.

Nakibuuka, J., Sajatovic, M., Katabira, E., Ddumba, E., Byakika-Tusiime, J., & Furlan, A. J. (2014). Knowledge and Perception of Stroke: A Population-Based Survey in Uganda. *ISRN Stroke*, *2014*, 1–7. https://doi.org/10.1155/2014/309106

Nigat, A. B., Abate, M., Demelash, A. T., Tibebu, N. S., Tiruneh, C. M., Emiru, T. D., Abdu, M., Nega, A. D., & Yimer, Y. S. (2021). Knowledge on Stroke Warning Signs and Associated Factors Among Hypertensive Patients, Northwest Ethiopia: An Institution-Based Cross-Sectional Study. *Vascular Health and Risk Management*, *Volume 17*, 721–728. https://doi.org/10.2147/VHRM.S333394

Odiase, F. (2018). Awareness of Stroke Risk Factors and Warning Symptoms amongst Hypertensive Patients in Benin City. *Annals of Medical and Health Sciences Research*, *8*(1).

Peter Waweru & Samwel Maina Gatimu. (2021). Stroke Epidemiology, Care, and Outcomes in Kenya: A Scoping Review. *Frontiers in Neurology*, *16*(12).

Prabal Deb, Suash Sharma, & K M Hassan. (2010). Pathophysiologic mechanisms of acute ischemic stroke: An overview with emphasis on therapeutic significance beyond thrombolysis. *Epub*, *17*(3), 197–218.

Sadighi, A., Groody, A., Wasko, L., Hornak, J., & Zand, R. (2018). *Recognition of Stroke Warning Signs and Risk Factors Among Rural Population in Central Pennsylvania*. *10*.

Sapna, Bhatia Rohit, Sharma Gautam, & Gopichandran L. (2016). A Comparative Study to Assess the Knowledge on Risk Factors, Warning Signs and Immediate Treatment of Stroke among Stroke Survivors and Patients of Cardiovascular Disorders who are at risk of Stroke. *Asian Journal of Nursing Education and Research*, *6*(3).

Supa Pengpid & Karl Peltzer. (2020). Prevalence, awareness, treatment and control of hypertension among adults in Kenya: Cross-sectional national population-based survey. *East Mediterr Health J.*, *26*(8), 923–932.

Taiwo Akindahunsi, Olusola Olabisi Ogunseye, Olumayowa Adeleke Idowu, & Tobi Ayomide Lawal. (2019). Early signs of stroke: How your body warns you. *World Journal of Advanced Research and Reviews, 03*(02), 91–100.

World Stroke Organization (WSO). (2022). *Global Stroke Fact Sheet 2022*. World Stroke Organization.

Yi-wang Guo, Pengyue Li, Qing-li Guo, Ke-xin Shang, Dan Yan, & S. Du, Yang Lu. (2014). Pathophysiology and Biomarkers in Acute Ischemic Stroke – A Review. *Tropical Journal of Pharmaceutical Research*, *12*, 1097–1105.

Yongfang Li, Guo-Yuan Yang. (2017). Pathophysiology of Ischemic Stroke. *Medicine*.

APPENDICES

Appendix I: Consent Form

My name is Abdiweli M. Bashir. I am a Masters public health (Epidemiology & Disease control) at Kenyatta University. I am conducting a study titled “Awareness on stroke risk factors and warning signs among Hypertensive patients attending Garissa County referral hospital in Garissa County, Kenya”. The information generated from the study will be used to develop health education strategies that will be given to you and other hypertensive patients to reduce the risk and impact of stroke.

Procedures to be followed

Participation in this study will require that I ask you some questions and I will record the information from you in a questionnaire.

Voluntarism

You have the right to refuse participation in this study. You will get the same services and care whether you agree to join the study or not and your decision will not change the care you will receive. Please remember your participation in this study is voluntarily. You may ask questions related to the study at any time.

You may refuse to respond to any questions, and you may stop an interview at any time. You may also stop being in the study at any time without any consequences to the services you receive in this clinic now or in the future.

Discomforts and Risks

Your participation in this study puts you at no risk however answering some questions in the interview may be uncomfortable for you. If there are any questions you do not want to answer; you can skip them. You have the right to refuse the interview, or any questions asked during the interview. The information you provide will not in any way compromise the quality of care you receive from this facility.

Benefits

The study will aim to determine the level of awareness of stroke warning signs and risk factors among hypertensive patients. There is no financial or material benefit in participating in the study; however, the information generated from the study will be used to develop health education strategies that will be given to you and other hypertensive patients to reduce the risk and impact of stroke.

Reward

There is no financial or material benefit in participating in the study.

Confidentiality

The interviews will be conducted in a private setting within the clinic. Your name will not be recorded on the questionnaire. The questionnaires will be kept in a locked cabinet for safe keeping at Kenyatta University. Everything will be kept private and only shared with the study team.

Contact Information

If you have questions about the study, call the Dr. Judy. Mugo on 0720671286, Supervisor 1 or Dr. Gordon Ogweno on 0725715623, supervisor 2. However, if you have questions about your rights as a study participant: You may contact Kenyatta University Ethical Review Committee Secretariat on chairman.kuerc@ku.ac.ke,

Participant's statement

The above information regarding my participation in the study is clear to me. The study has been explained to me and I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I can leave the study at any time. I understand that I will still get the same care and medical treatment whether I decide to leave the study or not and my decision will not change the care that I will receive from the clinic today or that I will get from any other clinic at any other time.

Code of the Participant: ________________________

____________________________ ____________________________

Signature or Thumbprint Date

Investigators statement

I, the undersigned, have explained to the volunteer in a language s/he understands, the procedures to be followed in the study and the risks and benefits involved

____

Name of Interviewer

______________________________ ______________________________

Signature Date

Appendix II: Questionnaire

Section 1. Socio-demographic information

1. How old are you? ----------------- (*Age in Years*)

2. What is your gender? Male …… Female…….

3. Which sub-county do you reside in? (*Tick appropriate option*)

   a) Garissa Township Sub- County ☐

   b) Balambala Sub- County ☐

   c) Madogashe Sub- County ☐

   d) Dadaab Sub- County ☐

   e) Fafi Sub- County ☐

   f) Ijara Sub- County ☐

   g) Outside of Garissa County ☐

4. What is your marital status?

   a) Single ☐

   b) Married ☐

   c) Divorced/Separate ☐

   d) Widow/Widower ☐

5. What religion do you profess?

   a) Islam ☐

   b) Christianity ☐

   c) Hindu ☐

   d) Traditionalist ☐

   e) None ☐

6. What is your highest level of education?
    a) Primary
    b) Secondary
    c) Tertiary
    d) No formal education
7. What is your current employment status?
    a) Self-employed
    b) Employed
    c) Casual Labourer
    d) Unemployed
8. What is your average monthly household income (in Ksh)?

Section 2: Clinical Characteristic

9. How long have you had high blood pressure (hypertension)?
    a) < 6 months
    b) 6-12 months
    c) 1 year – 5 years
    d) 5 years
10. How long have you been on hypertension treatment?
    a) < 6 months
    b) 6 months
    c) Not on treatment
11. How many anti-hypertensive medications are you currently using?
    a) One
    b) Two
    c) Three
    d) More than three
    e) None

12. Other than hypertension, do you have any of the following other diseases?
    a) Diabetes Mellitus ☐
    b) Heart disease ☐
    c) Kidney disease ☐
    d) High blood cholesterol ☐
    e) Asthma/COPD ☐
    f) Any Cancer ☐
    g) None ☐
13. Are you on any drugs for high blood cholesterol levels? (*review patient file)*
    a) Yes ☐
    b) No ☐
14. Are you currently on any antiplatelet medications? *(review patient file)*
    a) Yes ☐
    b) No ☐
15. How well controlled is the patient's blood pressure today?
    a) Controlled < 140/90 ☐
    b) Uncontrolled ≥ 140/90 ☐
16. What is your Height today in meters? (*Interviewer to measure if not done*)

    ____
17. What is your weight today in Kgs? (*Interviewer to measure if not done*)

    ____
18. Have you ever been diagnosed with a stroke or mini stroke (TIA) in the past?
    a) Yes ☐
    b) No ☐
19. Do you know anyone in your family diagnosed with stroke or Mini stroke (TIA)? ☐
    a) Yes
    b) No ☐

20. Do you drink alcohol?

    a) Yes
    b) No

21. Do you have any history of cigarette smoking?

    a) Current smoker
    b) Ex-smoker
    c) Non-smoker

NB: if nonsmoker, skip Q22 & 23

22. On average how many sticks of cigarette did you or do you smoke a day? __________

23. In total how many years have or are you smoking cigarette? ________________

Section C: Awareness of stroke warning signs

24. Do you know about stroke?

    a) Yes
    b) No

25. Can you name some of the warning signs/symptoms of stroke that you know? (*Tick any warning sign/symptom listed by the participant*)

    a) Weakness on one side of the body/Limb weakness
    b) Slurred speech
    c) Facial weakness/drooping
    d) Unusual severe headache
    e) Loss of balance
    f) Sudden loss of vision
    g) Dizziness
    h) Sudden difficulty swallowing
    i) Sudden memory loss

j) Sudden reduced/ loss of sensation on one side of the body/body part. ☐

k) I do not know ☐

26. What would you do if you suspect that you are having a stroke? (*Tick appropriately)*

a) Wait and see ☐

b) Ask for or seek medical care immediately ☐

c) Ask for or seek medical care the following day ☐

d) Seek spiritual intervention ☐

e) Seek traditional medicine ☐

f) I don't know ☐

Section D: Awareness of stroke risk factors

27. Do you think you are at risk of stroke?

a) Yes ☐

b) No ☐

28. List any risk factors for stroke that you know (*Tick any risk factor listed by the participant*)

a) Hypertension ☐

b) Diabetes mellitus ☐

c) High blood cholesterol ☐

d) Obesity/overweight ☐

e) Cigarette smoking ☐

f) Sedentary lifestyle ☐

g) Heavy alcohol use ☐

h) Unhealthy diets ☐

i) Previous history of stroke ☐

j) Family history of stroke ☐

k) Advancing age ☐

l) I don't know ☐

Appendix III: Key Informant Interview

Key informant interview for one clinic doctor, nurse, and the Medical Superintendent.

INTRODUCTION

The interview's goal is to gather information that will help us know the level of awareness of stroke risk factors and warning signs among hypertensive patients attending Garissa County Referral Hospital. This interview will involve the principal researcher and one research assistant.

The principal researcher is a postgraduate student while the co-investigators is a trained research assistant. The findings of this study will help develop health education strategies aimed at improving awareness, risk factor mitigation strategies, and enhancing prompt arrival to the hospital.

Do you consent to participate Yes, ☐ No ☐ KI Signature--------------?

QUESTIONS

1. How would you rate the awareness levels of hypertensive patients regarding stroke risk factors at Garissa County Referral Hospital?
2. What is your perception of the awareness levels among hypertensive patients on follow-up regarding stroke warning signs at Garissa County Referral Hospital?
3. In your opinion, what factors contribute to influencing the awareness levels of stroke risk factors and warning signs among hypertensive patients?
4. Does your facility implement a structured health education strategy for hypertensive patients?
5. Do you believe hypertensive patients receiving follow-up care in your facility receive adequate health education regarding stroke risk factors, risk reduction measures, and recognizing warning signs? If not, what could be the potential reasons?
6. In your view how can patients' level of awareness of stroke risk factors and warning signs be improved?

END: Thank you for actively participating.

Appendix IV: Research Authorization – Kenyatta University

KENYATTA UNIVERSITY
OFFICE OF EXECUTIVE DEAN, GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Our Ref: Q57/CE/29040/2015

DATE: 19th October 2023

Director General,
National Commission for Science, Technology and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR. ABDIWELI M. BASHIR – REG. NO. Q57/CE/29040/2015

I write to introduce Mr. Abdiweli M. Bashir who is a Postgraduate Student of this University. He is registered for M.Sc. degree programme in the **Department of Community Health and Epidemiology**.

Mr. Abdiweli M. Bashir intends to conduct research for a M.Sc. Thesis Proposal entitled, ***"Awareness of Stroke Risks Factors and Warning Signs Among Hypertensive Patients Attending Garissa County Referral Hospital in Garissa County, Kenya".***

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELISHIBA KIMANI
EXECUTIVE DEAN, GRADUATE SCHOOL

KENYATTA UNIVERSITY OFFICE OF EXECUTIVE DEAN GRADUATE SCHOOL 24 OCT 2023

HO/...

Appendix V: Research Approval – Kenyatta University Ethical Review

KENYATTA UNIVERSITY
CENTRE FOR RESEARCH ETHICS AND SAFETY

P. O. Box 43844,

Fax: 8711242/8711575
Email: chairman.kuerc@ku.ac.ke
Nairobi, 00100

Tel: 8710901/12

Website: www.ku.ac.ke

Date: 22nd November, 2023

Our Ref: **KU/ERC/APPROVAL/VOL.1**

Abdiweli M.Bashir
P.O Box 43844, 00100
Nairobi.

Dear Bashir,

APPLICATION NUMBER: PKU/3854/I1977- AWARENESS OF STROKE RISK FACTORS AND WARNING SIGNS AMONG HYPERTENSIVE PATIENTS ATTENDING GARISSA COUNTY REFERRAL HOSPITAL,KENYA

This is to inform you that ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** has reviewed and approved your above research proposal. Your application approval number is **PKU/3854/I1977.**The approval period is ***22nd /11/2023 to 22nd /11/2024.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE***
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.

vii. Submission of an executive summary report within 90 days upon completion of the study to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE***

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

To serve you better, researchers are kindly requested to access and complete a customer feedback form and sent it back online as you continue with research and upon completion of data collection found on the following website link; ;(https://docs.google.com/forms/d/1ytWefDwvyz5h1oz_VIn0xbxg3uGdIDzMXFWNDsMrRPQ/edit?usp=sharing

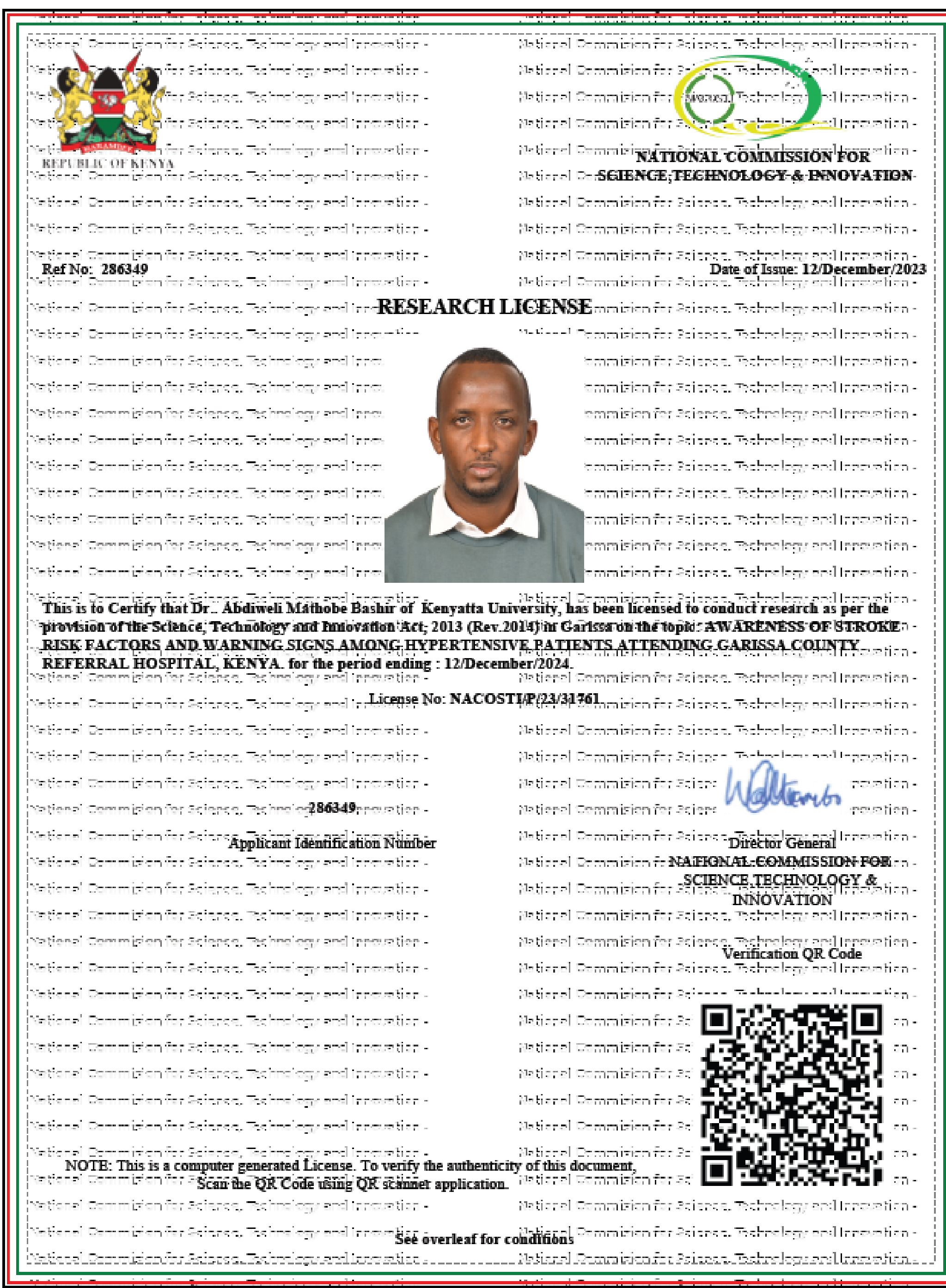
Yours sincerely

KENYATTA UNIVERSITY OFFICE OF THE CHAIRMAN 22 NOV 2023 ETHICS REVIEW COMMITTEE P.O. BOX 43844 - 00100 NAIROBI

Prof. Judith Kimiywe

Director: Centre for Research Ethics and Safety

Appendix VI: Research Permit - NACOSTI



REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 286349

Date of Issue: 12/December/2023

RESEARCH LICENSE

This is to Certify that Dr.. Abdiweli Mathobe Bashir of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Garissa on the topic: AWARENESS OF STROKE RISK FACTORS AND WARNING SIGNS AMONG HYPERTENSIVE PATIENTS ATTENDING GARISSA COUNTY REFERRAL HOSPITAL, KENYA. for the period ending : 12/December/2024.

License No: NACOSTI/P/23/31761

286349

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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See overleaf for conditions

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)
Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was the established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

CONDITIONS OF THE RESEARCH LICENSE

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way;
    i. Endanger national security
    ii. Adversely affect the lives of Kenyans
    iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
    iv. Result in exploitation of intellectual property rights of communities in Kenya
    v. Adversely affect the environment
    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. The license any rights thereunder are non-transferable
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

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Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
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E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke

Appendix VII: Map of Garissa County