UNIVERSITY OF ILORIN

THE TWO HUNDRED AND THIRTIETH (230TH)
INAUGURAL LECTURE

"IN THE QUEST FOR A MASTERSTROKE FOR STROKE"

By

PROFESSOR KOLAWOLE WASIU WAHAB
MBBS (Ilorin), MPH (Ilorin), MSc (London), MD (Nig.), FMCP (Nig.), FANA (USA), FAAN (USA), Cert. Health Plan. & Mgt. (Ilorin), Cert. FIS (Washington), Cert. ICTPH (Baton Rouge)

DEPARTMENT OF MEDICINE
FACULTY OF CLINICAL SCIENCES
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF ILORIN, ILORIN, NIGERIA

THURSDAY, 16TH MARCH, 2023

This 230th Inaugural Lecture was delivered under the Chairmanship of:

The Vice-Chancellor

Professor Wahab Olasupo Egbewole SAN
LL.B (Hons) (Ife); B.L (Lagos); LL.M (Ife); Ph.D. (Ilorin); FCArb; Fspsp

16th March, 2023

ISBN: 978-978-8556-18-3

Published by:

The Library and Publication Committee,
University of Ilorin, Ilorin, Nigeria.

Printed by
Unilorin Press, Ilorin, Nigeria.

PROFESSOR KOLAWOLE WASIU WAHAB

MBBS (Ilorin), MPH (Ilorin), MSc (London), MD (Nig.), FMCP (Nig.), FANA (USA), FAAN (USA), Cert. Health Plan. & Mgt. (Ilorin), Cert. FIS (Washington), Cert. ICTPH (Baton Rouge)

PROFESSOR OF MEDICINE
DEPARTMENT OF MEDICINE
FACULTY OF CLINICAL SCIENCES
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF ILORIN, ILORIN, NIGERIA

BLANK

Courtesies
The Vice-Chancellor
Deputy Vice-Chancellor (Academic)
Deputy Vice-Chancellor (Management Services)
Deputy Vice-Chancellor (Research, Technology and Innovation)
The Registrar
The Bursar
The University Librarian
The Provost, College of Health Sciences
The Dean, Faculty of Clinical Sciences
Deans of other Faculties, Postgraduate School, and Student Affairs
The Chief Medical Director, University of Ilorin Teaching Hospital
The Chairman, Medical Advisory Committee, University of Ilorin Teaching Hospital
Professors, and other members of Senate
Directors of various Units
Head, Department of Medicine
Heads of other Departments
All other academic colleagues
Members of Administrative and Technical Staff
My Lords, Spiritual and Temporal
Members of my nuclear and extended families
Distinguished students of Medicine
Esteemed invited Guests, Friends and Relatives
Great students of the University of Ilorin
Scholars and Alumni of the University of Ilorin
Gentlemen of the Print and Electronic Media
Distinguished Ladies and Gentlemen

Preamble

Mr. Vice-Chancellor, Sir, today's inaugural lecture entitled "I**n the Quest for a Masterstroke for Stroke"** is the 230th in the series of inaugural lectures in the University of Ilorin and the 8th from the Department of Medicine. I give due credit to my forebears, some of whom I have had to stand on their shoulders

to see this far. However, I request that you kindly join me in thanking Allah (SWT) for preserving my life to stand before you today to deliver the very first inaugural lecture by a neurologist in the Department of Medicine of this great University *Alhamdulillah!* The title has been carefully chosen to showcase my humble efforts at reducing the burden of stroke in Nigeria and other Low- and Middle-income Countries (LMICs) through research collaborations at local, national, continental, and global levels.

Introduction

An inaugural lecture is a significant milestone in the career of an academic which brings the town and gown together to celebrate the research achievements of the presenter. It is, therefore, pertinent that a baseline information is presented to the mixed audience so that the obviously elated inaugural lecturer will not be "talking to himself" as he is trying to showcase what he has achieved. Hence, I need to provide some background information so that you can follow me as the lecture progresses.

The Human Nervous System

From elementary biology, we know that we are created from a basic building unit which is the cell. These cells aggregate to form tissues and the tissues aggregate to form organs which interconnect to form systems. The cells in the nervous system are called neurons. These neurons aggregate to form nervous tissues and organs which interconnect to form the nervous system. Thus, the human nervous system consists of billions of interconnected neurons linking the central (brain and spinal cord) and peripheral (autonomic and somatic) nervous systems together and maintain normal activities (Figure 1). The brain controls the body, hence when there is a problem with this important organ, things may go haywire! Figure 2 is an illustration of the different parts of the brain and their respective functions. In the classic work of von Bartheld and colleagues entitled "*The search for true numbers of neurons and glial cells in the human brain: A review of 150 years of cell counting*", it has been estimated that human beings have about 65-90 billion neurons in the brain: 10-20 billion in

the cerebral cortex and 55-70 billion in the cerebellum alone!(von Bartheld et al., 2016)Is it therefore not absolutely amazing that you and I have these billions of neurons inside our skulls but there is no disorderliness? This reminds me of the oft-repeated verse in *Surat-ul-Rahman* (Glorious Qur'an Chapter 55): *"Which of the favours of your Lord will you deny?"*Our neurons are nourished by the oxygen and glucose they receive from the blood supplied through a network of pipes called blood vessels which principally originate from the heart and divide into branches (the circulatory system). The blood supply of the brain is illustrated in Figure 3. The nervous and circulatory systems are similar in location and perform similar functions in every human being, with no ambiguity whatsoever. No wonder, our Creator says in The Glorious Qur'an Chapter 95 verse 4: "*We have indeed created man in the best of moulds*".

Mr. Vice-Chancellor Sir, distinguished ladies and gentlemen, I am able to make this presentation and you are able to listen and comprehend simply because our brains are working well to coordinate the reception and processing of the information being sent and received. When there is lack of synchrony in the activities of these neurons and coordination breaks down, then we say there is a nervous system disorder.

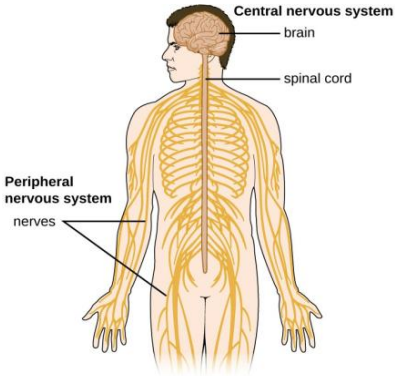

Figure 1: Human Nervous System (https://courses.lumenlearning.com/suny-microbiology/chapter/anatomy-of-the-nervous-system/ Accessed 22 February, 2023.

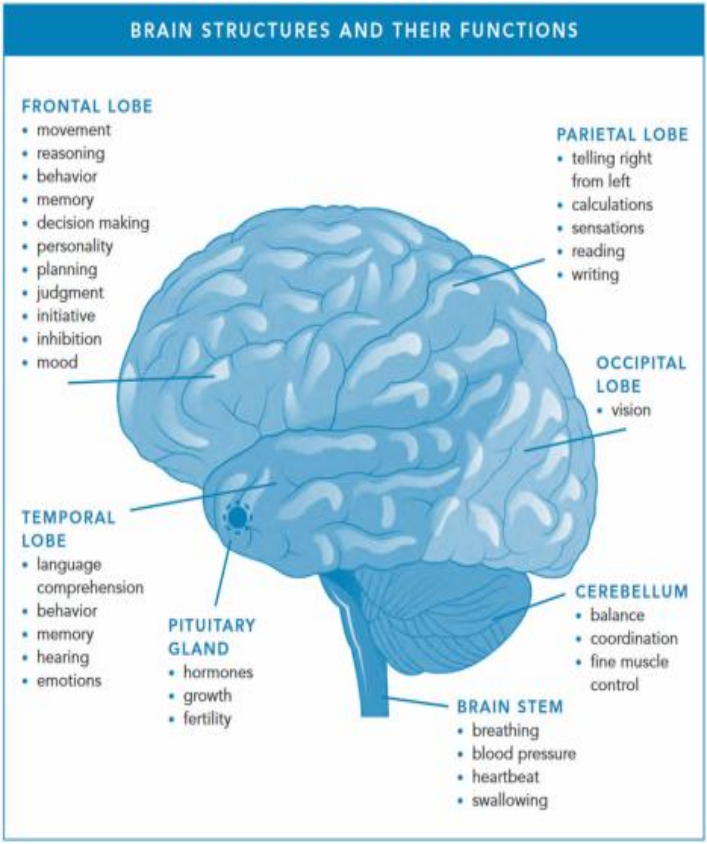

Figure 2: Brain Structures and their Functions (https://healthjade.com/human-brain/ Accessed 24February, 2023)

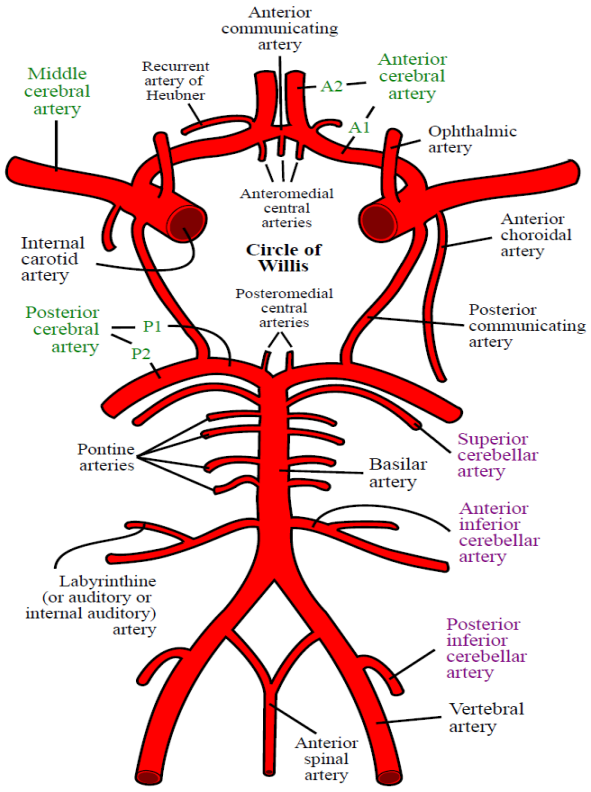

Figure 3: Blood Supply of the Brain (Circle of Willis By Rhcastilhos - Gray519.png, Public Domain, https://commons.wikimedia.org/w/index.php?curid=1597012 Accessed 22 February, 2023)

Choice of Neurology as an Area of Sub-specialisation

Neurology is a sub-specialty of internal medicine that deals with treatment of diseases of the brain, spinal cord, peripheral nerves and muscles. Thus, a neurologist is a specialist who has undergone further postgraduate trainings in the treatment of diseases of the brain, spinal cord, peripheral nerves and muscles. The length of training is currently a minimum of six years, beginning after six years of undergraduate education to obtain

the qualifying degree of Bachelor of Medicine, Bachelor of Surgery (MBBS), followed by successful internship and then National Youth Service (or exemption where applicable). It is a tortuous journey that begins with Primary Fellowship examination which must be passed to enrol in the clinical cum academic training at an accredited institution and ends with success in the Part II Fellowship examinations of either the National Postgraduate Medical College of Nigeria or West African College of Physicians. It needs to be emphasised that the Part II Fellowship examination is the most rigorous of any examination, consisting of written paper in Neurology, and at least one hour each on oral examination in Neurology subspecialty and General Internal Medicine in addition to defence of research dissertation on a neurological research question. To be eligible for the award of Fellow of the Medical College in *Physic* (FMCP), all arms of the examination must be passed. With successful completion of Fellowship training in Neurology, the options available to the young Fellow is to work as a clinical neurologist as a full hospital consultant or to join academic medicine as a Lecturer I with an adjunct appointment as a honourary consultant neurologist by the teaching hospital.

Neurology is a sub-specialty of internal medicine which many undergraduates and postgraduates dread because of its perceived complexity, although it is a statement of fact that the brain is the most complex organ in the body. However, I chose the sub-specialty because I have always had the passion for simplifying problems and breaking new grounds to make life and living more meaningful because of my inquisitiveness. At the time I was starting my postgraduate residency training in the Department of Medicine of the University of Ilorin Teaching Hospital in 2000, there was no consultant neurologist. Therefore, after my success in the Part I Fellowship examination of the National Postgraduate Medical College of Nigeria in May 2002,

I decided to follow the footsteps of my senior colleague, late Prof. E.O. Sanya who was already rounding off his Neurology training at the University College Hospital, Ibadan under the supervision of Prof. A. Ogunniyi. I chose to go to Lagos University Teaching Hospital, Idi Araba to train under the supervision of Prof. M.A. Danesi, a great teacher and mentor. Today, the rest is history.

I worked briefly as a locum hospital consultant at the Federal Medical Centre, Katsina after completing my Neurology training in November,2005 before I was appointed a Consultant Neurologist at Irrua Specialist Teaching Hospital, Irrua, Edo State which is the hospital being used by Ambrose Alli University as its Teaching Hospital. However, my passion for my alma mater made me return to the University of Ilorin in 2007 and I want to specially appreciate Prof. I. O. Oloyede, the then Vice-Chancellor and the current Registrar of the Joint Admissions and Matriculation Board (JAMB) who facilitated the appointment. With all enthusiasm, I assumed duty on 4th April, 2007 as Lecturer I and all forms of praise belong to Allah that by 1st October, 2017 the Council of this University found me worthy of elevation to the rank of a Professor of Medicine.

Definition of Terms

Some important terminologies are crucial to this inaugural lecture. These are stroke, quest and masterstroke.

Stroke: Stroke is defined as "a sudden onset of focal or global neurological deficit lasting more than 24 hours or leading to death with no apparent cause other than vascular origin".(Aho et al., 1980) With improvement in diagnostic and treatment modalities, and for accurate diagnosis and phenotyping for research purposes, the definition of stroke was improved upon in 2013. Hence, stroke is now defined as "an acute episode of focal dysfunction of the brain, retina, or spinal cord lasting longer than 24 hours, or of any duration if imaging (computed tomography

(CT) or magnetic resonance imaging (MRI)) or autopsy show focal infarction or haemorrhage relevant to the symptoms". (Sacco et al., 2013) This definition excludes Transient Ischaemic Attack (TIA) which refers to focal dysfunction of less than 24 hours duration with no imaging evidence of infarction.

Quest: According to the Oxford Advanced Learner's Dictionary, *quest* means "**a long search for something that is difficult to find**". Thus, the object of a quest needs serious exertion on the part of the hero, who must overcome several obstacles to get to the target.(Hornby, 1995)

Masterstroke: The same Oxford Advanced Learner's Dictionary defines *masterstroke* as "**something clever that you do that gives a successful result**".(Hornby, 1995)

Mr. Vice-Chancellor, Sir, and my distinguished audience, please fasten your seatbelt as I present to you my humble strides ***in the quest for a masterstroke for stroke***.

Mechanism of Stroke

Stroke, or "brain attack," occurs when blood circulation to the brain fails. Brain cells (neurons) depend on glucose and oxygen supplied by the blood. Thus, when stroke occurs, brain cells die because of lack of glucose and oxygen due to an abrupt disruption of blood flow to the affected area. Just like other organs of the body, the brain receives its blood supply through a network of pipes which are called arteries. When there is blockage of these pipes, stroke can occur; this type is called *ischaemic stroke or cerebral infarction*. Similarly, one of the pipes can rupture and let out its content into the substance of the brain or its surrounding tissue; this type is called *haemorrhagic stroke* which is sub-divided into *intracerebral haemorrhage* and *subarachnoid haemorrhage*. The types of stroke and their relative frequencies are illustrated in Figures 3 and 4.

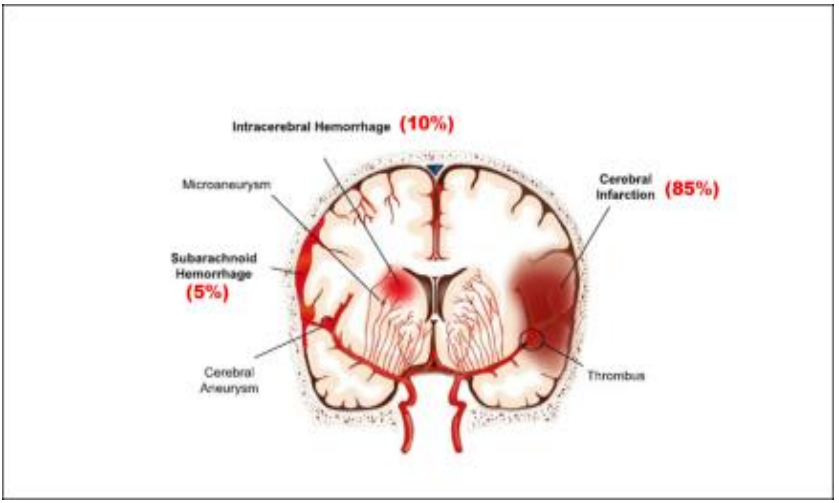

Figure 3: Pathological Types of Stroke (Kitagawa, 2022)

Figure 4A: Normal pipe with free-flowing water (analogous to normal blood flow to the brain) (https://books.google.com.ng/books/about/Simple_Machines_in_Your_Home.html?id=qK62BQAAQBAJ&printsec=frontcover&source=kp_read_button&hl=en&redir_esc=y Accessed 27 February, 2023)

Figure 4B: Water pipe with narrowed bore (image on the left) which will reduce water flow (analogous to ischaemic stroke) (https://www. therecord.com/news/waterloo-region/2015/01/21/aging-water-system-in-kitchener-means-big-rate-hikes-or-more-water-main-breaks.html Accessed 27 February, 2023).

Figure 4C: Ruptured pipe showing that the pipe (blood vessel) may rupture before getting to its destination, thus letting out its content and depriving the house of water and wetting the surrounding (analogous to haemorrhagic stroke). (https://alla splumbingllc.com/ choosing-between-repiping-vs-repair/ Accessed 27 February, 2023).

Enormity of the Problem of Stroke

Stroke is a significant cause of death and disability worldwide and the situation in Nigeria is not different.(Wahab, 2008) The World Health Organisation projects that 80% of all strokes will occur in developing countries of the world by the year 2030. The reasons for the projected increase have been postulated to be adoption of western lifestyle and transition from infectious to non-infectious diseases.

Stroke Statistics at a Glance:

a. 1 in 4 people worldwide will have a stroke in their lifetime.
b. Every minute, six indigenous Africans develop new strokes.(Sarfo et al., 2023)
c. Every other second stroke attacks a person – regardless of age or gender.
d. Every 6 seconds stroke kills someone.
e. Stroke is the second leading cause of death in the world.
f. This year alone, 12.2 million people will experience a stroke and 6.5 million will not survive.
g. Worldwide 110 million people have experienced stroke and live with impacts that can include severe physical disability, communication difficulties, changes in how they think and feel, loss of work, income and social networks".(https://www.world-stroke.org/world-stroke-day-campaign/why-stroke-matters accessed 18 February, 2023).

However, behind these numbers are **real lives!** These numbers represent individuals who are mothers, fathers, sisters, brothers, breadwinners, loving and loved ones. Thus, stroke imposes emotional and financial burden on the sufferers, their families and the society at large. The burden of stroke is rapidly escalating and needs urgent attention because it affects the most productive age group in Africa, as we have previously reported.(Sarfo et al., 2018)Already, the lifetime cost of stroke exceeds $90,000 per patient for ischemic stroke and $225,000 per patient for hemorrhagic stroke in the US.(Scott & Silbergleit, 2006) Within two weeks, a hospitalized stroke patient in SSA spends about 170 times higher than the average person spends per year on health, and the cost of management of the condition in a private hospital in Nigeria within the first 36 weeks is almost $5,000 (≈N2,300,000.00 @ the official exchange rate).(Birabi et al., 2012; Guinhouya et al., 2010).

Risk Factors for Stroke

Risk factors are those conditions that can increase the chances of someone developing a particular disease. However, having a risk factor for stroke does not mean you will have a stroke. Similarly, the fact that you do not have a risk factor does not mean you are not going to suffer from the disease. It all depends on how you handle your health! It is, however, important to note that the risk of stroke grows as the number and severity of risk factors increases.

Stroke risk factors are traditionally divided into *non-modifiable and modifiable risk factors*. Just as the name implies, non-modifiable risk factors are those that cannot be modified to achieve a reduction in the risk of developing stroke. Those with clear, supportive epidemiological evidence and evidence of risk reduction when modified in the context of clinical trials are referred to as well-documented modifiable risk factors. On the other hand, those with less clear evidence of risk reduction from clinical trials are referred to as less-well documented or potentially modifiable risk factors.(Meschia et al., 2014).

Non-modifiable Risk Factors

***Age*:** Advanced age is a risk factor for first and recurrent stroke with a doubling of the risk in each successive decade after 55 years of age.(Meschia et al., 2014) This could be because of the atherosclerosis associated with ageing. Age-specific incidence of stroke is higher in men at 55–75 years, and levels out at ages older than 75 years.(Gorelick, 2019)

***Sex*:** Generally, stroke is more prevalent in men compared to women(Brown et al., 1996) except for the 35-44 and >85 years age groups where there is a slightly higher age-specific incidence in women compared to men (Sacco et al., 1998).

Low birth weight: It has been documented that the odds of stroke is more than double for those who weigh <2.5kg at birth compared with those weighing 4.0 kg.(Goldstein et al., 2011).

Race/Ethnicity: Blacks have a higher incidence of stroke and higher mortality compared with whites and this is particularly true for young and middle-aged blacks.(Lackland et al., 1999; Owolabi et al., 2017)This disparity has been postulated to be due to poor management of risk factors and socio-economic disparities.(Ashley & Berry, 2021)

***Genetic Factors/Family History*:** The risk of stroke is increased by about 30% in someone with a positive family history. The possible mechanisms of this increased susceptibility include genetic heritability of stroke risk factors, inheritance of susceptibility to the effects of risk factors, familial sharing of environmental/lifestyle risk factors and interaction between genetic and environmental factors.(Akinyemi et al., 2017; Flossmann et al., 2004; Wahab et al., 2019)

Well-documented and Modifiable Risk Factors

***Hypertension*:** Hypertension refers to a clinical state when the blood pressure is >140/90 mmHg. It remains the dominant modifiable risk factor for stroke worldwide. The higher the blood pressure, the higher the risk of developing stroke.(Lewington et al., 2002)Experience has shown that a vast majority of stroke patients in Nigeria are not usually aware of their hypertension status

before being affected by stroke. (KW Wahab, MU Sani, et al., 2007; Wahab, 2008; K. W. Wahab, N. U. Okubadejo, et al., 2008).

Diabetes Mellitus: Persons with diabetes have an increased risk of stroke ranging from 1.8 to nearly 6-fold because of increased susceptibility to atherosclerosis and increased prevalence of pro-atherogenic risk factors.(Meschia et al., 2014)

Smoking: The risk of ischaemic stroke and subarachnoid haemorrhage is increased by cigarette smoking. Passive smoking has been shown to also increase the risk. We have seen a few cases of stroke in young adults in Ilorin due to smoking of marijuana (Indian hemp).

Atrial Fibrillation: This is a disorder of heart rhythm is which the beating of the heart is uncoordinated and becomes irregular, resulting in palpitations.

Other Risk Factors: Other risk factors that have been implicated in stroke include:

- Cholesterol imbalance(dyslipidaemia)
- Physical inactivity
- Obesity
- Unhealthy eating habit
- Sickle cell anaemia, et cetera.

How Does One Recognise Stroke?

The following are symptoms or signs of stroke:

- Sudden numbness or weakness of face, arm, or leg, especially on one side of the body
- Sudden confusion, or trouble talking or understanding speech
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, or loss of balance or coordination
- Sudden severe headache with no known cause

Unfortunately, awareness of the warning signs and risk factors for stroke is poor, even among Nigerians at increased risk.(Wahab, Kayode, et al., 2012; Wahab et al., 2010; Wahab et al., 2015; Kolawole W Wahab et al., 2008).

Stroke Management

Management of stroke has evolved over the years from watchful waiting to active interventions in applicable cases. Where the facilities are available, ischaemic strokes are treated with the use of clot bursters (thrombolytic therapy) while intracerebral haemorrhage has no known evidence-based treatment at the moment. Management in a Stroke Unit, an organised in-hospital facility staffed by a multidisciplinary team, with at least six beds devoted to the care of patients with stroke, has been shown to improve outcome by reducing morbidity and mortality.(Langhorne, 2021)

Prevention of Stroke

To tackle the rising burden of stroke in Nigeria and other LMICs, prevention is the key. Hence, there is a need for concerted efforts to identify risk factors and control the modifiable ones among them.

Contributions to Knowledge in the Quest for a Masterstroke for Stroke

Mr. Vice-Chancellor Sir, my research interest lies in how to reduce the high and escalating burden of stroke in Nigeria, although I still conduct research and publish in other areas of Neurology including headaches, pain, movement disorders, epilepsy, neurological infections, *et cetera*.(Adebayo et al., 2017; Adekeye et al., 2012; Ayanniyi et al., 2016; Bakare et al., 2018a, 2018b; Bello et al., 2019; Ibekwe et al., 2011; Isiavwe et al., 2005; Ojo et al., 2020; Ojo et al., 2021; Okokhere et al., 2016; Okubadejo et al., 2019; Opadijo et al., 2013; Salami et al., 2009; Sanya et al., 2020; Sanya et al., 2008; Sanya et al., 2015; Suleiman et al., 2015; Suleiman et al., 2016; KW Wahab, FI Ojini, et al., 2007; Wahab, Olanrewaju, et al., 2012; Wahab et al., 2016; Wahab & Salami, 2011; Wahab, Sanya, et al., 2017; K. W. Wahab et al., 2014; Wahab & Ugheoke, 2009; A. S. Yusuf et al., 2015).

I crave your indulgence to narrow the focus of my contributions to knowledge to some of the research works conducted in my quest for a masterstroke for stroke.

A. Stroke Outcome Research

My initiation into stroke research began with my Postgraduate Fellowship dissertation entitled "*Prognostic Value of Admission Hyperglycaemia in Adult Nigerians with Acute Ischaemic Stroke*" which was submitted to the Faculty of Internal Medicine of the National Postgraduate Medical College of Nigeria and successfully defended in 2005. This culminated in the award of the Fellowship of the Medical College in *Physic* (FMCP) with sub-specialisation in Neurology (FMCP [Neurology]).

A.1. Effect of Admission Hyperglycaemia on Short Term Outcome in Acute Ischaemic Stroke

Although the exact relationship between hyperglycaemia and stroke outcome (causal or indicative of more severe stroke) remains controversial, putative mechanisms via which hyperglycaemia exerts its deleterious effects have been postulated.(Duan et al., 2023; McCowen et al., 2001) Elevated blood glucose levels are associated with an increased progression of hypoperfused at-risk tissue to infarction and thus leads to poor stroke outcome. This mechanism appears to be promoted by hyperglycaemia-induced increase in lactate production.(Parsons et al., 2002)The justification for our study was the paucity of evidence on the effect of admission hyperglycaemia on the prognosis of acute ischaemic stroke in Africans. We, therefore, studied 100 consecutively consenting adults presenting to the Emergency Unit of the Lagos University Teaching Hospital between February 2003 and May 2004. All patients had stroke severity on admission assessed with the National Institutes of Health Stroke Scale (NIHSS) and a random blood glucose estimation was done. They all received standardised management based on the protocols for managing acute ischaemic stroke and were periodically assessed for progress and/or development of complications. The outcome measures assessed at 30 days were: case fatality rate and improvement in NIHSS score. The mean age of the patients was 58.6 ± 14.1 years with no significant gender difference. Based on a cut off

value of ≥140 mg/dl, admission hyperglycaemia was present in 34% of cases. Overall, the 30-day case fatality rate was 28% and was significantly higher in hyperglycaemic compared to normoglycaemic patients (41.2% vs. 21.2%, p=0.04). Improvement in NIHSS score at 30 days was better in normoglycaemic compared to hyperglycaemic patients, however this was not statistically significant (34.6% vs. 60%; p=0.05). Although the findings were not novel, our study was the first prospective study on the effects of admission hyperglycaemia on short-term outcome in Nigerians with ischaemic stroke and our data added to the existing evidence on the adverse outcome associated with hyperglycaemia in acute ischaemic stroke. We concluded that although the jury was still out on the efficacy and target values of glycaemic control in acute ischaemic stroke, the evidence of a detrimental effect of elevated glucose in stroke provided from our study and earlier ones emphasized the need for well-designed, randomized clinical trials to know the effect of blood glucose lowering on stroke outcome. (Kolawole Wahab et al., 2007).

A.2. Predictors of Short-term Intra-Hospital Case Fatality Following First-ever Acute Ischaemic Stroke in Nigerians

To improve stroke outcome, it is important to continuously identify factors that predict poor outcome as a first step to applying interventions aimed at modifying or forestalling such factors. This is even more important in Low- and Middle-income Countries (LMICs) where stroke management is still largely conservative and in general wards instead of in dedicated Stroke Units which has been consistently shown to improve outcome independent of patient age, sex, stroke type, or initial stroke severity.(Langhorne, 2021)We did a post-hoc analysis of the data from my Fellowship dissertation, with the scientific premise that studies on predictors of outcome were sparse. Our objective was to determine the 30-day case fatality rate (CFR) and its predictors among adult Nigerians admitted to the Lagos University Teaching Hospital for first-ever acute ischaemic stroke.(K. W. Wahab, N. U. Okubadejo, et al., 2008) During the

course of hospital admission, 44% of the patients developed at least one complication, with aspiration pneumonitis/pneumonia accounting for 29.6%. We reported a 30-day CFR of 28% (male 28.3% vs. female 27.7%; p=0.94). The CFR was significantly higher in patients with admission NIHSS scores >13 ($p = 0.02$) and presence of complications ($p<0.001$). CFR was highest in those with aspiration pneumonitis (72.7%). In multiple logistic regression analysis, presence of complications emerged as the independent predictor of 30-day case fatality rate ($\beta = 0.48$; $p < 0.001$). We concluded that our findings would go a long way in guiding acute and continuing management of stroke in Nigeria. Therefore, all efforts should be made to prevent complications from developing. However, if they develop, they should be managed aggressively in order to improve survival.(K. W. Wahab, N. U. Okubadejo, et al., 2008).

A.3. Patient-Level and System-Level Determinants of Stroke Fatality Across 16 Large Hospitals in Ghana and Nigeria: A Prospective Cohort Study

About six indigenous Africans develop new strokes every minute of every hour. Translated to a 24-hour period, this data is scary and at the same time unacceptable for a disease with well-documented modifiable risk factors and evidence-based treatment for ischaemic stroke.(Sarfo et al., 2023) However, many studies on the factors affecting stroke outcome have been from underpowered single-centre studies. In the Stroke Investigative Research and Educational Network (SIREN) multisite study, we identified and quantified the contributors to patient- and system-level determinants of inpatient stroke case fatality across 16 hospitals in Nigeria and Ghana. We recruited adults with clinical and radiological evidence of an acute stroke. Data on stroke services and resources available at each study site were collected and analyzed as system-level factors while some clinical and sociodemographic variables were analyzed as patient-level factors. As system-level factors, we collected data on the availability of 23 items namely: CT or MRI scans, angiography, electrocardiography, echocardiography, carotid

Doppler ultrasonography, stroke unit, intravenous thrombolysis, mechanical thrombectomy, and neurosurgical decompression therapy for severe strokes. Other services assessed included: availability of physiotherapy, occupational therapy, and speech therapy for post-stroke rehabilitation. Medications assessed for availability included antihypertensives, insulin and oral hypoglycaemics, antiplatelets, anticoagulants, statins, and mannitol. A total of 3,739 patients were recruited. Overall, in-hospital case fatality rate was 21·8% with a higher case fatality rate in patients with intracerebral haemorrhage compared to ischaemic stroke (30.6% vs. 18.1%). All the study sites had only 12 (52.2%) of the 23 assessed variables, namely a CT scan machine, electrocardiography, a neurologist, a cardiologist, physiotherapists, antihypertensives, oral hypoglycaemics, insulin, antiplatelets, anticoagulants, statins, and mannitol. However, only five (31·3%) of the 16 sites had a stroke unit. (Figure 5) None of the sites provided reperfusion therapies, namely intravenous thrombolysis and mechanical thrombectomy. Six patient-level factors were associated with stroke fatality, these factors with their adjusted risk ratios (aRRs) were: low vegetable consumption, 1·19 (95% CI 1·07-1·33); systolic blood pressure, 1·02 (1·01-1·04) for each 10 mm Hg rise; stroke lesion volume >30 cm^3, 1·48 (1·22-1·79); NIHSS score, 1·20 (1·13-1·26) for each 5-unit rise; raised intracranial pressure, 1·75 (1·31-2·33); and aspiration pneumonia, 1·79 (1·16-2·77).Case fatality rate was lower in hospitals where stroke units were available compared to those without (48.5% vs. 58.6%). From our findings, it becomes apparent that there is an urgent need for: (a.) development of local, context-attuned protocols for screening and management of swallowing abnormalities to prevent aspiration pneumonia, (b.) adequate blood pressure management, and (c.) establishment of stroke units.(Sarfo et al., 2023).

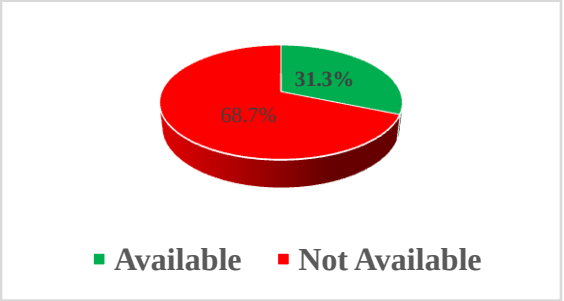

Figure 5: Availability of Stroke Unit Across the 16 Study Sites

B. Stroke Risk Factors

As already alluded to, stroke risk factors are divided into non-modifiable and potentially modifiable types. My contribution to knowledge in the area of stroke risk factors include:

B.1.Modifiable Cardiovascular Risk Factors Among Apparently Healthy Adult Nigerian Population – A Cross Sectional Study

In a cross-sectional study, we assessed 300 apparently healthy adults for modifiable cardiovascular risk factors at the Federal Medical Centre, Katsina. There were 129 males and 171 females, with a mean age of 37.56±10.57 years. We found a high prevalence of cardiovascular risk factors among the participants as follows (Sani et al., 2010; K. W. Wahab, M. Sani, et al., 2008; Wahab et al., 2011):

Generalized Obesity: 21.3% (males 10.9%, females **29.2%**, $p < 0.05$),

Truncal Obesity: 43.7% (males 12.4%, females **67.3%**, $p < 0.05$),

Hypertension: 25.7% (males 27.9, females 24%, $p > 0.05$),

Type 2 Diabetes Mellitus: 5.3% (males 5.4%, females 5.3%, $p > 0.05$),

Hypercholesterolaemia: 28.3% (males 23.3%, females **32.2%**, $p < 0.05$),

Elevated LDL-cholesterol: 25.7% (males 28%, females 24%, $p > 0.05$),
Low HDL-cholesterol: 59.3% (males 51.9%, females **65%**, $p < 0.05$),
Hypertriglyceridaemia: 15% (males 16.3%, females 14%, $p > 0.05$) and
Metabolic Syndrome: 22% (males 10.9%, females **30.4%**, $p < 0.05$).

We concluded that there is a high prevalence of cardiovascular disease risk factors among apparently healthy Nigerian adults. There is a need to encourage healthy lifestyle to reduce the observed high prevalence.(Sani et al., 2010).

B.2. Dominant Modifiable Risk Factors for Stroke in Ghana and Nigeria (SIREN): A Case-Control Study

In the Stroke Investigative Research and Educational Network (SIREN), which was an NIH-funded project involving sites in Nigeria and Ghana, we analyzed data from 2,118 case-control pairs.(Owolabi et al., 2018) Of the cases, 1,430 (68%) had ischaemic stoke, while 682 (32%) had haemorrhagic stroke. We found that 98·2% (95% CI 97·2-99·0) of adjusted population attributable risk (PAR) of stroke was associated with 11 potentially modifiable risk factors with odd ratios (ORs) and PARs (in descending order) as shown in Table 1. The odd of stroke is highest with hypertension (OR 19·36 (95% CI 12·11-30·93)) with a PAR of 90·8% (95% CI 87·9%-93·7%). The implication of our findings is that although hypertension is the cardinal target for control of stroke in Africa, lifestyle and psychosocial factors also need to be addressed through strategic public health interventions.(Owolabi et al., 2018).

B.3. Hypertension and Stroke

Hypertension is the dominant potentially modifiable risk factor for first and recurrent stroke and the situation in Nigeria and other African countries is not different.(Akpalu et al., 2022; Owolabi et al., 2018; Wahab, 2008; K. W. Wahab, N. U. Okubadejo, et al., 2008). However, available evidence suggests

that the 25 by 25 roadmap of the World Heart Federation(S. Yusuf et al., 2015), which aims to reduce premature mortality from cardiovascular diseases by 25% by the year 2025 is seriously threatened because of the high and escalating burden of hypertension in sub-Saharan Africa (SSA). SSA has the highest burden of hypertension, with a pooled prevalence of 30%; however, only 18% of these are on treatment, of which only 7% have their BP controlled.(Ataklte et al., 2015) A random effects meta-analysis estimated the overall prevalence of hypertension to be 28.9% in Nigeria with a pooled awareness rate of 17.4%.(Adeloye et al., 2015) As part of our quest for a masterstroke for stroke, we determined the frequency of hypertension in Nigeria during the International Society of Hypertension sponsored May Measurement Month in 2017, 2018, 2019 and 2021.(Ogah et al., 2019; Wahab et al., 2021; Wahab et al., 2020)As shown in Table 2, the frequency of hypertension ranged from 36.2% in 2017 to 39.2% in 2020. The data from 2021 screening exercise has been analysed and submitted for publication. The rate of control with use of antihypertensive medication marginally increased from 41.2% in 2017 to 46.8% in 2019. From the results obtained from each annual screening, we concluded that the proportion of participants with hypertension is high, and control rates are low. Indeed, the frequency has remained almost the same while the control rate has not significantly improved. Even among hypertensive stroke survivors, only about 40% were able to achieve BP<140/90 mmHg in another study.(Wahab, Kolo, et al., 2017)Therefore, concerted efforts are needed to improve awareness and treatment of hypertension in Nigeria to reduce the high rate of complications associated with uncontrolled BP, the most devastating of which is stroke.

Table 1: Potentially modifiable risk factors for stroke from the SIREN Study

Variable	OR (95% CI)	PAR (95% CI)
Hypertension	19·36 (12·11-30·93)	90·8% (87·9%-93·7%)
Dyslipidaemia	1·85 (1·44-2·38)	35·8% (25·3%-46·2%)
Regular meat consumption	1·59 (1·19-2·13)	31·1% (13·3%-48·9%)
Increased waist-to-hip ratio	1·48 (1·13-1·94)	26·5% (12·9%-40·2%)
Diabetes mellitus	2·58 (1·98-3·37)	22·1% (17·8%-26·4%)
Low green leafy vegetable consumption	2·43 (1·81-3·26)	18·2% (14·1%-22·3%)
Stress	1·89 (1·40-2·54)	11·6% (6·6%-16·7%)
Added salt at the table	2·14 (1·34-3·43)	5·3% (3·3%-7·3%)
Cardiac disease	1·65 (1·09-2·49)	4·3% (0·6%-7·9%)
Physical inactivity	2·13 (1·12-4·05)	2·4% (0·7%-4·1%)
Current cigarette smoking	4·42 (1·75-11·16)	2·3% (1·5%-3·1%)

Please Note: *Ten of these factors were associated with ischaemic stroke and six with haemorrhagic stroke occurrence.*

Table 2: Frequencies of Hypertension in Nigeria (Data from Annual Nationwide May Measurement Month Surveys)

Year	Frequency of Hypertension, %	Control Rate with use of AHM*, %	Overall Control Rate, %
2017	36.2%	41.2%	Data unavailable
2018	36.4%	43.1%	18.0%
2019	39.2%	46.8%	25.9%

*AHM, Antihypertensive medication

B.5. Secondhand (Passive) Smoking and Stroke Risk

Secondhand smoking refers to exposure to smoke from burning any form of tobacco product(s) or exposure to smoke exhalation by a person who smokes any form of tobacco product (Institute of Medicine, 2010; Services, 2014). In view of the paucity of information on the role of secondhand smoke exposure (SHSE) in stroke epidemiology among indigenous

Africans, we conducted an analysis of 2,990 case-control pairs of West Africans who had never smoked to determine the relationship of SHSE to stroke occurrence using conditional logistic regression. We found that SHSE increased the risk of stroke by 25% (OR 1.25 (95% CI 1.04-1.50; p = 0.02) and this was independent of stroke subtypes. We therefore concluded that culturally relevant primary prevention strategies targeted at SHSE might be promising in preventing stroke among Africans.(Okekunle et al., 2022).

B.6. Frequent Vegetable Consumption is Inversely Associated with Hypertension Among Indigenous Africans

We assessed the association of vegetable consumption with the odds of hypertension among indigenous Africans in a study of 16,445 participants across five African countries (Nigeria, South Africa, Kenya, Ghana and Burkina Faso) in SIREN and Africa Wits-INDEPTH partnership for Genomic studies.(Akpa et al., 2022). In that study, we harmonized data on prior vegetable consumption and hypertension occurrence. Vegetable consumption (in servings/week) was classified as 'low' (<6). 'moderate' (6-11), 'sufficient' (12-29), and 'high' (≥30). Odds ratios (ORs) and 95% confidence interval (CI) of hypertension were estimated by categories of vegetable consumption (using 'low' consumption as reference), with adjustment for sex, age in years, family history of cardiovascular diseases, education, smoking, alcohol use, physical inactivity, body mass index, diabetes mellitus and dyslipidaemia using logistic regressions. The mean age of participants was 53.0±10.7 years, and 7,552 (45.9%) were males. Hypertension was present in 7,070 (42.9%) of the participants. In addition, 6,672 (40.6%) participants had 'low' vegetable consumption, and 1,758 (10.7%) had 'high' vegetable consumption. Multivariable-adjusted OR for hypertension by distribution of vegetable consumption (using 'low' consumption as reference) were 1.03 (95% CI: 0.95, 1.12) for 'moderate' consumption; 0.80 (0.73, 0.88) for 'sufficient', and 0.81 (0.72, 0.92) for 'high' consumption, p-for-trend <0.0001. We concluded that Indigenous Africans who consumed at least

12 servings of vegetables per week were less likely to be found hypertensive.

C. Stroke Genetics

My research team has contributed (and is contributing) to the knowledge landscape in the quest for a masterstroke for stroke through the genetic studies funded by the National Institutes of Health (NIH), namely: Stroke Investigative Research and Educational Network (SIREN), Systematic Investigation of Blacks with Stroke using Genomics (SIBS-Genomics) and African Neurobiobank for Precision Stroke Medicine (Ethical Legal and Social Implications (ELSI) of Stroke Genetic Study). We reported the first ever specific association of Apolipoprotein L1 (APOL1) with small vessel disease and concluded that further research is needed to confirm these initial findings to deepen the understanding of stroke genetics in people of African ancestry with possible implications for other ancestries.(Akinyemi et al., 2018).

In a systematic review of genetic risk of spontaneous intracerebral hemorrhage (SICH), we reported that 38 genetic loci were variously associated with the risk of SICH, hematoma volume, functional outcome and mortality, out of which 8 were from Genome-wide association studies (GWAS), namely *APOE, CR1,KCNK17, 1q22, CETP, STYK1, COL4A2* and *17p12.* However, none of the studies included indigenous Africans. We therefore concluded that more genomic studies are needed to provide additional insights into the pathophysiology of SICH, and develop targeted preventive and therapeutic strategies, especially with inclusion of indigenous African populations.(Wahab et al., 2019).

Mr. Vice-Chancellor, Sir, I am happy to inform you and this august audience that our efforts are beginning to yield fruits. In a demonstration of the beauty of big data science, our team had a landmark publication in ***Nature*** a few months ago which involved hundreds of authors from all the collaborating consortia across the globe.(Mishra et al., 2022)Cross-ancestry GWAS meta-analyses of 110,182 patients who have had a stroke (five

ancestries, 33% non-European) and 1,503,898 control individuals were conducted. We found that a polygenic score integrating cross-ancestry and ancestry-specific strokeGWASs strongly predicted ischaemic stroke in populations of European, East Asian and African ancestry. Stroke genetic risk scores were found to be predictive of ischaemic stroke independent of clinical risk factors in 52,600 clinical-trial participants with cardiometabolic disease. These results provide insights to inform biology, reveal potential drug targets and derive genetic risk prediction tools across ancestries.

D. Stroke Clinical Trials

Mr. Vice-Chancellor, Sir, In collaboration with The George Institute for Global Health in Australia, I currently lead two international clinical trials in Nigeria, namely Intensive care bundle with blood pressure Reduction in Acute Cerebral haemorrhage Trial (INTERACT-3) funded by the Medical Research Council, United Kingdom and Triple therapy prevention of Recurrent Intracerebral Disease Events Trial (TRIDENT)funded by the National Health and Medical Research Council, Canberra, Australia. The collaborating sites in Nigeria are University College Hospital, Ibadan, Lagos University Teaching Hospital, Ahmadu Bello University Teaching Hospital and Jos University Teaching Hospital. (Anderson et al., 2022; Song et al., 2021) While we have finished data collection for INTERACT-3, the results are embargoed for release at the European Stroke Organization Conference scheduled to hold in Germany in May, 2023. For TRIDENT study, recruitment is ongoing, but preliminary data will be presented at the World Stroke Congress in Canada in October, 2023. We have previously reported that task-shifting blood pressure management to nurses has a potential to improve blood pressure control in a pilot feasibility study of a nurse-led intervention to improve blood pressure control after stroke in Nigeria.(Wahab, Owolabi, et al., 2017).

E. Stroke Guidelines

Evidence-based stroke management guidelines evolve from adequately powered clinical trials. Just last month, we published a systematic review and a synthesis of global stroke guidelines for the World Stroke Organization.(Mead et al., 2023)It is anticipated that with my team's involvement in some of the ongoing landmark stroke clinical trials,(Anderson et al., 2022; Song et al., 2021) we would be able to get data that can be locally applicable to Africans.

Contributions to Stroke Care and Infrastructure

1. I am grateful to the management of the University of Ilorin Teaching Hospital for providing an enabling environment for the establishment of the first Stroke Care Unit in Nigeria in 2013, pioneered by Late Prof. E.O. Sanya, my senior colleague in the Neurology Unit then. Within one year of establishment of the Unit, we were able to reduce mortality from stroke by about 50%.(K. Wahab et al., 2014) We had 9 beds in a geographically isolated area of the Male Medical Ward. We, however, moved to another location where we now have about 14 beds including 2 private rooms. Special thanks to Prof. A.W.O. Olatinwo, the immediate past Chief Medical Director of UITH under whose watch the Stroke Unit was established and to Prof. A.D. Yussuf, the incumbent Chief Medical Director for sustaining the vision and improving on the facilities. The Unit has a special place in the books of UITH administration and we have been enjoying a lot of goodwill from the current CMD. The Unit has a dedicated inpatient Physiotherapy Section which when fully furnished will provide better rehabilitative services to the increasing number of patients being admitted to the Unit. We appreciate all the efforts and like Oliver Twist, we ask for more: we need other facilities like intermittent pneumatic compression devices, more multiparameter monitors and other things. We also appeal to well-meaning Nigerians to come and support the laudable initiatives of the hospital.

2. Through TRIDENT and INTERACT-3 studies, we were able to procure facilities like a multiparameter patient monitor, an infusion pump, a syringe pump, and sphygmomanometers. Some of these have been bequeathed to the Unit after the study. A mobile ECG machine was procured for our stroke studies.
3. Through SIREN and SIBS-Genomic Studies, we were able to equip and furnish a Stroke Research Office, with employment of research staff for various research activities in the Neurology Unit.
4. Through SIREN and SIBS-Genomics Studies, we procured a -20^0C freezer with solar backed inverter to maintain the integrity of our samples.

Contributions to Manpower Development in Nigeria and Globally

1. I have co-trained hundreds of doctors who have passed through the University of Ilorin Medical School and the first set of doctors produced by Ambrose Alli University in 2006, in addition to periodic interactions with clinical students of Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso as a Visiting Consultant Neurologist. A lot of these doctors have become specialists in their chosen sub-specialties while many are practicing in Europe and North America.
2. I have co-supervised the training of 5 Fellows in core Neurology: 3 of them are currently working in Nigeria as Consultant Neurologists (Dr. A.H. Bello, Dr. W.A. Alaofin and Dr. A.K. Bakare) while 2 are working in the United Kingdom (Dr. K. Adekeye and Dr. B. Ademiluyi).
3. I have co-supervised other Senior Residents in other subspecialties like ophthalmology (Dr. Ibrahim Yusuf, Consultant Ophthalmologist) and otorhinolaryngology (Dr. Mohammed Akeem, Consultant Otorhinolaryngologist).
4. I currently supervise one Senior Resident in Neurology (Dr. Olufemi Sanyaolu) and one in Cardiology (Dr. Maruf Jimoh), in addition to my 5 supervisees for Doctoral Degree

award of the National Postgraduate Medical College of Nigeria. Unfortunately, I lost one of my supervisees, Dr. Tolulope Alabi about one year ago. May God continue to comfort his family.

5. I have served as an external examiner at either undergraduate or postgraduate levels to Ambrose Alli University, University of Benin, Ladoke Akintola University of Technology and Obafemi Awolowo University.
6. I am an assessor to a number of universities within and outside Nigeria for appointment to the Professorial cadre.

Community Service

Mr. Vice-Chancellor, Sir, some of my major community services include:

A. University of Ilorin Assignments:

1. Director, Centre for Research Development and In-house Training (2020 to 2023).
2. Coordinator, University of Ilorin Stem Cell Research Centre (2014-2017).
3. Sub-Dean, Students Affairs Unit, College of Health Sciences (2014-2016).
4. Research Manager, Faculty of Clinical Sciences (2017-2020).

B. University of Ilorin Teaching Hospital Assignments:

1. Chairman, Independent Assessment Panel on Open Heart Surgery (June 2015).
2. Co-Chairman, Religious Harmony Committee (April 2015).
3. Member, Ethical Review Committee (2012-2016).
4. Coordinator, Postgraduate Residency Training, Department of Medicine (2011-2014).
5. Chairman, Ad-hoc Committee on development of management protocols for common emergencies at the University of Ilorin Teaching Hospital (2013).
6. Chief Resident, Department of Medicine, University of Ilorin Teaching Hospital (2004-2005).

C. National Assignments:

1. Assistant Secretary, Faculty of Internal Medicine, National Postgraduate Medical College of Nigeria (2020 to date).
2. Secretary-General, Nigerian Hypertension Society (2017 to date).
3. Editor, Journal of Clinical and Applied Neurosciences, the official journal publication of the Nigerian Society of Neurological Sciences (2018 to date).
4. Examiner at Part I and Part II Levels, Faculty of Internal Medicine, National Postgraduate Medical College of Nigeria (2013-date).
5. Member of Accreditation Panels to various training institutions in Nigeria on behalf of the National Postgraduate Medical College of Nigeria (2012 to date).

D. International Assignments:

1. Member, Guidelines Committee, World Stroke Organisation (2021 to date).
2. Guest Editor, Journal of the American Heart Association (2022 to date).
3. Country Manager for Nigeria, Annual May Measurement Month supported by the International Society of Hypertension (2018 to date).
4. Commissioner representing Nigeria in the World Health Organisation/ Lancet Neurology Commission on Stroke in Low- and Middle-income Countries (2017 to date).

E. Other Community Services:

1. Chairman, Board of Directors of Dome Capital Resources Investment Limited (2016 to date).
2. I have granted several interviews in the print and electronic media to improve awareness of risk factors and prevent stroke.
3. President, Al-Mubarak Multipurpose Cooperative Society (the first registered interest-free Cooperative Society in Kwara State) (2012-2014).
4. President, Islamic Development Bank Graduates' Association (2012-2014).

Conclusions

Stroke is fast becoming an epidemic in Nigeria. The high and escalating burden of the disease is driven by high prevalence of undiagnosed, poorly controlled hypertension and other modifiable risk factors, besides non-modifiable risk factors. Consumption of at least 12 servings of vegetables per week has been found to be protective against hypertension in our cohort. Unfortunately, awareness of stroke warning signs and risk factors is poor, even among those at high risk. Mortality from stroke in Nigeria is high and is influenced by presence of complications, the most common of which is aspiration pneumonia. Also, facilities are lacking in many tertiary hospitals for adequate management of patients with stroke. Although thrombolysis and mechanical thrombectomy are established evidence-based treatment modalities for acute ischaemic stroke, their application in Nigeria is virtually non-existent because of lack of infrastructural backbone for deployment.

Recommendations

Unless conscious efforts are urgently made, the country's public health could be overstretched, with devastating social and economic consequences. I therefore make the following recommendations to reduce the currently high and escalating burden of stroke in Nigeria:

A. Actionable Recommendations at Individual Level:

1. Individuals should check their blood pressures regularly.
2. For those who are hypertensive, please note that hypertension is the dominant modifiable risk factor for stroke. Fortunately, with control of hypertension, the risk of stroke can be significantly reduced. Therefore, you should use your antihypertensive medications religiously. Additionally, in order to keep your blood pressure normal, eat healthy diet rich in fruits and vegetables, reduce salt intake, exercise regularly and maintain a healthy weight.

3. For the sake of emphasis, if you are hypertensive, please take your drug(s) regularly.
4. Healthy lifestyles including regular aerobic exercises, quitting smoking and alcohol consumption, reduction of red meat consumption and salt intake and regular consumption of fruits and vegetables in adequate quantities are encouraged.
5. Even if you are not a smoker, it is good that you avoid exposing yourself to the person who is smoking, because your risk of developing stroke in increased by about 25% through such exposure.
6. Individuals with a family history of stroke need to take extra care to live a healthy lifestyle and periodically check their blood pressure and other modifiable risk factors so that if present, these can be controlled to prevent stroke.
7. If you suspect that someone has suffered from stroke, quickly assess him or her so that necessary steps to seek immediate medical attention will be initiated. The **FAST** acronyms should be followed, i.e.:

   Face - Check the face. Has the mouth drooped?

   Arms - Can the person lift both arms?

   Speech - Is the speech slurred? Does the person understand you?

   Time - If you notice any abnormality in any of the above, please act FAST. Call local emergency medical services or get to the nearest hospital immediately, because time is critical! Every minute of delay may worsen the outcome.

B. Actionable Recommendations at Population Level:

1. Massive health education on stroke risk factors, warning signs and prevention is urgently needed. This could be done through the mass media.
2. Concerted efforts to screen the populace for stroke risk factors are needed.

C. Actionable Recommendations at System Level:

1. Universal health coverage through adequate health insurance to improve access to potent medications to treat hypertension and other treatable cardiovascular risk factors to target.
2. Government should adequately equip our tertiary hospitals so that they will be able to deliver state-of-the-art healthcare services to those who may require stroke care.
3. Existing Stroke Units in Nigeria should be upgraded to be able to offer thrombolytic and mechanical thrombectomy which have been shown to significantly improve outcome of ischaemic stroke.
4. Aggressive surveillance and monitoring of every stroke patient admitted to the hospital to prevent development of complications (especially aspiration pneumonia), which have been shown to worsen outcome.
5. Continuing Medical Education (CME) for primary care practitioners and other healthcare workers to educate on stroke care and the need to check swallowing reflex before institution of oral feedings to reduce the risk of aspiration pneumonia which increases mortality.
6. Well-to-do individuals in the country should assist with the provision of facilities to take care of stroke patients. This could be through donations or public-private partnership.
7. Relevant government agencies could assist with establishment of Centres of Excellence in Stroke Care across the six geopolitical zones of the country. With our demonstrated capacity in the face of limited and dwindling resources, University of Ilorin and University of Ilorin Teaching Hospital are well positioned to be one of such Centres. This will develop needed capacity in terms of regular and short courses for all categories of healthcare workers involved in the stroke care pathway in the country.

8. Improvement in incentives for training of neurologists to attract our teeming graduates who would otherwise emigrate out of the country because of poor motivation and lack of job satisfaction.
9. *Japa* Syndrome has further depleted the inadequate manpower in the nation's healthcare system, and this is worse with neurological care. I am currently the only neurologist under the employment of the University of Ilorin. Government should remove all bureaucratic bottlenecks which have made it difficult for universities to employ. If not for the support the Department of Medicine receives from some of our specialists who are working as full hospital consultants, it would have been impossible to continue the training of our medical students. Therefore, something needs to be done urgently.
10. Improvement of research funding at the university and national levels to improve research outputs and potentially provide contextually and culturally acceptable interventions for stroke prevention and treatment in the country.

Acknowledgements

I will always be grateful to Almighty Allah: *Al-Wahaab* (The Bestower), *Al-Waasi*' (The All-encompassing) for His unending favours, and which of them can I deny? In *Hadith 19* of *an-Nawawi* collection it was reported that Abu Abbas Abdullah bin Abbas said: "*One day I was behind the Prophet (PBUH) [riding on the same mount] and he said, "O young man, I shall teach you some words [of advice]: Be mindful of Allah and Allah will protect you. Be mindful of Allah and you will find Him in front of you. If you ask, then ask Allah [alone]; and if you seek help, then seek help from Allah [alone]. And know that if the nation were to gather to benefit you with anything, they would not benefit you except with what Allah had already prescribed for you. And if they were to gather to harm you with anything, they would not*

harm you except with what Allah had already prescribed against you. The pens have been lifted and the pages have dried." Mr. Vice-Chancellor, Sir, from my humble beginning as an inconsequential child of a junior staff of Oyo State Ministry of Works to getting to the zenith of my profession, I fully understand that indeed *"....the pens have been lifted and the pages have dried*"! I recognise all the people that Allah has used in my academic sojourn and in my quest for a masterstroke for stroke.

To my late parents: Mr. Wahab Ajadi Gbadamosi (of the great Gbadamosi Olaifa dynasty at Oopo Yeosa in the heart of Ibadan) and Mrs. Sariyu Alari Wahab nee Bello (of the great Bello dynasty at Ile Akinigain, Oke Foko in the heart of Ibadan), I will forever be grateful. You toiled day and night to give me and my siblings the best training any parent could give their children at the time despite all odds. Thank you for teaching us to patiently persevere, and to be hardworking, focused, humble, contented, morally upright and God-fearing. These are great virtues that have distinguished us everywhere we go. At the end of each academic term when we would take our report cards home in those days, my late dad would always say to us: "You are doing well. Remember, I want to have a Professor from my lineage". Baba, your words were all the motivation I needed to propel me to continue my sojourn into the unknown future. I trudged on with focus and determination to make you happy. Today, that future is a reality. How I wished that you and Mama were sitting down in the audience today. *Alhamdulillah*!

I especially appreciate my siblings and their families: Issa Alarape (Late), Ishaq Gbolagade, and Saudat Iyabode for the comradeship and love we have been sharing since childhood. Brother Issa was the one who took me for registration at St. Peter's Catholic School, Oke-Are in 1976 for my primary school education while my immediate elder brother, Ishaq Gbolagade was the one who followed me to check my placement in

Secondary School in 1982. He also followed me to the then Oyo State College of Arts and Science (OSCAS), Ile-Ife in 1988 and gave me nuggets on how to survive hostel life. Thank you for always being there.

I also specially appreciate Mr. Abdulkareem Bello (Late), Alhaji Muili Bello, Alhaja Fatimah nee Bello, who are siblings of my late mother for standing as great pillars of support to me and all of us their children. May Allah preserve you in good health and sound mind to continue to reap the fruits of your hard labour. I thank the Oladokuns: Laide, Muideen, Iyabo and Omolara for the love we continue to share. I recognize my cousins: Abduljeleel, Abdulrasheed, Sulaiman, Rahmatallah, Kunle, Akeem, Hammed, Halimah, Mustapha, Sulaiman, Sheriff, Abideen, Shadiya, Fadeke, Kemi, and their spouses.

To my late in-laws: Late Sheikh Habeebullah Mahmoud of Okepopo Central Mosque, Lagos Island who shared Ajashe-Ipo and Ilorin heritage and Alhaja Tahjat Abegbe Mahmood nee Ashogbon from Epe, thank you for believing in me and giving me your daughter to marry despite being separated by distance. To my principal in-laws in Ilorin, Prof. Abdullateef Oladimeji and Alhaja Bilqees Oladimeji, I cannot thank you enough for the belief you have in me and for the love shown to me, my wife and my children. Thank you so much for everything. Thank you for standing by us when the goings were tough, especially when our rented apartment got burnt while I was studying in the United Kingdom on Commonwealth Scholarship. I also thank my other in-laws Alhaji and Alhaja R. Babajide, Alhaji and Alhaja H. Fagbenro, Alhaji and Alhaja A. Badmus, Alhaji and Alhaja A. Buhari, Alhaji and Mrs. A. Mahmoud, Alhaji Muslim Mahmoud and the rest of the Mahmoud family. You have been more than in-laws to me. May Allah reward you abundantly and grant you the best of both worlds. Also deserving of recognition are Rukayat, Musharafah, Lateefat, Hameedah (a.k.a "my communicator"), and their families and our other beloved

children: Sofiyah, Mutiat, Fareedah, Misturah, Yesirat, Mubinat, Habeeb, Imran, Maryam, Qudus, Zainab, Abdullateef (a.k.a. Baba Pampers) and a host of others.

According to Sir Isaac Newton, "If I have seen further than others, it is by standing on the shoulders of giants"! I therefore recognize my teachers and mentors right from primary school. My school Principal at Apata Community Grammar School, Mama Olabisi Are and her husband, Late Dr. Lekan Are (an Ibadan High Chief) were strong pillars of support to all of my colleagues in secondary school then. They used to motivate us by charging us to live by one of the stanzas of our school anthem:*".... Sprouting in a humble way, growing from strength to strength!*" Today, we are very proud of you and your legacies. Thank you so much for impacting our lives positively. My Biology Teacher, Mrs. Gloria Ohiaeri was a great motivator who gave me all I needed to excel, thank you for giving me a very strong foundation. Without your tutelage, it would have been impossible to pass Biology as a subject, let alone study Medicine and then sub-specialise in Neurology. I likewise recognize my other teachers: Alhaji M. Akinyele (Physics and Chemistry), Mr. O. Olanrewaju (Chemistry), Mr. A. Adeseye (Mathematics) and Mr. John Ayoola (Economics). I appreciate my language teachers: Mrs. Olayinka (English), Mrs. Oworu (English), Mrs. Fashina (Yoruba) and Mr. Sho-Silva (French). I recall that I ended up offering Yoruba and French languages as a compromise at a point in Form 3 before moving to Pure Science Class in Form 4 because both teachers (Mrs. Fashinaand Mr. Sho-Silva) wanted me to offer their subject, and I couldn't say no. Thank you all for believing in me.

My teachers, mentors and senior colleagues at the University of Ilorin and the University of Ilorin Medical School, thank you so much for the tutelage that has made me, and indeed all your students to stand out of the crowd everywhere we go. Late Emeritus Prof. M.A. Araoye, Prof. B.J. Bojuwoye (a great role

model), Prof. Y.M. Fakunle, Prof. A.B.O. Omotoso (a great teacher and mentor under whom I served as Chief Resident and who is currently the President of Nigerian Hypertension Society to which I am the Secretary-General), Prof. P.O. Oluboyo (I was the leader of his group in 600 level), Sir. Dr. A. Aderibigbe (a great Nephrologist), Prof. E.O. Okoro, Prof. O.G. Opadijo (a great mentor), Prof. A. Chijioke, Prof. A.K. Salami, Prof. I.A. Katibi, Late Prof. E.O. Sanya (my senior colleague- may God continue to be with your family), and Dr. K. Olarinoye, I say thank you very much. The same goes to my teachers and mentors like Prof. Abdulwahab B.R. Johnson and Family, Prof. Bashir Okesina, Prof. Albert Anjorin, Prof. D.B. Parakoyi, Prof. A.G. Abdulrahman, Prof. Omotosho Musa, Prof. T.M. Akande, Prof. Olugbenga Mokuolu, Prof. A. A. G. Jimoh among others. I also thank my other colleagues in the Department of Medicine: Prof. Philip Kolo, Prof. Abdulfatai Olokoba, Prof. Ademola Fawibe, Dr. Timothy Olanrewaju, Dr. Ayo Ogunmodede, Dr. Abdullahi Adamu, Dr. Mathew Bojuwoye, Dr. Toyosi Ilesanmi, Dr. Nasir Sanni, Dr. Olalekan Agede, Dr. M. Aliyu, and Dr. Dapo Oyedepo. Special recognition goes to my colleague, brother and mentee in the Neurology Unit, Dr. Hamzat Abiodun Bello for being a humble, great and selfless team player and to Dr. Stephen Ayedun for being a wonderful colleague. I also appreciate Dr. Wemimo Alaofin (immediate past CMAC of General Hospital, Ilorin), another humble, great and selfless protégé who has just returned to UITH after a long wait.

I thank my trainer, mentor and supervisor, Prof. Mustapha Abudu Danesi for his inspiration and tutelage. I also appreciate my other teachers in the Neurology Unit of the Lagos University Teaching Hospital: Prof. Frank Ojini and Prof. Njide Okubadejo for the training you gave me. My classmate, Dr. Omolara Ojo (LUTH) and my colleague, Dr. Osigwe Agabi (LUTH), thank you so much. Other mentors worthy of appreciating are Prof. Adesola Ogunniyi and Prof. Abayomi Ogun, among other

fantastic leaders in neurology that I have had course to interact with. I also appreciate my MSc. supervisor at the University College London Institute of Neurology, Prof. David Werring and my MPH supervisor, Prof. Bode Kayode.

My institutional collaborators in Nigeria are specially recognized: Prof. Mayowa Owolabi, Prof. Rufus Akinyemi (UCH, Ibadan), Prof. Njide Okubadejo, Dr. Omolara Ojo, Dr. Osigwe Agabi (LUTH, Lagos), Prof. Reginald Obiako & Prof. Sani Abubakar (ABUTH, Zaria) and Dr. Godwin Osaigbovo (JUTH, Jos), among others that are too numerous to mention. I also recognize my collaborators outside Nigeria: Prof. Fred Sarfo (Ghana), Dr. Albert Akpalu (Ghana), Prof. Bruce Ovbiagele (USA), Prof. Craig Anderson (Australia), Dr. Lily Song (China), Dr. Carlos Abanto (Peru), Dr. Cheryl Carcel (Australia), Dr. Saima Hilal (Singapore), Emerita Prof. Carolyn Jenkins (USA), Prof. Gbenga Ogedegbe (USA), Prof. Kola Okuyemi (USA), Prof. Bamidele Tayo (USA), among others.

I thank all members of my research team and collaborators in Ilorin: Dr. H.A. Bello, Prof. P.M. Kolo, Dr. Ayo Ogunmodede, Prof. Olalekan Oyinloye, Dr. M.M.B. Uthman, Mr. Sunday Adeniyi (Mr. Fix-it), Mr. Lanre Omotosho, Mr. Abdulraheem Jimoh, Pharmacist Rahman Bola Raheem, Mrs. Comfort Arikembi, Miss. Qudrah Yusuf, Dr. Kifayah Jidda, Dr. Abdulrasheed Tijani, Dr. Dooshima Alicia Belabo, Dr. M. Ijaiya, and a host of ad hoc research staff who have been involved in our various research activities. I also thank the members of SIREN, SIBS-Genomics and ELSI studies Community Advisory Board: Mr. S. Toye, Alhaji A.E. Sanni, Dr. Lukman Olatubosun (Chief Imam, UITH), Reverend Dr. Samuel Olugbenga Obaniyi (Senior Pastor at Foursquare Gospel Church, Fate), Hajia F. Adesina (Matron-in-Charge at Model Health Centre, OkeOse), Mrs. Akanbi (Legal Unit, UITH), and Mr. Kamaldeen (UITH).

I thank the authorities of the University of Ilorin Teaching Hospital ably led by the Chief Medical Director, Prof. Abdullahi

DaSilva Yussuf, Dr. L.O. Odeigah (Chairman MAC), Mr. Agbana (Director of Administration), Prof. S.A. Biliaminu (Deputy CMAC, Clinicals) and Dr. Bola Olafimihan (Deputy CMAC, Training). I also appreciate AlhajaYussuf (Head of Procurement), Mr. Shehu Suberu (Head of Personnel), Mrs. Adebayo (Head of Accounts) and others too numerous to mention for all the supports over the years.

My quest for a masterstroke for stroke would have been impossible without a committed team of workers at the University of Ilorin Teaching Hospital Stroke Unit. I recognize Mrs. Ologunde (Pioneer Head Nurse of Stroke Unit, UITH), Mrs. Adeseye, Mrs. Onibiyo, Mrs. Tejumola, Mrs. Edward, and other fantastic, selfless and highly professional nurses we have been working together to provide succor to our patients. I also appreciate the physiotherapists: Dr. Saliu Akinwale (HOD, Physiotherapy), Dr. Abolarin, Late Mr. Alejolowo, and others who have been working tirelessly to provide the best service within the limit of available human and material resources. I specially recognize Prof. Timothy Odebode, the Head of Neurosurgery Unit, Dr. Adeleke and Dr. Adegboye for the humongous support we have been getting from them. My current Senior Registrar, Dr. Femi Sanyaolu is highly appreciated, and I wish him success in his Part II Fellowship examinations in May this year. I also remember Late Dr. Tolu Alabi who would have taken the same examination with him, but God knows why he took him away. I also appreciate all past and present resident doctors, interns and students who have passed through my tutelage.

Similarly, I especially appreciate Prof. I.O. Oloyede who made it possible for me to be employed in 2007 and gave me all necessary support when I won my first international research grant which was a token of $6,700.00. It was during his tenure that I also won the Commonwealth Scholarship that took me to the United Kingdom for further studies. It was also during his

tenure that I was promoted to Senior Lecturer. I appreciate Prof. Sulyman Alege Kuranga who was the Chief Medical Director who appointed me as Honourary Consultant Neurologist in 2007. I specially thank Sheikh Dr. Yusuf Kolawole Jumuah (Baba Y.K. Jumuah) for taking me as one of his children and for all the supports I got when I was seeking employment with the University of Ilorin and for all the love my family and I still receive up till this moment. It is instructive to note that Baba Y.K. Jumuah was part of the officiating Imams during my wedding on 3rdJune, 2000. I thank Prof. Abdulganiyu Ambali during whose tenure I was promoted to Reader and for providing me the opportunity to serve under him as the Coordinator of Unilorin Stem Cell Research Centre and Sub-Dean Student Affairs in the College of Health Sciences, among other Committee responsibilities. I also thank the immediate past Vice-Chancellor, Prof. Sulyman Age Abdulkareem during whose tenure my promotion to the rank of full Professor was approved and for appointing me as the Director of Centre for Research Development and In-house Training, despite not working with me prior to the appointment.

My special thanks go to the current Vice-Chancellor, Prof. Wahab Olasupo Egbewole, *SAN* for the opportunity to complete my tenure as Director of CREDIT, for all other responsibilities given to me and for approving this inaugural lecture. I thank all the other Principal Officers of the University: Prof. Olubunmi Omotesho (DVC-Academics), Prof. Suleiman Ambali (DVC-Management Services), Dr. Fola Olowoleni (Registrar), Dr. Kamaldeen Omopupa (University Librarian) and Mr. Hakeem Shonde (Bursar) and all those I previously worked with. I also thank Prof. Yasir A. Quadri for giving me all necessary support each time I knocked on his door. I say a big thank you all current and past Provosts of the College of Health Sciences and all current and past Deans of the various Faculties in the College. I am grateful to the Chairman of the Library and Publications

Committee, my dear brother, Prof. AbdulRasheed Adeoye for taking his time to correct the manuscript of this lecture. I also appreciate all members of staff of the Directorate of Academic Support Services and CREDIT: Prof. Y.O. Imam (Research Manager, Humanities Cluster), Dr. Christiana Abikoye (Deputy Director, Research), Dr. Hussain Kehinde Okoro (Deputy Director, Training), Mrs. NafisatAriyo, Mr. Lukman Kola Adegboyega, Mrs. Roseline Yusuf, Mr. Y. Amuda, Mr. Peter Adewoye and Mrs. Jimoh. All Faculty Research Managers that I have worked with, I appreciate you.

I thank my friends and colleagues, some of whom we have been together from childhood: Pharm. Razaq Adeyanju, Tunde Osinjolu, Pharm. Obinna Esiaba, Kazeem Oladejo (Bosnia-Herzegovina), Femi Abe (London, UK), Febi Abiona (Canada), Dr. Abiola Oshodi (Canada), and all members of Apata Community Grammar School Old Students' Association (ACGSOSA), especially the 1987 Set, Prof. Zaid Aderolu (Unilag) of ACGS 1986 Set, Dr. O.O.K. Ibrahim, Prof. A.B. Olokoba, Dr. A.O. Ayinla (Permanent Secretary, Kwara State Ministry of Health), Dr. A.O. Usman, Prof. Kunle Olawepo, and all members of ILUMSA 1997 Set, Dr. Bashir Oyeyemi, Prof. M.A.N. Adeboye, Dr. Nasir Abdulrasheed, and others too numerous to mention. To our spiritual father, Sheikh Sulaiman Adesina Ajani, Chief Imam of Mubo Street and the entire family, I say *jazakumullahu khaeran*! I also appreciate members of Dome Capital Resources Investment Limited, Al-Mubarak Cooperative Society, Islamic Medical Association of Nigeria (IMAN), leadership and members of the Nigerian Society of Neurological Sciences, leadership and members of the Nigerian Hypertension Society, Nigerian Stroke Organisation, African Stroke Organisation, African Academy of Neurology, Nigerian Medical Association and Medical and Dental Consultants' Association of Nigeria. Many thanks to the Islamic Development Bank, Commonwealth Scholarship Commission in the UK,

International Brain Research Organisation, World Federation of Neurology, American Academy of Neurology, World Heart Federation, International Association for the Study of Pains, among others for the scholarships and fellowships they granted me at different times for training and skill acquisition in my quest for a masterstroke for stroke.

I thank all members of non-teaching staff of Department of Medicine at the University of Ilorin and University of Ilorin Teaching Hospital. To all friends and friendly faces in the audience, I say thank you so much for making this event a great success.

Finally, I want to specially appreciate my children: Muhammad Kolawole, Mahfouz Olayinka and Mubarak Oladipupo for being very wonderful and for making the family proud. All of them are students of the "Better By Far" university. I pray that you are greater than we your parents and that Allah makes you good role models. To my jewel of inestimable worth, Mrs. Karimat Omolara Wahab, a submissive wife with a rare combination of 4Bs: beauty, brain, bravery and belief, I cannot thank you enough. You have been a strong pillar of support in my quest for a masterstroke for stroke. You have been a lover, a confidant, a mother, and of course a hyper efficient "one and only Head Girl in an All-Boys' Hostel"!You have stood firmly by me through thick and thin. May Allah preserve us in good health and sound mind so that we would be able to enjoy the fruits of our sacrifices.

Mr. Vice-Chancellor, Sir, distinguished members of the audience, we aren't done yet! The quest for a masterstroke for stroke continues……

Thank you for your attention and I wish you safe journey back to your various destinations.

References

Adebayo, P. B., Bakare, A., Bello, M. M., Olaewe, O. D., &**Wahab, K. W.** (2017). Dyke-Davidoff-Masson syndrome in a Nigerian. *Epilepsy Behav Case Rep*,7, 10-12. https://doi.org/10.1016/j.ebcr.2016.09.003

Adekeye, K., **Wahab, K.**, & Sanya, E. (2012). A retrospective review of adult tetanus and its outcome at the University of Ilorin Teaching Hospital, Ilorin, Nigeria. *Savannah Journal of Medical Research and Practice*,1(2), 48-49.

Adeloye, D., Basquill, C., Aderemi, A. V., Thompson, J. Y., & Obi, F. A. (2015). An estimate of the prevalence of hypertension in Nigeria: a systematic review and meta-analysis. *J Hypertens*,33(2), 230-242. https://doi.org/10.1097/hjh.0000000000000413

Aho, K., Harmsen, P., Hatano, S., Marquardsen, J., Smirnov, V. E., & Strasser, T. (1980). Cerebrovascular disease in the community: results of a WHO collaborative study. *Bull World Health Organ*,58(1), 113-130.

Akinyemi, R., Arnett, D. K., Tiwari, H. K., Ovbiagele, B., Sarfo, F., Srinivasasainagendra, V., Irvin, M. R., Adeoye, A., Perry, R. T., Akpalu, A., Jenkins, C., Owolabi, L., Obiako, R., **Wahab, K.**, Sanya, E., Komolafe, M., Fawale, M., Adebayo, P., Osaigbovo, G., . . . Owolabi, M. (2017). Interleukin-6 (IL-6) rs1800796 and cyclin dependent kinase inhibitor (CDKN2A/CDKN2B) rs2383207 are associated with ischemic stroke in indigenous West African Men. *J Neurol Sci*,379, 229-235. https://doi.org/10.1016/j.jns.2017.05.046

Akinyemi, R., Tiwari, H. K., Arnett, D. K., Ovbiagele, B., Irvin, M. R., **Wahab, K.**, Sarfo, F., Srinivasasainagendra, V., Adeoye, A., Perry, R. T., Akpalu, A., Jenkins, C., Arulogun, O., Gebregziabher, M., Owolabi, L., Obiako, R., Sanya, E., Komolafe, M., Fawale, M., . . . Owolabi, M. (2018). APOL1, CDKN2A/CDKN2B, and HDAC9 polymorphisms and small vessel ischemic stroke. *Acta*

Neurol Scand,137(1), 133-141. https://doi.org/10.1111/ane.12847

Akpa, O. M., Okekunle, A. P., Asowata, O. J., Chikowore, T., Mohamed, S. F., Sarfo, F., Akinyemi, R., Akpalu, A., **Wahab, K.**, Obiako, R., Komolafe, M., Owolabi, L., Osaigbovo, G. O., Ogbole, G., Tiwari, H. K., Akinyemi, J., Fakunle, A., Uvere, E., Adeoye, A. M., . . . Owolabi, M. (2022). Frequent vegetable consumption is inversely associated with hypertension among indigenous Africans. *Eur J Prev Cardiol*,29(18), 2359-2371. https://doi.org/10.1093/eurjpc/zwac208

Akpalu, A., Sarfo, F. S., Akinyemi, J., **Wahab, K.**, Komolafe, M., Obiako, R., Owolabi, L., Osaigbovo, G. O., Ogbole, G., Adebayo, P., Onoja, A., Fakunle, A., Balogun, O., Fawale, B., Ogah, O., Akinyemi, R., Owolabi, M., & Ovbiagele, B. (2022). Frequency & factors associated with recurrent stroke in Ghana and Nigeria. *J Neurol Sci*, 439, 120303. https://doi.org/10.1016/j.jns.2022.120303

Anderson, C. S., Rodgers, A., de Silva, H. A., Martins, S. O., Klijn, C. J., Senanayake, B., Freed, R., Billot, L., Arima, H., Thang, N. H., Zaidi, W. A. W., Kherkheulidze, T., **Wahab, K.**, Fisher, U., Lee, T. H., Chen, C., Pontes-Neto, O., Robinson, T., Wang, J., . . . Chalmers, J. (2022). Triple Therapy Prevention of Recurrent Intracerebral Disease Events Trial: Rationale, design and progress. *Int J Stroke*,17(10), 1156-1162. https://doi.org/10.1177/17474930211068671

Ashley, C., & Berry, S. D. (2021). The Association Between Race and Stroke Prevalence in a Patient Cohort in Mississippi. *Perspect Health Inf Manag*,18(Winter), 1i.

Ataklte, F., Erqou, S., Kaptoge, S., Taye, B., Echouffo-Tcheugui, J. B., & Kengne, A. P. (2015). Burden of undiagnosed hypertension in sub-saharan Africa: a systematic review and meta-analysis. *Hypertension*, 65(2), 291-298. https://doi.org/10.1161/hypertensionaha.114.04394

Ayanniyi, R., Biliaminu, S., **Wahab, K**., Sanya, E., Ighodalo, M., Oyeleke, S., & Ologe, M. (2016). Electrolyte Profile of Epileptic Patients on Carbamazepine Monotherapy. *Trop J Hlth Sc*, 23(1), 8-11.

Bakare, A. K., **Wahab, K.**, Ilesanmi, O., & Sanya, E. (2018a). Intraparenchymal Intracerebral Hemorrhage Complicating Venomous Snakebite in Nigeria: A Case Report (P6.235). *Neurology*,90(15 Supplement), P6.235.

Bakare, A. K., **Wahab, K.**, Ilesanmi, O., & Sanya, E. (2018b). Intraparenchymal Intracerebral Hemorrhage Complicating Venomous Snakebite in Nigeria: A Case Report (P6. 235). In: Wolters Kluwer Health, Inc. on behalf of the American Academy of Neurology.

Bello, A., **Wahab, K.**, & Sanya, E. (2019). Prevalence and Factors Associated with Diabetic Peripheral Neuropathy in Ilorin, North-Central Nigeria. (P3.9-074). *Neurology*,92(15 Supplement), P3.9-074.

Birabi, B. N., Oke, K. I., Dienye, P. O., & Okafor, U. C. (2012). Cost burden of post stroke condition in Nigeria: a pilot study. *Glob J Health Sci*,4(6), 17-22. https://doi.org/10.5539/gjhs.v4n6p17

Brown, R. D., Whisnant, J. P., Sicks, J. D., O'Fallon, W. M., & Wiebers, D. O. (1996). Stroke incidence, prevalence, and survival: secular trends in Rochester, Minnesota, through 1989. *Stroke*,27(3), 373-380.

Duan, H., Yun, H. J., Rajah, G. B., Che, F., Wang, Y., Liu, J., Tong, Y., Cheng, Z., Cai, L., Geng, X., & Ding, Y. (2023). Large vessel occlusion stroke outcomes in diabetic vs. non-diabetic patients with acute stress hyperglycemia. *Front Neurosci*,17, 1073924. https://doi.org/10.3389/fnins.2023.1073924

Flossmann, E., Schulz, U. G., & Rothwell, P. M. (2004). Systematic review of methods and results of studies of the genetic epidemiology of ischemic stroke. *Stroke*,35(1), 212-227. https://doi.org/10.1161/01.Str.0000107187.84390.Aa

Goldstein, L. B., Bushnell, C. D., Adams, R. J., Appel, L. J., Braun, L. T., Chaturvedi, S., Creager, M. A., Culebras, A., Eckel, R. H., Hart, R. G., Hinchey, J. A., Howard, V. J., Jauch, E. C., Levine, S. R., Meschia, J. F., Moore, W. S., Nixon, J. V., & Pearson, T. A. (2011). Guidelines for the primary prevention of stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*,42(2), 517-584. https://doi.org/10.1161/STR.0b013e3181fcb238

Gorelick, P. B. (2019). The global burden of stroke: persistent and disabling. *Lancet Neurol*,18(5), 417-418. https://doi.org/10.1016/s1474-4422(19)30030-4

Guinhouya, K. M., Tall, A., Kombate, D., Kumako, V., Apetse, K., Belo, M., Balogou, A. K., & Grunitzky, K. E. (2010). [Cost of stroke in Lome (Togo).]. *Sante*. https://doi.org/10.1684/san.2010.0192 (Cout des accidents vasculaires cerebraux a Lome (Togo).)

Hornby, A. S. (1995). *Oxford advanced learner's dictionary of current English / [by] A.S. Hornby ; editor Jonathan Crowther*. Fifth edition. Oxford, England : Oxford University Press, 1995. https://search.library.wisc.edu/catalog/999766027502121

Ibekwe, T. S., Okokhere, P. O., Asogun, D., Blackie, F. F., Nwegbu, M. M., **Wahab, K. W.**, Omilabu, S. A., & Akpede, G. O. (2011). Early-onset sensorineural hearing loss in Lassa fever. *Eur Arch Otorhinolaryngol*,268(2), 197-201. https://doi.org/10.1007/s00405-010-1370-4

Institute of Medicine. (2010). *Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence*. The National Academies Press. https://doi.org/doi:10.17226/12649

Isiavwe, A., **Wahab, K.**, Okubadejo, N., Fasanmade, O., & Ohwovoriole, A. (2005). Lipid profile of patients with ischaemic stroke.*Endocrine and Metabolism Society of Nigeria*

Kitagawa, K. (2022). Blood pressure management for secondary stroke prevention. *Hypertens Res*,45(6), 936-943. https://doi.org/10.1038/s41440-022-00908-1

Lackland, D. T., Egan, B. M., & Jones, P. J. (1999). Impact of nativity and race on "Stroke Belt" mortality. *Hypertension*,34(1), 57-62. https://doi.org/10.1161/01.hyp.34.1.57

Langhorne, P. (2021). The Stroke Unit Story: Where Have We Been and Where Are We Going? *Cerebrovasc Dis*,50(6), 636-643. https://doi.org/10.1159/000518934

Lewington, S., Clarke, R., Qizilbash, N., Peto, R., & Collins, R. (2002). Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet*,360(9349), 1903-1913. https://doi.org/10.1016/s0140-6736(02)11911-8

McCowen, K. C., Malhotra, A., & Bistrian, B. R. (2001). Stress-induced hyperglycemia. *Crit Care Clin*,17(1), 107-124. https://doi.org/10.1016/s0749-0704(05)70154-8

Mead, G. E., Sposato, L. A., Silva, G. S., Yperzeele, L., Wu, S., Kutlubaev, M. A., Cheyne, J., **Wahab, K.**, Urrutia, V. C., Sharma, V. K., Sylaja, P. N., Hill, K., Steiner, T., Liebeskind, D. S., & Rabinstein, A. A. (2023). Systematic review and synthesis of global stroke guidelines for the World Stroke Organization. *Int J Stroke*, 17474930231156753. https://doi.org/10.1177/17474930231156753

Meschia, J. F., Bushnell, C., Boden-Albala, B., Braun, L. T., Bravata, D. M., Chaturvedi, S., Creager, M. A., Eckel, R. H., Elkind, M. S., Fornage, M., Goldstein, L. B., Greenberg, S. M., Horvath, S. E., Iadecola, C., Jauch, E. C., Moore, W. S., & Wilson, J. A. (2014). Guidelines for the primary prevention of stroke: a statement for healthcare professionals from the American Heart Association/American Stroke Association.

Stroke,45(12), 3754-3832. https://doi.org/10.1161/str.0000000000000046

Mishra, A., Malik, R., Hachiya, T., Jürgenson, T., Namba, S., Posner, D. C., Kamanu, F. K., Koido, M., Le Grand, Q., Shi, M., He, Y., Georgakis, M. K., Caro, I., Krebs, K., Liaw, Y. C., Vaura, F. C., Lin, K., Winsvold, B. S., Srinivasasainagendra, V., . . . Debette, S. (2022). Stroke genetics informs drug discovery and risk prediction across ancestries. *Nature*,611(7934), 115-123. https://doi.org/10.1038/s41586-022-05165-3

Ogah, O. S., Arije, A., Xin, X., Beaney, T., Adebiyi, A., Sani, M. U., Ojji, D. B., Sogade, T. T., Isezuo, S., Chukwuonye, II, Akinwusi, P., Mbakwem, A. C., Daniel, F. A., Omotoso, A. B., & Poulter, N. R. (2019). May Measurement Month 2017: screening for hypertension in Nigeria-Sub-Saharan Africa. *Eur Heart J Suppl*,21(Suppl D), D86-d88. https://doi.org/10.1093/eurheartj/suz064

Ojo, O. O., Abubakar, S. A., Iwuozo, E. U., Nwazor, E. O., Ekenze, O. S., Farombi, T. H., Akinyemi, R. O., Williams, U. E., Bello, A. H., **Wahab, K. W.**, Iyagba, A. M., Arigbodi, O., Erameh, C. O., Komolafe, M. A., Fawale, M. B., Onwuegbuzie, G. A., Obiabo, Y. O., Taiwo, F. T., Agu, C. E., . . . Okubadejo, N. U. (2020). The Nigeria Parkinson Disease Registry: Process, Profile, and Prospects of a Collaborative Project. *Mov Disord*,35(8), 1315-1322. https://doi.org/10.1002/mds.28123

Ojo, O. O., **Wahab, K. W**., Bello, A. H., Abubakar, S. A., Ekeh, B. C., Otubogun, F. M., Iwuozo, E. U., Farombi, T. H., Adeniji, O., & Ojini, F. I. (2021). A Cross-Sectional Comprehensive Assessment of the Profile and Burden of Non-motor Symptoms in Relation to Motor Phenotype in the Nigeria Parkinson Disease Registry Cohort. *Mov Disord Clin Pract*, 8(8), 1206-1215.

Okekunle, A. P., Asowata, O. J., Fakunle, A. G., Akpa, O. M., Sarfo, F. S., Akpalu, A., **Wahab, K.**, Obiako, R., Komolafe, M., Owolabi, L., Osaigbovo, G. O., Tiwari, H. K., Akinyemi, J., Jenkins, C., Arulogun, O., Ibinaiye, P., Appiah, L., Agunloye, A. M., Adeoye, A. M., . . . Owolabi, M. (2022). Secondhand smoke exposure is independently associated with stroke among non-smoking adults in West Africa. *J Neurol Sci*,443, 120489. https://doi.org/10.1016/j.jns.2022.120489

Okokhere, P. O., Akhuemokhan, K. I., **Wahab, K. W**., Akhigbe, T. O., & Akpede, G. O. (2016). Multiple cerebral tuberculomas without focal neurological deficit in an immunocompetent adult Nigerian: a case report. *Sanamed*,11(3), 221-224.

Okubadejo, N. U., Ojo, O. O., **Wahab, K. W.**, Abubakar, S. A., Obiabo, O. Y., Salawu, F. K., Nwazor, E. O., Agabi, O. P., & Oshinaike, O. O. (2019). A Nationwide Survey of Parkinson's Disease Medicines Availability and Affordability in Nigeria. *Mov Disord Clin Pract*, 6(1), 27-33. https://doi.org/10.1002/mdc3.12682

Opadijo, O., Sanya, E., Kolo, P., &**Wahab, K.** (2013). An Open Comparative Antihypertensive Effects Of Amlodipine ("Norvasc®"), Lisinopril ("Zestril®") and Bendrofluazide. *Trop J Hlth Sc.* 20(1); 13-17.

Owolabi, M., Sarfo, F., Howard, V. J., Irvin, M. R., Gebregziabher, M., Akinyemi, R., Bennett, A., Armstrong, K., Tiwari, H. K., Akpalu, A., **Wahab, K. W.**, Owolabi, L., Fawale, B., Komolafe, M., Obiako, R., Adebayo, P., Manly, J. M., Ogbole, G., Melikam, E., . . . Howard, G. (2017). Stroke in Indigenous Africans, African Americans, and European Americans: Interplay of Racial and Geographic Factors. *Stroke*,48(5), 1169-1175. https://doi.org/10.1161/strokeaha.116.015937

Owolabi, M. O., Sarfo, F., Akinyemi, R., Gebregziabher, M., Akpa, O., Akpalu, A., **Wahab, K.**, Obiako, R., Owolabi, L., & Ovbiagele, B. (2018). Dominant modifiable risk

factors for stroke in Ghana and Nigeria (SIREN): a case-control study. *Lancet Glob Health*,6(4), e436-e446. https://doi.org/10.1016/s2214-109x(18)30002-0

Parsons, M. W., Barber, P. A., Desmond, P. M., Baird, T. A., Darby, D. G., Byrnes, G., Tress, B. M., & Davis, S. M. (2002). Acute hyperglycemia adversely affects stroke outcome: a magnetic resonance imaging and spectroscopy study. *Ann Neurol*,52(1), 20-28. https://doi.org/10.1002/ana.10241

Sacco, R. L., Kasner, S. E., Broderick, J. P., Caplan, L. R., Connors, J. J., Culebras, A., Elkind, M. S., George, M. G., Hamdan, A. D., Higashida, R. T., Hoh, B. L., Janis, L. S., Kase, C. S., Kleindorfer, D. O., Lee, J. M., Moseley, M. E., Peterson, E. D., Turan, T. N., Valderrama, A. L., & Vinters, H. V. (2013). An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*,44(7), 2064-2089. https://doi.org/10.1161/STR.0b013e318296aeca

Salami, A. K., Ogunmodele, J. A., Fowotade, A., Nwabuisi, C., **Wahab, K. W.**, Desalu, O. O., & Fadeyi, A. (2009). Cryptococcal meningitis in a newly diagnosed AIDS patient: a case report. *West Afr J Med*,28(5), 343-346. https://doi.org/10.4314/wajm.v28i5.55944

Sani, M. U., **Wahab, K. W.**, Yusuf, B. O., Gbadamosi, M., Johnson, O. V., & Gbadamosi, A. (2010). Modifiable cardiovascular risk factors among apparently healthy adult Nigerian population - a cross sectional study. *BMC Res Notes*,3, 11. https://doi.org/10.1186/1756-0500-3-11

Sanya, E. O., Adeyanju, O. A., Olarinoye, J. K., Bello, H., Alaofin, W. A., **Wahab, K. W.**, & Soladoye, A. A. (2020). Magnesium Supplementation did not affect the Antiseizure Property of Ketogenic Diet but Reduced Lipid Dysmetabolism. *West Afr J Med*,37(1), 7-12.

Sanya, E. O., Kolo, P. M., Adamu, U. G., Opadijo, O. G., **Wahab, K. W.**, Mustapha, A. F., & Omotoso, A. B. (2008). Intracardiac tumor: a risk factor for stroke in the young--a case report. *Niger J Clin Pract*,11(1), 81-84.

Sanya, E. O., **Wahab, K. W.**, Desalu, O. O., Bello, H. A., Ademiluyi, B. A., Alaofin, W. A., & Busari, K. (2015). A 3 year audit of adult epilepsy care in a Nigerian tertiary hospital (2011-2013). *Ann Afr Med*,14(2), 97-102. https://doi.org/10.4103/1596-3519.149878

Sarfo, F. S., Akpa, O. M., Ovbiagele, B., Akpalu, A., **Wahab, K.**, Obiako, R., Komolafe, M., Owolabi, L., Ogbole, G., Fakunle, A., Okekunle, A. P., Asowata, O. J., Calys-Tagoe, B., Uvere, E. O., Sanni, T., Olowookere, S., Ibinaiye, P., Akinyemi, J. O., Arulogun, O., . . . Owolabi, M. O. (2023). Patient-level and system-level determinants of stroke fatality across 16 large hospitals in Ghana and Nigeria: a prospective cohort study. *Lancet Glob Health*. 16:S2214-109X(23)00038-4.https://doi.org/10.1016/s2214-109x(23)00038-4

Sarfo, F. S., Ovbiagele, B., Gebregziabher, M., **Wahab, K.**, Akinyemi, R., Akpalu, A., Akpa, O., Obiako, R., Owolabi, L., Jenkins, C., & Owolabi, M. (2018). Stroke Among Young West Africans: Evidence From the SIREN (Stroke Investigative Research and Educational Network) Large Multisite Case-Control Study. *Stroke*,49(5), 1116-1122. https://doi.org/10.1161/strokeaha.118.020783

Scott, P. A., & Silbergleit, R. (2006). Economic benefit of increasing utilization of intravenous tissue plasminogen activator for acute ischemic stroke in the United States. *Stroke*,37(4), 943-944; author reply 944. https://doi.org/10.1161/01.str.0000210181.05204.eb

Services, U. D. o. H. a. H. (2014). *The Health Consequences of Smoking: 50 Years of Progress: a Report of the Surgeon General*. C. f. D. C. a. P. Department of Health and Human Services. https://www.ncbi.nlm.nih.gov/books/NBK179276/pdf/Bookshelf_NBK179276.pdf

Song, L., Hu, X., Ma, L., Chen, X., Ouyang, M., Billot, L., Li, Q., Muñoz-Venturelli, P., Abanto, C., Pontes-Neto, O. M., Antonio, A., Wasay, M., Silva, A., Thang, N. H., Pandian, J. D., **Wahab, K. W.**, You, C., & Anderson, C. S. (2021). INTEnsive care bundle with blood pressure reduction in acute cerebral hemorrhage trial (INTERACT3): study protocol for a pragmatic stepped-wedge cluster-randomized controlled trial. *Trials*,22(1), 943. https://doi.org/10.1186/s13063-021-05881-7

Suleiman, Z. A., Kolawole, I. K., Ahmed, B. A., &**Wahab, K. W.** (2015). Fluoroscopic-guided supra-scapular nerve block in the management of shoulder pain in a Nigerian Teaching Hospital: Report of five cases. *Niger Med J*,56(5), 369-371. https://doi.org/10.4103/0300-1652.170387

Suleiman, Z. A., **Wahab, K. W.**, & Kolawole, I. K. (2016). Opioid prescribing habits of physicians in Kwara State, Nigeria. *Ghana Med J*,50(2), 63-67. https://doi.org/10.4314/gmj.v50i2.2

von Bartheld, C. S., Bahney, J., & Herculano-Houzel, S. (2016). The search for true numbers of neurons and glial cells in the human brain: A review of 150 years of cell counting. *J Comp Neurol*, 524(18), 3865-3895. https://doi.org/10.1002/cne.24040

Wahab, K., Kayode, B., & Musa, O. (2012). Knowledge of Stroke Risk Factors among Patients with Hypertension and Diabetes Attending the Outpatient Clinics of a Nigerian Tertiary Hospital (P04.068). *Neurology*, 78(1 Supplement), P04.068-P004.068.

Wahab, K., Ojini, F., Sanya, E., Olokoba, A., Katibi, I., & Omotoso, A. (2007). Correlation of Admission Blood Pressures with 30-Day Outcome in Acute Ischaemic Stroke in Nigerians. *Nigerian Medical Journal*,48(3), 58-61.

Wahab, K., Okubadejo, N., Ojini, F., & Danesi, M. (2007). Consequence de l'hyperglycemie a l'admission dans le

pronostic a court terme apres un accident vasculaire cerebral ischemique. *African Journal Of Neurological Sciences*, 26(2), 48-57.

Wahab, K., Olanrewaju, T., & Aderibigbe, A. (2012). One-Year Prevalence of Recurrrent Headaches among Adult Nigerians with Sickle Cell Disease (P04.236). *Neurology*,78(1 Supplement), P04.236-P204.236.

Wahab, K., Sani, M., Samaila, A., Gbadamosi, A., & Olokuba, A. (2007). Stroke at a tertiary medical institution in northern Nigeria: Patients\'profile and predictors of outcome. *Sahel Medical Journal*,10(1), 6-10.

Wahab, K., Sanya, E., Ademiluyi, B., Abiodun, B., & Alaofin, W. (2014). Stroke Mortality And Its Predictors In Nigeria: Results Of A Hospital-Based Study (I10-1.008). In: AAN Enterprises.

Wahab, K., Ugheoke, A., Okokhere, P., & Ibekwe, T. (2016). Validation of The 3-Question Headache Screen in The Diagnosis of Migraine in Nigeria. *Ethiop J Health Sci*, 26(1), 5-8. https://doi.org/10.4314/ejhs.v26i1.3

Wahab, K. W. (2008). The burden of stroke in Nigeria. *Int J Stroke*, 3(4), 290-292. https://doi.org/10.1111/j.1747-4949.2008.00217.x

Wahab, K. W., Kayode, B. O., & Musa, O. (2010). Awareness of Stroke by Nigerians at High Risk. *Neurology*, 74 (9), A343-A343

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.

Wahab, K. W., Kolo, P. M., Odili, A., Iwuozo, E., Ifebunandu, N., Ademiluyi, B., Okunola, O., Sani, M. U., Akinlade, M., Isezuo, S., Ale, O. K., Beaney, T., de la Rosa, C. N., Clarke, J., Poulter, N. R., & Omotoso, A. B. (2021). May Measurement Month 2019: an analysis of blood pressure screening results from Nigeria. *Eur Heart J Suppl*,23(Suppl B), B114-b116. https://doi.org/10.1093/eurheartj/suab059

Wahab, K. W., Kolo, P. M., Salawu, F. K., & Sanya, E. O. (2017). Blood Pressure Control among Hypertensive Stroke Survivors in Nigeria. *J Stroke Cerebrovasc Dis*,26(6), 1222-1227. https://doi.org/10.1016/j.jstrokecerebrovasdis.2017.01.011

Wahab, K. W., Kolo, P. M., Sani, M. U., Okubadejo, N. U., Peter, J. O., Aigbe, F., Makusidi, M. A., Aje, A., Adewale, A., Adebola, P., Beaney, T., Ster, A. C., Poulter, N. R., Xia, X., & Omotoso, A. B. (2020). May Measurement Month 2018: an analysis of blood pressure screening results from Nigeria. *Eur Heart J Suppl*,22(Suppl H), H96-h99. https://doi.org/10.1093/eurheartj/suaa038

Wahab, K. W., Okokhere, P. O., Ugheoke, A. J., Oziegbe, O., Asalu, A. F., & Salami, T. A. (2008). Awareness of warning signs among suburban Nigerians at high risk for stroke is poor: a cross-sectional study. *BMC Neurol*,8, 1-5.

Wahab, K. W., Okubadejo, N. U., Ojini, F. I., & Danesi, M. A. (2008). Predictors of short-term intra-hospital case fatality following first-ever acute ischaemic stroke in Nigerians. *J Coll Physicians Surg Pak*,18(12), 755-758.

Wahab, K. W., Owolabi, M., Akinyemi, R., Jenkins, C., Arulogun, O., Akpa, O., Gebregziabher, M., Uvere, E., Saulson, R., & Ovbiagele, B. (2017). Short-term pilot feasibility study of a nurse-led intervention to improve blood pressure control after stroke in Nigeria. *J Neurol Sci*, 377, 116-120. https://doi.org/10.1016/j.jns.2017.04.005

Wahab, K. W., & Salami, A. K. (2011). Pain as a Symptom in Patients Living With HIV/AIDS Seen at the Outpatient Clinic of a Nigerian Tertiary Hospital. *J Int Assoc Physicians AIDS Care (Chic)*,10(1), 35-39. https://doi.org/10.1177/1545109710368863

Wahab, K. W., Sani, M., Gbadamosi, M., & Yandutse, M. (2008). Frequency and determinants of the metabolic syndrome in apparently healthy adult Nigerians. *Trop*

Doct,38(4), 224-226. https://doi.org/10.1258/td.2007.070335

Wahab, K. W., Sani, M. U., Yusuf, B. O., Gbadamosi, M., Gbadamosi, A., & Yandutse, M. I. (2011). Prevalence and determinants of obesity - a cross-sectional study of an adult Northern Nigerian population. *Int Arch Med*,4(1), 10. https://doi.org/10.1186/1755-7682-4-10

Wahab, K. W., Sanya, E. O., Adebayo, P. B., Babalola, M. O., & Ibraheem, H. G. (2017). Carpal Tunnel Syndrome and Other Entrapment Neuropathies. *Oman Med J*,32(6), 449-454. https://doi.org/10.5001/omj.2017.87

Wahab, K. W., Sanya, E. O., Ademiluyi, B. A., & Bello, A. H. (2014). Posterior reversible encephalopathy syndrome complicating postpartum eclampsia in a Nigerian: case report. *Niger Postgrad Med J*,21(3), 266-268.

Wahab, K. W., Tiwari, H. K., Ovbiagele, B., Sarfo, F., Akinyemi, R., Traylor, M., Rotimi, C., Markus, H. S., & Owolabi, M. (2019). Genetic risk of Spontaneous intracerebral hemorrhage: Systematic review and future directions. *J Neurol Sci*,407, 116526. https://doi.org/10.1016/j.jns.2019.116526

Wahab, K. W., & Ugheoke, A. J. (2009). Migraine: prevalence and associated disability among Nigerian undergraduates. *Can J Neurol Sci*,36(2), 216-221. https://doi.org/10.1017/s0317167100006570

Yusuf, A. S., Adeleke, N. A., Babalola, O. M., **Wahab, K. W.**, Oyebanji, L. O., Ahmed, A. B., & Omokanye, H. K. (2015). Intramedullary tuberculoma of thoracic spinal cord in an apparently healthy Nigerian: Case Report. *J West Afr Coll Surg*,5(4), 90-97.

Yusuf, S., Wood, D., Ralston, J., & Reddy, K. S. (2015). The World Heart Federation's vision for worldwide cardiovascular disease prevention. *Lancet*,386(9991), 399-402. https://doi.org/10.1016/s0140-6736(15)60265-3