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TABLE OF CONTENTS

GENERAL INFORMATION	1C
INFORMATION FOR AUTHORS	1F
EDITORIAL NOTES – The Stroke Epidemic and Associated Co-morbidities by Prof. Gregory E. Erhabor	1111
ORIGINAL ARTICLES	
10-Year Risk of Developing Type 2 Diabetes Mellitus – A Survey of Rural Communities in Southern Nigeria	1113
A. O. Idowu, O. A. Adesegun, A. Akintunde, B. A. Alalade, B. T. Osibowale, O. I. Odelola, J. O. Ogunkoya, A. A. Idowu, A. O. Ayoade, O. A. Omokore, O. T. Imishue	
Challenges of Case Management of COVID-19 in University of Uyo Teaching Hospital: A One-Year Experience	1119
I. P. Oloyede, A. Onukak, O. O. Motilewa, A. Ekuma, S. Udoette, C. Eyo, E. K. Abudu, V. A. Umoh, E. Bassey, E. Peters	
Fungal Nail Infections amongst Cassava Farmers and Processors in Southwest Nigeria	1127
O. O. Ayanlowo, R. O. Oladele	
Immunohistochemical Study and Clinicopathologic Correlation of Cox-2 and Her-2 Expression in Colorectal Carcinoma: A 5-Year Retrospective Study	1134
L. A. Odukoya, K. B. Badmos, G. Khramtsova, L. A. Adebayo, O. I. Olopade, F. B. Abdulkareem	
The Impact of Co-Morbidities on the Pattern of Blood Pressure Control in Elderly Hypertensives in Nigeria	1141
C. N. Ugwu, C. I. Okafor, E. C. Ejim, N. I. Ugwu, N. M. Chika-Igwenyi, N. Obeka, R. C. Ikeagwulonu, T. C. Iyidobi, U. U. Nnadozie, F. O. Afolabi, A. U. Kalu, G. C. Isiguzo	
Phenotypic Characterisation of <i>Staphylococcus aureus</i> Isolated from Patients in Healthcare Institutions in Zaria Metropolis, Kaduna State, Nigeria	1148
I. A. Joshua, F. J. Giwa, J. K. P. Kwaga, J. Kabir, O. A. Owolodun, G. A. Umaru, A. G. Habib	
The Relationship between Adolescents’ Family Background, Perceived Self-Concept and Health Seeking Behaviour in an Urban City of South-Western Nigeria	1156
T. A. Agbesanwa, A. O. Ibrahim, O. E. Adegbilero-Iwari, A. A. Oniyide, W. O. Ismail, Y. O. Akinola	
Awareness and Adherence to COVID-19 Preventive Measures among Oral Health Care Workers in Nigeria	1165
L. L. Enone, A. Oyapero, J. O. Makanjuola, R. O. Ojikutu	
Short Term Visual and Refractive Outcome following Surgical Intervention for Posterior Capsule Opacification (PCO) in Children in a Tertiary Eye Hospital	1174
Q. I. Sazzad, M. Hossain, H. Alimi, M. Khatun, M. R. Chowdhury, S. Toufique, S. M. Naznin	
Preferences, Utilization and Factors affecting Use of Contraceptives among Women attending Primary Health Care Facilities in Delta State, Southern Nigeria	1180
D. T. Obong, N. S. Awunor, P. G. Oyibo	
Prevalence of Hyponatremia in Acute Stroke Patients in a Federal Teaching Hospital, Abakaliki, Nigeria	1188
C. O. Eze, O. F. Afolabi, A. U. Kalu	
An Evaluation of Renal Care received by Human Immunodeficiency Virus (HIV) Patients admitted in a Tertiary Hospital in Sierra Leone	1193
J. Coker, A. Niang, I. Turay, S. Lakoh, V. Conteh, J. B.W. Russell	
Assessment of <i>MTR</i> Rs1805087 SNP as Possible Modifier of Sickle Cell Disease Severity in a Nigerian Population	1198
V. O. Osunkalu, A. A. Ogbenna, N. O. Davies, F. O. Olowoselu, O. E. Aiyelokun, O. J. Akinsola, I. A. Taiwo	
Quest to Improve Management of Prostate Cancer in West Africa: Development of a Clinical Audit Tool	1205
S. O. Osaghae	
CLINICAL PERSPECTIVE	
Roll Back Stroke: The Way Forward for Physicians and Patients	1209
Y. Ogun, A. Morawo	
INDEX TO VOLUME 39, NO. 11, 2022	
Author Index	1215
Subject Index	1216
E-PUBLISHED	
Identification of the new progress on Pyrazole Derivatives Molecules as Antimicrobial and Antifungal Agents	1217
F. E. Bennani, L. Doudach, Y. El rhayam, K. Karrouchi, Y. Cherrah, A. Tarib, M. Ansar, M. E. A. Fauzi	



Roll Back Stroke: The Way Forward for Physicians and Patients

Faire reculer l'AVC : La Voie à Suivre pour les Médecins et les Patients

¹Y. Ogun, ²A. Morawo

ABSTRACT

The 6-lettered word “Stroke” is an ancient disease, likened Biblically to “666” in Revelation 13 verse 18. Globally, it is the commonest cause of acquired long-term disability. While its incidence has been declining in high-income countries, low/middle-income countries (LMICs) have witnessed an increase. This increase is driven by epidemiologic-transition/modernization-complex, healthcare disparities, and increasing prevalence of vascular risk-factors. Despite the disproportionate burden of stroke in LMICs, these countries have the lowest rate of access to acute reperfusion-interventions leading to greater stroke-related morbidity/mortality. Effective primordial, primary, secondary, tertiary, and quaternary prevention-strategies coordinated at all levels of care are needed to reduce stroke incidence and poor outcomes. The World Stroke Organization (WSO) has proposed achieving global primary prevention through 1) Population-wide approach to limiting stroke risk-factors exposure, 2) App-based motivational population-wide approach to mitigating stroke risk-factors, 3) use of low-cost combination/poly-pill to treat hypertension/dyslipidemia and 4) addressing behavioural risk-factors through interventions by community health-workers.

The need to set-up stroke-units, post-hospitalisation rehabilitation-centres, stroke-registers/registries, stroke-clubs, and encourage community health-education, must be emphasised for optimal care in LMIC.¹³ Community Health Empowerment (CHE) with the Acronym **BE FAST / STRoke** as warning signs of stroke must be emphasised (**B**: Balance-loss; **E**: Eye vision-loss; **F**: Facial Asymmetry; **A**: Arm weakness; **S**: Speech difficulties; **T**: Time is brain; Or first 3-letters of **STRoke** – Can Patient Smile? Talk? Or Raise-arm?). Stroke hemorheology/blood-flow and treatment involve **3Ps**’ of pathogenic principles/strategies (**P**assenger, **P**assage, **P**ower). Its complications include the **10D**’s: **D**eath, **D**isability, **D**epression, **D**ementia, **D**elirium, **D**ysphagia, **D**ehydration, **D**eep-Venous Thrombosis, **D**ecubitus-ulcers, **D**ysphasia, **S**eizures. **WAJM 2022; 39(11): 1209–1214.**

Keywords: Disability, Epidemiology, Health-education, Prevention, Stroke.

RÉSUMÉ

L'accident vasculaire cérébral (AVC) est une maladie ancienne, assimilée bibliquement à “666” dans l'Apocalypse 13 verset 18. Dans le monde, c'est la cause la plus fréquente d'invalidité acquise à long terme. Alors que son incidence a diminué dans les pays à revenu élevé, les pays à revenu faible ou intermédiaire (PRFM) ont connu une augmentation. Cette augmentation est due au complexe épidémiologie-transition/modernisation, aux disparités en matière de soins de santé et à la prévalence croissante des facteurs de risque vasculaire. Malgré le fardeau disproportionné de l'AVC dans les PRFM, ces pays ont le plus faible taux d'accès aux interventions de reperfusion aiguë, ce qui entraîne une morbidité/mortalité plus importante liée à l'AVC. Des stratégies de prévention primordiales, primaires, secondaires, tertiaires et quaternaires efficaces et coordonnées à tous les niveaux de soins sont nécessaires pour réduire l'incidence des AVC et les mauvais résultats. La World Stroke Organization (WSO) a proposé de réaliser une prévention primaire globale par 1) une approche à l'échelle de la population pour limiter l'exposition aux facteurs de risque d'AVC, 2) Basé sur une application approche motivationnelle à l'échelle de la population pour atténuer les facteurs de risque d'AVC, 3) l'utilisation d'une combinaison de pilules à faible coût pour traiter l'hypertension et la dyslipidémie et 4) la prise en compte des facteurs de risque comportementaux par des interventions des agents de santé communautaires.

La nécessité de créer des unités d'AVC, des centres de réadaptation post-hospitalisation, des registres/registres d'AVC, des clubs d'AVC, et d'encourager l'éducation sanitaire communautaire, doit être soulignée pour des soins optimaux dans les PRFM.¹³ L'autonomisation de la santé communautaire (CHE) avec l'acronyme **BE FAST / STRoke** comme signes d'alerte de l'AVC doit être soulignée (**B** : Perte d'équilibre ; **E** : Perte de la vision oculaire ; **F** : Asymétrie faciale ; **A** : Faiblesse du bras ; **S** : Difficultés d'élocution ; **T** : Le temps, c'est le cerveau; ou les 3 premières lettres de **STRoke** - Le patient peut-il sourire? Parler ? Ou lever le bras ?). L'hémorhéologie/la circulation sanguine et le traitement de l'AVC impliquent des **3P** de principes/stratégies pathogènes (**P**assager, **P**assage, **P**uissance). Ses complications comprennent les **10D** : **D**écès, **D**épression, **D**émence, **D**élice, **D**ysphagie, **D**éshydratation, **D**éshydratation, thrombose veineuse profonde, ulcères de décubitus, **D**ysphasie, convulsions. **WAJM 2022; 39(11): 1209–1214.**

Mots-clés: Épidémiologie, Éducation sanitaire, Prévention, Accident vasculaire cérébral, Handicap.

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Abbreviations: CHE, Community Health Empowerment; WSO, The World Stroke Organization.

INTRODUCTION

Stroke is the commonest cause of acquired disability (Disability Adjusted Life Years - DALYs) and death in low and middle-income countries (LMICs), and the second leading cause of preventable deaths worldwide.¹⁻³ LMICs experienced a forty-eight percent (48%) increase in stroke-related DALYs while in high income countries (HICs) there was a twenty-five percent (25%) decline between 1990 and 2019.³ LMICs accounted for 85% of the global stroke burden in 2001, increased to 87% in 2005, and 89% in 2019.¹ About 6.6 million deaths and 143 million DALYs were documented, next to neonatal disorders (children)/ ischemic heart disease (adults).³ The incidence increased by 12% in LMICs, and decreased by 12%, in HICs,^{4,5} especially where health divide/inequity exists, with an incidence of 17% amongst medical emergency admissions,^{6,7-10} and a community-based prevalence of 1.14/1000 population in Nigeria.¹¹

The stroke epidemic has been on the increase in LMICs due to scientific advances, epidemiological transition (modernisation complex), encompassing advancing/aging population, changes in climate, modifications of lifestyle, rapid unchecked urbanization/ industrialization, terrorism and conflicts.^{5,12} Furthermore, worsening severity, cognitive/ physical outcomes, enhanced innate predisposition, genetic/environmental-factors, different patterns of stroke subtypes/types, comparatively younger age range (15 years or less) in blacks, have been documented^{4,7,8,12} due to disparities in healthcare-seeking, traditional practices, and differential access to hospital services.¹²

The five leading risk factors of stroke are hypertension, diabetes mellitus, high body mass index/ overweight (BMI ≥ 25 /waist-to-hip ratio: 0.8 in women, 0.9 in men), ambient particulate matter pollution, and smoking. Others include low physical activity (<2.5 hours/week of moderate to vigorous exercise), poor unbalanced diet (<6 servings a day of fruits/vegetables), excessive sodium intake (>2g/day; equivalent to 5g of salt/day), cardiac causes (Congenital heart disease, atrial fibrillation, valvular heart disease,

congestive cardiac failure), dyslipidaemia (total cholesterol >5mmol/L or >200mg/dL; LDL-C >4mmol/L or >150mg/dL; HDL-C <1mmol/L or <40 mg/dL; triglycerides >1.7mmol/L or 150/mg/dL), persistent stress/depression; alcohol consumption (>2 standard drink/day for men or >1 standard drink for women).^{3,13}

The 6-lettered word “Stroke” is an ancient disease, likened Biblically to “666” in Revelation 13 verse 18. One of 6 individuals will develop stroke in their lifetime (now one of 4); every 6 seconds, one individual develops stroke worldwide (now every 3 seconds) and every 6 seconds, one death is recorded for stroke globally. Also, 6 million deaths, 6 million disabilities, and 6 million survivors are documented annually.^{5,6} Clot-retrieval/endovascular-thrombectomy (ET) is indicated <6-hours (Now: DEFUSE-3 study: 16 hours; DAWN study: 24 hours); NIH Stroke Scale/score (NIHSS) is >6, ASPECT score is >6.^{5,14,15} Moreover, optimal recovery post-stroke takes 6 weeks to 6 months.⁶ The terminology “Brain attack” emphasises that there are two hundred billion neurons in the brain, and for every non-interventional one minute, 2 million neurons or 12-kilometre fibre-length of neurons are lost.⁵ Hence, the paradigm or slogan “**Time is Brain and Brain needs Time.**”

Stroke hemorheology/blood-flow and treatment involve 3Ps’ of pathogenic principles/strategies (Passenger, Passage, Power):

Passenger: Occlusion by thrombosis/ embolism and subsequent use of thrombolytics/clot busters, endovascular-thrombectomy (ET) or clot retrievals, and use of blood-thinners such as Aspirin.

Passage: Occlusion by vasospasm/ atherosclerotic plaques, with subsequent use of carotid endarterectomy or Statins. Cerebral infarction (CI) occurs with passage-occlusion and blockage of capillaries and arterioles (‘Front doors’), in the absence of adequate collateral circulation (‘Back doors’). There are 3 degrees of collaterals - 1^o: circle of Willis; 2^o: leptomeningeal and ophthalmic arteries; and 3^o: angiogenesis or

neovascularisation with medications such as Tocotrenols, Neuroaid. Collaterals are relevant with proximal occlusion, and irrelevant with lacunar infarcts because these are distal end-arteries occlusion. Long-standing hypertensives develop lipohyalinosis leading to Charcot–Bouchard aneurysms which could rupture/bleed, or get blocked by micro-atheroma with resultant penumbra (apoptosis) or umbra (necrosis).

Post-stroke, there is loss of cerebral autoregulation, necessitating permissive hypertension (PH), as cerebral perfusion becomes pressure-passive. Moreover, PH opens the collaterals (back doors) and is required to maintain the cerebral perfusion pressure (CPP), because of increased intracranial pressure (ICP) (CPP = MAP - ICP). An exception to this occurs in extra-cerebral complications such as dissecting aortic aneurysm, ischemic heart disease/myocardial ischemia, acute pulmonary oedema, or rapid decline in renal function. In intracerebral haemorrhage (ICH), blood pressure should be brought down within the first 6 hours to 140/90 if patient is <60 years or has DM; and 150/90 if >60 years (INTERACT-2).¹⁷

Power: Brain insult or injury needing brain rewiring or neuroplasticity with medications such as NeuroAid that enhances brain-derived neurotrophic factor (BDNF) production. This stimulates stem cells in the periventricular or subventricular regions to migrate to the site of insult or injury and induce neuronogenesis (axonal sprouting or axonogenesis and reactivation of latent or inactive synapses or synaptogenesis). Furthermore, to maintain the neurovascular unit hypothesis, there must be new vessel formation (3^o) of collaterals (angiogenesis or neovascularisation following use of Tocotrenols/Tocovid, NeuroAid or Citicoline).¹⁷

The optimal time for thrombolysis and ET is within 4.5-9 hours and 24 hours post-stroke, respectively.¹⁸ Emergency treatment interventions, speedy response times, should improve in the African community which currently has the lowest rates of thrombolysis (clot-busters) or ET of <1% globally.^{5,19,20}

Moreover, over 80% of our stroke population present after 24 hours post-stroke onset/ictus.¹² This is as a result of cultural beliefs, attribution of stroke to a spiritual aetiology, fear of injections, confusion of stroke with poliomyelitis that injections could aggravate/trigger, amongst others.¹⁷⁻²⁰

Preventive Measures

Stroke preventive strategies need to be strengthened at 5 levels.

Primordial – Prevention at this level incorporates universal prevention of diseases by scaling up information deliveries, health-care providers training, and awareness campaigns; implementation of universal economic programs, and policies; and increasing efforts to scale down the use of salt, sugar, tobacco and substance abuse.^{15,22}

Primary – This involves prevention processes that reduce incidence and prevalence by controlling risk factors.^{7,23} This includes the use of polypill-containing generic blood pressure lowering medications and statins (SBP 120–160mmHg)/LDL-C goal of <190mg/dL (<4.9mmol/L). Treat Dyslipidaemia with Statins: LDL-C goal of <190mg/dL; HBP: 10-year CVD risk score is 10%, so target BP should be <130/80mmHg. Aspirin is not routine for primary stroke prevention. Recreational drugs should be avoided. Patients should be encouraged to consume healthy diet which includes vegetables, fruits, nuts, whole-grains, lean vegetables, animal protein and fish. Patients should reduce the intake of trans-fats, red meat or processed red meats, refined carbohydrates, and sweetened beverages. For those overweight or obese, counselling should be done for calorie restriction and exercise. Adults should be encouraged to engage in >150 minutes per week of accumulated moderate-intensity physical activity; or 75 minutes per week of vigorous-intensity physical activity. Life-course approach for a healthy lifestyle should be taught from maternal/child health.²⁴

Secondary – Preventive activities at this level reduce re-occurrence/prevalence, after an initial stroke. The specific set of secondary prevention strategies depends on the individual's stroke

aetiology and risk factors. This may include lifestyle modifications, vascular risk factors management, and use of antithrombotics in nearly every patient; anticoagulation in cardioembolic strokes; left atrial appendage closure in selected patients with atrial fibrillation; carotid revascularization in moderate-severe extracranial carotid stenosis; extracranial-intracranial bypass procedures in moyamoya vasculopathy; and closure of a patent foramen ovale in appropriately selected patients. Other less common causes of stroke such as primary CNS vasculitis may require other targeted interventions.²⁵

Tertiary – Preventive measures reduce mortality, disability, and improve outcomes, with prompt hyper-acute, acute or post-acute treatment in stroke-units.

Quaternary – This involves avoiding the harm that comes from unnecessary interventions while patient is being evaluated and treated, as well as guidance on therapeutic options or choice of class of medications.

The need to set up stroke units, stroke registers/registries and stroke clubs, and encourage community health education, must be emphasised for optimal care.¹³ Community health empowerment (CHE) scales up stroke literacy, inculcates steps to bridge the health-divide, and the philosophical/geographical disconnect between research institutes and communities on one hand, and between the rich and the poor, on the other hand.^{6,21}

The Acronym **BE FAST / STRoke** are warning signs of stroke that must be taught at all levels of education (**B**: Balance-loss; **E**: Eye vision-loss; **F**: Facial Asymmetry; **A**: Arm weakness; **S**: Speech difficulties; **T**: Time is brain; Or first 3 letters of **STRoke** - Can Patient Smile? Talk? Or Raise-arm?).

Stroke Complications include the **10D's** of **Death, Disability, Depression** (one out of 3 each), **Dementia** (after First stroke: 10%; Second stroke: 30%); **Delirium** (<first 30 days); **Dysphagia, Dehydration, Deep Venous Thrombosis, Decubitus ulcers, Dysphasia, and Seizures**, amongst others.^{5,12,17-19}

Sources of information for stroke are mass media (television/radio), family members and relatives, newspapers/magazines, medical institutions, schools, and the internet. Health education could be delivered consistently and systematically by computerized health education. Significant predictors of poor knowledge of stroke risk factors include older age and lower level of education.²⁶ Children, as “transmission-vectors,” could serve as community health educators, and children's health education would improve parental literacy on focused or specific-ailments, and could be extended to include the increasing burden of non-communicable (NCD) and communicable diseases (CD).²¹

The growing communicable and non-communicable diseases in LMICs, with facilities/manpower insufficiency constitute an **inverse double-burden relationship**, requiring the need to intensify preventive measures.^{5,12,18-20} This burden results in LMICs diminished proficiency, in the face of inadequate qualified personnel, brain drain, poorly equipped stroke units, neuro-imaging, and rehabilitation efforts, which negatively impacts the carers, community, family, and individuals.^{5,12,19,20}

This increasing incidence, mortality and DALYs in black populations and LMICs, have attained epidemic proportions of Public Health concern.³⁻⁵ Collaborative interventions at intra/interpersonal levels, community, ecological, institutional, state, national/international, and policy-levels to ‘**Roll back Stroke**’ have been advocated,^{4,5,12} with the urgent need to conduct research studies and programs on stroke.

Guidelines/Pragmatic Solutions: The World Stroke Organization (WSO) recommends four strategies for global primary prevention of stroke and dementia.^{1,3,28-30} These include (1) Population-wide policy strategies to reduce exposure to risk factors for stroke/dementia, CVD and other NCDs (including environmental risk factors such as air pollution) across lifespan of entire population regardless of the level of individual CVD risk; (2) Motivational population-wide strategy using health-apps (free **Stroke-Riskometer app**)^{32/}

similar mobile phone apps; **PreventS webapp** for clinicians). Also, to reduce lifestyle/other risk-factors through mass approaches such as smoking-cessation campaigns, reducing salt/sugar in processed food, restricting alcohol consumption) and more individual-focused motivational education about behavioural risks (physical inactivity). In addition, simple inexpensive screening for vascular risks by community health-workers, stroke support organisations (SSO) in resource-poor settings or by medical professionals in more affluent countries, would identify individuals needing prophylactic drug therapy and lifestyle/behavioural interventions.²⁵ Community medical officers have recommended continuing ex-ward-care covering social, medical, and environmental services at home after hospitalization/discharge.

In 2011, United Nations (UN) resolution followed by WHO Global Action Plan (2013–2020) called upon all governments to give primary prevention of NCDs the highest priority to achieve a 25% reduction in NCD-related burden by 2025.²⁸ The Lancet Neurology Commission on Stroke established collaborations between WHO/WSO to lead strategies accelerating global efforts focusing on LMICs with deficiencies in existing guidelines/gaps in primary prevention. A set of pragmatic solutions for implementation of primary stroke prevention, with emphasis on population-wide prevention strategies (PWPS); task sharing and health system re-engineering, that includes patients, health professionals, funders, policymakers, implementation partners and the entire population. There is need to improve stroke services/outcomes, increase community capacity needs, health-care workers capacity, institutional capacity building, improve preventive activities, bridge capacity gaps, and scale-up emergency calls.^{15,22,26}

There is need for global, international/national efforts and collaboration between various sectors of healthcare and decision-makers, government/non-government agencies (stroke, CVD/NCD organisations), industry, communities and individuals for effective reduction of stroke-burden. Engagement of societal opinion-shapers

via establishment of **Global Stroke Control, Observatory and Reduction Ecosystem (gSCORE)** to: (i) address key environmental factors via policy change – social determinants of health, making default choices healthy; (ii) enhance stroke literacy through key community influencers; (iii) address motivation, self-efficacy, self-management skills; and (iv) empower stroke commissioners to be champions/advocates, ensuring rigorous implementation and evaluation.^{3,29} This will operate at country, regional/global-levels in collaboration with relevant policy makers/implementation partners including national/regional stroke, neurology, CVD, NCD organisations and relevant alliances. There is a need for synergy between healthcare providers, government/non-government agencies, industry, academic organisations, societal opinion leaders, and individuals.

Effective stroke-prevention must include population-wide and individual-based strategies best accomplished using mobile technology; and shifting/sharing of tasks from highly trained health professionals to healthcare workers, particularly community-based health workers, with less training/qualifications/education to facilitate stroke prevention interventions on the individual level.³

Governments should provide adequate health services, reduce inequities and influence environmental (air pollution) and lifestyle factors (smoking, reducing salt, sugar in processed foods and alcohol intake through legislation/taxation). Revenues from these taxations should be invested into public health sector and health research to improve health of taxpayers, and funding of primary prevention strategies for stroke/CVD/NCDs. Strategies/interventions, that are cost-efficient, such as avoidance of physical inactivity, tobacco misuse, and unhealthy diet (salt, trans fat) have been found to be rewarding.^{31–35}

Four main Target Areas to improve Stroke Outcome^{5,19,20}

1) Population strategy in stroke care: Public awareness programs are important for adults/children with the need to present early for

evaluation, treatment and prevention of further attacks. Stroke issues should be introduced in schools, churches, mosques, plays on television, in the theatre and brought to national attention.

- 2) The role of the physician in preventive care: There must be strategy for risk factor control such as stroke study groups and development of local guidelines. Physicians must identify patients at risk. This risk assessment includes taking good history of risk factors, thorough clinical examination: BP, PR (ECG), cholesterol level, C-reactive protein; calculate BMI.
- 3) Managing acute stroke patient: Stroke Unit reduces mortality by 30%; reduces disability/need for institutionalised care, and improves functional outcomes (Tertiary Prevention).
- 4) Rehabilitation/Prevention of recurrence: development of post-hospitalisation rehabilitation-centres, stroke-registers/registries and stroke-clubs.

REFERENCES

1. GBD 2019 Stroke-Collaborators. Global regional national burden of stroke/risk factors, 1990–2019: systematic-analysis for Global Burden of Disease Study 2019. *Lancet Neurology*. 2021.
2. Brainin M, Feigin VL, Norrving B, Martins SCO, Hankey GJ, Hachinski V. Global-prevention of stroke/dementia: WSO Declaration. *Lancet Neurology*. 2020; **19**: 487–488.
3. Owolabi, MO, *et al*. Primary stroke prevention worldwide: translating evidence into action on-behalf of World Stroke Organization/WSO Stroke-Experts Collaboration-Group/YomiOgun.
4. Sarfo FS, Akassi J, Awuah D, Adamu S, Nkyi C, Owolabi M, Ovbiagele BJ. *Neurol Sci*. 2015 Aug 4. pii: S0022-510X(15)00464-5. doi:10.1016/j.jns.2015.07.043.
5. Ogun SA. Stroke Health Education in children and impact on parental stroke literacy in Nigeria- a “Roll Back Stroke” strategy; MPH research project:/ University of Roehampton, Centre for

- Student Success. 2019. Available at: [http://success.roehampton-online.com/ResearchProject/\(in press\)](http://success.roehampton-online.com/ResearchProject/(in press)).
6. Ogun SA. Acute stroke mortality at the Lagos University Teaching Hospital (LUTH). *Nig Quart J Hosp Med*. 2000; **10**: 8–10.
 7. World Health Organization (2007). Prevention of cardiovascular disease: guidelines for assessment/management total cardiovascular risk. World Health Organization. Accessed May 3, 2019. <http://www.who.int/iris/handle/10665/43685>.
 8. Owolabi MO, Thrift AG, Martins S, et al. State of stroke services across globe: report of WSO//WHO surveys. *International Journal of Stroke*. 2021.
 9. Owolabi MO, Pandian JD, et al. Towards Making Stroke Guidelines effective in low and middle-income countries – a Systematic review. *Bulletin of WHO* 2021
 10. United Nations. Transforming our world: 2030 agenda for sustainable development. New York, NY: United Nations. 2015.
 11. Danesi M, Okebadejo N, Ojini FI. Prevalence of stroke in urban, mixed-income community, Lagos, Nigeria. *Neuroepidemiology*. 2007; **28**: 216–223.
 12. Ogun SA, Ojini FI, Ogungbo BO, Danesi MA, Kolapo KO. Stroke in South-West Nigeria – a ten-year review. *Stroke*. 2005; **(6)**: 1120–1123.
 13. O'Donnell MJ, Chin SL, Rangarajan S, et al. Global/regional effects of potentially modifiable risk-factors associated with acute stroke in 32 countries (INTERSTROKE): case-control study. *Lancet*. 2016; **388**: 761–775.
 14. Sacco RL, Boden-Albala B, Abel G, et al. Race-ethnic disparities in the impact of stroke risk factors: Northern Manhattan Stroke Study. *Stroke*. 2001; **32**: 1725–1731.
 15. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA Guideline Primary Prevention of Cardiovascular Disease: Executive Summary: Report of ACC/AHA Task-Force on Clinical Practice Guidelines. *Circulation*. 2019; **140**: e563–e95.
 16. Feigin VL, Brainin M, Norrving B, et al. What Is Best Mix of Population Wide/High Risk Targeted Strategies of Primary-Stroke/Cardiovascular Disease Prevention? *Journal American Heart Association*. 2020; **9**: e014494.
 17. Christopher LH, Chen Sherry HY, Young, Herminigildo H, Gan, Rajinder Singh, Annabelle Y. Lao, Alejandro C. BaroqueII, Hui Meng Chang, John Harold B. Hiyadan, Carlos L. Chua, Chinese Medicine Neuroaid Efficacy on Stroke Recovery A Double-Blind, Placebo-Controlled, Randomized Study Originally published 18 Jun 2013 <https://doi.org/10.1161/STROKEAHA.113.002055> *Stroke*. 2013; **44**: 2093–2100.
 18. Venketasubramanian N.^a · Young S.H.^b · Tay S.S.^b · Umapathi T.^c · Lao A.Y.^d · Gan H.H.^e · Baroque II A.C.^f · Navarro J.C.^f · Chang H.M.^g · Advincula J.M.^h · Muengtaweepongsa S.ⁱ · Chan B.P.L.^j · Chua C.L.^k · Wijekoon N.^l · de Silva H.A.^l · Hiyadan J.H.B.^m · Suwanwela N.C.ⁿ · Wong K.S.L.^o · Pongvarin N.^p · Eow G.B.^q · Lee C.F.^r · Chen C.L.H.^s · for the CHIMES-E Study Investigators CHinese Medicine NeuroAid Efficacy on Stroke Recovery – Extension Study (CHIMES-E): A Multicenter Study of Long-Term Efficacy *Cerebrovasc Dis*. 2015; **39**: 309–318 <https://doi.org/10.1159/000382082>.
 19. Bayona H, Owolabi M, Feng W, et al. Systematic comparison of key features of ischemic stroke prevention guidelines in low/middle-income vs. high-income countries. *J Neurol Sci*. 2017; **375**: 360–366.
 20. Arabambi B, Oshinaike O, Akilo OO, Yusuf Y, Ogun SA. Pattern, Risk-Factors, Outcome of Acute Stroke in Nigerian University Teaching Hospital: 1 Year-Review. *Nigerian Journal Medicine*. 2021; **30**: 252–256.
 21. Arabambi B, Oshinaike O, Ogun SA, Eze C, Bello AH, Igetei S, et al. Stroke units in Nigeria: Report from Nationwide organizational cross-sectional survey. *Pan African Medical Journal/PAMJ*. 2022; **42**.
 22. Akinyemi RO, Ogah OS, Ogundipe RF, Oyesola OA, Oyadoke AA, Ogunlana, MO, Otubogun FM, Odeyinka TF, Alabi BS, Akinyemi JO, Osinfade JK, Kalaria RN. Knowledge/perception of stroke amongst hospital-workers in African-community. *European Journal of Neurology*. 2009; **16**: 998–1003.
 23. Williams O, Leighton-Herrmann E, DeSorbo A, Hecht M, Hedmann M, Huq S, Gerin W, Chinchilli V, Ogedegbe G, Noble J. Hip Hop Stroke: Study-Protocol for Randomized Controlled Trial to Address Stroke Literacy. *J Clin Trials*. 2015; **5**: 242.
 24. Feigin VL, Norrving B, Mensah GA. Primary prevention of cardiovascular disease through population-wide motivational strategies: insights using smartphones in stroke prevention. *BMJ Global Health*. 2017; **2**: e000306.
 25. Meschia JF, Bushnell C, Boden-Albala B, Braun LT, Bravata DM, Chaturvedi S, et al. American Heart Association Stroke Council; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; Council on Functional Genomics and Translational Biology; Council on Hypertension. Guidelines for the primary prevention of stroke: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2014; **45**: 3754–832. doi: 10.1161/STR.000000000000046. Epub 2014 Oct 28. PMID: 25355838; PMCID: PMC5020564.”
 26. Kleindorfer DO, Towfighi A, Chaturvedi S, Cockroft KM, Gutierrez J, Lombardi-Hill D, et al. Guideline for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline From the American Heart Association/American Stroke Association. *Stroke*. 2021; **52**: e364–e467. doi: 10.1161/STR.0000000000000375. Epub 2021 May 24. Erratum in: *Stroke*. 2021; **52**: e483–e484. PMID: 34024117.
 27. Pearson TA, Palaniappan LP, Artinian NT, et al. AHA-Guide for Improving Cardiovascular Health at Community Level, 2013 update: scientific statement for public health practitioners, healthcare providers, health policy makers. *Circulation*. 2013; **127**: 1730–1753.
 28. Zhao Jingjing, Zhou Muke, Guo Jian, Zhang Jingjing, Yang Yaqiong, Yu Fan, He Li. Differences in knowledge/compliance with secondary prevention of stroke between TIA patients with/without subsequent stroke. *Journal Clinical Nursing*. 2014; **23**: 2939–2948.
 29. Pandian JD, Gall SL, Kate MP, et al. Prevention of stroke: global-perspective. *Lancet*. 2018; **392**: 1269–78.
 30. United Nations General Assembly. Resolution adopted by General Assembly: 66/ 2: Political Declaration of High-level Meeting of General-Assembly on Prevention/ Control of Non-communicable Diseases. Adopted September 19, 2011. Published January 24, 2012 ed: 2012.
 31. WHO. Global action plan for prevention/control of NCD 2013-2020. WHO, Geneva http://www.who.int/nmh/events/ncd_action_plan/en/ 2013.
 32. United Nations General Assembly, Seventy-second session. Progress on prevention/control of NCD. Report of

- Secretary-General. Dec 2017. A/72/662 https://ncdalliance.org/sites/default/files/resource_files/UNSG%20Report%20on%20NCDs%20December%202017%20A.72.662%20SG%20report.pdf 9 March 2018.
33. Krishnamurthi R, Barker-Collo SAT, *et al.* Mobile technology for primary stroke prevention: proof-of-concept pilot randomised controlled trial brief report. *Stroke*. 2018; **50**: 196–198.
34. Bernabe-Ortiz A, Sal y Rosas VG, Ponce-Lucero V, *et al.* Effect of salt substitution on community-wide blood pressure/ hypertension incidence. *Nature Medicine*. 2020; **26**: 374–378.
35. Goodchild M, Perucic AM, Nargis N. Modelling the impact of raising tobacco taxes on public health/finance. *BulletinWHO* 2016; **94**: 250–257.
36. Akinyemi R, Ovbiagele B, Adeniji O, *et al.* Stroke in Africa: Profile, Progress, Prospects, Priorities. *Nature Reviews Neurology*. 2021; **17**: 634–656.