Published in final edited form as:

J Neurol Sci. 2017 February 15; 373: 289–294. doi:10.1016/j.jns.2017.01.022.

Administration of a Pictorial Questionnaire to screen for Stroke among Patients with Hypertension or Diabetes in Rural Ghana

Fred S. Sarfo^{1,2}, Rexford Adu Gyamfi³, Sheila Adamu², Osei Sarfo-Kantanka², Mayowa Owolabi⁴, and Bruce Ovbiagele⁵

¹Kwame Nkrumah University of Science & Technology, Kumasi, Ghana

²Komfo Anokye Teaching Hospital, Kumasi, Ghana

³Agogo Presbyterian Hospital, Agogo, Ghana

⁴University of Ibadan, Ibadan, Nigeria

⁵Medical University of South Carolina, South Carolina, USA

Abstract

Background—Stroke prevention is an important public health goal in Low-and-Middle Income countries (LMIC) due to its high mortality and morbidity in these settings. Epidemiological data from high-income countries have demonstrated a potent predictive association between self-reported stroke symptoms and risks of future strokes, incident cognitive impairment and all-cause mortality.

Objective—To utilize a pictographic version of the 8-item Questionnaire for Verifying Stroke Free Status (QVSFS) to screen for stroke symptoms and determine its predictors among hypertensive and diabetic patients in a rural hospital within a LMIC.

Methods—Between July and October 2016, 500 consecutive patients with hypertension and/or diabetes mellitus encountered in clinic at the Agogo Presbyterian Hospital, a district level health institution in Ghana were enrolled. A validated pictographic version of the QVSFS was administered by trained research assistants to all study participants and demographic and clinical information on hypertension and diabetes control were collected. The neurologist/ Specialist Physician examined all patients neurologically using a structured questionnaire and reviewed medical charts for objective documentary evidence of stroke. Predictors of stroke symptoms were assessed using a multivariate logistic regression model.

Results—Among the cohort, median (IQR) age was 58 (51–66) years, 399 (79.8%) were women, 388 (77.6%) had hypertension, 92 (18.4%) had diabetes and hypertension, and 20 (4.0%) had just diabetes. 30 (6.0%) patients had confirmed stroke/TIA after physician evaluation, 151 (30.6%) had

Corresponding Author Dr. Fred Stephen Sarfo, Neurology Unit, Department of Medicine, Kwame Nkrumah University of Science & Technology, P.M.B. Kumasi, Ghana, +233 243 448464, stephensarfo78@gmail.com.

Conflict of Interest: None to declare

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

at least one symptom of stroke (SS) without prior diagnosis of stroke/TIA and 319 (63.8%) reported no stroke symptoms. Independent predictors of reporting stroke symptoms were increasing age - aOR: 1.38 (1.16–1.64) for each 10 years older and HBA1C–OR: 1.74 (1.16–2.61) for each 2% increase. Subjects with previous Stroke/TIA diagnosis had significantly higher mean $\pm$ SD systolic blood pressure (148.0 ± 21.2 mmHg vs. 136.0 ± 17.3 mmHg vs. 138.3 ± 19.7 mmHg, $p=0.009$) and median (IQR) HBA1C (8.8% (6.7–10.2) vs. 8.2 (6.4–10.6) vs. 7.2 (6.3–8.0), $p=0.05$) compared with SS and asymptomatic groups.

Conclusion—One in three patients with hypertension and/ diabetes in rural Ghana report stroke-like symptoms. Routine use of the pictographic version of the QVSFS could assist in identifying patients with or at high risk for stroke who may benefit from appropriate prevention treatments.

Keywords

Stroke symptoms; prevention; risk factors; developing countries

Introduction

Stroke prevention is an important public health priority in Low- and Middle-Income Countries (LMICs) including sub-Saharan Africa where the already high burden of stroke is predicted to escalate over the coming decades.^(1–3) High rates of hypertension, diabetes mellitus, dyslipidemia and obesity, underpinned by the adoption of western lifestyles combined with low health literacy rates on stroke have contributed to the upsurge of stroke in these settings.^(4–7) Cost-effective primary and secondary preventive strategies, in particular tools for screening high-risk populations for stroke symptoms are urgently needed for targeted interventions to reverse the dire projected trends of stroke in developing countries.

The 8-item questionnaire for Verifying Stroke Free Status (QVSFS) is an accurate, reliable and easy-to-use questionnaire with excellent diagnostic features for ruling out stroke by assessing previous diagnosis of stroke/TIA and 6 cardinal stroke symptoms.⁽⁸⁾ A spectrum of stroke has been described via use of the QVSFS in screening adult populations ranging from asymptomatic, Stroke symptoms without stroke diagnosis (SS), transient ischemic attacks (TIA) and strokes. Findings from the population based prospective REGARDS study⁹ in the US, where the QVSFS was used to screen enrolled participants, indicate a high prevalence of stroke symptoms among stroke-free individuals¹⁰ which is strongly predictive of prospective risks for strokes^{11,12}, and cognitive impairment¹³. Indeed, self-reported stroke symptoms among stroke-free individuals have been identified as a potent risk factor for future stroke after adjustment for the traditional vascular risk factors of CVDs¹².

Furthermore, these investigators found graded associations between the spectrum of stroke and risk for future strokes and all-cause mortality.¹⁴ However, the prevalence of symptoms of stroke among individuals at high risk for cardiovascular disease such as diabetes and hypertension in resource-limited settings where the greatest burden of stroke resides remains unknown.

The prospects for the QVSFS to be used as a tool for screening for the presence of stroke and/or stroke symptoms among hypertensive and diabetic patients have hitherto not been

explored. The performance of this instrument in resource-limited settings was recently assessed in a validation study in three commonly spoken West African languages with a modification that included the addition of pictographs of stroke symptoms and was found to be excellent.^{15,16} Application of the questionnaire for the purposes of screening high CVD risk patients under routine care may enhance the detection of unreported stroke/TIA diagnosis or stroke symptoms by clinicians for the appropriate interventions to be implemented and could further offer an opportunity to educate patients on stroke symptoms during clinic visits or community screening programs. Our objectives for the present study are to assess rates and predictors of stroke symptoms among hypertensive and diabetic patients at high risk for cardiovascular disease (CVD) and assess the performance of the QVSFS in a rural Ghanaian hospital.

Methods

This cross-sectional study was ethically approved by the Committee on Human Research Publications and Ethics and was conducted at the Agogo Presbyterian hospital at the Ashanti Akim district in the Ashanti region of Ghana. The hospital serves predominantly a rural population of farmers and has a dedicated hypertension and diabetes clinics where subjects for the present study were recruited. 500 consecutive hypertensive and/or diabetic patients were enrolled into the study between July and October 2016 after obtaining informed consent. Basic demographic information were collected by 5 trained research assistants who then administered the 8-item QVSFS with pictures for question items 3 to 8 which assesses *sudden onset* hemiparesis, hemisensory loss, mono-/bi-ocular visual loss, hemi-anopsia, expressive or receptive aphasia. (Supplementary information 1). The questionnaire was translated into Akan language as previously described^{15,16} and administered in the local dialect and the answers recorded as yes, no, or don't know for each question item. Participants were subsequently reviewed by a Specialist Physician, who being blinded to the responses of the QVSFS, reviewed the medical records of all participants for evidence of previously documented diagnosis of stroke/TIA, then examined the patient neurologically to elicit the presence of hemiparesis, hemianesthesia, visual field defects, and aphasia and adjudicate whether the patient has had a stroke/TIA as a gold standard. Clinic systolic and diastolic blood pressures (in mmHg) for the previous two clinic visits as well as the HbA1C (%) levels within the previous 3 months for diabetes mellitus patients were collected.

Statistical Analysis

Baseline demographic and clinical characteristics of participants were compared using the Chi-squared test (categorical variables), Mann Whitney U-test or Student's t-test for medians or means respectively for paired continuous variables and ANOVA or Kruskal-Wallis tests for more than 2 group comparisons of continuous variables. Participants who scored 0 to 8 (no to all questions) were classified stroke free/asymptomatic; subjects who answered 'Yes' to any of the item numbers 3–8 but 'No' to Items 1 and 2 and were found not have objective clinical evidence of stroke by the attending Physician were classified as Stroke Symptoms without Stroke diagnosis (SS) and subjects were classified as having a stroke/TIA if the attending physician found objective evidence of stroke on review of medical chart, history and examination. We estimated the sensitivity, specificity, positive and

negative predictive values of the QVSFS with their corresponding 95% confidence intervals based on a positive response any of the 8 items compared with physicians diagnosis of stroke as gold standard. We also assessed the demographic and clinical predictors of having at least one stroke symptom using a multivariable logistic regression analysis where stroke symptom was specified as the dependent variable and pre-specified independent variables were age, gender, educational status, domicile location, systolic blood pressure and HBA1C. In all analyses, statistical significance was attained if a 2-tailed $p < 0.05$ was reached with no adjustments for multiple comparisons.

Results

Demographic characteristics

The 500 study participants comprised of 399 (79.8%) females and 101 (20.2%) males with an overall median (IQR) age of 58 (51–66) years. There were 388 (77.6%) hypertensive, 92 (18.4%) diabetic hypertensive, and 20 (4.0%) diabetic patients.

Frequency of stroke symptoms

169 (33.8%) subjects had experienced at least one symptom of stroke with 110, 40, 9, 7 and 3 individuals reporting 1, 2, 3, 4 and 5 out of the 6 possible symptoms respectively. 30 (6.0%) patients had confirmed stroke/TIA after physician evaluation, 151 (30.6%) had at least one symptom of stroke (SS) without prior diagnosis of stroke/TIA and 319 (63.8%) reported no stroke symptoms (Asymptomatic). Individual item responses to the QVSFS, duration of symptoms and frequency of clinically demonstrable neurologic deficits are as shown in table 1.

Comparison of demographic and clinical features according stroke/TIA status

As shown in table 2, subjects with confirmed stroke/TIA and the SS groups are comparably older than those asymptomatic for stroke with a proportionally higher propensity for male than female subjects to have confirmed stroke/TIA. In a decreasing manner, the highest concentrations of HBA1C were observed among those with stroke/TIA followed by the SS group and the asymptomatic group whilst the highest systolic blood pressures were noted among stroke/TIA subjects with comparable levels among the SS and asymptomatic groups. The distribution of the stroke spectrum according to vascular risk factor status i.e. hypertension, hypertension plus diabetes and diabetes alone is depicted in Figure 1.

Hemi-sensory loss and receptive dysphasia were significantly commoner among those with Stroke/TIA compared with the SS group whilst hemianopsia was more commonly reported among the SS groups compared with those with previous stroke/TIA (Table 3). Among 470 subjects without previous stroke/TIA diagnosis, 30.6% reported one or more stroke symptoms and the prevalence of each symptom is presented overall, and by age, sex, educational status, hypertensive or diabetic status in table 4. Hemianopsia was the commonest stroke symptom whilst receptive dysphasia was the least reported symptom. In general, speech and visual symptoms were significantly commoner above age 60 years while hemiparesis was commoner among diabetics than non-diabetics.

Predictors of stroke symptoms

Increasing age, male gender and higher HBA1C levels were significantly associated with having stroke symptoms in unadjusted analysis. Upon adjustment for confounders, increasing age - OR: 1.38 (1.16–1.64) for each 10 years older and HBA1C—OR: 1.74 (1.16–2.61) for each 2% increase in HBA1C levels- were significantly associated with risk of having stroke symptoms.

Performance of the QVSFS questionnaire for stroke diagnosis

The QVSFS had a sensitivity, specificity, positive and negative predictive values of 0.93 (0.68–1.00), 0.66 (0.61–0.70), 0.08 (0.04–0.13) and 1.00 (0.98–1.00). Question item 1 had the highest sensitivity, specificity, PPV and NPV as shown in table 6.

Discussion

We report a high frequency of stroke symptoms among hypertensive and diabetic patients attending a rural Ghanaian hospital in West Africa. Almost 34% of study participants reported at least one symptom of stroke with only 6% clinically diagnosed with stroke or transient ischemic attack. 31% had stroke-like symptoms without clinically diagnosed stroke/TIA. Independent predictors of reporting stroke symptoms were increasing age and poor glycemic control and stroke/TIA subjects had higher systolic BP and HBA1C compared with SS and asymptomatic groups indicating a poor control of these cardinal risk factors and heightened risk for recurrent stroke.

Among study participants without Stroke/TIA, stroke-like symptoms such as visual loss, expressive and receptive aphasia were commoner among subjects older than 60 years and diabetics were more likely to report hemiparesis and homonymous hemianopsia than non-diabetics. The high frequency of stroke-like symptoms among this study population could be due undiagnosed minor strokes from which subjects may have recovered, transient cerebral/retinal ischemia or stroke mimics such as hypoglycemia, hypertensive encephalopathy, neuropathy or hypertensive/diabetic retinopathy as previously suggested.¹⁷ It is likely that most of the symptoms elicited were of evanescent nature given that detailed neurological examination of study subjects for objective clinical evidence of these deficits often yielded negative findings and there was an overall low frequency of permanent neurological deficits. Again the mean duration of these symptoms ranged from a few months to several years. These caveats notwithstanding, there is a growing notion that self-reported stroke-like symptoms may represent an intermediate phenotype in the stroke spectrum between an asymptomatic stroke-free state and clinical TIA/Stroke state with adverse prognostic consequences. In the REGARDS cohort, 18% of the general population aged 45+ reported stroke-like symptoms in the absence of stroke or TIA at enrollment¹⁰. The investigators have prospectively identified associations between presence of stroke-like symptoms and higher Framingham Stroke Risk Score,¹⁰ increased risk of cognitive impairment¹³, lower quality of life¹⁸, incremental risk for future stroke based on number of stroke symptoms reported¹² and most significantly an increased risk of all-cause mortality¹⁴. In the present study 3 in 10 had stroke-like symptoms without prior diagnosis of stroke/TIA.

We found that increasing age was an independent risk factor for self-reported stroke symptoms with a 38% increased odds for each 10-year increment after accounting for the moderating effects of other confounders. Furthermore the mean age of subjects with stroke/TIA was not significantly different from those with stroke-like symptoms without stroke. The salience of these observations is supported by the positive correlation between increasing age and the frequency of 'silent infarcts'-evidence of vascular injury on neuroimaging without a clinical history of stroke. The frequency of asymptomatic cerebral ischemia noted among persons aged 55–64 years is 11%, progressively increasing to 43% for individuals >85 years of age.^{19, 20} We also noted that for each 2% increase in HBA1C level, odds of reporting stroke symptoms increased by 74% which is an interesting observation because diabetes mellitus is often associated with lacunar strokes^{21, 22} which may present with mild or transient stroke symptoms, however poorly controlled diabetes could also present with stroke mimics due to glycemic excursions. From a pathophysiologic viewpoint however, it has been amply demonstrated that subjects with diabetes and hypertension have a profound predisposition to atherosclerosis which is strongly linked to the pathogenesis of stroke via arterial inflammation and stiffness.^{23–25} Although males were more likely to experience stroke symptoms in unadjusted analysis, the effect of gender was lost on adjusted analysis. Thus the elderly and poorly controlled diabetics may require closer monitoring to ensure that targets for primary and secondary prevention of CVD are met to avert vascular events.

Conceptually, the QVSFS was designed to rule out stroke diagnosis to enable the identification of control subjects for epidemiological studies⁸ when such individuals responded negatively to all 8-items on the questionnaire. However the questionnaire could have wider applications beyond research settings, particularly in routine clinic care for identification of patients with vascular risk factors at high risk for adverse outcomes such as those with stroke/TIA and certainly those with stroke symptoms without a clinical diagnosis of stroke. Regarding the use of the QVSFS for detection of stroke/TIA in the present study, we found that it maintained a high sensitivity and negative predictive value of 93% and 100% respectively but a lower specificity of 66% and positive predictive value of 8% due probably to the diluting effect of the high frequency of stroke-like symptoms in the present cohort. Altogether, our observations suggest that there may be added value in routinely screening patients at high risk for CVD using the QVSFS given its excellent diagnostic qualities for stroke diagnosis, its predictive value for future vascular events and cognitive impairment, its low-cost and ease of use. The introduction of pictographs could enhance the utility of the instrument as an educational tool for use by health care workers evaluating hypertensive or diabetic patients in clinic or within the community.

Limitations of the present study include the cross-sectional nature which precludes causal associations from being drawn, recollection of stroke symptoms by study subjects which could be subject to recall bias and stroke diagnosis was confirmed in most instances on medical review and clinical examination without recourse to neuroimaging, the study being conducted in a rural setting without these resources. These limitations present potential avenues for designing prospective cohort studies for evaluation of the role of self-reported stroke symptoms on risks for strokes, dementia, and mortality particularly among patients at high risk for these events. A key sub-study would be the inclusion of neuroimaging to

ascertain the prevalence of vascular insults in relation to purported stroke symptoms. Thus said, interventions such as stringent control of vascular risk factors among such patients would mitigate the dire outcomes predicted on the basis of the known associations poor risk factor control and vascular events^{25–27}.

Conclusion

Nearly 3 out of 10 patients with hypertension and diabetes reports having stroke-like symptoms. The routine utilization of the pictographic version of the QVSFS in screening for stroke symptoms is recommended to help clinicians identify patients at high risk for adverse vascular outcomes for targeted interventions to mitigate this risk.

Acknowledgments

We are grateful to Ernest Oduro Acquah, Emmanuel Oppong, Bright Amoako Asiamah, Francis Agyei, and Edith Sai-Affreh for helping with data collection.

Source of funding: National Institute of Health- National Institute of Neurological Disorders & Stroke; R21 NS094033 and NHGRI, NIH-NINDS; U54 HG007479.

References

1. Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, Bennett DA, et al. Global and regional burden of stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. *Lancet*. 2014 Jan 18; 383(9913):245–54. [PubMed: 24449944]
2. Feigin VL, Krishnamurthi RV, Parmar P, Norrving B, Mensah GA, Bennett DA, et al. Update on the Global Burden of Ischemic and Hemorrhagic Stroke in 1990–2013: The GBD 2013 Study. *Neuroepidemiology*. 2015; 45(3):161–76. [PubMed: 26505981]
3. Feigin VL, Roth GA, Naghavi M, Parmar P, Krishnamurthi R, Chugh S, et al. Global burden of stroke and risk factors in 188 countries, during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet Neurol*. 2016 Jun 9.
4. Owolabi MO, Karolo-Anthony S, Akinyemi R, Arnett D, Gebregziabher M, Jenkins C, et al. The burden of stroke in Africa: a glance at the present and a glimpse into the future. *Cardiovasc J Afr*. 2015 Mar; 26(2 Suppl 1):S27–S38. [PubMed: 25962945]
5. O'Donnell MJ, Chin SL, Rangarajan S, Xavier D, Liu L, Zhang H, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. *Lancet*. 2016 Jul 15.
6. Cox AM, McKeivitt C, Rudd AG, Wolfe CD. Socioeconomic status and stroke. *Lancet Neurol*. 2006 Feb; 5(2):181–8. [PubMed: 16426994]
7. Sarfo FS, Akassi J, Awuah D, Adamu S, Nkyi C, Owolabi M, Ovbiagele B. Trends in stroke admission and mortality rates from 1983 to 2013 in central Ghana. *J Neurol Sci*. 2015; 357(1–2): 240–5. [PubMed: 26293417]
8. Jones WJ, Williams LS, Meschia JF. Validating the Questionnaire for Verifying Stroke-Free Status (QVSFS) by neurological history and examination. *Stroke*. 2001; 32:2232–2236. [PubMed: 11588306]
9. Howard VJ, Cushman M, Pulley L, et al. The reasons for geographic and racial differences in stroke study: objectives and design. *Neuroepidemiology*. 2005; 25:135–143. [PubMed: 15990444]
10. Howard VJ, McClure LA, Meschia JF, Pulley L, Orr SC, Friday GH. High prevalence of stroke symptoms among persons without a diagnosis of stroke or transient ischemic attack in a general population: The reasons for geographic and racial differences in stroke (REGARDS) study. *Arch Intern Med*. 2006; 166:1952–1958. [PubMed: 17030827]

11. Chambless LE, Toole JF, Nieto FJ, Rosamond W, Paton C. Association between symptoms reported in a population questionnaire and future ischemic stroke: The ARIC study. *Neuroepidemiology*. 2004; 23:33–37. [PubMed: 14739565]
12. Kleindorfer D, Judd S, Howard VJ, McClure L, Safford MM, Cushman M, et al. Self-reported stroke symptoms without a prior diagnosis of stroke or transient ischemic attack: a powerful new risk factor for stroke. *Stroke*. 2011; 42:3122–2126. [PubMed: 21921283]
13. Kelley BJ, McClure LA, Letter AL, Wadley VG, Unverzagt FW, Kissela BM, et al. Report of stroke-like symptoms predicts incident cognitive impairment in a stroke-free cohort. *Neurology*. 2013; 81(2):113–8. [PubMed: 23783751]
14. Judd SE, Kleindorfer DO, McClure LA, Rhodes JD, Howard G, Cushman M, et al. Self-report of stroke, transient ischemic attack, or stroke symptoms and risk of future stroke in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) Study. *Stroke*. 2013; 44(1):55–60. [PubMed: 23233382]
15. Sarfó FS, Gebregziabher M, Ovbiagele B, Akinyemi R, Owolabi L, Obiako R, Armstrong K, Arulogun O, Akpalu A, Melikam S, Saulson R, Jenkins C, Owolabi M. SIREN. Validation of the 8-item questionnaire for verifying stroke free status with and without pictograms in three West African languages. *eNeurologicalSci*. 2016; 3:75–79. [PubMed: 27148595]
16. Sarfó FS, Gebregziabher Mulugeta, Ovbiagele Bruce, Akinyemi Rufus, Owolabi Lukman, Obiako Reginald, Akpa Onoja, Armstrong Kevin, Akpalu Albert, et al. Multilingual Validation of the Questionnaire for Verifying Stroke-Free Status in West Africa. *Stroke*. 2016 Jan; 47(1):167–172. [PubMed: 26578660]
17. Gao L, Meschia JF, Judd S, Muntner P, McClure LA, Howard VJ, et al. What stroke symptoms tell us: Association of risk factors and individual stroke symptoms in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. *J Stroke Cerebrovasc Dis*. 2012; 21(5):411–416. [PubMed: 22726606]
18. Haley WE, Roth DL, Kissela B, Perkins M, Howard G. Quality of life after stroke: A prospective longitudinal study. *Qual Life Res*. 2011; 20:799–806. [PubMed: 21136298]
19. Knopman DS, Penman AD, Catellier DJ, et al. Vascular risk factors and longitudinal changes on brain MRI: the ARIC study. *Neurology*. 2011; 76:1879–1885. [PubMed: 21543737]
20. Vermeer SE, Longstreth WT Jr, Koudstaal PJ. Silent brain infarcts: a systematic review. *Lancet Neurol*. 2007; 6:611–619. [PubMed: 17582361]
21. You R, McNeil J, O'Malley H, Davis S, Donnan G. Risk factors for lacunar infarction syndromes. *Neurology*. 1995; 45:1483–1487. [PubMed: 7644045]
22. Tuttolomondo A, Pinto A, Salemi G, Di Raimondo D, Di Sciacca R, Fernandez P, et al. Diabetic and non-diabetic subjects with ischemic stroke: Differences, subtype distribution and outcome. *Nutrition, Metabolism and Cardiovascular Diseases*. 2008; 18:152–157.
23. Tuttolomondo A, Pecoraro R, Di Raimondo D, Di Sciacca R, Canino B, Arnao V, Buttà C, Della Corte V, Maida C, Licata G, Pinto A. Immune-inflammatory markers and arterial stiffness indexes in subjects with acute ischemic stroke with and without metabolic syndrome. *Diabetol Metab Syndr*. 2014 Feb 27.6(1):28. [PubMed: 24571954]
24. Tuttolomondo A, Di Sciacca R, Di Raimondo D, Serio A, D'Aquanno G, Pinto A, et al. Arterial stiffness indexes in acute ischemic stroke: relationship with stroke subtype. *Atherosclerosis*. 2010; 211(1):187–194. [PubMed: 20226464]
25. Tuttolomondo A, Casuccio A, Della Corte V, Maida C, Pecoraro R, Di Raimondo D, et al. Endothelial function and arterial stiffness indexes in subjects with acute ischemic stroke: Relationship with TOAST subtypes. *Atherosclerosis*. 2016 Pii:S0021-9150(16)31466–6 (Epub ahead of print).
26. Lloyd-Jones D, Adams R, Carnethon M, De Simone G, Ferguson TB, Flegal K, et al. Heart disease and stroke statistics-2009 update: A report from the American heart association statistics committee and stroke statistics subcommittee. *Circulation*. 2009; 119:480–486. [PubMed: 19171871]
27. Johnston SC, Fayad PB, Gorelick PB, Hanley DF, Shwayder P, van Husen D, et al. Prevalence and knowledge of transient ischemic attack among US adults. *Neurology*. 2003; 60:1429–1434. [PubMed: 12743226]

28. Lisabeth LD, Ireland JK, Risser JM, Brown DL, Smith MA, Garcia NM, et al. Stroke risk after transient ischemic attack in a population-based setting. *Stroke*. 2004; 35:1842–1846. [PubMed: 15192239]

Highlights

- The 8-item QVSFS could be used to screen for stroke symptoms among high risk CVD subjects
- 500 Ghanaian hypertensive $\pm$ diabetic subjects were screened for stroke symptoms using a pictorial version of the QVSFS
- 6% of study population had previous strokes/TIA
- 3 in 10 had stroke-like symptoms without prior diagnosis of stroke with high risk for future CVD events and dementia
- The QVSFS could assist in identifying patients to benefit from CVD preventive interventions in routine care settings

Figure 1. Distribution of stroke spectrum (stroke/TIA, stroke symptoms without stroke, asymptomatic) according vascular risk factor profile.

Table 1

Frequencies & duration of symptoms in response to Items on the 8-item QVSFS.

QUESTION	Self-reported Frequency, n (%)	Mean $\pm$ SD duration (years)	Frequency of deficits on clinical examination
Previous diagnosis of stroke	18 (3.6%)	4.5 $\pm$ 3.1	
Previous diagnosis of 'mild stroke'/TIA	25 (5.0%)	3.0 $\pm$ 2.8	
Sudden painless weakness of half of body	47 (9.4%)	2.0 $\pm$ 2.6	5 (1.0%)
Sudden numbness or dead feeling on one side of body	20 (4.0)	2.9 $\pm$ 2.8	1 (0.2%)
Sudden painless loss of vision in one or both eyes	66 (13.2%)	3.5 $\pm$ 3.7	0 (0.0%)
Suddenly lost one half of your vision	72 (14.4%)	1.7 $\pm$ 2.2	1 (0.2%)
Loss of the ability to understand what people are saying	39 (7.8%)	3.3 $\pm$ 4.2	0 (0.0%)
Lost of ability to express verbally or in writing	16 (3.2%)	2.1 $\pm$ 2.4	1 (0.2%)

Table 2

Comparison of subjects with Stroke/TIA, Stroke symptoms but no stroke, and no stroke symptoms High Risk CVD patients.

Variable	Stroke/TIA n = 30	Stroke symptoms but no stroke (SS) n = 151	No stroke symptoms n = 319	P-value
Age, mean $\pm$ SD	59.7 $\pm$ 12.6	60.7 $\pm$ 10.2	56.5 $\pm$ 11.0	0.0005
Female gender, n (%)	14 (46.7)	123 (81.5)	264 (82.8)	<0.0001
Educational status, n (%)				0.32
Primary/None	14 (46.7)	89 (58.9)	169 (53.0)	
>Secondary	16 (53.3)	62 (41.1)	150 (47.0)	
Location of domicile				0.80
Rural	25 (83.3)	122 (80.8)	252 (79.0)	
Semi-urban/urban	5 (16.7)	29 (19.2)	67 (21.0)	
Hypertension, n (%)	29 (96.7)	145 (96.0)	304 (95.3)	0.90
Diabetes Mellitus, n (%)	7 (23.3)	40 (26.5)	65 (20.7)	0.34
SBP (mmHg), mean $\pm$ SD	148.0 $\pm$ 21.2	136.0 $\pm$ 17.3	138.3 $\pm$ 19.7	0.009
DBP (mmHg), mean $\pm$ SD	82.6 $\pm$ 12.4	79.3 $\pm$ 10.9	79.4 $\pm$ 11.3	0.32
HbA1C (%), median (IQR)	8.8 (6.7– 10.2)	8.2 (6.4–10.6)	7.2 (6.3– 8.0)	0.05

Table 3

Comparison of Frequency of Stroke Symptoms by those with History of stroke/TIA compared with no History of stroke but stroke symptoms

Stroke symptom	History of stroke/TIA (n=30)	No History of stroke (n=151)	P-value
Sudden weakness on one side	8 (26.7%)	39 (25.8%)	0.92
Sudden numbness on one side	10 (33.3%)	10 (6.6%)	<0.0001
Painless loss of vision	7 (23.3%)	59 (39.1%)	0.10
Painless loss of vision one half of vision	7 (23.3%)	65 (43.0%)	0.04
Loss of ability to communicate	9 (30.0%)	30 (19.9%)	0.21
Loss of ability to understand	7 (23.3%)	9 (6.0%)	0.002

Table 4

Prevalence of individual stroke symptoms among Hypertensive and Diabetes Patients *without History of Stroke/TIA* diagnosis.

SUB-GROUPS	Unilateral painless weakness (n=39)	Unilateral numbness (n = 10)	Painless loss of vision = 59)	Loss of one half of vision (n = 65)	Loss of ability to communicate (n = 30)	Loss of ability to understand (n = 9)
Overall	8.3%	2.1%	12.6%	13.8%	6.4%	1.9%
Age, years	<i>P=0.91</i>	<i>P=0.11</i>	<i>P=0.0002</i>	<i>P=0.49</i>	<i>P=0.005</i>	<i>P=0.05**</i>
<60 (n=257)	21 (8.2%)	3 (1.2%)	19 (7.4%)	33 (12.8%)	9 (3.5%)	2 (0.8%)
>60 (n=213)	18 (8.5%)	7 (3.3%)	40 (18.8%)	32 (15.0%)	21 (9.9%)	7 (3.3%)
Sex	<i>P=0.96</i>	<i>P=0.84</i>	<i>P=0.83</i>	<i>P=0.22</i>	<i>P=0.52</i>	<i>P=0.60</i>
Male (n=83)	7 (8.4%)	2 (2.4%)	11 (13.3%)	15 (18.1%)	4 (4.8%)	1 (1.2%)
Female (n=387)	32 (8.3%)	8 (2.1%)	48 (12.4%)	50 (12.9%)	26 (6.7%)	8 (2.1%)
Education	<i>P=0.12</i>	<i>P=0.74</i>	<i>P=0.31</i>	<i>P=0.93</i>	<i>P=0.04</i>	<i>P=0.47</i>
No/Primary (n=258)	26 (10.1%)	6 (2.3%)	36 (14.0%)	36 (14.0%)	22 (8.5%)	6 (2.3%)
>Secondary (n=212)	13 (6.1%)	4 (1.9%)	23 (10.8%)	29 (13.7%)	8 (3.8%)	3 (1.4%)
Hypertension	<i>P=0.40</i>	<i>P=1.00</i>	<i>P=0.67</i>	<i>P=0.56</i>	<i>P=0.13</i>	<i>P=0.34</i>
Yes (n=449)	36 (8.0%)	10 (2.2%)	57 (12.7%)	63 (14.0%)	27 (6.0%)	8 (1.8%)
No (n=21)	3 (14.2%)	0 (0.0%)	2 (9.5%)	2 (9.5%)	3 (14.3%)	1 (4.8%)
Diabetes	<i>P=0.001</i>	<i>P=0.86</i>	<i>P=0.95</i>	<i>P=0.04</i>	<i>P=0.30</i>	<i>P=0.99</i>
Yes (n=105)	20 (19.0%)	2 (1.9%)	13 (12.4%)	21 (20.0%)	9 (8.6%)	2 (1.9%)
No (n=365)	29 (7.9%)	8 (2.2%)	46 (12.6%)	44 (12.1%)	21 (5.8%)	7 (1.9%)

Note 30 patients with history of Stroke/TIA were excluded from this analysis.

Table 5

Predictors of having stroke symptoms among High CVD Risk Patients using multivariable logistic regression modeling.

Predictor	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Age, each 10 years older	1.39 (1.17– 1.65)	0.0002	1.38 (1.16– 1.64)	0.0003
Gender				
Male	1.56 (1.00– 2.44)	0.05	1.47 (0.93– 2.32)	0.10
Female	1.00			
Educational status				
Secondary or above	0.87 (0.60– 1.25)	0.45	–	-
None/Primary	1.00			
Domicile location				
Urban	0.88 (0.56– 1.39)	0.58	-	-
Rural	1.00			
Hypertension				
Yes	1.22 (0.49– 3.04)	0.68	-	-
No	1.00			
Diabetes Mellitus				
Yes	1.32 (0.86– 2.03)	0.21	-	-
No	1.00			
HBA1C, every 2% rise	1.55 (1.09– 2.20)	0.01	1.74 (1.16– 2.61)	0.008
Systolic BP				
>140mmHg	0.90 (0.62– 1.32)	0.60	-	-
<140mmHg	1.00			

Table 6

QVSFS global score and Item-by-item performance for stroke diagnosis

Question	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
1–8	0.93 (0.68– 1.00)	0.66 (0.61– 0.70)	0.08 (0.04–0.13)	1.00 (0.98–1.00)
1	0.93 (0.68– 1.00)	0.99 (0.98– 1.00)	0.78 (0.52–0.94)	1.00 (0.99–1.00)
2	0.67 (0.38– 0.88)	0.97 (0.95– 0.98)	0.40 (0.21–0.61)	0.99 (0.98–1.00)
3	0.47 (0.21– 0.73)	0.92 (0.89– 0.94)	0.15 (0.06–0.28)	0.98 (0.96–1.00)
4	0.40 (0.16– 0.68)	0.97 (0.95– 0.98)	0.30 (0.12–0.54)	0.98 (0.96–0.99)
5	0.27 (0.08– 0.55)	0.87 (0.84– 0.90)	0.06 (0.02–0.15)	0.97 (0.96–0.99)
6	0.20 (0.04– 0.48)	0.86 (0.82– 0.89)	0.04 (0.01–0.12)	0.97 (0.95–0.96)
7	0.20 (0.04– 0.48)	0.93 (0.90– 0.95)	0.08 (0.02–0.21)	0.97 (0.96–0.99)
8	0.33 (0.12– 0.62)	0.98 (0.96– 0.99)	0.33 (0.12–0.62)	0.98 (0.96–0.99)

Gold standard for stroke diagnosis= Physician history taking, focused neurological examination and review of medical charts for previous documented diagnosis of stroke.