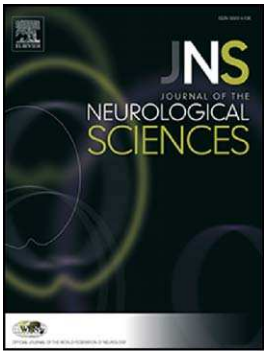

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Stroke survivors in Nigeria: A door-to-door prevalence survey from the Niger Delta Region

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ABSTRACT

The burden of stroke has been projected to increase in low-and middle-income countries due to the ongoing epidemiological transition. However, community-based stroke prevalence studies are sparse in sub-Saharan Africa particularly in Nigeria. This study aimed to provide a comparative estimate of the prevalence of stroke survivors in the rural Niger Delta region. A three-phased door–to-door survey was conducted using WHO modified instruments. In the first-phase, 2028 adults (≥18 years) participants randomly selected from two rural communities were screened by trained health research assistants for probable stroke. In the second phase, suspected cases were screened with stroke-specific tool. Positive cases were made to undergo complete neurological evaluation by two study neurologist in phase-three. Stroke diagnosis was based on clinical evaluation using WHO criteria. Overall, 27 (8 first-ever and 19 recurrent cases) stroke survivors with crude prevalence of 13.31/1000 (95% CI, 8.32-18.31) and a non-significant difference in prevalence between the two study communities were found, (P= 0.393I). In addition, age-adjusted prevalence of stroke survivors was 14.6/1000 person, about 7-folds higher than previous estimates outside the Niger Delta region. The prevalence increases significantly with advancing in age, P<0·001. Among others, hypertension (92.59%) was the commonest risk factor and comorbidity found. Improved stroke surveillance and care, as well as better management of the underlying risk factors, primarily undetected or uncontrolled high blood pressure, remains a public health priority.

Key Words: Stroke Survivor; Cross-sectional; Prevalence; Rural; Niger Delta; Nigeria

Highlights

A three-phased door-to door survey was conducted to identify stroke survivors

Age-adjusted prevalence of 14.6/1000 persons was found, which is 7-fold the rates in Nigeria

The finding has huge socioeconomic and wider health implication in a rural community

Improved surveillance and management of HBP may reduce the burgeoning stroke burden

1. Introduction

Recent global estimates found that stroke ranked as the second commonest cause of death with estimated 5.9 million stroke-related deaths and 102 million disability-adjusted life-years (DALY) lost in 2010 [1]. Despite the infectious disease scourge, it has been predicted that about 80% of all stroke will occur in LMICs by the year 2030 particularly in sub-Saharan Africa where the pooled estimates is currently 3.5 per 1,000 population and with the annual increase of 12.0% [2] and [3]. Evidence also found that the risk of death is higher in LMICs compared high income countries. The possible explanations for this observation have been due in part to direct effect of poverty, poor healthcare and increased comorbidity particularly HIV/AIDS [4]. Due to the current epidemiological transition driven by rapid economic development and combined effects of population growth and aging, and sociocultural changes, there is huge concern of continuous increase in the prevalence of stroke in LMICs including Nigeria, and among relatively younger populations [2]. Recent systematic review of population-based studies revealed a consistent evidence that the prevalence of stroke and its major risk factors particularly high blood pressure were now higher in LMICs compared to high income countries and that young adults who present with stroke were unaware of their high blood pressure [2], [5], [6] and [7]. These important revelations were poorly known or underexplored in the rural areas of most LMICs such as in the Niger Delta region in Nigeria.

Epidemiological studies of stroke in Nigeria are few and far between due to health policy priority and funding availability [5], [6] and [7]. Specifically, the prevalence of stroke across studies in Nigeria varies from 0·58/1000 in 1987 to 8.51/1000 in 2015 [4], [8], [9], [10], [11], [12] and [13]. Review evidence found that a 30-day case fatality and 3-year rate was as high as 40%, while the estimated mortality was 12.6/1000 persons [14]. Study evidence suggests

that the influence of rural-urban factors, urbanisation and adoption of western lifestyles particularly among relatively younger population plays an important role [4], [9], [11], [15], and [13]. Research evidence also found that younger patients have higher chance of surviving the acute phase of stroke with residual disability and much better outcomes than older patients leading to increased survivor rates [15].

Niger Delta region in the southern part of Nigeria has continued to witness huge epidemiological and environmental risk transitions due to crude oil and natural gas production and allied activities and lifestyle changes, however, data on prevalence of stroke remains scanty. Initial attempt to unravel the prevalence of stroke in a rural community of Niger Delta in 2014 reported a prevalence of 8.51/1000 [4]. This rate is about 6-fold higher compared to other regions in Nigeria and more than the rates found in most urban and rural populations in LMICs particularly in Africa and South America [7], [16], [17], [18], [19] and [20]. Despite the increased morbidity occasioned by shortage of neurological care and prohibitive out-of-pocket cost for quality care, health policy target has not recognised the enormity of the problem. Given the socioeconomic situation and the associated risk of environmental pollution, we are unsure if the previous estimate can be generalised in the rural Niger Delta. This study aims to provide a comparative estimate of the prevalence of stroke survivors in the rural Niger Delta communities. The finding of the study will help inform decision regarding improved policy responses in screening of high-risk population and public health management of the disease across the rural communities within the region and in Nigeria as a whole.

2. Materials and Methods

2.1. Settings and study design

A community-based cross-sectional study of the prevalence of stroke survivors was conducted for adults aged 18 years and over who have lived for at least 10 years in the two rural communities in the Niger Delta region in Nigeria, along with a study of hypertension prevalence [21]. We aimed to select study participants that are representative of the rural population in the Niger Delta region. Therefore, we stratified the rural communities in the Niger Delta region into two main group on the presence of oil and gas production activities or non-oil and gas production activities. In all, two communities (Ebubu and Usokun) were purposively selected. The selected communities have comparable socioeconomic and cultural features of rural environment in the Niger Delta. However, they differ in terms of the presence of oil and gas production and allied industrial activities. With an average population growth rate of about 2.90% and with reference from the 2006 national census estimate, the current population of the two communities is about 51,000 persons [22].

Ebubu is a rural farming settlement with sparse social infrastructure in Eleme local government area. It is a highly polluted community with history of oil and gas exploration activities by Shell Petroleum Development Company and other major oil companies [23]. The residents are mostly local farmers, artisans and unskilled workers who benefits from oil and gas production activities for their livelihood. Usokun on the other hand is a pristine rural settlement, a non-oil and gas producing community in Degema local government area (Supplementary Fig.1). The main occupation of the residents is fishing, vegetable and crop farming at subsistent level. Fish and other seafood such as clams, oysters and periwinkles are major part of their diet. Usokun residents also share the same health risk from environmental pollution like other communities in the Niger Delta due to poor ambient air quality and polluted rivers and fishing water [23].

According to World Bank report, despite the vast oil and gas production activities and current reserves, the Niger Delta region particularly the rural communities remains poor [24] and [25]. The GNP per capita is below the national average of US$280 in the face of high population growth rate combined with severe habitable land constraints and poor dwellings [23] and [25]. A typical family dwelling is made of mud and thatched roof made from locally sourced materials. It is estimated that about 14,000 fishermen and farmers are involved in fishing and crop farming in these communities with estimated average annual earnings of US$300 [25]. Earlier reports and investigations showed that about 60% of these were in the age range of 25 to 60 with an average of 20 years of fishing or cropping experience [25]. While formal education is rare with the older fishermen, the younger ones were found on the average to have spent between 6-8 years or equivalent to primary school level. Few graduates or educated young men either remain at their home bases working in the nearest local council or move to the city centres and the oil industry locations for paid employment. The two communities are served by two primary health centres. However, the services of local medicine dealers, traditional healers and a few private clinics and maternity homes run by traditional birth attendants are very pronounced.

Details of the sample size calculation for eligible adult residents and sampling of households have been reported previously [21]. Briefly, we estimated a minimum sample size of 2010 for the study. The estimated sample size was calculated using a prevalence of 18% at 3% sampling error margin, 90% power and 95% confidence level. Using the household numbers on an updated census sample frame, we conducted a simple random sample of 700 household based on an assumption of average of 3 adults aged 18 years and over per household. Participants were recruited through a door-to-door visit to the households and through invitations to attend data collection sessions at the designated health centres.

Selected participants are true representatives of the two communities. The study was conducted over a 4-months period from June 1, 2014 to September 18, 2014. The point prevalence was taken as September 18, 2014. The research team comprised of stroke specialists, public health physicians, nurses, field clinicians, health science researchers and field assistants. All the team officials received relevant training before the survey. The research assistants were recruited from the communities and were specifically trained according to WHO-STEPS protocol [26].

2.2. Ethical review

The study was part of an ongoing research collaboration between University of Warwick Medical School and the Preventive and Social Medicine Department, of the University of Port Harcourt in Nigeria. Ethical approval for this study was obtained from the Biomedical and Scientific Research Ethics Sub-committee, University of Warwick, United Kingdom (REGO-2013-448) and the Research Ethics Committee of the University of Port Harcourt, Nigeria (REC/04-2014). Participation in the study was purely voluntary and all participants consented (through signature and/or thumb print) to the study accordingly before assessment.

2.3. Study procedure

Appropriate study information including study aim and objectives were circulated through the local churches, health centres, markets and established occupational groups. Community announcers (town criers) were also employed and they went round the whole communities daily during the study period.

Assessments of study participants were in 3 phases. In the first phase, participants were screened using a pretested general questionnaire adapted from WHO-STEP instrument [21]. The general questionnaire consisted of 3-parts. Part 1 and 2 were socio-demographic, health

and behavioural information while part 3 consisted of anthropometric and blood pressure measurements. The questionnaire has 4 stroke-specific questions intended to identify suspected stroke cases. In the second phase, stroke-screening tool adopted from World Health Organization protocol for epidemiologic studies of Neurological Disorders was used to further evaluate the participants who screened positive following the stroke questions. The stroke tool has also been used in previous studies in LMICs including Nigeria [4], [9], [11], [13] and [16]. In the last phase, participants adjudged to be positive cases in phase 2 were further invited in phase 3 to attend the neurological and laboratory examinations.

Details of anthropometric and blood measurements including self-reported lifestyle factors have been reported previously [21]. All participants included in phase 3 underwent a complete neurological examination. They were evaluated independently by 2 field specialists to detect residual paralysis (hemiparesis / hemiplegia), exaggerated deep tendon reflex, extensor plantar response and hemisensory loss. Radial and all other peripheral pulses were also assessed. Heart sound and carotid bruit were also listened for [27]. Any disagreement was resolved by both specialists examining the patient together. All suspected cases were subjected to routine laboratory test to rule out infections (such as malaria, tuberculous meningitis, cryptococcal meningitis parasitic infection and syphilis). Fasting blood glucose and lipid concentrations were also assessed [28] and [29]. Study specialists also combined participant's medical reports, laboratory results and current medication (if available) and neurological assessment to confirm stroke diagnosis. The diagnosis of stroke was based on the World Health Organization criteria [30]. All participants fulfilling the diagnostic criteria for stroke received free consultation and were considered a prevalence case. We could not use the brain computerized tomography (CT) scan and magnetic resonance imaging (MRI) due to logistics and associated cost, hence, unable to distinguish between stroke subtypes.

2.4. Outcome variables

The main outcome of interest is confirmed stroke and the confounding variables were grouped into socio-demographics variables (such as age and sex, marital status of participants), lifestyle factors (such as smoking status, drinking status and sleep duration), and hypertension status, sleep deprivation and measures of body fat.

2.5. Data Analysis

We used summary statistics to show the distribution of the main variables. The values were expressed as absolute numbers with percentages (proportion of study participants with stroke) for categorical and mean with standard deviation for continuous variables respectively. Rates and means were presented with 95% confidence intervals (CIs) and compared for differences using chi-square (χ^2) and t-test respectively. Crude and age-adjusted (using USA population 2000 reference) prevalence of stroke survivors were calculated. Age-specific stroke prevalence were also calculated. The significance tests were two-tailed and statistical significance was defined at the alpha level of 0·05. All statistical analyses were done using Stata version 14 for Windows (Stata Corp, College Station, Texas). The paper is reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

3. Results

3.1. Characteristics of the study participants

A total of 2028 subjects were included in the survey and completed the first phase of the screening. Almost equal numbers of the participants were from Ebubu community (51.08%) with preponderance of women (57.05%). The demographic profile and clinical data for all the

participants were presented in table 1. The overall participants' mean age was 44.32 (standard deviation: 13.97), this differed between the Ebubu and Usokun communities, albeit non-significantly, 44.72 (13.28) vs 43.90 (14.66), P=0.09. Overall, more than one-third of participants were hypertensive (37.38%). This differs significantly between the two study communities, Ebubu (43.34%) vs Usokun (31.15%), P < 0.01. We found that more than half of our participants were drinkers (60·60%), overweight/obese (55·08%), educated at secondary or high school level (61.88%) or engaged in either skilled (artisan) or unskilled labour which are mostly farming and fishing (81·71%).

Overall, there were 386 positive responses for stroke following initial assessment. After the second screening phase using stroke-specific tool, they were reduced to 249 suspected cases. These individuals were further invited for neurological examination at the primary health centres in the third phase of the assessment, only 1 person declined. Among the 248 individuals who attended the neurological assessment, we found that two persons had transient ischemic attack (TIA), and 27 cases (made up of 8 first-ever and 19 recurrent cases) were diagnosed as having stroke. Only two of the eight first-ever stroke cases were on hypertensive drugs while three were on herbal medicine. Among the 19 recurrent cases, six were on hypertensive medication, two were on lipid-lowering drug (statin) while six were on traditional medicine sourced locally. We also found that the rate of adherence to medication among those on hypertensive and lipid-lowering drugs were low and that the low rate is mostly associated with socioeconomic factors particularly the cost of drugs, distance to the hospital and medical bills. The flow diagram illustrating the assessment and diagnostic steps was shown in fig.1.

3.2. Prevalence of stroke survivors

A total of 27 participants have confirmed stroke with a crude prevalence rate of 13.31/1000 population (Table 2). There was no gender difference among participants diagnosed with stroke. The prevalence varies from 11·24/1000 (95% CI, 5·54–17·32) in female to 16·07/1000 (95% CI, 7·71–24·44) in male, P=0·347. Comparatively, Ebubu community had a non-significantly higher estimate compared to Usokun community, 15.44/1000 versus 11.09/1000, P= 0.393. The result showed a trend of increasing prevalence with advancing age. Crude and age-adjusted prevalence using USA Population 2000 standard population [31] was shown in table 3. The result showed that age-adjusted prevalence of stroke in this study was 14.64/1000 population. Among the risk factors, we found that 25 of the 27 stroke case have hypertension.

4. Discussion

4.1. Main findings

The finding of our study showed a high overall crude prevalence of stroke at 13.31/1000 population. The crude prevalence is higher than the previously reported estimates in community-based studies in the Niger Delta region and elsewhere in Nigeria [4], [8], [9], [10], [11], [12] and [13], [14]. We standardized our results to the WHO World Standard Population to compare better with data from other studies. The result showed a higher age-adjusted prevalence rate of 14.64/1000 population in the rural communities.

Comparatively, we found a slightly higher prevalence of stroke in Ebubu than in Usokun communities, but the difference is not statistically significant (15.44/1000 versus 11.09/1000, P= 0.393). This estimate provides evidence that stroke in rural Niger Delta is a huge public health issue which require urgent intervention. The results of this study represent up-to-date and accurate estimate on the prevalence of stroke in this region where adequate health and social infrastructure are lacking.

As reported previously, rural communities in the Niger Delta are exposed 24 hours per day and 7days per week to gaseous air particulate pollution due to oil and gas emissions in addition to oil-polluted surface and underground water [23]. Meta-analysis of epidemiological studies have established strong and positive associations between exposure to environmental air pollution and increased health outcomes including heart attack, high blood pressure and stroke (Supplementary Fig.2) [32] and [33]. The influence of the pollutant exposures on cerebrovascular health may be possible in this population, however, further studies and in particular environmental pollutant data are required to establish this relationship.

4.2. Comparison with other studies

Apart from the study conducted in Tanzania which found a crude prevalence of 23/1000 persons among elderly (70 years and over), this is the highest age-adjusted rate recorded in any community-based study previously conducted anywhere in Nigeria (Table 4) and in African region [2]. The fact that the result from this current study was comparable with the current estimates reported in most LMICs particularly in Latin America, South East Asia, Europe and Central Asia [2] further underpins the size of the problem in relation to the associated socioeconomic burden among the population in the rural Niger Delta in Nigeria.

We noted a steep-rise in prevalence with advancing in age with the highest estimate between 65 and 74 years in both gender. Stroke appears to occur at a younger age or below 55 years in this study (Fig. 2). This is comparable to other studies carried out in Nigeria [4], [8], [9], [10], [11], [12] and [13] and in other LMICs as shown in the reviewed literature evidence [2], [6] and [7]. The only important difference is that most studies in upper-middle-income countries were sampled from urban rather than rural settings like the current study and from an area with high life expectancy (aging population) driven by high standard of living and quality

health care compared to Nigeria where life expectancy from birth averages 53 years in 2015 [34] and [22].

We also found a huge difference in the age-specific prevalence reported in our study and those conducted previously (Table 3 and Fig. 2). Following age-adjustment and across age strata, the highest prevalence rate was in the age stratum 75 years and over. The age-adjusted prevalence rate in the present study was even higher than other studies conducted in urban areas in Nigeria and Africa [2] and [7]. Interestingly, the age-adjusted rate result is comparable with the result (12.3/1000 population) of the only study conducted previously in Niger Delta [4]. Consistent with the study hypothesis, the similarity in the prevalence estimate may suggest that the entire constituent communities in Niger Delta may be affected by high risk of stroke an indication of reverse epidemiology when compared with study conducted in urban areas.

4.3. Implication of the result

The financial burden associated with stroke treatment and care is huge particularly in this rural population where there is absence of essential social infrastructure including high level of poverty, malnutrition, illiteracy and unsafe drinking water [35] and [36]. The consequences are increased loss in productivity, reduced labour efficiency and increased comorbidity with poorer outcomes [2] and [35]. Evidence of these have been shown among survivors who were on self-medication using locally sourced treatment due to inaccessibility of low-cost neurological care and prohibitive out-of-pocket cost for conventional drugs with proven efficacy [5]. The finding of this study has huge socioeconomic and wider health implication in a rural community in Niger Delta and may help policymakers particularly in LMICs institute effective public health response. If established, the potential association between rural settings, oil and gas production activities and high stroke prevalence may

provide an entry point for screening and assessment purposes to identifying population at high-risk of stroke before diagnosis and to target intervention appropriately.

We found a very high prevalence of hypertension, socioeconomic and lifestyle factors. These have widely been reviewed previously [37]. In addition, the current epidemiological transition driven by demographic and nutritional changes portends great danger in the light of the evidence of double burden of non-communicable diseases (such as hypertension), and communicable diseases such as HIV/AIDS, malaria and other vaccine preventable diseases that dominates the public health landscape.

Beyond biological plausibility, oil pollution and influence of exploration activities of oil industry in the rural communities could increase vulnerability including loss of livelihood and psychosocial stress [38] and [39]. For instance, loses incurred as a result of oil pollution of farmland, drinking water and fishing sources may have a knock-on effect to vulnerable individuals and families due to loss of occupational activities, income and leisure. The results of these could lead to lifestyles and behavioural changes, reduced access to health care and exacerbation of major stroke risk factors particularly hypertension [21]. These evidence could be tested in longitudinal studies with appropriate analytical model.

4.4. Study Limitations and Strengths

Our study is of relatively large sample size with detailed study protocol. Our result is very reliable because of our survey approach and the fact that we used validated stroke screening instrument that has been used in previous studies [4] and [11]. However, caution need to be used in generalising the result. We did not provide data on stroke-related disability or case-fatality. Although such data are important for stroke-care planning and management, such estimates may be unreliable in this rural population due to conflicting information on causes

of death, non-existence of stroke registers and overlapping disabilities caused by other disorders that accompany stroke particularly in older patients and the fact that majority of stroke survivors do not access the health service due to prohibitive out-of-pocket expenses, distance to urban hospital and lack of stroke functioning units in the primary health care centres in our study communities [2]. We are unable to access or monitor the pollutant concentration data in the various environmental media (Air, water and soil) in the two communities. It could be that the higher estimate of stroke in one of the two study communities was in tandem with higher pollutant concentration and exposure time. Our inability to assess some conditions that may cause blood clots or rupture of blood vessels including heart diseases (e.g. Cardiomyopathy, heart failure, and atrial fibrillation), brain aneurysms and other important modifiers such as poor health service, poverty and healthcare spending may not only confound but also limit our understanding of the aetiology and influence of these to the increased stroke estimate. We did not use a standard tool for self-report of medication adherence evaluation, however, important barriers to treatment adherence identified are consistent with reviewed evidence reported previously [40], [41] and [42].

In addition, we could not use the brain computerized tomography (CT) scan and magnetic resonance imaging (MRI). These are common limitations in stroke surveillance in low-resource settings like Nigeria [2] and [6]. Apart from the cost implication, and associated logistics, availability of CT and MRI in few neurological units in specialist hospitals remain a huge barrier. Therefore, we are unable to distinguish or ascertain specific stroke sub-types. It could be argued that some participants with acute stroke with quick recovery time and mild disability could have been missed especially if the stroke occurred long before the survey. However, the survey protocol including detailed epidemiological exercise (physical,

neurological and other clinical indicators in each case), increased publicity and recruitment strategies ensured that elderly, out-of-reach persons or those with restricted mobility were not missed.

5. Conclusion

Our study provided good estimate that reflected the huge prevalence of stroke survivors in Niger Delta population which mirrors the challenges faced by individuals, families and the health sector in Nigeria and sub-Saharan Africa. Apart from uncontrolled hypertension and lifestyle factors which are the commonest risk factors identified, more research on environmental pollution and its relationship with stroke prevalence in this population is warranted. The wider socioeconomic implication of the increased stroke prevalence in our study portends huge underinvestment and decline in gross domestic product (GDP) reflecting increased loss in productivity and reduced labour efficiency. The emergence of self-medication (using local herbs with unproven effectiveness) and lack of neurological services in this population should provide early warning to the public health challenges ahead. The study findings will be useful for the design of stroke screening tool (including high blood pressure and other predictors) to not only identify high-risk group but also for treatment, rehabilitation, and related public health prevention strategies particularly in Niger Delta and Nigeria as a whole.

Author contributions

All authors contributed to the study concept and design. ME, OM, AE, AO, EA and BE contributed in data collection and entry. ME, OU, AE, Y-FC, analysed the data. ME wrote the first draft and all authors contributed in the manuscript correction.

Compliance with Ethical Standards

All procedures in this study were in accordance with the ethical standards of the institutional research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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Conflict of interest

The authors declare that they have no conflict of interest

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TABLES

FIGURES

E-COMPONENTS

Fig. 1. Map of the study local councils showing the study areas with oil and gas production sites in Eleme/Ebubu [23]

Fig.2. Pathophysiological mechanism of air pollution and cardiovascular outcomes [43]

FIGURES

Fig. 1. Flow diagram showing diagnoses of stroke in the study communities, survey of stroke prevalence, 2014

Fig, 2 Age-specific comparison of stroke prevalence with previous studies

Fig. 1. Flow diagram showing diagnoses of stroke in the study communities, survey of stroke prevalence, 2014

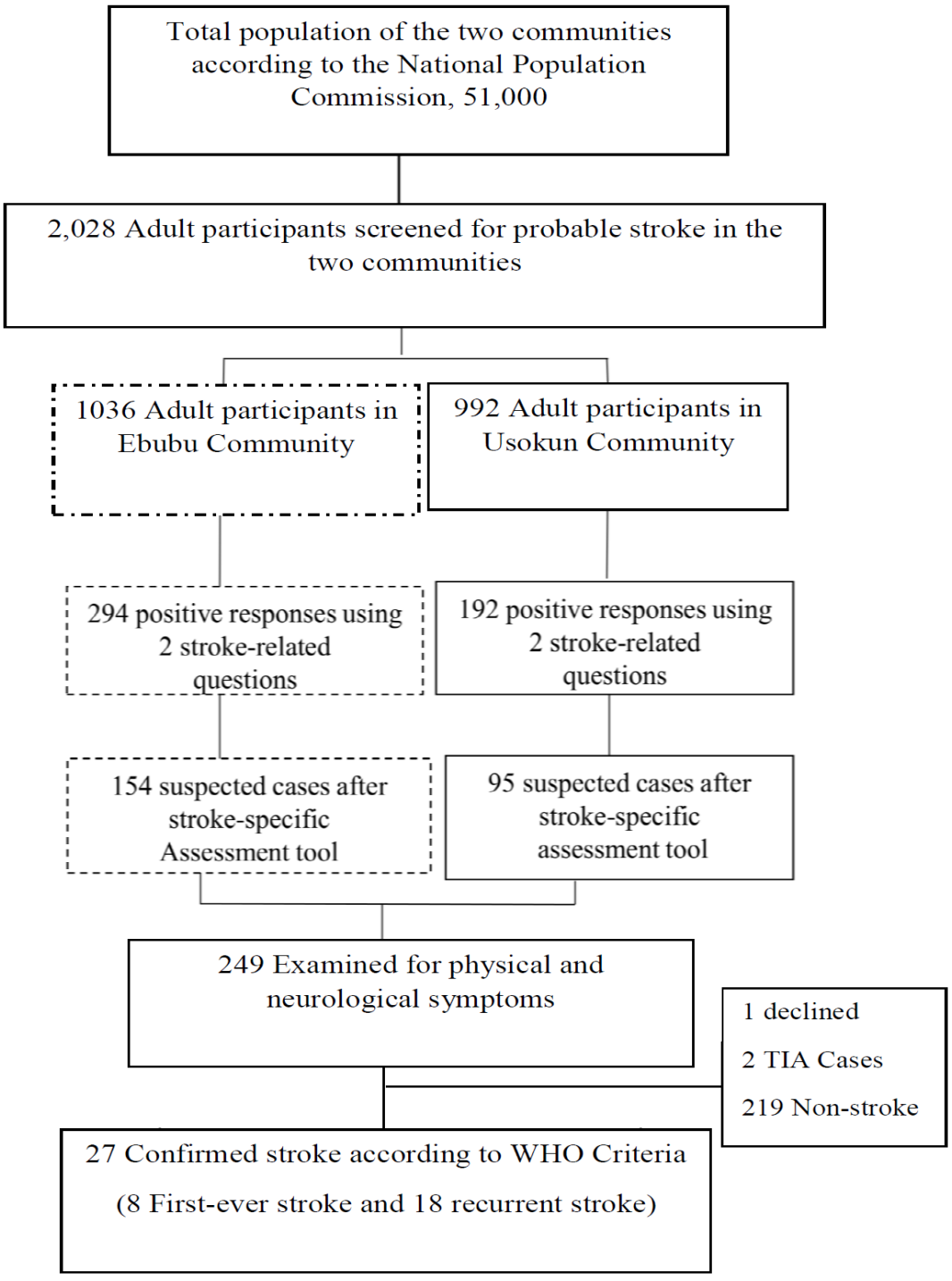
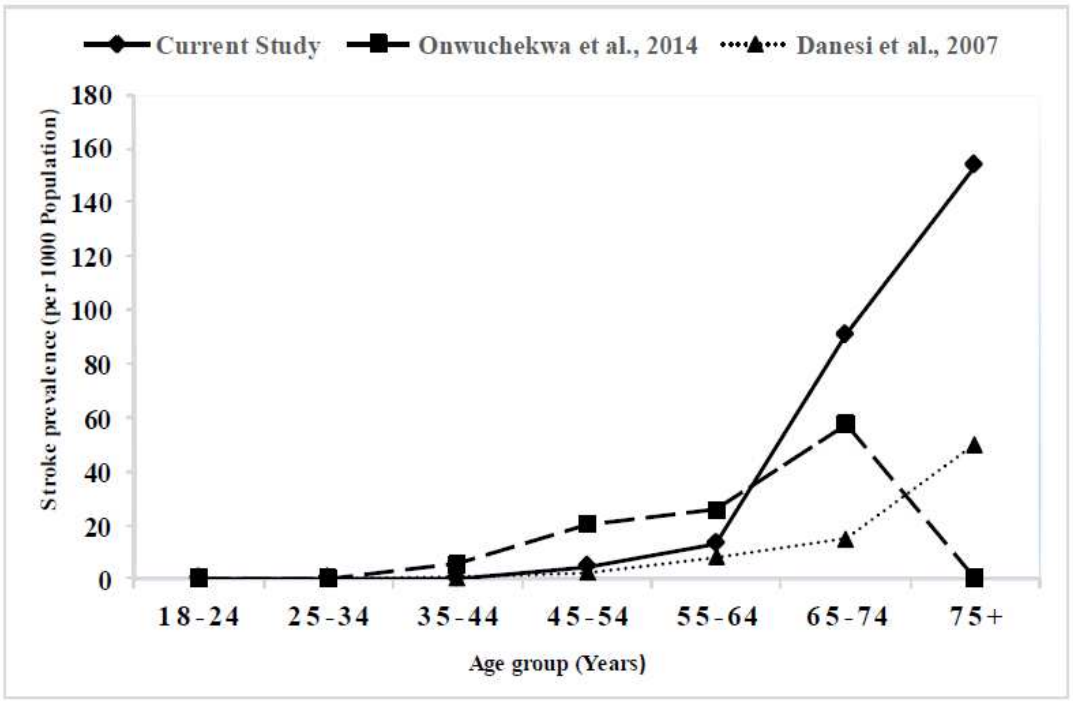


Fig. 2. Age-specific comparison of stroke prevalence with previous studies



TABLES (1-4)

Table 1 Socio-demographic characteristics of the participants, by study communities, survey of stroke prevalence, 2014: numbers and percentages

Table 2 Prevalence of stroke in the study population by study charateritics, 2014: numbers and percentages

Table 3 Crude and Age-adjusted prevalence of stroke, survey of stroke prevalence, 2014: numbers and percentages

Table 4 Comparative characteristics of stroke prevalence studies in Nigeria

Table 1 Socio-demographic characteristics of the participants, by study communities, survey of stroke prevalence, 2014: numbers and percentages

Variable	Total (n=2028)	Ebubu (n=1036)	Usokun (n=992)	P-value[a]
Mean age (SD)	44.32 (13.97)	44.72 (13.28)	43.90 (14.66)	0.09
Age group, n (%)				
18-24	146(7.20)	77(7.43)	69 (6.99)	
25-34	423(20.86)	177(17.08)	246(24.80)	
35-44	490(24.16)	252(24.32)	238(23.99)	
45-54	453(22.34)	272(26.25)	181(18.25)	
55-64	303(14.94)	175(16.89)	128(12.90)	
65-74	187(9.22)	77(7.43)	110(11.09)	
≥75	26(1.28)	6(0.58)	20 (2.02)	0.001
Gender, n (%)				
Male	871 (42.95)	417(40.25)	454 (45.77)	
Female	1157 (57.05)	619(59.75)	538(54.23)	0.001
Marital Status, n (%)				
Never married	544 (26.84)	235(22.71)	309(31.15)	
Ever married	1483 (73.16)	800(77.29)	683(68.85)	0.001
Education attainment, n (%)				
No education (<6 years)	362 (17.85)	221(21.33)	141(14.21)	
Primary (6-11 years)	411 (20.27)	178(17.18)	233(23.49)	
Secondary/higher (≥ 12 Years)	1255 (61.88)	637(61.49)	618(62.30)	0.001
Employment status, n (%)				
Unemployed	371 (18.29)	165(15.93)	206(20.77)	
Presently working	1657 (81.71)	871(84.07)	786(79.32)	0.005

Body mass index, n (%)				
Underweight	35 (1.73)	17(1.64)	18(1.81)	
Normal	876 (43.20)	374(36.10)	502(50.60)	
Overweight	786(38.76)	429(41.41)	357(35.99)	
Obese	331(16.32)	216(20.85)	115(11.59)	0.001
Weight-Hip-Ratio, n (%)				
Normal	682(33.63)	348(33.59)	334(33.67)	
Overweight	720(35.50)	324(35.14)	396(39.92)	
Obese	626(30.87)	364(35.14)	262(26.41)	0.001
Hypertension Status, n (%)				
Hypertensive	1036(51.08)	449(43.34)	587(56.66)	
Normotensive	992(48.92)	309(31.15)	683(68.85)	0.001
Family history of HTN, n (%)				
No	1724(85.01)	847(81.76)	877(88.41)	
Yes	304(14.99)	189(18.24)	115(11.59)	0.001
Hypertension awareness, n (%)				
Low	1292(63.83)	724(70.16)	568(57.26)	
Moderate	483(23.86)	231(22.38)	252(25.40)	
High	249(12.30)	77(7.46)	172(17.34)	0.001
Smoking status, n (%)				
Non-smoker	1689 (83.28)	925(89.29)	764(16.72)	
Ever smoker	339 (16.72)	111(10.71)	228(22.98)	0.001
Drinking status, n (%)				
Non-drinker	799 (39.40)	523(50.48)	276(27.82)	

Mild drinker	656 (32.35)	309(29.83)	347(34.98)	
Moderate-to-heavy drinker	573 (28.25)	204(19.69)	369(37.20)	0.001
Sleep deprivation, n (%)				
No	1326 (65.42)	564(54.44)	762(76.89)	
Mild	283 (13.96)	182(17.57)	101(10.19)	
Moderate-to-severe	418 (20.62)	290(27.99)	128(12.92)	0.001
Physical activity, n (%)				
Sedentary	79 (3.90)	33(3.19)	46(4.64)	
Low intensity	624 (30.77)	346(33.40)	278(28.02)	
Moderate-to-high intensity	1325 (65.34)	657(63.42)	668(67.34)	0.001
Salt intake, n (%)				
Low	800 (39.45)	551(53.19)	249(25.10)	
Moderate-to-high	1228 (60.55)	485(46.81)	743(74.90)	0.001
Fat intake, n (%)				
Low	977 (48.18)	578(55.79)	399(40.22)	
Moderate-to-high	1051 (51.82)	458(44.21)	593(59.78)	0.001

Table 2 Prevalence of stroke in the study population by study charateritics, 2014: numbers and percentages

Variables	Total Population N (%)	Stroke cases /population (n/N)	Stroke prevalence (n/1000)	P value
Gender				
Male	871(42·95)	14/871	16·07	
Female	1157(57·05)	13/1157	11·24	0·347
Age group				
18–24	146(7·20)	0/146	0·00	
25–34	423(20·86)	0/423	0·00	
35–44	490(24·16)	0/490	0·00	
45–54	453(22·34)	2/453	4·42	
55–64	303(14·94)	4/303	13·20	
65–74	187(9·22)	17/187	90·91	
≥75	26(1·28)	4/26	153·85	0·001
Study Communities				
Ebubu	1,036(51·08)	16/1036	15·44	
Usokun	992(48·92)	11/992	11·09	0·392
Education attainment				
Uneducated (< 6years)	362(17·85)	9/362	24·86	
Primary (6-11 years)	411(20·27)	7/411	17·03	
Secondary/higher (≥12 years)	1255(61.88)	11/1255	8.76	0.048
Employment status				
Unemployed	371(18.52)	5/371	13.33	
Currently working	1657(81.71)	22/1657	13.28	0.976
Body Mass Index				
Underweight	35(1·73)	0/35	0·00	
Normal	876(43·20)	5/876	5·71	
Overweight	786(38·75)	13/786	16·54	
Obese	331(16·32)	9/331	27·19	0·020
Waist-hip-ratio				
Normal	682(33.63)	6/682	8.80	

Overweight	720(35.50)	7/720	9.72	
Obese	626(30.87)	14/626	22.36	0.059
Smoking status				
Non smoker	1689(83·28)	21/1689	12·43	
Ever smoked	339(16·72)	6/339	17·70	0·440
Drinking status				
Non drinkers	799(39·40)	9/799	11·26	
Mild drinkers	656(32.35)	4/656	6.10	
Moderate-heavy drinker	573(28.25)	14/573	24.43	0.016
Salty food intake				
Low	800(39.45	13/800	16.25	
Moderate-high	1228(60.55)	14/1228	11.40	0.352
Fatty food intake				
Low fat intake	977(48.18)	18/977	18.42	
Moderate-high fat intake	1051(51.82)	9/1051	8.56	0.053
Sleep deprivation				
No sleep deprivation	1326(65.42)	4/1326	3.02	
Mild sleep deprivation	283(13.96)	4/283	14.13	
Moderate-severe sleep deprivation	418(20.62)	19/418	45.45	0.001
Hypertension status				
Normortensives	1270(62·62)	2/1270	1·57	
Hypertensives	758(37·38)	25/758	32·98	0·001
Family history of hypertension				
No	1724(85·01)	8/1724	4·64	
Yes	304(14·99)	19/304	62·50	0·001
Hypertension awareness				
Low	1292(63.83)	12/1292	9.29	
Moderate	483(23.86)	4/483	8.28	
High	249(12.30)	11/249	44.18	0.001

Table 3. Crude and Age-adjusted prevalence of stroke, survey of stroke prevalence, 2014: numbers and percentages

Age group (Years)	Total population	Number of Stroke	Crude prevalence n/1,000	Age-adjusted prevalence (USA 2000 Population)
18–24	146	0	0·00	0·00
25–34	423	0	0·00	0·00
35–44	490	0	0·00	0·00
45–54	453	2	4·42	0·59
55–64	303	4	13.20	1·15
65–74	187	17	90·91	6·00
≥75	26	4	153·85	6·90
Total	**2,028**	**26**	**13·31**	**14·64**

Table 4. Comparative characteristics of stroke prevalence studies in Nigeria

Study	Data collection Year(s)	Location	Study Setting	Sample size	Mean age (Years)	Age range studied (Years)	Stroke prevalence (n/1000)
Osuntokun	1982	South West	Rural	903	NA	All	4·40
Osuntokun	1882	South West	Rural	18954	NA	>7	0·58
Longe	1987	South West	Rural	2925	NA	All	0·70
Danesi	2005–06	South West	Urban	13127	26·9±15·4	All	1·14
Onwuchekwa	2008	South South	Rural	1057	35·8 ± 14·8	≥18	8·51
Enwereji	2011	South East	Rural	6150	29·0±20·8	All	1·63
Sanya	2009–10	North Central	Semi-Urban	12992	NA	≥18	1·31
This study	**2014**	**South South**	**Rural**	**2028**	44·3 ±14·0	**≥18**	**13·31**

Highlights

A three-phased door-to door survey was conducted to identify stroke survivors

Age-adjusted prevalence of 14.6/1000 persons was found, which is 7-fold the rates in Nigeria

The finding has huge socioeconomic and wider health implication in a rural community

Improved surveillance and management of HBP may reduce the burgeoning stroke burden