Prevalence of Stroke in an Urban, Mixed-Income Community in Lagos, Nigeria

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Introduction

Global estimates of disease burden indicate that over the next two decades, cerebrovascular disease will continue to rank amongst the top 4 leading causes of death, even in low-income developing countries [1]. This scenario is typified in Nigeria, the most populous black nation, which is experiencing a quasi-epidemiological/demographic transition marked by westernization, an increase in non-communicable diseases (including stroke), the HIV pandemic and an emergence of multi-drug-resistant malaria. An earlier rural community-based study of neurological disorders in south-western Nigeria, conducted two decades ago, reported a stroke crude prevalence rate of 0.58/1,000 [2]. The only urban register-based incidence study of stroke in Nigerians (and indeed one of the few from Africa) between 1973 and 1975 documented an incidence rate of 26/100,000 per year [3]. As such, the current status of the incidence and prevalence of stroke in Nigerians (and indeed most of Africa) remains unknown. Hospital-based reports, though subject to bias, suggest an increase in the burden of strokes in the last decade [4, 5].

Determining the current epidemiology of stroke is important for several reasons. For instance, data for comparison with other global populations will be provided, while such information will also serve to guide allocation of scarce health care resources for stroke prevention and interventional strategies against the background of infra-
structural, manpower and material challenges. The purpose of our study was to determine the current prevalence of stroke in an urban community in south-western Nigeria, as a prelude to conducting a register-based stroke incidence study.

Methodology

This study was a population-based, door-to-door survey, conducted in Surulere Local Government Area (LGA) of Lagos State, Nigeria, between June 1, 2005, and May 30, 2006. Approval of the study protocol was obtained from the Research and Ethics Committee of the Lagos University Teaching Hospital, and administrative permission was obtained from the Medical Officer of Health, Surulere LGA. Surulere LGA is a mixed-income, urban, stable community in Lagos State, the commercial nerve centre of Nigeria, West Africa. At the time of the study, the LGA had approximately 750 enumeration areas for the purpose of census administration, with each enumeration area comprising about 1,000 persons. As such, the estimated population of the area was 750,000 (based on data from the National Population Commission of Nigeria). Based on this, utilizing a computer-based programme for selection of random numbers, we randomly selected 2% of the enumeration areas (estimated population of 15,000) for the study. The maps of these areas were then obtained from the National Population Commission, and community entry preliminaries (including obtaining permission from the LGA administration and sensitization of community leaders) were conducted. The surveys were conducted by 12 trained bilingual field assistants supervised by 2 study assistants. The field assistants were trained and re-trained in the application of the questionnaires in both vernacular and English languages.

Modification of the Stage I Survey Questionnaire

Utilizing focused group discussions, the original survey questionnaire of the World Health Organization (WHO) Protocol for Epidemiological Studies of Neurological Disorders in developing countries was modified for the purpose of the study [6]. The discussion group comprised the researchers, the field assistants and the study assistants. The original questions were translated into vernacular language (Yoruba). The questions where then back-translated into English and the translations compared to ensure that the content remained the same. In addition, the physical examination component of the questionnaire was removed as the study protocol included a physical examination stage, and also to limit time of administration and improve participation. The questionnaire was pretested in a sample of the population, and difficulties were resolved prior to the final version. For instance, the questions were re-arranged to have less probing questions earlier on in the interview. The modified version is shown in table 1.

Stage I: Population Census and Administration of Modified WHO Questionnaire

We conducted a door-to-door census of the selected enumeration areas over a 6-month period from June 1, 2005, to November 30, 2005. Each pair of field assistants simultaneously collected demographic data per household and administered the WHO questionnaire in the household. Participation rates were generally high with approximately 4 of every 5 households (80%) participating. Non-residential buildings (e.g. offices, schools) were not surveyed to avoid including persons not normally resident in the LGA. Information was collected directly from participants or household proxies such as a parent or mature sibling or relative (where the person was unable or unavailable to respond, e.g. children). Demographic data collected included names, age, gender, self-reported ethnicity, religion, occupation and house address. Respondents were included if they were resident in the area as on May 1, 2005.

Stage II: Administration of Stroke-Specific Questionnaire

Following review of the responses from the modified WHO questionnaire, all persons screening positive for stroke according to the stroke-specific questions (table 1, questions Q4, Q7 and Q8) were re-screened with a stroke-specific questionnaire developed for the purpose of this study (table 2) from November 1, 2005, to mid-March 2006. The questionnaire included the initial screening questions and additional stroke-specific questions to further authenticate the diagnosis and document the approximate dates and known risk factors for stroke. To improve coverage, surveys were conducted during weekdays, at weekends and during public holidays. Repeat visits were scheduled when necessary.

Stage III: Physical Examination of Stage II Stroke-Positive Persons

In the third stage, all persons responding positively to the stroke-specific questionnaire administered in stage II were written formally and invited to undergo a general physical and neurological examination at the Neurology Unit of the Department of Medicine, Lagos University Teaching Hospital, Lagos, Nigeria. All the patients agreed to be examined. The examination was at no cost to the participants, and transportation costs were reimbursed to the participants. In addition, an equal number of persons who screened negative for stroke according to the questionnaire were also invited. These persons were randomly selected from age (±2 years) and sex-matched participants. The mean age ± standard deviation (SD) of the stroke-positive cases was 63.4 ± 12.3 years, while the stroke-negative cases were aged 63.1 ± 9.9 years (p > 0.05). Where the individual was unable to come to the hospital for the examination, we conducted the examination at their residence. All patients who responded positively to the stroke-specific questionnaire in stage II agreed to be investigated. In all, 60 persons were examined (30 stroke positive and 30 stroke negative). A uniform format was used for the neurological examination. Of the stroke-questionnaire-positive persons, 15 were diagnosed as having had a stroke, whereas 15 had other conditions including paraplegia, osteoarthritis and peripheral neuropathy. The diagnosis of stroke was based on the WHO definition [7]. None of the individuals who screened negative for stroke using the stroke-specific questionnaire had a final diagnosis of stroke. Thus, the true-positive rate was 15/30 = 50%, the false-positive 15/30 = 50%, the true-negative 30/30 = 100% and the false-negative 0/30 = 0%. This resulted in a sensitivity of 100% (95% confidence interval, CI, 78–100), a specificity of 66.7% (95% CI 51–80) and a likelihood ratio of a positive test of 2.99 (95% CI 1.98–4.53).
**Table 1. Modified WHO Questionnaire**

<table>
<thead>
<tr>
<th>Age or date of birth (last completed year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex 1 = Male 2 = Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residence: were you resident in this area before May 1, 2005?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = No 2 = Yes, all my life 3 = Yes, not all my life 4 = Don’t know 5 = Didn’t respond</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = unknown 1 = Preschool 2 = School 3 = Housework 4 = Complete housewife 5 = Trading 6 = Artisan 7 = Teacher 8 = Farmer 9 = Civil servant 11 = Retiree 12 = Other (specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relationship to respondent: fill in the appropriate relation to respondent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Self 2 = Spouse 3 = Parent 4 = Offspring 5 = Other (specify)</td>
</tr>
</tbody>
</table>

- **Q1** Do you suffer from headache even when you don’t have fever?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q2** Do you suffer from severe headaches, chiefly on one side of the head, which come on from time to time?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond 5 = Not applicable
- **Q3** In association with these headaches, do you suffer from nausea or vomiting?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond 5 = Not applicable
- **Q4** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q5** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q6** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q7** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q8** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q9** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q10** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q11** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q12** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q13** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond
- **Q14** Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?  
  1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond

**To be screened by stroke questionnaire (for office use only)**  
1 = Yes 2 = No
Table 2. Stroke-specific questionnaire used in stage II of the study

**Personal data**
(a) Surname: ___________________________ Name: ___________________________
(b) Age (years): _____ (c) Date of birth: _____ (day) _____ (month) _____ (year)
(d) Serial No.: _____ (e) EA No.: __________ (f) FA name: ________ (g) Date of initial survey: _____ - _____ - 2005
(h) Address: ____________________________________________________________

**Questionnaire**

Have you ever noticed that your face or mouth was shifted to one side (paralysed) for more than 24 h?
1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond

Have you ever had loss of sensation or abnormal sensation affecting your arms and legs, lasting for more than 24 h?
1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond

Have you ever had paralysis of one side of your body (arm or leg) lasting for more than 24 h?
1 = Yes 2 = No 3 = Don’t know 4 = Didn’t respond

1) When did you suffer from paralysis (weakness) affecting your arm and leg?
   (day) (month) (year)
2) How did the paralysis start?
   [ ] Suddenly
   [ ] Gradually (over a period of 1 week or more)
3) If sudden, what were you doing when the paralysis occurred?
   [ ] Resting
   [ ] Intense activity (e.g. arguing) (specify) ______________________
4) What other symptoms did you have when the paralysis started?
   [ ] None
   [ ] Vomiting
   [ ] Convulsion
   [ ] Headache
   [ ] Loss of consciousness
   [ ] Loss of speech
   [ ] Others (specify) ______________________
5) What time did the paralysis occur (approximate time)? _____ AM _____ PM
6) When did you start receiving treatment?
   [ ] Same day
   [ ] Within a week
   [ ] After 1 week
   [ ] No treatment
7) What side of your body was affected by the paralysis?
   [ ] Right side
   [ ] Left side
8) Which hand do you normally use to write or work?
   [ ] Right
   [ ] Left
   [ ] Both
9) Current neurological state (from observation or questioning)
   [ ] Paralysis still present
   [ ] Paralysis recovered fully
   [ ] Speech difficulties still present
   [ ] Speech difficulties recovered fully
10) Do you have any of the following conditions?
    [ ] Hypertension (high blood pressure)
    [ ] Diabetes
    [ ] Heart disease
    [ ] Sickle cell disease
    [ ] Epilepsy
    [ ] Migraine
11) Are you using any of these medications?
    [ ] Blood pressure medicine
    [ ] Diabetes medicine
    [ ] Others (specify) ______________________
12) Do you have a family member who has suffered from stroke in the past?
    [ ] Yes
    [ ] No
    If yes, specify who: [ ] Father [ ] Mother [ ] Brother [ ] Sister
    Other relative (specify relationship) ______________________
13) Do you have a family member with hypertension (high blood pressure)?
    [ ] Yes
    [ ] No
    If yes, specify who: [ ] Father [ ] Mother [ ] Brother [ ] Sister
    Other relative (specify relationship) ______________________
14) Do you have a family member with diabetes?
    [ ] Yes
    [ ] No
    If yes, specify who: [ ] Father [ ] Mother [ ] Brother [ ] Sister
    Other relative (specify relationship) ______________________
**Data Management and Analysis**

Data were entered and analyzed using Epi Info® 2002 statistical software. Data checks were conducted periodically and missing data recollected during subsequent visits. Continuous variables are presented as means ± SD while categorical variables are presented as proportions. Comparison of means was done by Student’s t test, while proportions were compared using Yates corrected chi-square test. A p value <0.05 was regarded as being statistically significant.

**Results**

**Demographic Profile of Study Population**

The total population screened was 13,127, comprising 5,832 females (44.4%) and 7,295 males (55.6%). The mean age ± SD of the study population was 26.9 ± 15.4 years, with a range of 1 month to 99 years. The mean age by gender was 26.6 ± 15.2 years (range 4 months to 95 years) in females and 27.2 ± 15.6 years (range 1 month to 99 years) in males (p > 0.05). The demographic profile of the population is shown in table 3. The population sizes (frequencies) for the age ranges 0–14 years, 15–64 years, and 65 years and above were 3,086 (23.5%), 9,751 (74.3%) and 290 (2.2%). The corresponding estimates for the Nigerian population for 2006 for these age ranges for the combined urban and rural population are 42.3, 54.6 and 3.1%, respectively [8].

The distribution of the population by self-reported ethnic origin and in the major ethnic groups was as follows: Yoruba 9,208 (70.2%), Ibo 2,696 (20.5%), Ijaw/Itseseiki/Urhobo 605 (4.6%), Efik/Ibibio 358 (2.7%), Hausa/Fulani 130 (1.0%), other minority 80 (0.6%) and non-Nigerian 50 (0.4%).

**Prevalence of Stroke Overall and by Gender**

In the population of 13,127, 15 persons were diagnosed as having a stroke, giving a crude prevalence rate of 1.14/1,000 overall. In males, the crude prevalence rate of stroke was 1.51/1,000 (11/7,295), while it was 0.69/1,000 (4/5,832) in females (relative risk 2.20, 95% CI 0.70–6.90, p = 0.26). Table 3 shows the stroke prevalence rates in mid-decade strata overall and by gender. The cumulative stroke prevalence rates for persons aged ≥15, 45, 55, 65, 75 and 85 years (overall and by gender) are shown in figure 1.

**Age-Adjusted Stroke Prevalence Rates**

Table 4 provides age-adjusted prevalence rates per 1,000 population for this study. The adjustments were made using both the USA population 2000 [9] and the WHO new world population [10] as the reference populations. Following age adjustment, the highest prevalence rate was in the age stratum 75–84 years, being 2.04 and 1.11 per 1,000 using the USA population 2000 and WHO new world populations, respectively.

We also compared our data to the stroke prevalence rate emanating from the study by Osuntokun et al. [2] conducted in a rural community in Nigeria 30 years ago, using a population aged above 7 years. The population size of the present study in the same age stratum (>7 years) was 12,558, while the corresponding population from the earlier study was 18,954. The crude prevalence rates per 1,000 are 1.19 for this study and 0.58 for the study by Osuntokun et al. [2]. Following age adjustment to the USA population 2000, the age-adjusted stroke prevalence rates for persons aged above 7 years are 0.53/1,000 for the earlier study by Osuntokun et al. [2] and 1.10/1,000 for the present study.
Discussion

Recent reviews of stroke epidemiology have emphasized the importance of providing current prevalence data from developing countries, where the burden and mortality from stroke are projected to be rising [11–13]. The age distribution of our study population varies from that of the combined urban and rural population distribution estimates for Nigeria [8], with our study population having a higher proportion of persons in the age bracket 15–65 years. The higher proportion of persons between 15 and 65 years in our study may reflect the expected higher ratio of the more active population sector in rural compared to urban populations. There are however no reliable census data specifically providing age distributions for urban populations only in Nigeria. The study has other strengths regarding the population surveyed including the high participation rates, population stability and the fact that it is a mixed-income, multi-ethnic locality.

Table 3. Demographic profile and age-specific stroke prevalence rates in mid-decade age strata in urban Nigeria

<table>
<thead>
<tr>
<th>Age category</th>
<th>Total population</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number of strokes/population size</td>
<td>stroke prevalence n/1,000</td>
<td>number of strokes/population size</td>
</tr>
<tr>
<td>Below 15 years</td>
<td>0/3,086</td>
<td>0</td>
<td>0/1,700</td>
</tr>
<tr>
<td>15–24 years</td>
<td>0/3,635</td>
<td>0</td>
<td>0/1,977</td>
</tr>
<tr>
<td>25–34 years</td>
<td>0/2,603</td>
<td>0</td>
<td>0/1,460</td>
</tr>
<tr>
<td>35–44 years</td>
<td>1/1,802</td>
<td>0.56</td>
<td>1/999</td>
</tr>
<tr>
<td>45–54 years</td>
<td>3/1,219</td>
<td>2.46</td>
<td>3/704</td>
</tr>
<tr>
<td>55–64 years</td>
<td>4/492</td>
<td>8.13</td>
<td>1/284</td>
</tr>
<tr>
<td>65–74 years</td>
<td>3/203</td>
<td>14.78</td>
<td>2/120</td>
</tr>
<tr>
<td>75–84 years</td>
<td>3/66</td>
<td>45.45</td>
<td>3/46</td>
</tr>
<tr>
<td>Above 85 years</td>
<td>1/21</td>
<td>47.61</td>
<td>1/8</td>
</tr>
<tr>
<td>Overall</td>
<td>15/13,127</td>
<td>1.14</td>
<td>11/7,295</td>
</tr>
</tbody>
</table>
The crude stroke prevalence rate found in this study (1.14/1,000 overall, and specifically 1.19/1,000 in persons above 7 years) is higher than the previously reported crude stroke prevalence rate of 0.58/1,000 in Nigerians aged above 7 years documented by Osuntokun et al. [2]. The age-adjusted prevalence rate in the same stratum remains higher in the present study (0.53 vs. 1.10/1,000 population above 7 years). The earlier study was conducted in a rural community in the same geographic axis (south-western Nigeria) about three decades ago. The higher prevalence in our study may reflect the increasing burden of cardiovascular disease with westernization or represent a difference in burden between rural and urban communities.

The crude and age-adjusted prevalence rates documented in our study are however lower than the average values reported from most other populations, including recent studies from both developing and developed countries [11, 14–17]. In a recent review of stroke epidemiology studies in the late 20th century (1990 and later), Feigin et al. [11] reported crude prevalence rates from 9 studies, ranging from 0 to 10.2/1,000, with most of the rates being above 4.7/1,000.

There is considerable variability in the age groups reported in various stroke prevalence studies. We compared our data to some of the most recently published prevalence studies that assessed either the entire population, persons aged ≥15 years or ≥65 years. Of the studies reviewed by Feigin et al. [11], only one (from rural Bolivia) screened all age groups and reported an overall crude prevalence rate of 1.7/1,000 [18]. A recent study from Agincourt, rural South Africa, evaluated stroke prevalence in persons aged ≥15 years [14]. The crude prevalence rates for persons ≥15 years are lower in our population (1.49/1,000) compared to theirs (2.43/1,000). However, in persons ≥65 years, our rates were higher (24.14 vs. 14.94/1,000). In contrast, our crude rates are lower than those of most reports from the European population, where the prevalence rates in the elderly (≥65 or >70 years) are generally higher, averaging about 70/1,000 [16, 17].

Age-specific rates provide a better basis for comparison of stroke prevalence across populations. This is partly because differing population structures (e.g. proportions in each age stratum) can confound the comparison of crude prevalence rates. In this study, we present age- and gender-specific data to enhance the comparability of our data with those of other studies, and also present data following age standardization to both the USA 2000 population and the WHO new world population.

The increasing prevalence of stroke with advancing age in this study and the male preponderance are largely in keeping with the findings from other studies [11, 14, 15, 17].

Several possibilities exist that may explain the generally lower prevalence rate of stroke in our population. Stroke mortality is higher in developing countries (including Nigeria) [5] and may thus explain the tendency to find fewer stroke survivors in the community. The lower prevalence may also be a true reflection of lower incidence rates related to the generally lower (though emerging) prevalence of cardiovascular risk factors in less westernized countries.

We acknowledge the methodological limitations of our study. Recommendations for community-based prevalence studies suggest utilizing a survey of populations of...
at least 50,000 [11]. However, financial constraints are a reality of research in developing countries and limit the surveyable size when multi-staged approaches (aimed at improving the quality of the study and case ascertainment) are employed. The specific stroke subtype identification was not done in this study due to financial constraints precluding brain imaging for stroke cases identified. To reduce the potential for omitting active persons from the survey on weekdays, surveys were conducted at multiple times including weekdays, weekends and public holidays to ensure capturing the working and student populace. Non-residential areas were omitted from the survey to avoid inclusion of non-resident populations.

The interpretation of prevalence data in general is hampered because variations in prevalence between communities could be caused by differences in case fatality, incidence or both. We thus recognize the need to initiate incidence studies in Africa to assess the impact of stroke on the society, and also monitor changes in disease burden (e.g. variations in underlying risk factors). In furtherance of this, we have recently commenced a community registry-based stroke incidence study in the same locality to determine the incidence of stroke, risk factor profile and case fatality rate in urban Nigeria.

Acknowledgements

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References