

Stroke: Prevalence and Disability in Cotonou, Benin

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Key Words

Stroke · Prevalence · Sub-Saharan Africa · Door-to-door study

Abstract

Background: Little is known about the burden of stroke in sub-Saharan Africa that may increase with the ongoing demographic and socioeconomic transition. This study aims to assess the prevalence of stroke, its related disability rate and consequences in the quality of daily life in an urban door-to-door survey in Cotonou, Benin. **Methods:** A three-phase door-to-door study was performed in two districts of Cotonou with a broad range of socioeconomic income. A population of 15,155 individuals aged ≥ 15 years was evaluated. The first phase consisted in screening of stroke in the population using the modified WHO questionnaire, the second phase included the medical evaluation of all suspected cases, and in the third phase the diagnosis of stroke was confirmed by CT scan evaluation. **Results:** Out of 15,155 subjects, 321 cases were identified as possible stroke cases. The diagnosis was confirmed in 70 cases. The crude prevalence of stroke was thus estimated to be 4.6/1,000 (8.7/1,000 and 7.7/1,000 adjusted to the WHO and SEGI World Population). The mean age of the patients at onset was 56 ± 13 years. Sixty percent of stroke survivors had a Rankin score ≥ 2 , and CT scan was

found abnormal in 90.0% of them. **Conclusion:** The stroke prevalence in urban areas of Cotonou is higher than that reported in other sub-Saharan countries, and the majority of stroke survivors present with good functional recovery and without severe disability in their everyday life.

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Introduction

Stroke is a major cause of morbidity and death throughout the world. The Global Burden of Disease Study estimated that there were 16 million new stroke cases and 5.7 million stroke deaths in 2005 worldwide. By 2015, there will be 18 million new cases and 6.5 million stroke-related deaths [1].

Developing countries are not spared by the stroke epidemic. Particularly, 87% of stroke deaths occurred in these countries in 2005 and 97% were reported in subjects younger than 70 years [2]. In 2004, stroke was the cause for 3% of all deaths in Africa, compared with 16% in Europe. Stroke caused approximately 52% of vascular deaths (deaths caused by either stroke or ischaemic heart disease) in Africa, compared with 38% of vascular deaths in European countries [3]. Results from several door-to-door studies performed in sub-Saharan Africa (SSA) suggested

a global progression of the disease during the last decades. This rise in the burden of stroke and chronic disease is attributed to population ageing and changes in modifiable risk factors such as tobacco use, poor diet leading to overweight or obesity, raised blood pressure, cholesterol and physical inactivity [2]. The prevalence of stroke varies from 200 to 300 per 100,000 persons in SSA, and its incidence ranges from 15 to 68 per 100,000, which is much lower than the incidence of 136 per 100,000 reported in Europe [4]. This discrepancy has been attributed to the high fatality rate and to the young age of the SSA population, since younger patients commonly have better outcomes than older patients [5].

Although stroke may represent a major public health problem, there are not enough health facilities for acute stroke care in SSA. Stroke units are only available in South Africa. Further, there is only 1 neurologist for 3 million inhabitants in Africa, compared with 1 for 20,000 in Europe. In Benin, the only neurology department is located in Cotonou, the capital, and comprises 14 beds without one dedicated to stroke. There is no MRI and no echo-Doppler device in the country, and only two CT scans are available [6, 7].

Only few valid epidemiological studies of stroke were previously obtained in SSA countries. Particularly, studies of incidence, prevalence or mortality rates of stroke are lacking [8, 9]. In Nigeria, the prevalence of stroke was estimated to be 1.1/1,000 in 2007 [10]. In Benin, both the stroke prevalence and incidence rate remain undetermined.

This study carried out in an urban setting was performed to estimate the prevalence of stroke and the frequency of related disabilities and consequences on the daily life in Benin.

Patients and Methods

Study Framework

This cross-sectional study was carried out in the population of Cotonou, the economic capital of Benin, between September 15, 2008, and May 15, 2009. Cotonou consists of a single township of 13 boroughs and 140 districts. The first and second boroughs where our study was performed are composed of 21 districts and were chosen for their social mix characteristic of Cotonou.

In 2002, 665,100 individuals were living in Cotonou, with a ratio of 94.5 men versus 100 women. At that time, the life expectancy was estimated at 59.2 years, with a projection of 61.4 years for 2009 [11]. The town, over 79 km², was made up of 9.8% of the country's population, corresponding to 8,419 inhabitants per km². The population of the first and second boroughs was 109,149, with 55,939 being females. The total population aged more than 15 years in these two boroughs was 69,869. Cotonou's ethnic majorities were Fons (32.9%) and Gouns (15.2%).

The study was descriptive and analytic and included a sample of 15,155 subjects aged more than 15 years. The estimated sample size was 14,969 subjects, which was calculated with Nquery Advisor 7.0 (Statistical Solutions, Saugus, Mass., USA) considering a stroke prevalence of 0.25% for the study area and a precision of 0.08% [4]. The number of individuals in the sample was proportional to the number of the population in each district. All individuals living in one district of the two boroughs at the time of the survey were included. All those working but not living in the study area were excluded. To detect stroke patients, investigators went from door to door in each area. They started from the area's centre in a random direction and went in every house. Each time the number of subjects planned in a given area was not reached, the investigators repeated the procedure, starting from the centre again but then going in another direction.

All subjects included in this study signed an informed consent (finger prints were used in illiterate subjects after detailed oral explanations). The study was approved by the Benin's National Ethics Committee.

Data Collection

We used two questionnaires: one for screening all suspected cases and one for confirming the stroke event. These two questionnaires were based on the WHO protocol for screening neurological disorders and were adapted to the specific context of Benin [12]. The screening test was considered positive if there was a positive response to any item of the questionnaire. The diagnosis of stroke was based on the WHO definition [13], on the neurologist's diagnosis and on the results of the CT scan obtained with a Siemens Somatom Emotion device with no injection. The prevalence was defined as the cumulative prevalence in the entire life of a subject.

To evaluate the potential consequences of stroke on everyday activities and associated depression, the modified Rankin scale score, the Functional Independence Measure (FIM) and the Montgomery and Asberg Depression Rating Scale (MADRS) were used [14–16].

To analyse CT scan results, the number and topography of lesions were assessed and the extent of periventricular and deep white matter changes was evaluated using the Fazekas scale [17]. The presence or absence of arterial calcifications was also analysed.

The study was carried out in three phases: (1) a screening phase (17 days), (2) a pre-confirmation phase (6 months), and (3) a confirmation phase (1 month).

Phase 1 corresponded to the identification of suspected stroke cases in the population by 36 investigators. Half of them were paramedics (mostly nurses). All others had experience in data collection and were already involved in a previous STEPS national pilot survey of cardiovascular disease in Benin [18]. The investigators worked in pairs (one of the two investigators was always a paramedic) and were supervised by six general physicians. All of them were trained before the survey to use the screening tool and to recognize the most current signs observed in stroke patients. All investigators were fluent in the most commonly spoken local languages in the study area and learned how to use the questionnaire in those languages before the survey began. To ensure that all subjects selected for the study will be questioned, the survey was carried out on weekdays and weekends. Each time the selected person was absent, the investigators had to return to his/her residence as often as needed.

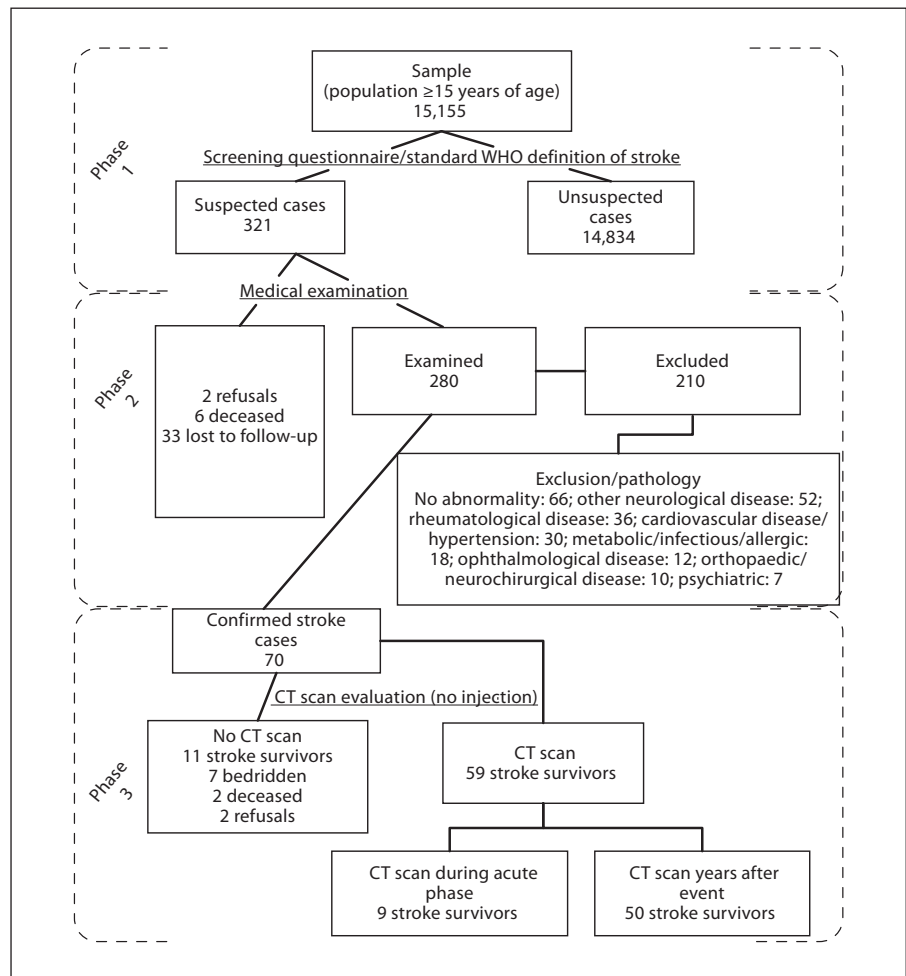


Fig. 1. Scheme of the study outline.

Phase 2 was carried out by two nurses and a general physician. The nurses had to localize the addresses of the suspected stroke cases reported after phase 1. Then, a clinical examination was performed by the general physician who either confirmed or not confirmed that the patient is actually suspected to have had a stroke. After this stage, two neurologists (C.G., D.H.) successively reviewed all suspected cases. After complete clinical evaluation including a detailed neurological examination, the diagnosis of stroke was confirmed or not by each neurologist separately. At this time, the confirmation questionnaire and scales were filled in by one investigator (M.-J.C.). After clinical evaluation, the two neurologists reviewed all cases. Each case with conflicting conclusion was analysed until a consensus was obtained.

During phase 3, all cases considered as stroke patients were evaluated by a CT scan. For more details on the different phases, see figure 1.

Data Analysis

The data were entered using EpiData and analysed with Epi-Info (3.2) and SPSS (13) for Windows. Continuous variables were presented as means \pm standard deviation (SD), while categorical variables were presented as proportions. The frequencies were

compared using the χ^2 test and p values <0.05 were considered statistically significant. The prevalence of stroke was standardised according to the WHO Standard Population and the SEGI Population [19, 20].

Results

Profile of the Study Population

The total population screened in this study included 15,155 subjects, of which 8,862 were women (58.5%). The mean age (\pm SD) was 31.0 ± 14.1 years. The majority of the population were Fons (43.1%) and Gouns (19.7%). They were mostly artisans, farmers and fishermen (26.3%) (table 1).

Among the 15,155 people included in the study sample, 321 were initially suspected to have had a previous stroke. The diagnosis was definitely confirmed in 70 of them. For more details, see figure 1.

Table 1. Characteristics of subjects included in the study depending on the presence of stroke

	Suspected cases (n = 251)	Stroke (n = 70)	No stroke (n = 14,834)
<i>Sex</i>			
Male	85 (33.9%)	38 (54.3%)	6,168 (41.6%)
Female	166 (66.1%)	32 (45.7%)	8,664 (58.4%)
MD	–	–	2 (0.0%)
<i>Age group, years</i>			
15–44	103 (41.0%)	4 (5.7%)	12,473 (84.1%)
45–54	49 (19.5%)	17 (24.3%)	1,146 (7.7%)
55–64	48 (19.1%)	19 (27.1%)	732 (4.9%)
65–74	29 (11.6%)	18 (25.7%)	301 (2.0%)
75–84	16 (6.4%)	10 (14.3%)	108 (0.7%)
85+	5 (2.0%)	2 (2.9%)	23 (0.2%)
MD	1 (0.4%)	–	51 (0.3%)
<i>Education level</i>			
No education	102 (40.6%)	36 (51.4%)	3,899 (26.3%)
Primary	84 (33.5%)	22 (31.4%)	4,171 (28.1%)
Secondary	45 (17.9%)	5 (7.12%)	5,515 (37.2%)
Secondary+	18 (7.2%)	7 (10.0%)	1,217 (8.2%)
MD	2 (0.8%)	–	32 (0.2%)
<i>Occupation</i>			
Retiree	13 (5.2%)	21 (30.0%)	298 (2.0%)
Housework	62 (24.7%)	13 (18.6%)	2,464 (16.6%)
Trading	54 (21.5%)	10 (14.3%)	2,966 (20.0%)
No occupation	27 (10.8%)	7 (10.0%)	703 (4.7%)
Working class	32 (12.7%)	6 (8.6%)	1,658 (11.2%)
Other	22 (8.8%)	6 (8.6%)	4,049 (27.3%)
Artisan	21 (8.4%)	4 (5.7%)	1,869 (12.6%)
Civil servant	18 (7.2%)	2 (2.9%)	797 (5.4%)
Farmer	1 (0.4%)	1 (1.4%)	13 (0.1%)
MD	1 (0.4%)	–	17 (0.1%)

MD = Missing data.

Global Prevalence of Stroke

We identified 70 stroke cases. The diagnosis was considered certain in 52 cases who presented with a clinical history highly suggestive of stroke, a focal neurological deficit at the time of examination and focal vascular lesions on CT scan. The diagnosis was considered as highly probable in 18 cases who presented with a typical clinical history, a focal neurological deficit at the time of examination but no visible lesion on CT scan (n = 9) or in the absence of imaging data (n = 9).

The crude prevalence of stroke in the population was 4.6/1,000 (3.6–5.8‰). Adjusted to the WHO Standard Population, the prevalence was 8.7/1,000, and adjusted to

the SEGI World Population it was 7.7/1,000. The prevalence of stroke increases with age, with a sharp decline after the age of 75 years. In men, the crude prevalence of stroke was 6.1/1,000, while it was 3.6/1,000 in women (table 2).

Characteristics of Stroke Survivors

Of the 70 stroke survivors, 38 were men and 32 women. The mean age in men and women was 61.3 ± 13.2 and 56 ± 13 years, respectively, at the time of the qualifying clinical event. Among the stroke patients, 51.4% had no scholar education, 31.4% had primary-level education and 17.1% secondary-level education or above. The majority of individuals (58.6%) were unemployed at the time of the study (table 1).

In one case, stroke occurred during the postpartum period, and in another one, stroke occurred during acute excessive alcohol consumption. Only 2 subjects experienced more than one acute neurological event: 6 months after the first clinical event in one case, and 11 days after the first event in the other case.

Imaging Data

CT scan data were obtained in 59 patients, either at the acute phase of stroke before the study (n = 9) or at the time of the study (n = 50), after a median delay of 36 months (range 3–300 days). Eleven stroke patients did not have a CT scan [because of severe disability or difficulties of transportation (n = 7), death (n = 2) or refusal (n = 2)].

An intracerebral haemorrhage was detected in only one acute stroke case. In all other cases, CT scans performed during the acute phase of stroke were either normal or showed a typical ischaemic lesion.

Among the 50 stroke survivors who had a CT scan during the study, 5 had no abnormality and 45 had evidence of vascular lesions. Among them, 5 patients had linear hypodensity highly suggestive of a post-haemorrhagic tissue lesion.

Thirty-five patients had diffuse white matter hypodensities suggestive of leukoaraiosis (9 mild, 7 moderate, and 19 severe according to the Fazekas scale). Of these 35 cases, 32 had focal ischaemic lesions either in the basal ganglia and/or in the deep white matter, suggestive of lacunar infarcts.

Impact of Stroke on Daily Life

Among the 70 stroke survivors, 90.0% had persisting neurological deficits. Forty percent of them had no significant disability (Rankin score 0 or 1), 21.4% had mild, 20.0% moderate and 15.5% severe disability (Rankin

Table 2. Demographic profile and age-specific stroke prevalence rates

Age group years	Total population		Males		Females	
	stroke prevalence n/1,000	number of strokes/ population size	stroke prevalence n/1,000	number of strokes/ population size	stroke prevalence n/1,000	number of strokes/ population size
15–44	0.3	4/12,580	0.6	3/5,300	0.1	1/7,279
45–54	14.0	17/1,212	20.3	9/443	10.4	8/769
55–64	23.8	19/799	29.1	9/309	20.4	10/490
65–74	51.7	18/348	62.9	10/159	42.3	8/189
75–84	74.6	10/134	120.0	6/50	74.1	4/84
85+	66.7	2/30	111.1	1/9	47.6	1/21
Total	4.6	70/15,103*	6.1	38/6,270	3.6	32/8,832

* Total population: 15,155; population size by age: 15,103, with 52 missing.

score 2, 3 or 4–5, respectively). The mean score of the FIM scale obtained for motor skills was 79.3 ± 16.5 (total score 91). The score for cognition was 32.2 ± 4.3 (total score 35), and the mean global FIM score was 111.6 ± 19.3 (total score 126). In the stroke population with complete independence, self-care was possible in 97.1% of the patients, control of sphincter was present in 81.4%, mobility and transfer in 71.4%, locomotion in 58.6%, communication (expression and comprehension) in 90.0%, and social cognition in 77.1%. Mild and moderate depression according to MADRS score was present in 35.7 and 12.9% of the subjects, respectively (table 3).

Discussion

A few door-to-door prevalence surveys have been carried out in SSA, and the majority were performed without a CT scan. Thus, this study represents a relevant starting point in estimating the burden and nature of stroke in the region. The stroke prevalence was found to be 4.6/1,000, and the majority of stroke survivors had a good functional recovery and were not severely disabled.

The stroke prevalence of 4.6/1,000 measured in the present survey in Benin is higher than that reported in other SSA countries. In 1989, the prevalence of stroke was estimated at 2.4/1,000 out of a population of 19,241 people in Kloto located in Togo. Six years later, in Abekou, Togo, it was estimated at 1.7/1,000 out of a population of 4,182 people. In individuals aged more than 39 years, the prevalence was 3.7/1,000 and 3.4/1,000 in men and women, respectively, in the same region [21]. In Nigeria, a prevalence of 1.1/1,000 was reported out of a population

of 13,127 people aged more than 15 years. In South Africa, the Stroke Prevention Initiative reported 2.4–3.0 stroke cases per 1,000 individuals in a population of 42,378 persons aged over 15 years [22]. The prevalence of stroke in Benin is also higher than that reported outside the African continent in South America [23], India [24] or Arabic countries [25]. This discrepancy may have various origins. Particularly, in contrast with other studies mainly performed in rural areas, the present data were obtained in an urban environment. The growing urbanisation with an epidemiological and nutritional shift as observed in the study area may explain the present results due to a large increase of cardiovascular risk factors [26–28]. Although the prevalence found in this study is higher than that observed in developing countries, it is in line with the age-standardised prevalence reported in people aged 65 years or more worldwide, ranging from 46.1 to 73.3 per 1,000 globally and from 58.8 to 92.6 per 1,000 in men and from 32.2 to 61.2 per 1,000 in women [29]. This difference in prevalence between men and women was also highly significant in the present study. Stroke is found 40% more common in men than in women in different studies performed in Europe, Asia or the USA [30, 31]. There is accumulating evidence suggesting that the hormonal status related to the neuroprotective effects of estrogen in women may be involved in this gender contrast [32].

The mean age of stroke survivors in this study was around 61 years, which is older than that previously reported in other SSA countries but much younger than the age at stroke onset in developed countries [33]. The young age of the African population whose life expectancy is seriously compromised by the HIV/AIDS epidemic may partly explain this discrepancy [34, 35].

Table 3. Functional status and level of depression in stroke cases

Scales	n (%)
<i>FIM</i>	
Self-care	
Complete independence	68 (97.1)
Modified independence	1 (1.4)
Supervision	1 (1.4)
Sphincter control	
Complete independence	57 (81.4)
Modified independence	7 (10.0)
Supervision	3 (4.3)
Maximal assistance	2 (2.9)
Total assistance	1 (1.4)
Transfers	
Complete independence	50 (71.4)
Modified independence	13 (18.6)
Supervision	1 (1.4)
Moderate assistance	1 (1.4)
Total assistance	3 (4.3)
Maximal assistance	2 (2.9)
Locomotion	
Complete independence	41 (58.6)
Modified independence	17 (24.3)
Minimal assistance	1 (1.4)
Supervision	5 (7.1)
Maximal assistance	4 (5.7)
Total assistance	2 (2.9)
Communication	
Complete independence	63 (90.0)
Modified independence	4 (5.7)
Supervision	2 (2.9)
Total assistance	1 (1.4)
Social cognition	
Complete independence	54 (77.1)
Modified independence	6 (8.6)
Supervision	10 (14.3)
<i>Modified Rankin Scale</i>	
0 (no symptoms at all)	7 (10.0)
1 (no significant disability)	20 (28.6)
2 (slight disability)	16 (22.9)
3 (moderate disability)	15 (21.4)
4 (moderately severe disability)	6 (8.6)
5 (severe disability)	6 (8.6)
<i>MADRS</i>	
0–6 (normal/recovered)	36 (51.4)
7–19 (mild depression)	25 (35.7)
20–34 (moderate depression)	9 (12.9)

In this study, the majority of stroke survivors had a good functional recovery and were not found severely disabled. These results are difficult to compare to previous epidemiological data obtained in African countries due to the use of different outcome measures and a delay of evaluation from the stroke event. However, despite these limitations, the present results appear in line with data obtained in Tanzania, where 40.0% of stroke survivors were found to be independent concerning washing, dressing, bathing, feeding, transferring or toileting [36]. The high frequency of good recovery may result from the young age of the study population, with only 4% of the subjects aged more than 60 years. Moreover, the consequences of stroke may have been underestimated due to a high rate of mortality at the early stage of the event. The death rate after acute stroke was previously found to be close to 50% in hospitals of SSA countries, with more than 30% of death occurring during the first month [37].

In the context of this study, the validity of the used scales could obviously be questioned. However, they have been used widely in several settings and many different geographical areas, and their validity is largely recognised in the literature [38, 39].

There are several limitations to the present study. Elderly or severely diseased subjects may be underrepresented in the population study since the survey did not include subjects outside the geographic area, subjects who were hospitalized, or subjects who moved to another area in their native village or in another district. The number of stroke cases may be also underestimated because individuals with a complete recovery did not always report the qualifying event. In addition, patients with subtle symptoms or minor stroke might have been missed with the questionnaire used for screening. This study has also several strengths. It was performed in a representative, socially mixed area, the number of subjects was large, and the survey included a door-to-door design and the use of CT scans for diagnostic confirmation.

In conclusion, this is the first study of stroke prevalence in Benin, estimated at 4.6/1,000 inhabitants. The relatively good recovery of affected subjects in the present study is possibly due to the young age of stroke survivors or early death of the most severely disabled patients. We still need additional investigations (prospective cohort studies) in Benin, and generally in SSA countries, to confirm and refine these results.

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Disclosure Statement

The authors have no conflicts of interest to declare.

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