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Prevalence of stroke survivors in Parakou in northern Benin : a door-to-door community survey

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ABSTRACT

Introduction : Stroke is a major public health problem with a high burden in sub-Saharan Africa. We aimed to determine the prevalence of stroke in Titirou in Parakou.

Methods : It was a cross-sectional study using a door-to-door survey in Titirou (Parakou) from 15 march to 15 October 2016 and included 4671 adults. We did a two stages survey. In the first stage the World Health Organization (WHO) tool for the diagnosis of stroke in community was used. In the second phase all suspected cases underwent neurological exam and sometimes brain CT-scan. The WHO definition was used for the diagnosis of stroke. We recorded the sociodemographic data and the vascular risk factors. The prevalence was standardized on age according to the WHO type population. Multiple logistic regression was done to identify associated factors and estimate the adjusted Prevalence ratio (aPR) and their 95% confidence interval (CI).

Results : The mean age of the subjects was 27.7+/-12.9 years with a sex ratio of 0.97. After screening 161 were suspected and 54 confirmed cases, the overall prevalence of stroke in Titirou was 1.156 per 100,000 inhabitants [95%CI: 0.850 to 1.426]. The age-standardized prevalence of stroke was 3223 cases per 100,000 inhabitants. The associated factors were age (aPR 1.7 [1.5-1.9] for 10 years), history of hypertension (aPR: 64.8 [46.1-108.9]), diabetes mellitus (aPR: 4.5 [1.6-12.3]), low consumption of fruits and vegetables (aPR: 2.3 [1.2-4.4]), history of heart disease (aPR: 6.0 [2.6-13.7]), family history of stroke (PR: 4.6

[2.1-10.0]). Among the 54 subjects who had a stroke 10 were able to perform the brain CT-Scan: 40% were hemorrhagic and 60 % ischemic stroke.

Conclusion: Our study showed a high prevalence of stroke in Titirou and suggested urgent action for prevention.

Keywords : stroke, epidemiology, prevalence, Benin.

INTRODUCTION

Stroke remains a high public health problem worldwide. Overall it is the second cause of death [1,2]. Recent data suggested that the incidence remains stable between 1990 to 2016 [3]. In several studies conducted in Sub-Saharan Africa (SSA) communities the prevalence ranged from 15 to 1000 per 100,000 inhabitants [4-8]. Those prevalences were lower than in western countries however the alarming prevalence of stroke risk factors (RF) in SSA may lead to a higher burden of the disease.

In Benin, a previous study conducted in Cotonou in 2010 reported a stroke prevalence up to 460 per 100,000 inhabitants [9]. Stroke accounted for about 46% of all admission in the neurology clinics in Benin [10]. Benin had a high prevalence of vascular risk factors [11]. Indeed the prevalence of hypertension, smoking, obesity and diabetes were respectively 28.4%, 7.6%, 18.0% and 2.3%. In previous studies on vascular risk factors in Benin, in the Borgou country, the prevalence of diabetes mellitus, hypertension and smoking were respectively 12.4%, 27.9% and 10.8% [12].

The burden of stroke in the northern Benin communities was not documented, despite substantial data about the comorbidities such as depression [13], epilepsy [14], on prognosis [15] and their social participation [16]. Lifestyle and cultural considerations are different in the northern and in southern Benin. In this study we aimed to estimate the prevalence of stroke survivors in one sub-urban community in Parakou in northern Benin.

METHODS

Study design

This cross-sectional study was carried from 15 March to 15 October 2016 in Parakou with two stages. After screening by a door-to-door survey, suspected cases of stroke underwent a neurological examination at the hospital to confirm the diagnosis of stroke.

Setting

The city of Parakou is located in the northern Benin at 425 km from Cotonou. The population was estimated to 255,478 inhabitants [17]. It covers an area of 441 km² including about 70 km² of urbanized areas. Parakou has three districts and 41 neighbourhoods and villages. The city of Parakou currently has, in addition to its many health centers, two large hospital-university structures that are the University Teaching Hospital / Borgou-Alibori which constitutes the framework of practical teaching for the Faculty of Medicine of Parakou with two neurologists and the Military hospital of the Parakou. It has two CT scan units, including one at the army training hospital.

The study took place in Titirou district. It is the second most populated district of Parakou after Banikanni. The population was 25530 inhabitants with 12816 aged 15 years and over. It is subdivided into seven sub-districts. This district is located about 1km from the University Hospital and about 1km from the Army Training Hospital.

Participants

Inclusion criteria: all people (older than 15 years) resident in Titirou and present at the date of the survey, and consenting to participate to the study.

Sampling

Sample size

The sample size was computed for an expected prevalence of stroke 4.6 per 1000 [9] with a precision of 0.002 and an alpha risk of 0.05. The minimal number of subjects was 4,600.

Sampling

The size was divided proportionally to the size of each sub-district (number of persons older than 15 years) of Titirou. In each sub-district, the investigators randomly determined a direction from the center. All subjects meeting the inclusion criteria and living in households in this direction were interviewed up to the expected number. When this number is not reached, they returned to the center and repeated the operation for another direction until the expected number. The number of participants of each sub-district was summarized in the table 1.

Variables

Outcome variable: stroke

Stroke was defined according to the WHO definition as “rapidly developing signs of focal (or global) disturbance of cerebral function, lasting longer than 24 hours, with no apparent cause other than vascular” [18]. Any subject with

suspected stroke underwent a neurological examination at the University hospital of Parakou. Only the cases confirmed by a neurologist were diagnosed as stroke case.

The exposure variables

They were socio-demographic (age, sex, marital status, occupations, religion and ethnicity), anthropometric (weight, height, and body mass index), clinical (blood pressure), and medical history (family history of vascular disease, hypertension, diabetes, smoking, low consumption of fruits and vegetables, physical inactivity, alcoholism).

- Hypertension was defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg or previous history of hypertension or taking antihypertensive drug,
- Diabetes was defined as fasting plasma glucose ≥ 1.26 g/l or previous history of diabetes or taking hypoglycemic drug
- Smoking was defined as the current smoking (≥ 1 cigarette/day) or smoking tobacco last five years
- Alcoholism: drinking alcohol at least once per week more than 1 year
- Cardiac disease : any reported medical diagnosis as cardiac (mycardiopathy, heart failure, arrhythmia, ischaemic heart disease...) by self-report
- Low consumption of fruits and vegetables: less than 5 fruits and vegetables per day through self-report.

- Family history of vascular disease or hypertension: any self-report of these in the family.

Data collection

Two investigators collected the data. They were medical students at the end of their training in the Faculty of Medicine of Parakou University and had been trained on the questionnaire before the survey. The data was collected by using 2 questionnaires: a Stroke Screening Questionnaire in a door-to-door survey and a Stroke Confirmation Questionnaire. The 2 questionnaires were constructed based on the modified WHO questionnaire on neurological disorders [19, 20] which were used previously in Benin after back translation [9]. The screening questionnaire contained eight questions and any positive response was considered as a suspected case. Any suspected case underwent the neurological examination to confirm the diagnosis of stroke. During this exam the second part of the questionnaire was used and all data concerning the clinical features or the history of the stroke occurrence was recorded.

The screening questionnaire contained also socio-demographic data, vascular risk factors, anthropometrics data (height and weight) and blood pressure. For the last, each subject had been lying for at least 5 minutes in a room in the house and three blood pressure shots were taken on one arm. The last value of the arterial pressure was retained. A systolic value more than 160 mmHg and/or a diastolic value 90 mmHg were defined as elevated blood pressure.

The weight was taken using a weight scale (SECA*) with a precision of 100g for each slightly dressed person. For size one toise was used with a precision of 1 cm. The body mass index (BMI) was calculated by dividing the weight (Kg) by the square of size (m). The BMI less than 18.5 kg/m² was considered as thinness, BMI between 18.5 kg/m² -24.9 kg/m² as normal weight, between 25 kg/m² and 29.9 kg/m² as overweight and more than 30 kg/m² as obesity.

Statistical analysis

The Stata version 21.0 software (Stata Press, 4905 Lakeway Drive, College Station, Texas 77845) was used to enter data and for statistical analysis. The categorical variables were described as number and percentage with 95% confidence interval, continuous variables by using mean with one standard deviation.

The stroke prevalence (old and new cases) was estimated and age-standardized prevalence to World Health Organization (WHO) and SEGI type population was computed by using the direct standardisation method.

The association between stroke and sociodemographic data and vascular risk factors was estimated using prevalence ratio. The chi-2 test or exact Fisher test were used to compare percentages. All variables with a p-value of 0.1 or less were introduced in multivariate analysis by using step by step background logistic regression. The prevalence ratio and their confidence intervals at 95%

were determined to estimate the association between stroke and other variables. P-value under 0.05 were considered significant.

Ethical considerations

The formal authorization of the local authorities was obtained before the survey. The approval of the Local Ethical Committee of Biomedical Research of the University of Parakou was obtained. Each participant gave oral consent before inclusion. The confidentiality of the data was guaranteed. After the diagnosis each stroke patient received a treatment and was followed by the neurologists.

RESULTS

During the survey 4671 people were included. No refusal was recorded. They were 2306 males (49.4%) with the sex ratio of 0.97 and aged from 15 years to 99 years (mean of 27.7 ± 12.9 years). Among them 52.9% were under 25 years old. They were mostly students (40.0%), craftman (19.9%) and traders (16.8%). The majority of the population were christians (55.5) followed by muslims (43.7). The people without schooling represented 17.3% and those with secondary 55.3%.

The characteristics of the population are displayed in table 2. The average weight of the subjects was 64.2 ± 12.2 kg (ranged: 30-155 kg) and the mean height was 1.65 ± 0.08 m. The BMI ranged from 12.3 to 60.6 kg / m² with an average value of 23.6 ± 4.4 kg/m². The frequencies of overweight and obesity

were respectively 19.5% and 8.5%. The mean values of systolic blood pressure (SBP) and diastolic blood pressure (DBP) were respectively 120.9 ± 10.7 mmHg (range: 90-211 mmHg) and 79.3 ± 6.8 mmHg (53-125 mmHg), respectively. Of the 4671 subjects, 331 had a SBP ≥ 140 mmHg and or a DBP ≥ 90 mmHg. The incidence of elevated BP was 7.1%.

Among the 4671 people screened 161 were suspected of stroke and underwent neurological examination (figure 1). Only 54 cases were confirmed. CT-scan data were obtained in 10 cases.

The overall prevalence of stroke was 1156 per 100,000 persons with the 95% confidence interval of 850 to 1462 per 100,000 inhabitants.

The prevalence of stroke increased significantly with age ($p=0.00001$). The age-standardized prevalence of stroke according to WHO type population was 3223 cases per 100,000 population. The age-standardized prevalence of stroke according to the SEGI type population was 2,889 cases per 100,000 population.

Among the sociodemographics characteristics only sex were not associated to the stroke ($p=0.121$). Except smoking and alcoholism, all vascular risk factors were associated to the stroke (table 2). The history of hypertension (64.8 [46.1-108.9]), diabetes mellitus (4.5 [1.6-12.3]), low consumption of fruits and vegetables (2.3 [1.2-4.4]), history of cardiac disease (6.0 [2.6-13.7]), and the family history of strokes (4.6 [2.1-10.0]) remained significant in the multivariate analysis (table 3).

Among the cases of stroke, 23 (38.9%) were males. They were aged from 18 years to 85 years with a mean age of 51.3 ± 14.7 years. Among the stroke group only 34 (63.0%) were followed by a health worker, mainly a generalist practitioners (61.8%).

Hypertension (83.3%), and diabetes (9.3%) were the predominant risk factors.

The main symptoms were hemiplegia (57.7%), sensory loss (51.9%) visual impairment (28.8%), speech disturbance (25.0%), loss of consciousness (11.5%), headaches (23.1%), and dizziness (7.7%).

DISCUSSION

In this study we aimed to estimate the prevalence of stroke in a sub-urban area in Parakou. We had done a door-to-door survey in a community and used the WHO screening tool for stroke with a good validity. Other strengths of this study was the confirmation of stroke by a neurologist with experience in clinical diagnosis of stroke. We observed a prevalence of 1156 per 100,000 inhabitants. It is significantly higher than previously reported in a study in Cotonou [9] that used the same methodology. Several reasons could explain this difference. The Cotonou study included most of the districts and neighbourhoods of Cotonou whereas ours took place in one district of Parakou. Titirou is located halfway between the two major hospitals in the city of Parakou and many victims of stroke would be there to facilitate access to the rehabilitation center located at Parakou hospital. Moreover, because of the location of the re-education centers

(the only two public centers) in Parakou, subjects living far away could stay there for re-education sessions. This could artificially have increased the number of stroke survivors observed at Titirou and lead to an overestimate of the prevalence.

The importance of risk factors should be emphasized even though the population is relatively young compared to Cotonou, that explains a high prevalence standardized on age. However, this prevalence is close to that previously reported in the same community in 2014 in a study on the prevalence of neurological conditions in the community with a prevalence of 1300 per 100,000 inhabitants [21]. This figure is also in the higher values of the figures reported in sub-Saharan Africa. Studies in this region report figures between 18 and 1400 per 100,000 inhabitants [4-9]. This variability could be explained by the difficulty of carrying out epidemiological studies in this region and the importance of risk factors varying from one region to another but also by the study environment, some of which take place in urban areas and others in rural areas. The prevalence increased with age. The age is an independent risk factor for vascular disorder. Other studies in sub-saharan Africa reported age as the main associated factor of stroke. With the increasing of age people increase their risk of atherosclerosis and the risk of vascular damage in the brain. Those factors induced the stroke by many mechanisms. The population attributable risk (PAR) of this factor was reported in the SIREN study. In this case-control study the odds ratio (OR) of the stroke in persons older than 50 years was 4.54 with a

PAR of 58.8% [22]. We found other vascular risk factors associated with stroke in this study. The hypertension was strongly associated with stroke with a prevalence ratio of 64.8 (95%CI 46.1-108.9). The burden of hypertension in Africa is very high and can explain more than 75% of all stroke cases in this area. The SIREN study showed that the Population Attributable Risk of hypertension was 90.8% [22]. It was very high compared to what found in other regions in the world. Hypertension contributes to all stroke types by inducing small artery disease which can cause ischaemic stroke or hemorrhage stroke. This can be explained by the lack of accessibility to care service or late diagnosis of hypertension. Hypertension had many characteristics in the black people such as sodium abnormalities, increased peripheral vascular resistance, altered genes regulating renin angiotensin aldosterone system, socioeconomic stress [23]. Those features and the urbanization can explain the high prevalence of hypertension in Africa especially in urban area compared to rural. The diabetes, the self-reported heart disease, the family history of stroke and the low consumption of fruits and vegetables were other associated factors of stroke in this study. Those factors were previously reported in sub-saharan Africa [22]. The diabetes is the second vascular risk factor after the hypertension. It contributed to explain more ischaemic stroke in this area as well as it caused small artery disease. Its part of the population attributable risk was estimated to 22.1% [22]. Surprisingly, neither smoking nor alcoholism was associated with stroke. This can be explained by the definition of smoking and alcoholism used

in this survey that does not quantify the degree or specify the duration of exposure. For example, subjects who occasionally drink alcohol or smoke one cigarette a day are considered to be the same as chronic smokers (more than one pack a day for several years) and alcoholics (excessive alcohol consumption).

In summary the prevalence of stroke was very high in this setting compared to other reported in sub-saharan Africa and could be explained by vascular risk factors such as hypertension, diabetes, the heart diseases and the lifestyle. However, the cross-sectional nature of the study does not support causality, since measured risk factors may occur at the same time or after the stroke. This study emphasizes the importance of the screening and treatment of the vascular risk factors in primary prevention. We need urgent actions for prevention of those factors especially diabetes and hypertension and to promote the consumption of fruits and vegetables.

Limitations of the study

This study had some limitations. First the study was limited to only one sub-district of Parakou and cannot represent other regions in northern Benin. Although the population of Titirou cannot represent the population of Parakou, it should be noted that our sample consists of 2.1% of subjects over 65 years old, which is identical to the proportion of subjects over 65 in the city of Parakou and closed to the 2.3% of the Borgou [17]. However, the highest prevalences are observed in this age group.

The setting can induce an overestimation of the prevalence of stroke because of its location. The self-report of many of the vascular risk factors can introduce a bias. We didn't validated the respondents report in the hospital. We didn't recorded the treatment of each vascular risk factor. To confirm the stroke case the use of CT-scan to ascertain the subtype of stroke could improve the management. Nethertheless the confirmation of the case by a neurologist with experience in stroke clinical diagnosis is a strength of this study.

CONCLUSION

The prevalence of stroke is very high and associated with vascular risk factors that need to be taken into account in prevention strategies in order to reduce the importance of the disease. Large-scale epidemiological studies are needed to appreciate the importance of the disease.

In the future we need other studies to combine community and hospital-based studies to study the real burden of stroke.

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Table 1 : The number of people included in each subdivision in Titirou, Parakou

Name of the sub-division	Population (inhabitants)*	Number expected**	Number in the Survey
Borarou	490	190	195
Dama N’Kparou	312	118	123
Gounin	901	342	352
Mondouro	572	240	247
Titirou centre	9107	3200	3220
Tobou N’Kparou	545	200	209
Toukossari	889	310	325
TOTAL	12816	4600	4671

*[Reference 17], **=in proportion to the size of each sub-district

Table 2 : Prevalence of stroke survivors according to sociodemographics characteristics and vascular risk factors, Parakou 2016

	Sample N (%)	Stroke Cases N (Prevalence %)	Prevalence Ratio [CI95%]	P
Age (years)				<10 ⁻³
15-44	4125 (88.3)	15 (0.4)	1	
45-54	261 (5.6)	17 (6.5)	19.1 [9.4-38.7]	
55-64	184 (4.0)	12 (6.5)	19.1 [8.8-41.5]	
65-74	67 (1.4)	5 (7.5)	22.1 [7.8-62.7]	
75-84	28 (0.6)	4 (14.3)	45.7 [14.1-147.7]	
85 and more	6 (0.1)	1 (16.7)	54.8 [6.0-497.6]	
Sex				0.121
Males	2306 (49.4)	21 (0.9)	1	
Females	2365 (50.6)	33 (1.4)	1.5 [0.9-2.6]	
Marital status				<10 ⁻³
Alone	2649 (56.7)	6 (0.2)	1	
Couple	2022 (43.3)	48 (2.4)	10.7 [4.6-25.1]	
Level of education				<10 ⁻³
No schooling	807 (17.3)	23 (2.9)	1	
Primary	875 (18.7)	18 (2.1)	0.7 [0.4-1.3]	
Secondary	2581 (55.3)	10 (0.4)	0.1 [0.1-0.3]	
University	408 (8.7)	3 (0.7)	0.2 [0.1-0.8]	
Religion				0.038
Christian	2591 (55.5)	20 (0.8)	1	
Muslim	2043 (43.7)	34 (1.7)	2.2 [1.2-3.8]	
Other	37 (0.8)	0 (0.0)	-	
Body Mass Index (4662)				<10 ⁻³
Thinness	324 (6.9)	2 (0.6)	0.9 [0.2-3.8]	
Normal	3034 (65.1)	21 (0.7)	1	
Overweight	908 (18.5)	16 (1.8)	2.6 [1.3-4.9]	
Obesity	396 (8.5)	12 (3.0)	4.4 [2.2-8.8]	
Vascular risk factors				
Hypertension (Yes/No)	331 (7.1)	45 (13.6)	75.7 [36.6-156.4]	<10 ⁻³
Diabetes mellitus (Yes/No)	59 (1.3)	8 (13.6)	13.6 [6.7-27.5]	0.005
Heart disease (Yes/No)	87 (1.9)	13 (14.9)	16.6 [9.2-29.9]	<10 ⁻³
Dyslipidemia (Yes/No)	104 (2.2)	5 (4.8)	4.5 [1.8-11.0]	<10 ⁻³
Smoking (Yes/No)	161 (3.4)	3 (1.9)	1.6 [0.5-5.2]	0.393
Alcoholism (Yes/No)	801 (17.1)	6 (0.7)	0.6 [0.3-1.4]	0.236
Low consumption of fruits and vegetables (Yes/No)	1004 (21.5)	20 (2.0)	2.2 [1.2-3.7]	<10 ⁻³
Family history of stroke (Yes/No)	201 (4.3)	13 (6.5)	7.1 [3.8-12.9]	<10 ⁻³

CI=Confidence interval

Table 3 : Factors associated to stroke in multivariate analysis, Parakou 2016

	aPR (CI95%)	p
Age (for each 10years)	1.7 [1.5-1.9]	<10 ⁻³
Hypertension (Yes/No)	64.8 [46.1-108.9]	<10 ⁻³
Diabetes (Yes/No)	4.5 [1.6-12.3]	0.004
Heart disease (Yes/No)	6.0 [2.6-13.7]	<10 ⁻³
Family history of stroke (Yes/No)	4.6 [2.1-10.0]	<10 ⁻³
Low consumption of fruits and vegetables (Yes/No)	2.3 [1.2-4.4]	0.008

aPR : adjusted Prevalence ratio ; CI : confidence interval

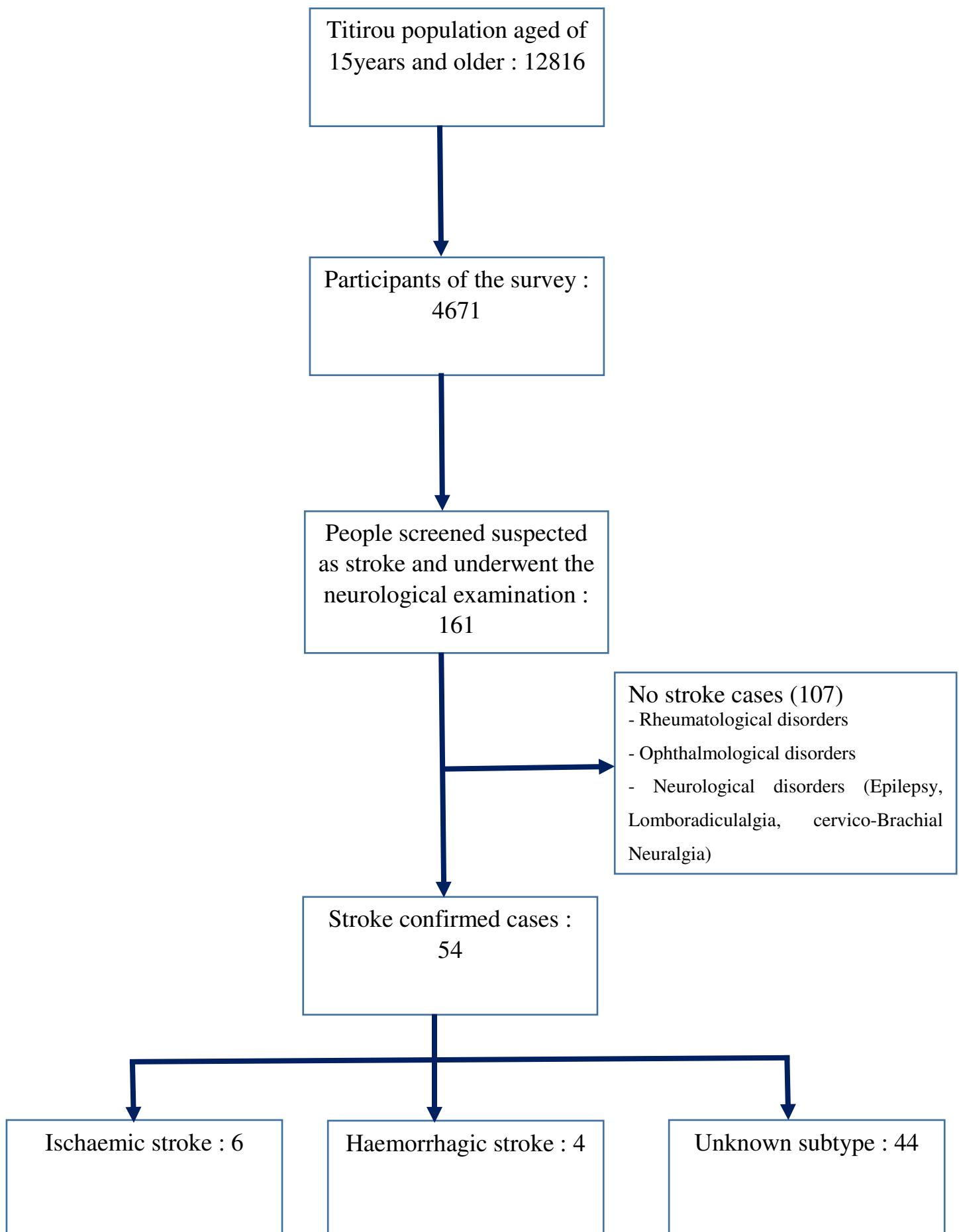


Figure 1 : Flow chart of the screening process of the participants, Parakou 2016