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Stroke management in two Benin university hospitals: a retrospective study

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Abstract

Due to the lack of data on stroke in Benin, particularly outside major urban centers such as Cotonou, this study aimed to describe the epidemiological, clinical, and management profiles of stroke patients in two regional university hospitals. A retrospective multicenter study was conducted from June 2014 to September 2019 at the Departmental University Hospital Centers of Ouémé-Plateau (CHUD-OP) (Porto-Novo) and Borgou-Alibori (CHUD-BA) (Parakou). All adult patients with a stroke confirmed by Computed Tomography Scan (CT scan) and managed in emergency, intensive care, or rehabilitation units were included. Among the 1,816 medical records reviewed, 282 patients were included, with 72.3% from CHUD-BA. The mean age was 56 years, with a male predominance (sex ratio: 1.5). Ischemic stroke was the most frequent type (48.6%), followed by hemorrhagic stroke (35.8%). The overall mortality rate was 24.8%, and only 45% of patients received physiotherapy. with 40.1% of patient records coming from the rehabilitation department, compared to 31.2% from intensive care and 28.7% from emergency rooms. These findings highlight the growing burden of stroke in these regions, significant disparities in care between centers, and limited access to post-stroke rehabilitation. This underscores the urgent need to improve stroke care delivery and control healthcare costs in regional settings.

Keywords: Benin, epidemiology, healthcare costs, mortality, physiotherapy, retrospective studies, stroke, university hospitals

Introduction

Stroke represents a major global public health challenge, with a significantly increasing prevalence in sub-Saharan Africa in recent years (Adoukonou et al. 2020; Minja et al. 2022). This condition involves an abrupt disruption of the brain's blood supply, resulting from either the blockage of an artery (arterial occlusion) or bleeding within the brain (intracerebral hemorrhage), which culminates in an acute deficit of neurological functions (Sarfo et al. 2024). This condition is commonly linked to several risk factors, including medical conditions such as hypertension, diabetes, and dyslipidemia; genetic predispositions; and lifestyle behaviors like smoking, unhealthy diet, and physical inactivity. These latter factors are especially significant in African settings (Azeez, Durotoluwa, et Makanjuola 2023; Okekunle et al. 2023). Currently, stroke represents the primary cause of acquired disability among adults and stands as a leading contributor to mortality within low- and middle-income nations (World Health Organization n. d.). Whereas extensive data exist for industrialized nations, the characteristics of stroke in West Africa, especially in non-capital regions, are not well-characterized. In Benin, the limited existing research has been largely concentrated at two tertiary care centers: the National University Hospital Center (CNHU) of Cotonou and the Departmental University Hospital Centers of Borgou-Alibori (CHUD-BA) (Adoukonou et al. 2017; Gbaguidi 2019). However, the scenario within regional hospitals like the Departmental University Hospital Centers of Ouémé-Plateau (CHUD-OP) of Porto-Novo has received little research attention. Consequently, the objective of this study is to characterize the demographic, clinical, and care management features of patients with stroke admitted to two regional university hospitals in Benin. This paper is organized into the following sections: background, methods, results, discussion, and implications for care planning.

Background

The World Health Organization (WHO) has characterized stroke as a 'silent pandemic,' projecting that the annual incidence could reach 23 million cases by 2030 in the absence of effective preventive strategies (World Health Organization n. d.). The burden of stroke in Africa is significant, where it has emerged as a primary driver of morbidity and hospital-related deaths, with mortality rates ranging from 20% in Mauritania to more than 40% in Ethiopia (Fekadu, Chelkeba, et Kebede 2019; Touré et al. 2008). In Benin, available data indicate that stroke accounts for up to 20% of neurological hospitalizations at the CNHU in Cotonou, with an in-hospital case fatality rate of 16.7% and a one-year mortality rate of 35.5% (Adoukonou et al. 2013, 2017). Furthermore, there are no published studies on stroke at the CHUD-OP in Porto-Novo, the nation's capital, or any interregional comparisons with the CHUD-BA in Parakou (HAS n. d.). In the context of Parakou, access to post-stroke physiotherapy is limited, with only 45% of patients benefiting from this essential care. This low rate is a critical concern for prospects of motor function recovery (Gbaguidi 2019). Indeed, the direct hospital cost of management in Benin is 316,810.3 CFA (approx. €483 or $552) in Parakou and 515,000 CFA (approx. €785 or $897) in Cotonou, making such care financially inaccessible to numerous Beninese households (Adoukonou et al. 2013, 2017).

This study is framed within a biopsychosocial model, conceptualizing stroke not only as a clinical event but also as a social and organizational challenge (Engel 1977). The study considers the influence of factors such as health system design, geography, and socioeconomic status on care delivery. The lead researcher, who holds a PhD in human motor skills and disability, brought extensive expertise in stroke rehabilitation. This experience was particularly

relevant for critically assessing gaps in current care provision and developing solutions tailored to the Beninese context.

This study aims to characterize the demographic, clinical, and care management profiles of stroke patients admitted to the CHUD de l'Ouémé-Plateau (Porto-Novo) and the CHUD du Borgou-Alibori (Parakou) from June 2014 to September 2019. The findings are intended to support improved planning for neurological and rehabilitation services in Benin. This study represents one of the few multicenter explorations to date of the reality of stroke in regional settings in Benin. Its originality and geographic scope compensate for the relative age of the data. In the Beninese context, where resources are limited and health planning is often constrained, having data, even if somewhat outdated, is crucial for guiding priorities in training, equipment acquisition, and funding. Furthermore, in the context of hospital-based stroke management, many conditions remain unchanged in that the previously identified gaps, such as limited access to post-stroke rehabilitation or disparities between hospitals, have not undergone major improvements since 2019.

Materials and methods

This retrospective, multicenter, comparative study was conducted at the Departmental University Hospital Centers of Ouémé-Plateau (CHUD-OP) and Borgou-Alibori (CHUD-BA), located in southern (Porto-Novo) and northern (Parakou) Benin, respectively. The initiative was driven by the need to better understand the hospital management of stroke in two contrasting regional settings. The study was led by the "Disability, Adapted Physical Activity, and Rehabilitation" Research Unit (UR-DAPAR) of INJEPS/UAC, in collaboration with the Clinical and Epidemiological Research Unit (URCE) of the Faculty of Medicine, University of Parakou. We retrospectively reviewed medical records from the Emergency, Intensive Care, Neurology, and Rehabilitation departments of both hospitals, including all stroke cases confirmed by CT scan between June 2014 and September 2019 through authorizations: N°21377/19/MS/DC/DDS-B/CHUD/B-A/SAAE/DGAP of February 24, 2019 (CHUD-BA) and N°1771/MS/DDS-O/P/CHUD-OP/DIR/SAAE/DGAP/SA of September 2, 2019 (CHUD-OP).

Cases were identified through a comprehensive screening of care registries and hospital records. Inclusion criteria were strictly defined as: adult patients (≥ 18 years of age) with a stroke diagnosis confirmed by Computed Tomography (CT) scan during the study period. Cases of transient ischemic attacks (TIAs), diagnoses not confirmed by CT scan, or files with incomplete data were excluded. At each hospital, data were collected by two independent teams over a six-week period. The collected data were then cross-referenced to ensure the reliability of the final dataset. The extracted information included: sociodemographic characteristics; clinical data (stroke type, admitting department, length of hospital stays); outcomes (discharge status, discharge destination); and access to rehabilitation (defined as any mention of physiotherapy). This was a retrospective study based on anonymized clinical records of patients treated between 2014 and 2019 at the Departmental University Hospital Centers of Borgou-Alibori (CHUD-BA, located in Parakou, Northern Benin) and Ouémé-Plateau (CHUD-OP, located in Porto-Novo, Southern Benin). At the time the study was conducted, no local Research Ethics Committee (REC) was operational within these institutions. The study involved no patient contact or intervention, and all data were handled confidentially after obtaining the following institutional authorizations: N°21377/19/MS/DC/DDS-B/CHUD/B-A/SAAE/DGAP of February 24, 2019 (CHUD-BA) and N°1771/MS/DDS-O/P/CHUD-OP/DIR/SAAE/DGAP/SA of September 2, 2019 (CHUD-OP). We ensured strict ethical conduct by adhering not only to

the Declaration of Helsinki guidelines (respect for confidentiality and the principle of non-maleficence) but also to the fundamental principles of research ethics in the African context, which emphasize Social Justice and Community Benefit. We acknowledge the importance of formal ethical oversight and commit to ensuring that all future retrospective analyses are submitted for review by accredited REC. Statistical analyses were performed using SPSS software (version 21), with the significance level set at $p < 0.05$. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD) after their normal distribution was verified using the Shapiro-Wilk test.

Results

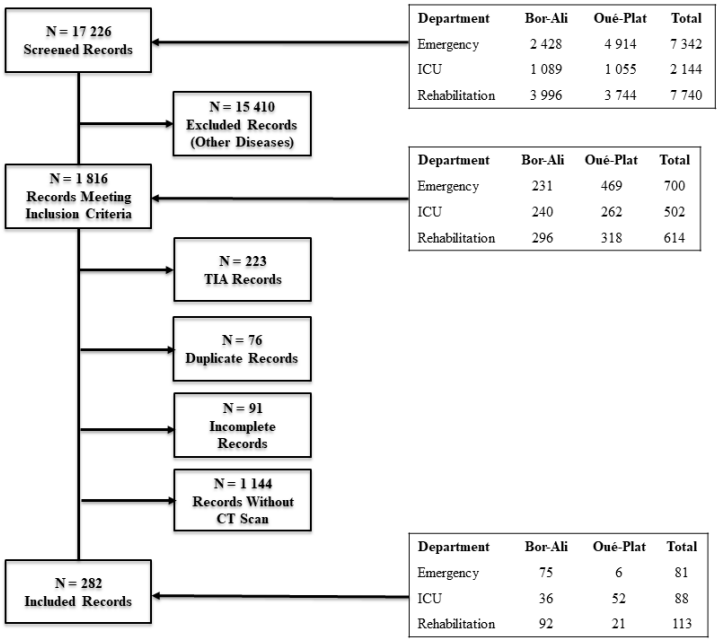
This section details the study's key findings, including: the demographic and clinical characteristics of the stroke patients; the patterns of in-hospital management; patient outcomes at discharge; and finally, access to rehabilitation. These findings are presented below, based on the data extracted from the CHUD-OP and CHUD-BA.

1. Stroke characteristics at CHUD-BA and CHUD-OP during the study period

Characteristics of Stroke Patient Medical Records

Between June 2014 and September 2019, 282 (15.5%) stroke patient records met the study criteria out of a total of 1,816 records reviewed at CHUD-BA and CHUD-OP. Consequently, 1,534 (84.5%) records were excluded because 223 files were AIT files, 76 were duplicates, 91 were inaccurately filled out (incomplete records), and 1,144 lacked a scan (*Figure 1*). Among the 282 patients included, cases were distributed across the following departments: Emergency (28.7%), Intensive Care (31.2%), and Rehabilitation (40.1%). The majority of stroke cases (72.3%) were recorded at CHUD-BA.

N: *Effective*
Bor-Ali*: Borgou-Alibori*
Oué-Pla : *Ouémé-Plateau*



Department	Bor-Ali	Oué-Plat	Total
Emergency	2 428	4 914	7 342
ICU	1 089	1 055	2 144
Rehabilitation	3 996	3 744	7 740

Department	Bor-Ali	Oué-Plat	Total
Emergency	231	469	700
ICU	240	262	502
Rehabilitation	296	318	614

Department	Bor-Ali	Oué-Plat	Total
Emergency	75	6	81
ICU	36	52	88
Rehabilitation	92	21	113

ICU: *Intensive Care Unit*

TIA: *Transient Ischemic Accident*
CT scan: *Computed Tomography*
Figure 1*: Population inclusion chart*

Distribution of Stroke Patients Across CHUD-BA and CHUD-OP

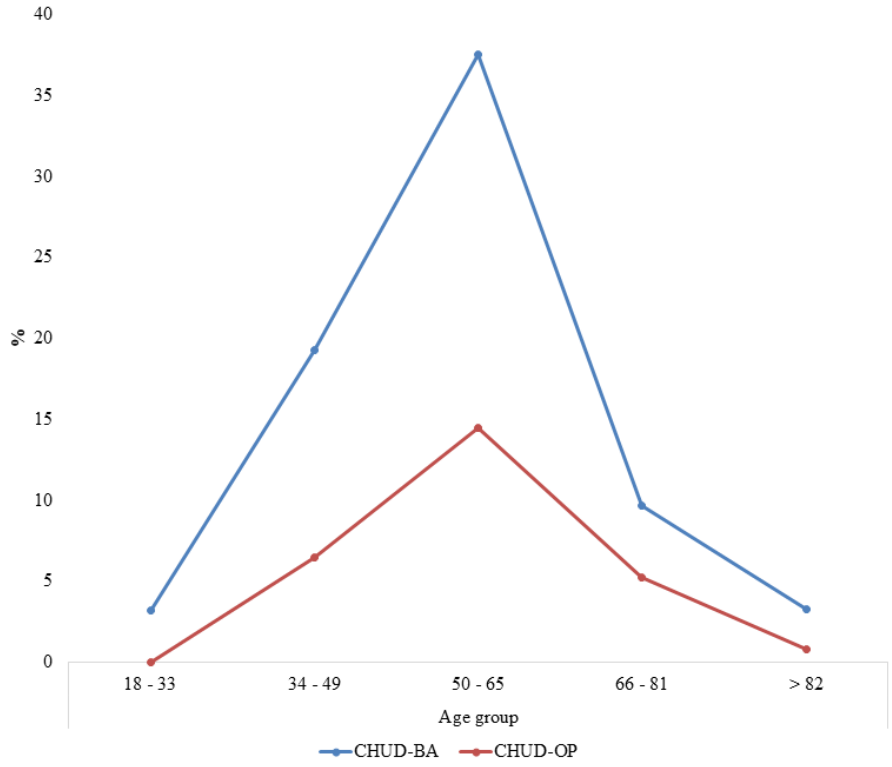
The average age of the study sample was 56 ± 13.5 years, with 56.6 ± 14.4 years for CHUD-BA and 57 ± 10.8 years for CHUD-OP. Males were more represented, accounting for 59.6% of cases, with a sex ratio of 1.50. Civil servants represented the smallest proportion of stroke victims (15.9%) (Table 1).

Table 1: Distribution of stroke patients over the study period

	CHUD-BA	**CHUD-OP**	**2 CHUD**
	203 (72)	79 (28)	282 (100)
AGES (years)©			
Male	*NR*	*NR*	55.3± 11.6
Female	*NR*	*NR*	57± 15.9
Total	55.6± 14.4	57± 10.8	56± 13.5
GENDER*			
Male	121 (42.9)	47 (16.7)	168 (59.6)
Female	82 (29.3)	32 (11.1)	114 (40.4)
PROFESSIONS*			
NR	80 (28.4)	7 (2.5)	87 (30.9)
Civil servants	8 (2.8)	37 (13.1)	45 (15.9)
Liberal professions	64 (22.7)	86 (30.5)	150 (53.2)
LENGTH OF STAY©			
Male	*NR*	*NR*	5.18± 5
Female	*NR*	*NR*	7.18± 8.5
Total	5.5± 6.5	7.7± 6.3	6± 6.4

©: Mean (standard deviation) ***:** Number of employees (Percentage**)** **NR:** Not specified **CHUD-OP:** Departmental University Hospital Center of Ouémé-Plateau
CHUD-BA: Departmental University Hospital Center of Borgou-Alibori
CHUD: Departmental University Hospital Center

Patients aged 50 to 65 years were the most affected by stroke throughout the study period, with a peak at CHUD-BA (37.6% vs. 14.5%; $p = 0.000$) (*Figure 2*).



CHUD-OP: *Departmental University Hospital Center of Ouémé-Plateau*
CHUD-BA: *Departmental University Hospital Center of Borgou-Alibori*
Figure 2*: Age distribution of stroke patients by CHUD over the study period*

2. Stroke patient management at CHUD-BA and CHUD-OP during the study period

Management was analyzed in terms of stroke types, care services, patient outcomes, and compliance with physiotherapy care.

Distribution of Patients by Care Services

The data collected show that 40.1% of patient records originated from the Rehabilitation department, compared to 31.2% from Intensive Care and 28.7% from Emergency (Table 2).

Patient Outcomes

The overall in-hospital mortality rate for the two centers was 24.8%, with 13.5% at CHUD-OP and 11.3% at CHUD-BA (Table 2).

Participation in Physiotherapy Care

Only 45% of patients included in the study sought physiotherapy care, with sessions ranging from 1 to 15 over periods of one, three- and 12-months post-stroke, respectively (Table 2).

Table 2: Some data on the management of stroke patients over the study period.

	CHUD-BA*	CHUD-OP*	2 CHUD*
	203 (72)	79 (28)	282 (100)
STROKE TYPE			
Undetermined	0	44 (15,6)	44 (15,6)
Ischemic	111 (39,4)	26 (9,2)	137 (48,6)
Hemorrhagic	92 (32,6)	9 (3,2)	101 (35,8)
CARE SERVICES			
Emergency	75 (26,6)	6 (2,1)	81 (28,7)
Intensive care	36 (12,8)	52 (18,4)	88 (31,2)
Rehabilitation	92 (32,7)	21 (7,4)	113 (40,1)
PATIENT OUTCOME			
	46 (16,3)	4 (1,4)	50 (17,7)
Released (evacuated, referred, transferred)	9 (3,2)	1 (0,4)	10 (3,6)
Discharged against medical advice	1 (0,4)	4 (1,4)	5 (1,8)
Alive	115 (40,8)	32 (11,3)	147 (52,1)
Deceased	32 (11,3)	38 (13,5)	70 (24,8)
PHYSIOTHERAPY CARE			
	78 (27,6)	58 (20,6)	136 (48,2)
Sessions performed			
0 sessions	4 (1,4)	0 (0)	4 (1,4)
1 - 15 sessions	106 (37,6)	21 (7,4)	127 (45)
16 - 30 sessions	14 (5)	*NR*	14 (5)
62 sessions	1 (0,4)	*NR*	1 (0,4)
Never performed	4 (1,4)	0 (0)	4 (1,4)

***:** Numbers (Percentage) **NR:** Not specified **CHUD-OP:** Departmental University Hospital Center of Ouémé-Plateau **CHUD-BA:** Departmental University Hospital Center of Borgou-Alibori **CHUD:** Departmental University Hospital Center

Stroke Types

Strokes were categorized as ischemic (48.6%), hemorrhagic (35.8%), and undetermined (15.6%). The percentage of ischemic stroke cases increased progressively from 2.4% in 2014 to 13.1% in 2019, while the percentage of hemorrhagic stroke cases rose from 2.3% in 2014 to 11% in 2019. Regardless of stroke type, the percentage of cases increased annually in both CHUDs, with hemorrhagic strokes being more frequent. Even among undetermined cases, an upward trend was observed over the years (*Figure 3*).

CHUD-OP: *Departmental University Hospital Center of Ouémé-Plateau*
CHUD-BA: *Departmental University Hospital Center of Borgou-Alibori*

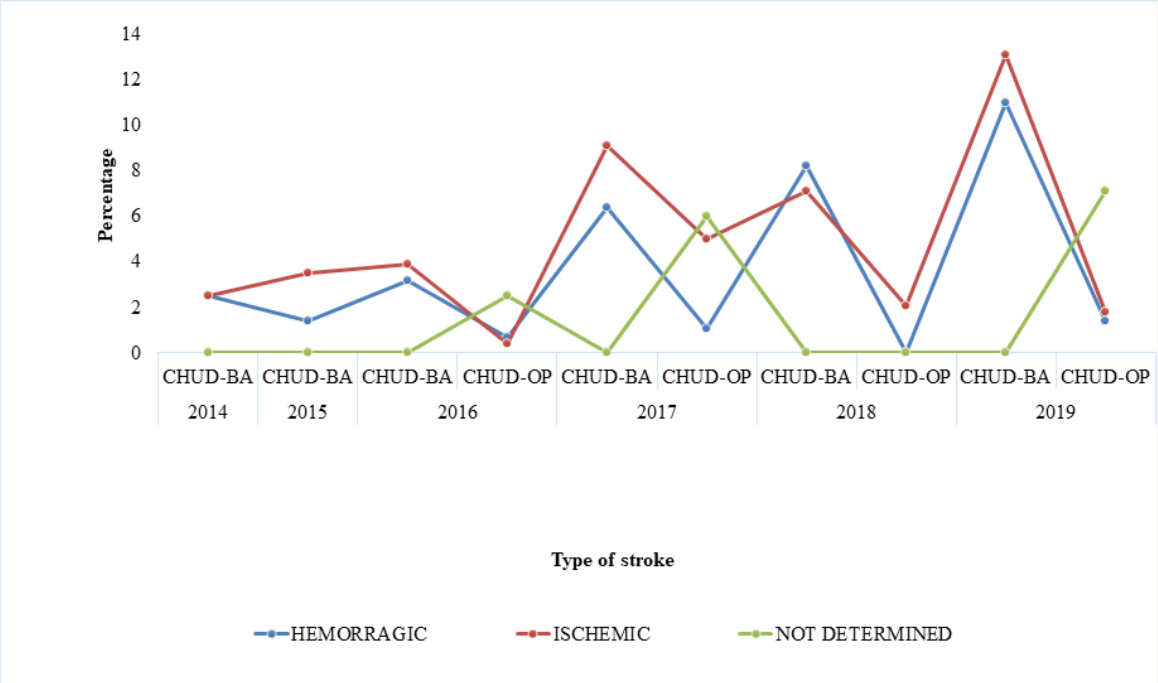


Figure 3*: Distribution of patients by stroke type over the study period.*

3. *Compliance with care among patients included during the study period*

The average duration of total hospitalization for stroke patients was 6 ± 6.4 days. At the CHUD-BA, most admissions (67.8%) had a length of stay of less than seven days. A minority of patients (7.2%) at the CHUD-OP experienced a prolonged hospitalization exceeding 15 days. (*Figure 4*).

CHUD-OP: *Departmental University Hospital Center of Ouémé-Plateau*
CHUD-BA: *Departmental University Hospital Center of Borgou-Alibori*

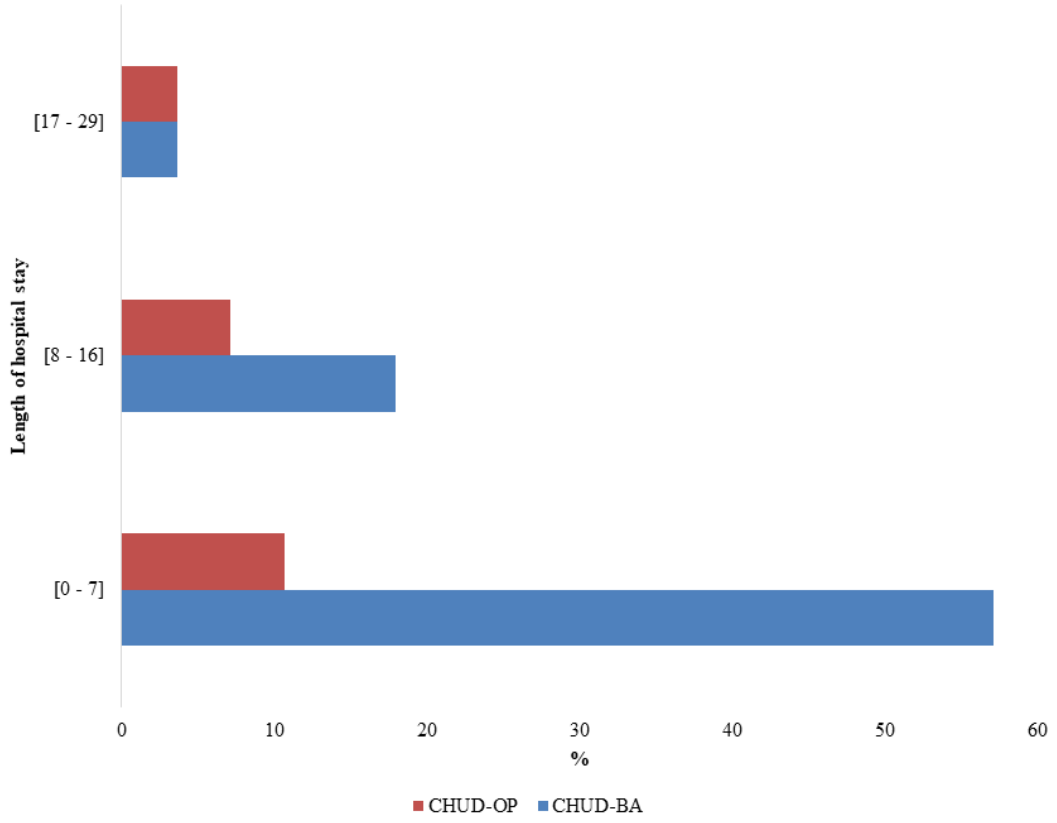


Figure 4: *Distribution of patients by length of hospital stay.*

Discussion

Characteristics of strokes between June 2014 and September 2019 at CHU Borgou-Alibori and Ouémé-Plateau

This multi-center study, performed at two university hospitals in Benin, elucidates the distinct features of stroke within this context. Our results indicate a relatively young mean age of onset at 56 years, a significant male predominance (sex ratio of 1.5), and a high prevalence of hemorrhagic stroke (36%). This, coupled with an in-hospital mortality rate of 24.8%, underscores the severity of stroke in this region and necessitates further investigation into its determinants and clinical management. In a previous study (Adoukonou et al. 2017), an average age of 54.9 ± 5.5 years was reported among 27 hemiparetic patients with vascular strokes from CHUD-Borgou-Alibori. Other studies conducted at the same CHU observed average values of 54.5 ± 9.3 years for stroke cases (Adoukonou et al. 2017). In 2015 in Abidjan, Yves et al. reported that among 176 adults with strokes, the average age was 60 years with a female predominance (Danesi, Okubadejo, et Ojini 2007). The study by Kemnang et al. (Kemnang et al. 2019) also indicated a younger age range between 42 and 88 years. This same trend is noted by several other authors who have revealed average ages of 65 years and 60 years (Adoukonou et al. 2017; Kane et al. 1997). The results of these authors corroborate those of the present study, which observed that the age group between 50 and 65 years is where the incidence of strokes significantly increases in both CHUDs.

Patients aged 50 to 65 years experienced more strokes over the years of the study, with a statistically significant frequency at CHUD-Borgou-Alibori (37.6% versus 14.5%; p = 0.000). The majority of stroke cases (72%) were recorded at CHUD-Borgou-Alibori. This may be due to the higher number of CT scans available in-patient records. The city of Parakou, where this CHUD is located, has two CT scan centers (one public), facilitating diagnosis and initiation of care. Porto-Novo, during the study, did not have such facilities. The only private center available was recently established. A notable observation during this study was the absence of CT scans for a significant number of stroke patients, complicating the work of various medical professionals. Besides the reasons mentioned above, as previously observed by other authors (Danesi et al. 2007), when these machines are available, they are often inaccessible due to prohibitive costs and geographical location. Indeed, the direct hospital cost of management in Benin is 316,810.3 CFA (approx. €483 or $552) in Parakou and 515,000 CFA (approx. €785 or $897) in Cotonou (Adoukonou et al. 2013, 2017). Only urban and semi-urban populations typically have access to these services. Generally, very few patients benefit from a CT scan, often too late. For instance, in 2006, only 9% of patients hospitalized in Nigeria for a stroke had received a CT scan (Kolapo et al. 2006), while 38.3% of Ethiopian patients (Zenebe, Alemayehu, et Asmera 2005) and 35.1% in Mauritania (Diagana et al. 2002) did (Scherbakov et al. 2013). Additionally, maintenance and energy availability must also be taken into account. This study found that males are more exposed than females (59.6% versus 40.4%; p=0.05). This distribution is also observed in the study conducted by Azé et al. (Azé et al. 2025), where stroke incidence by gender was evaluated at 63% and 72.7% respectively at CHUD-Borgou-Alibori and the University Hospital Center of Bellevue in Saint Etienne (CHUSE). A global systematic review indicates that the stroke incidence rate is, on average, 33% higher in men than in women, with significant variations observed across different populations (Appelros, Stegmayr, et Terént 2009). In a study conducted in Lagos, the former federal capital of Nigeria, the stroke prevalence was found to be 1.14 per 1000 people, with a prevalence of 1.51 per 1000 in men compared to 0.69 per 1000 in women (Ogun et al. 2005). This same trend was observed by

Lannuzel et al (Lannuzel et al. ma). in another study conducted in Guadeloupe (Danesi et al. 2007). This contrasts with the work conducted by N'goran et al. (N'goran et al. 2015) in Abidjan in 2015, where women were more affected regardless of stroke type, with 58.7% of diagnosed cases. Kane et al. found a female predominance in Senegal with a sex ratio of 0.45 (Kane et al. 1997). The trends of male stroke incidence at CHUD Ouémé-Plateau and CHUD Borgou-Alibori are similar to those found and published by the WHO in 2015.

Few studies address occupational burdens in stroke incidence

Few studies address the occupational burdens associated with stroke incidence. The limited studies conducted suggest that profession is a risk factor in non-communicable diseases (NCDs) (Scherbakov et al. 2013). This study also explored this issue, noting a low incidence among civil servants (15.9%), whereas the second category, composed of liberal professions, had an incidence rate of 53.2%. A publication on stroke in young people in Bamako indicates that civil servants represented 50% of cases, followed by traders with 19.2% (Yangatimbi et al. 2020). This discrepancy may be attributed to the fact that the majority of patients were primarily residents of a purely urban environment (Kane et al. 1997).

Management of stroke patients between June 2014 and September 2019 at CHU Borgou-Alibori and Ouémé-Plateau

Stroke presented in ischemic form (48.6%) and hemorrhagic form (35.8%) in both CHUs. Over the five-year period of the study, ischemic strokes increased from 2.5% to 13.1% at CHUD-BA, and from 0.4% to 1.8% at CHUD-OP, with rates of 5% in 2017 and 2.1% in 2018. Hemorrhagic strokes increased from 2.3% to 11% at CHUD-BA and from 0.7% to 1.4% at CHUD-OP, consistently showing a predominance of hemorrhagic strokes. This observation aligns with findings from other researchers who indicated that hemorrhagic strokes predominate in countries characterized by inadequate monitoring of non-communicable diseases. This specificity, already suggested by other authors in the region, could reflect a high prevalence and poor control of hypertension, one of the risk factors for hemorrhagic stroke (Akinyemi et al. 2021; O'Donnell et al. 2016). Indeed, Africa has the highest hypertension prevalence rates in the world, with particularly low control levels (Adeloye et al. 2015). However, a selection bias cannot be ruled out. It is acknowledged that studies conducted in hospital settings tend to overrepresent the most severe cases, such as hemorrhagic strokes, whose dramatic symptoms more systematically lead to hospitalization and brain imaging, at the expense of less severe cases that sometimes remain at home (Feigin et al. 2003). Moreover, it has been noted that strokes are frequent and severe, particularly in sub-Saharan Africa, where early mortality rates are significantly higher than in developed countries (Kane et al. 1997). The length of hospital stay for stroke patients is increasingly studied as a performance indicator in stroke management. Therefore, it would be beneficial for this parameter to be more thoroughly documented. The average hospital stay for stroke victims was 5.5 ± 6.5 days at CHUD Borgou-Alibori and 7.7 ± 6.3 days at CHUD Ouémé-Plateau. Notably, there were several hospitalizations within the first seven days at CHUD Borgou-Alibori, likely due to the higher number of cases included in this center (72% versus 28%). The average length of stay observed in this study is shorter than that reported by Adoukonou et al., where hospitalization varied from 2 to 46 days, with an average of 14.4 ± 10.1 days (Houinato et Adoukonou 2010). Similarly, Touré et al. found an average hospital stay of 16.4 ± 12.9 days at the CHU de Fann in Dakar, compared to 19.9 ± 13.5 days in Togo in 2007, as reported by Balogou et al. (Balogou et al. 2006). The reduction in hospital stay at CHUD Borgou-Alibori may be attributed to the establishment of a neurology service

and the availability of imaging services, which facilitate rapid decision-making and improve the quality of care.

Patient Compliance with Care Between June 2014 and September 2019 at CHU Borgou-Alibori and Ouémé-Plateau

At CHUD Borgou-Alibori and Ouémé-Plateau, some patients were noted to leave against medical advice. This trend is exacerbated by relatives who attribute stroke symptoms to mystical causes. In such cases, recourse to modern healthcare comes late or is interrupted in the pursuit of alternative salvation. The lethality rate in both CHUs was 24.8%, with 11.3% in Borgou-Alibori. A lethality rate of 35% has been reported in Kinshasa (Tshikwela et Longo-Mbenza 2012). Similar findings were observed in Dakar, where it is estimated at 37.5% (Adoukonou et al. 2013). In Tehran, it was reported at 46.7%, and 13% in Japan (Delbari et al. 2011; Kita et al. 2000) within 30 days following the stroke.

It should be noted that patients also had access to physiotherapy sessions, with an average of 7.8 ± 7.4 sessions. Excluding undetermined cases, the majority had access to a maximum of 15 sessions (45%), while 1.4% had never participated in any physiotherapy sessions. This figure, well below the international recommendations that advocate for early, intensive, and multidisciplinary rehabilitation (Winstein et al. 2016), reveals a major break in the care pathway. Several well-documented factors in sub-Saharan Africa may explain this low access: the high cost of sessions, often borne by families, the limited availability of qualified professionals, as well as persistent cultural barriers (Tawa et al. 2020). As reported in some cases, attributing symptoms to mystical causes may delay the use of modern care or lead to treatment abandonment, a phenomenon also observed in other regional contexts (Akinyemi et al. 2021). This fragmented care pathway likely contributes to the lethality rate of 24.8%, which is likely underestimated due to the lack of data on post-hospitalization follow-up.

Archives are essential for understanding a phenomenon to anticipate potential future catastrophes or recurrences. This study is subject to several important limitations. First, the retrospective design and inconsistent record-keeping resulted in substantial missing clinical data (including risk factors, BMI, and stroke history), thereby preventing a multivariate analysis of predictors for mortality or rehabilitation access. Second, requiring CT scan confirmation for inclusion likely introduced a significant selection bias by underrepresenting less severe cases and socioeconomically disadvantaged patients, which constrains the generalizability of our results. Lastly, the absence of post-discharge follow-up data precluded the evaluation of essential long-term outcomes such as functional disability and mortality.

This study represents one of the few multicenter explorations to date of the reality of stroke in regional settings in Benin. Its originality and geographic scope compensate for the relative age of the data. In the Beninese context, where resources are limited and health planning is often constrained, having data, even if somewhat outdated, is crucial for guiding priorities in training, equipment acquisition, and funding. Furthermore, in the context of hospital-based stroke management, many conditions remain unchanged in that the previously identified gaps, such as limited access to post-stroke rehabilitation or disparities between hospitals, have not undergone major improvements since 2019. This makes the findings still highly relevant for informing public health interventions. To this day, certain hospitals of this type still lack neurology departments, which are fundamental to stroke care. While physiotherapy services may exist, given the mortality rate, the establishment of physical medicine services would enhance motor

recovery after initial management and thus help reduce stroke-related disability and functional impairments. Addressing the availability of neurology and physical medicine services emphasizes both prevention and public awareness of stroke and its consequences. Most importantly, since the healthcare system is not yet fully able to fulfill its role, upstream population sensitization is essential to contain risk factors.

Implications and recommendations

Based on our findings regarding stroke management in two university hospitals in Benin, several major implications emerge for health policy, the training of professionals in Adapted Physical Activities (APAS), community awareness, and future research:

- Stroke rehabilitation capacity building: Our results highlight a lack of rehabilitation care in the hospitals studied. It is therefore imperative to train more rehabilitation professionals (APAS professionals, physical therapists, occupational therapists) and strengthen technical platforms for early and accessible functional rehabilitation. However, the absence of the APAS sector, which is essential for the training of APAS professionals, and the lack of concrete reforms in the health sector are among the many other possible limitations to these recommendations. The National Institute of Youth, Physical Education and Sport (INJEPS), which has the necessary personnel to train APAS professionals, could be supported by the government, which would put in place the necessary legislative framework.
- Need for a targeted primary prevention policy: The patient profile reveals a predominance of preventable risk factors (high blood pressure, unbalanced diet, sedentary lifestyle). Health authorities must develop community prevention campaigns targeting these factors by collaborating closely with APAS professionals. These recommendations are relevant because it targets major risk factors and mobilizes local actors.
- Community integration in the dissemination of results: The results of this study should be translated and disseminated in local languages in the form of brochures, radio broadcasts, or community workshops. Local health committees should be trained to interpret this data to strengthen community action against stroke. This approach promotes local ownership and access to information, but depends on the formation of committees.
- Proposal for an integrated stroke care pathway model: Based on the gaps observed in the continuity of care, we recommend the implementation of a standardized post-stroke care pathway including screening, hospitalization, rehabilitation, home follow-up, and psychological support. This model could be subsidized by the government to minimize associated costs and tested on a small scale before national expansion, particularly for low-income populations.
- Research gaps and methodological perspectives: A major weakness remains the lack of long-term post-hospitalization follow-up data. Longitudinal community-based research is needed to assess the true impact of rehabilitation on quality of life, independence, and social reintegration. We recommend mixed methods (quantitative and qualitative) to capture both clinical trajectories and patient experiences. This proposal highlights the need for reliable data and combines a clinical approach and patient experience.

Conclusion

This study highlights the epidemiological and management profiles of strokes in two tertiary hospitals in Benin. It reveals a younger age of onset, a predominance of hemorrhagic strokes, and limited access to physiotherapy. Improving access to imaging examinations and early

rehabilitation, as well as conducting public awareness campaigns, should be a priority to address the growing burden of strokes in Benin. Despite its limitations, it paints a concerning picture of stroke management in Benin. It underscores two public health emergencies: the need to strengthen access to imaging-based diagnosis throughout the country and, even more critically, the urgency of structuring and making financially accessible a post-stroke rehabilitation pathway. Prospective studies are now needed to assess the impact of such interventions.

Statements

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Ethical consideration

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Authorization to access patient data was obtained from the administrations of both hospitals. All records were fully anonymized to guarantee patient confidentiality.

AI Statement:

As part of this work, Google AI Studio was used to translate the content into English.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions of authors

- *Conceptualization: Oscar Dagbémabou Azé and Etienne Ojardias and Thierry Adoukonou*
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- *Investigation: Baudile Avocètien*
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Data Availability Statement

The anonymized dataset generated and analysed during the current study is available from the corresponding author on reasonable request.

Disclaimer

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