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Cost of Stroke Care at Public Hospitals in Brazzaville and Implication of Third Parties in Stroke Care Expenditure

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Abstract

Background: Among the main challenges of healthcare system throughout the world, there is stroke management. It is important to have data on the in-hospital costs of stroke care to help decision-makers to implement a health insurance system. **Objectives:** To evaluate the in-hospital costs of stroke care in Brazzaville; to determine the factors influencing the total mean in-hospital cost of stroke care; to identify third parties contributing to stroke care expenditure. **Methods:** This was a cross-sectional prospective and analytical study. It was carried out at 4 public hospitals in Brazzaville (University Hospital Center, Chinese and Congolese Friendship Hospital, Talangaï Hospital and Makélékélé Hospital), from May to August 2019 (4 months). It focused on patients who had a first episode of stroke confirmed by brain imaging and were at least 18 years old. The bottom-up approach was used to determine the in-hospital costs of stroke care. **Results:** This study included 109 patients who fulfilled inclusion criteria. Their mean age was 59.2 ± 13.7 years old, with limits of 35 and 90 years old. The total direct in-hospital cost of stroke care was 47,308,330 francs CFA (72,122 euro). The total mean in-hospital cost of stroke care was 1,389,590 francs CFA (2118 euro). The mean cost of intracerebral hemorrhage care was 510,988 francs CFA (779 euro) versus 373,457 francs CFA (569 euro) for cerebral arterial infarction care. The following factors affected the total mean cost of stroke care: type of hospital (p < 0.0001), length of hospital stay (p = 0.001), type of stroke (p = 0.01), stroke severity (p = 0.001) and complications (p = 0.001). The level of contribution to stroke care expenditure covered by third parties was: 78% for patient families; 2.8% for community self-help associations. **Conclusion:** In Congo, the mean

in-hospital cost of stroke care is elevated considering the guaranteed minimum wage of 70,000 francs CFA (107 euro). Five factors affect the total mean cost of stroke care. Patient families are the main financial assistance system for stroke care expenditure. To minimize the heavy financial burden induced by stroke on patients, households and families, it is important to implement a health insurance system and strengthen the stroke prevention program.

Keywords

Stroke, Hospital Cost, Associated Factors, Brazzaville

1. Introduction

Strokes are a public health problem throughout the world because of their prevalence, incidence and high rates of acquired disability, morbidity and mortality [1] [2] [3]. Worldwide, they are the second-leading cause of death [4].

Over the past twenty years, it has been noted a significant decrease of stroke-related deaths because of the development of neurovascular intensive care units and the use of actively targeted therapies [5]-[10]. Strokes now become a diagnostic and therapeutic emergency. This involves a coordinated approach to care [11] [12].

In Brazzaville (Congo), and precisely, at University Hospital Center, strokes are the first vascular emergency, with rate of 44.5% [13], and the first-leading cause of death in neurology department, with mortality of 25% [14].

If studies, which are about the financial burden induced by stroke, are legion in developed countries, this is not similar in low-income countries [15] [16] [17], such as Congo-Brazzaville where no data on the costs of stroke care are available. Thus, the present study was undertaken to have a good knowledge of the in-hospital costs of stroke care and to help decision-makers to implement a health insurance system. The objectives of this study are: to evaluate the in-hospital costs of stroke care in Brazzaville; to determine the factors influencing the total mean in-hospital cost of stroke care; to identify third parties contributing to stroke care expenditure.

2. Methods

It was a cross-sectional prospective and analytical study. It was carried out at 4 public hospitals in Brazzaville: 3 referral hospitals (Chinese and Congolese Friendship Hospital; Talangaï Hospital; Makélékélé Hospital) and 1 tertiary hospital (University Hospital Center, at neurovascular intensive care unit and neurology department). It was conducted from May to August 2019 (4 months). It was approved by the national ethics committee.

Inclusion criteria were patients: with a first episode of stroke confirmed by brain imaging; who were at least 18 years old; who gave informed consent to participate in the study or their parents if they were in a coma.

Non-inclusion criteria were patients: with cerebral venous thrombosis or sub-arachnoid hemorrhage; with stroke recurrence; abandoned by their families during the hospitalization period; benefiting from preferential tariffs; discharged from hospital against medical advice.

During the study period, 366 patients were hospitalized for stroke. Among the 366 patients, there were 130 (35.5%) patients who were victims of a first episode of stroke and 236 (64.5%) patients who had a stroke recurrence. Of the 130 patients with a first episode of stroke, 109 (83.8%) fulfilled the inclusion criteria and 21 (16.2%) were excluded from the study. Among the 21 patients, there were 4 patients abandoned by their families at Makélékélé Hospital and 17 patients benefiting from preferential tariffs.

For each patient, the following information was collected on a data record: age, sex, professional patient sector, source of financial resources for stroke care (patient, patient partner and third parties), incomes of third parties (company, community self-help associations and patient families: father, mother, children, in-laws, sons-in-law, daughters-in-law and collaterals of patients), type of stroke, treatment administered, complications, NIHSS score (0 to 6 for no/mild stroke; 7 to 17 for moderate stroke; 18 to 36 for severe stroke), patient outcome, treatment time after onset of stroke symptoms, length of hospital stay and type of hospital.

The bottom-up approach was used to evaluate the in-hospital costs of stroke care [18] [19]. Costs consisted of expenses for medical services and expenses for hospitalization room. Medical services consisted of consultation, hospitalization, brain imaging (CT-scan and/or brain magnetic resonance imaging), biological examinations, medications and pharmaceutical consumables (nasogastric tube, urinary catheter, urinary bag, cathlon, cotton, alcohol, towel, examination gloves, mouthwash, compresses and sticking plaster).

When a patient was referred from the referral hospital to the tertiary hospital, expenditures for stroke care at the referral hospital were included in those at the tertiary hospital.

Costs were collected through invoices and cash receipts. The costs related to transport and meal were not included in the study. In fact, transportation of patients and biological samples for investigations in another hospital was done by family cars or taxis. Meals were prepared by the patient's family.

Costs were expressed in franc CFA (African Francophone Community). The latter is the currency used in Congo. It was converted to euro at the exchange rate of 1 euro = 655.95 francs CFA.

The data collected were analyzed using the Epi-info software version 7.2.6. Qualitative and quantitative variables were expressed as, respectively, percentages (%) and means with standard deviation. The Student's t-test and the Mann-Whitney test were used to compare means for categorical variables with two modalities. The Kruskal-Wallis test and variance analysis were used to compare means for categorical variables with more than two modalities. The Bartlett's test was used to check the homogeneity of the variance. For the determination of factors asso-

ciated with the mean in-hospital cost of stroke care, univariate logistic regression was used, followed by multivariate logistic regression including variables with p-value less than or equal to 20% during the univariate analysis. P-value of <0.05 was considered as statistically significant.

3. Results

Among the 109 patients who fulfilled the inclusion criteria, there were 99 (90.8%) at University Hospital Center, 5 (4.6%) at Chinese and Congolese Friendship Hospital and 5 (4.6%) at Talangaï Hospital.

The study population was more male, unemployed, retired and patients in the informal sector. Table 1 presents the characteristics of the study population in relation to the socio-professional aspects.

Of the 99 patients recruited at University Hospital Center, 51 (51.5%) had a cerebral arterial infarction and 48 (48.5%) were victims of intracerebral hemorrhage. All patients recruited at Chinese and Congolese Friendship Hospital and Talangaï Hospital had a cerebral arterial infarction.

Table 2 presents the patient characteristics in relation to the clinical aspects. The rates of patients who were treated within 4 hours of onset of cerebral arterial infarction symptoms and 7 hours of intracerebral hemorrhage onset were very low. Motor deficit was the predominant neurological disorder in patients (95.2%). The predominant etiology found in patients was high blood pressure (42.2%). The major complications noted in patients were: urinary tract infections; pneumonia; lower limb thrombophlebitis. Global in-hospital mortality was 24.8%.

On admission, the average NIHSS score was 7.3 ± 5.1, with limits of 0 and 36. The average length of hospital stay was 11.9 ± 8.3 days, with limits of 2 and 56 days.

Table 3 presents the costs of stroke care. The total direct in-hospital cost of stroke care was 47,308,330 francs CFA (72,122 euro). The total mean in-hospital cost of stroke care was 1,389,590 francs CFA (2118 euro). The costs of stroke care were significantly higher at University Hospital Center than at Chinese and

Table 1. Socio-professional characteristics of the study population.

		Mean ± Standard deviation	n (%)
Gender	Female		41 (37.6)
	Male		68 (62.4)
Age		59.21 ± 13.74 years (Range: 35 - 90 years)	
Sector of professional activity	Public sector		16 (14.7)
	Formal private sector		7 (6.4)
	Informal sector		29 (26.6)
	Unemployed		28 (25.7)
	Retired		29 (26.6)

Table 2. Data on clinical aspects.

		n (%)
Treatment time after onset of symptoms	Cerebral arterial infarction: <5 hours	22 (36.1)
	Intracerebral hemorrhage: <8 hours	5 (10.4)
Neurological disorders	Motor deficit	100 (95.2)
	Oral language disorders	31 (29.5)
	Balance disorders	8 (7.6)
Etiologies	High blood pressure	46 (42.2)
	Large artery atherosclerosis	36 (33)
	Small vessel occlusion	24 (22%)
	Aneurysm rupture	2 (1.8)
	Embolic heart disease	1 (1%)
Complications	Urinary tract infections	17 (15.6)
	Pneumonia	13 (11.9)
	Lower limb thrombophlebitis	13 (11.9)
	Bedsores	1 (0.9)
In-hospital mortality	Cerebral arterial infarction	11 (18)
	Intracerebral hemorrhage	16 (33.3)

Table 3. Distribution of the costs of stroke care by stroke type and hospital type.

		Direct cost in franc CFA (in euro)	Mean cost in franc CFA (in euro)
Cerebral arterial infarction	University Hospital Center	20,386,591 (31,080)	399,737 ± 273,868 (609 ± 418)
	Chinese and Congolese Friendship Hospital	1,333,835 (2033)	266,767 ± 47,690 (407 ± 73)
	Talangaï Hospital	1,060,490 (1617)	212,098 ± 64,743 (323 ± 99)
Intracerebral hemorrhage	University Hospital Center	24,527,414 (37,392)	510,988 ± 288,812 (779 ± 440)
	Chinese and Congolese Friendship Hospital	0	0
	Talangaï Hospital	0	0

Congolese Friendship Hospital and Talangaï Hospital (p < 0.0001). No significant difference was observed between the latter. The mean cost of intracerebral hemorrhage care was significantly higher (510,988 francs CFA; 779 euro) than that of arterial infarction care (373,457 francs CFA; 569 euro) (p = 0.01).

Table 4 presents the factors influencing total mean cost. The latter was significantly affected by: stroke severity (p = 0.001); length of hospital stay (p = 0.001); complications (p = 0.001).

The expenditure rates of the determinants of total mean cost were: 45.7% for hospitalization room (637,116 francs CFA; 971 euro); 31.6% for medications (438,575 francs CFA; 669 euro); 14.2% for brain imaging (197,935 francs CFA; 301 euro); 5.2% for biological examinations (70,406 francs CFA; 107 euro); 3.3% for pharmaceutical consumables (45,658 francs CFA; 69 euro).

Table 4. Factors influencing the total mean cost of stroke care.

		Mean cost in franc CFA (in euro)	p
NIHSS Score	≤17	420,065 ± 250,314 (640 ± 382)	0.001
	>17	969,525 ± 367,259 (1478 ± 560)	
Complications	Yes	875,442 ± 345,944 (1335 ± 527)	0.001
	No	514,148 ± 215,206 (784 ± 328)	
Lenght of hospital stay	2 - 9 days	295,691 ± 172,853 (451 ± 264)	0.001
	10 - 19 days	454,254 ± 223,744 (693 ± 341)	
	20 - 29 days	835,418 ± 367,453 (1274 ± 560)	
	≥30 days	954,045 ± 219,362 (1454 ± 334)	

Sources of financial resources of stroke care were: patient families in 78% of cases (n = 85 patients); patient in 43.1% of cases (n = 47); patient partner in 10.1% of cases (n = 11 patients); community self-help associations in 2.8% of cases (n = 3 patients).

The monthly income of patient families who contributed to stroke care expenditure was on average: 250,000 francs CFA (381 euro) for those in the public sector; 200,000 francs CFA (305 euro) for those in the formal private sector; 60,000 francs CFA (92 euro) for those in the informal sector. According to the sector of professional activity, the monthly income of patients and patient partners was the same as that of patient families. The financial resources allocated to stroke victims by the community self-help associations ranged from 100,000 francs CFA (152 euro) to 300,000 francs CFA (457 euro).

4. Discussion

This study focuses on the in-hospital costs of stroke care at public hospitals in Brazzaville, the factors influencing the total mean in-hospital cost of stroke care and the third parties contributing to stroke care expenditure.

The data on the costs of stroke care determined at University Hospital Center are robust, compared with those estimated at Chinese and Congolese Friendship Hospital and Talangaï Hospital because the latter have small patient populations. The difference in patient numbers between these two hospitals and the University Hospital Center is due to the transfer of some stroke victims from the referral hospital (Chinese and Congolese Friendship Hospital; Talangaï Hospital) to the tertiary hospital (University Hospital Center) for specialized care requiring neurologists, a neurovascular intensive care unit and a coordinated approach to care involving the neurology department with other departments such as radiology, cardiology, physiotherapy.

The literature shows that the costs of stroke care are high [15] [16] [17]. This characteristic has also been found in the present study. Indeed, at University Hospital Center where both types of stroke exist (Table 3) and there are enough patients, the mean in-hospital cost of stroke care is 13 times the guaranteed

minimum wage, which is 70,000 francs CFA (107 euro) in Congo [20]. Studies in sub-Saharan Africa indicate that the mean in-hospital cost of stroke care is 8 to 17 times the guaranteed minimum wage [21] [22].

We have not compared our data on the in-hospital costs of stroke care with those found in low-income countries, precisely in sub-Saharan African countries. In fact, some series included the expenditures related to transport in the evaluation of in-hospital costs [23] [24] [25] [26] [27]. Other series included the expenditures related to hospital meals in the cost assessment [28] and still other series included the costs of transport and hospital meals [21] [22].

Literature data indicate the existence of 2 cases classified on the basis of the costs of cerebral arterial infarction care and intracerebral hemorrhage care. In the first case, the cost of cerebral arterial infarction care is higher than that of intracerebral hemorrhage care [26] [27] [29] [30] [31] [32]. In the second case, the cost of intracerebral hemorrhage care is higher than that of cerebral arterial infarction care [15] [22] [25] [28] [33]-[38]. Our data match those of the second case.

Among the 3 main determinants of the total mean in-hospital cost of stroke care, noted in this study, there are hospitalization room, medications and brain imaging. This is also encountered in other studies [21] [22] [26] [27] [28].

Our rate of the expenditures related to hospitalization room (45.8%) is higher than those found in Benin (17.9%) [27], Cameroon (13% - 31%) [26] [22], Pakistan (39%) [28] and Togo (13.8%) [21]. It is lower than those estimated in Japan (69%) [39], Thailand (57.6%) [40], Togo (52%) [41] and USA (50%) [42]. It is due to the following factors: stroke severity on admission, complications, motor deficit and morbid diseases (Table 2 and Table 4). These factors are the cause of a hospital stay longer, and therefore the cause of the heavy financial burden [29] [30] [39].

In our series, the rate of the expenditures related to medications (31.6%) is lower than those noted in the studies carried out in Cameroon (42.4%) [22], China (50.6%) [31] and Togo (38.8%) [21]. It is higher than those evaluated in Benin (28.4%) [27], Cameroon (28%) [26] and Pakistan (18.8%) [28].

In this study, the rate of the expenditures related to brain imaging (14.2%) is lower than those estimated in Cameroon (17%) [22] [25], Pakistan (17.6%) [28] and Togo (19.8%) [21]. This feature may be explained by the type of morphological examination used to explore cerebral arterial infarction and intracerebral hemorrhage.

Variations in the mean in-hospital cost of stroke care due to hospital type, stroke type and length of hospital stay, noted in this study, have also been found in the series carried out in Cameroon [22].

The influence of complications on the mean in-hospital cost of stroke care, established in our study, has also been observed by other investigators [34] [35].

The implication of stroke severity on the mean in-hospital cost of care, noted in this study, is in line with the feature of other series [40] [42] [43].

Considering the monthly income of patients and the guaranteed minimum

wage, stroke care is expensive, and this requires a collective commitment, *i.e.* from decision-makers and third parties.

In Congo, the culture of health insurance does not exist. This is why the population is heavily involved in mobilizing financial resources to enable patients to cover illness care expenditure.

In our study, two financial assistance systems for stroke care expenditure are identified: community self-help associations and patient families. Patient partner is a part of household.

Community self-help associations are the minor financial assistance system for stroke care expenditure. They have a low coverage of the patient population.

Patient families are the predominant financial assistance system for stroke care expenditure because they have a high coverage of the patient population.

All these data reflect the need for the implementation of a health insurance system in Congo in order to minimize the heavy financial burden induced by stroke on patients, households and families.

5. Strengths

The use of the bottom-up approach in this study has provided indicative and robust data that could help decision-makers to implement a health insurance system, improve stroke care interventions and strengthen the stroke prevention program.

6. Conclusion

The in-hospital costs of stroke care are elevated in Congo. Five factors affect the total mean cost of stroke care: type of hospital, length of hospital stay, type of stroke, complications and stroke severity. Patient families are the main financial assistance system for stroke care expenditure. To minimize the heavy financial burden induced by stroke on patients, households and families, it is important to implement a health insurance system and strengthen the stroke prevention program.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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