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Cost of Managing a Painful Vaso-Occlusive Crisis at National Center for Research and Care for Sickle Cell Patients of Lomé in 2024

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Abstract

Introduction: Despite reduced fees, many patients struggle to access care at the National Center for Research and Care for Sickle Cell Patients (CNRSD). This prompted an evaluation of the costs associated with managing a painful vaso-occlusive crisis (VOC), the most common reason for hospitalization among individuals with sickle cell disease. **Methods:** This was a cross-sectional study which was conducted among patients admitted to the CNRSD for painful VOC. Costs were calculated in CFA francs (XOF), encompassing consultation fees, medication expenses, laboratory test costs, and hospitalization charges. The total cost per patient was derived by summing these components. **Results:** The study included 300 patients with a median age of 16.5 years. Most were children and adolescents (61.33% were under 20 years of age) with an SS genotype (64%). The average length of hospital stay was 3.1 days, with variations based on genotype. The median cost of managing a VOC episode was 64,130 XOF (€97.77), with 66.5% of this expenditure attributable to medications and consumables. Costs were influenced by age and genotype but were not associated with the presence of comorbidities. Notably, 67.33% of patients reported no fixed monthly income, significantly hindering their ability to afford care. **Conclusion:** The cost of managing a painful VOC episode is relatively high, exceeding the minimum wage in Togo. The lack of universal health insurance coverage exacerbates the difficulty for individuals with chronic conditions, such as sickle cell disease, to access quality care.

Keywords

Sickle Cell Disease, Cost, Vaso-Occlusive Crisis, Togo

1. Introduction

Sickle cell disease (SCD), also known as sickle cell anemia or hemoglobin S disease, is a genetic disorder caused by a mutation in one of the genes encoding hemoglobin [1]. It is characterized by increased susceptibility to infections, organ damage, and episodes of vaso-occlusive crises (VOC) [2] [3]. VOCs represent the most common acute complication and the primary reason for hospitalization in sickle cell disease [4] [5]. All organs are potential targets of VOC [4]. It often requires multidisciplinary care which can lead to significant healthcare expenditures [3] [6] [7]. Hospitalization for VOC management involves costs related to medications, diagnostic tests, and inpatient care. In Togo, no study has determined the economic impact of sickle cell disease on families or on the country budget. A median monthly economic burden of around N76,711 (USD385) per person was found in Nigeria. That's a lot of money for people in a low-income country [8].

National Center for Research and Care for Sickle Cell Patients (CNRSD) has been operational since November 2018 in Togo [9]. Patients suffering from acute complications of sickle cell disease are hospitalized in this center. It has been observed that some patients are hospitalized several times within the same month or quarter, often struggling to afford their care due to financial constraints. The objective of this study was to evaluate the cost of managing a painful VOC at CNRSD in 2024.

2. Materials and Methods

This was a cross-sectional descriptive survey conducted at the CNRSD from 1 June to 31 August 2024. A structured pre-tested interviewer-administered quiz was used to collect primary data from patients hospitalized at the CNRSD for painful VOC. Painful VOC was defined as bone or joint pain, pain in the ribs or spine, pelvis, skull, or abdominal pain. Patients were included if they consented to participate by signing the questionnaire form, which served as proof of consent. For patients under 18 years of age, consent was provided by a parent who brought the child to the hospital.

Exclusion criteria included indigent patients who received assistance from the social service, patients referred to the CNRSD after receiving care in another facility, and patients who died during hospitalization.

In addition to the quiz used to collect medical and social data (**Appendix 1**), each patient included in the study was asked to carefully record all expenses incurred during hospitalization.

When the patient was discharged, the various invoices were collected to com-

plete the patient's quiz. Parameters analyzed included age, presence of comorbidities, patient phenotype, duration of hospitalization, hospital-related expenditures, and the patient's average income. Costs were calculated in CFA francs (XOF). Total care costs were derived by summing consultation fees, medication expenses, diagnostic test charges, and hospitalization fees. The tariffs in effect at the CNRSD during the study period are provided in **Appendix 2**.

3. Results

During the study period, 765 patients were admitted for painful VOC. Of these, 300 patients (39.22% of the target) were included in the study. Most of the patients were of the SS genotype (n = 192). The monthly incidence of VOC was 255, equating to an average of 8.5 VOC managed daily at the CNRSD.

The median age of the patients was 16.5 years, with an interquartile range of [7; 23] and extremes of 2 and 60 years. The cohort included 178 females and 122 males, with a sex ratio of 0.68. Most patients (61.33%) were under 20 years of age, as shown in Figure 1.

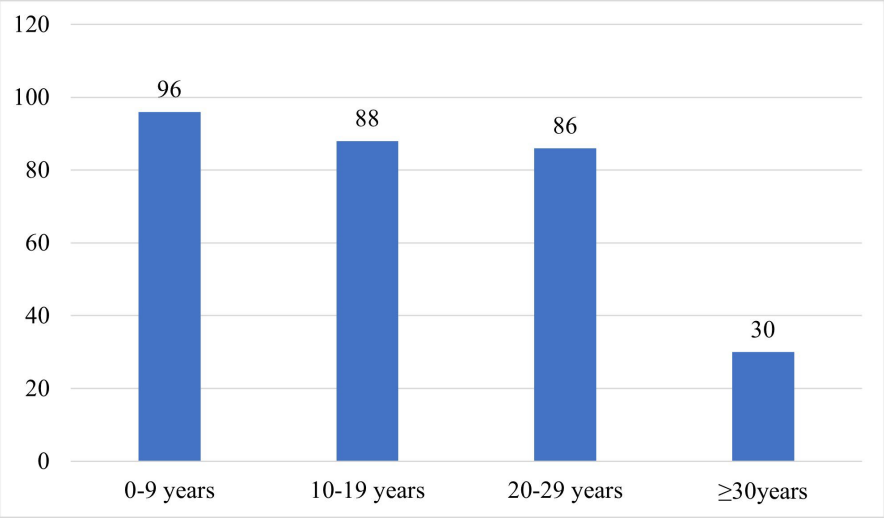

Figure 1. Distribution of patients by age group (in years).

The duration of hospitalization was longer in patients with the SS phenotype, as shown in Table 1.

Table 1. Average duration of hospitalization (in days) by patient phenotype.

	N = 300	Hemoglobin phenotype			p-value[1]
		SS N = 192	SC N = 90	S/β N = 18	
Mean (SD)	3.1 (3.1)	3.7 (3.7)	2.2 (1.2)	2.1 (0.8)	**0.005**
Range (Min; Max)	1 - 28	1 - 28	1 - 6	1 - 3	

[1]Kruskal-Wallis rank sum test; Min = minimum; Max = maximum; SD = standard deviation.

The study population was predominantly young, and the majority had no income (Figure 2).

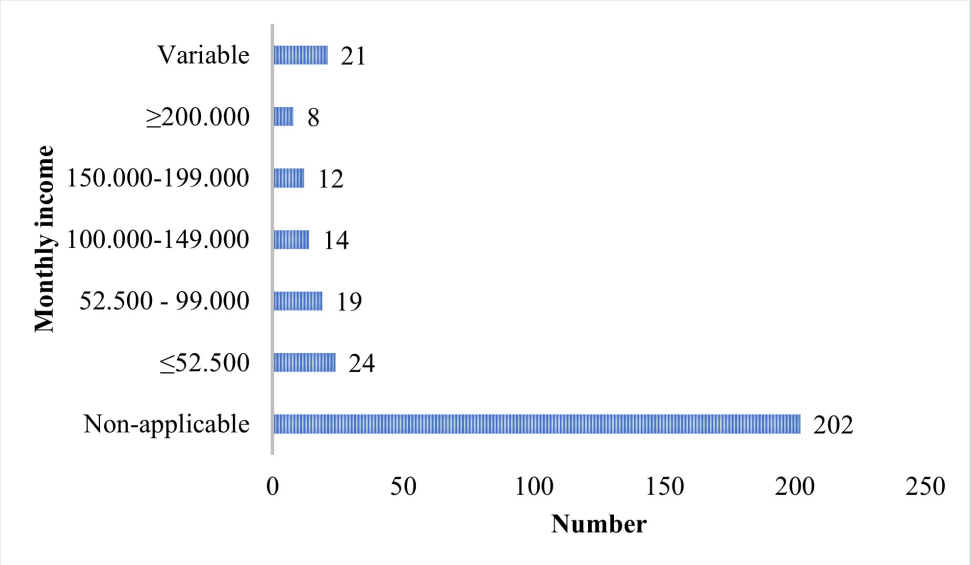

Figure 2. Distribution of patients by monthly income. Non-applicable: Children and unemployed patients.

The median costs of the various requirements for managing a painful VOC are in Table 2.

Table 2. Median costs (XOF) of various components of VOC management.

	Q_1	Median	Q_3
Prescription costs	28,990	42,645	61,632
Laboratory test costs	6000	9000	11,500
Hospitalization costs	6000	12,000	18,000
Total expenses	**41,805**	**62,630**	**92,260**

Q_1 = First quartile; Q_3 = Third quartile.

The consultation fee, which was 1500 XOF (€2.29), must be included. Thus, in 2024, the median cost of managing a painful VOC at the CNRSD was 64,130 XOF (€97.77).

The hospitalization duration for SS patients was generally longer, leading to correspondingly higher expenses (Table 3).

The cost of managing a VOC varied with the patient's age; it was lower among younger patients (below the median age), as shown in Table 4.

The presence of comorbidity (e.g., asthma, hypertension, diabetes, history of stroke) did not affect the cost of managing a painful VOC (Table 5).

Table 3. Median cost (XOF) of a VOC by patient haemoglobin phenotype.

	Patient's phenotype			p-value[1]
	SS, N = 192	SC, N = 90	S/β, N = 18	
Prescription costs				**0.011**
Median	44,550	33,690	28,950	
IQR	32,400; 69,765	22,650; 55,200	26,745; 42,600	
Laboratory costs				**0.009**
Median	9500	6500	7500	
IQR	6000; 12,500	5500; 9500	6000; 9500	
Hospitalization costs				**0.020**
Median	15,000	12,000	12,000	
IQR	8000; 21,000	6000; 15,000	9000; 15,000	
Total expenses				**0.005**
Median	66,250	53,350	46,420	
IQR	47,205; 101,660	37,575; 75,000	37,050; 66,275	

[1]Kruskal-Wallis rank sum test; IQR = Interquartile range.

Table 4. Median cost (XOF) of managing a VOC by patient age.

	Age (in years)		p-value[1]
	≤16.5 N = 150	>16.5 N = 150	
Prescription costs			**0.002**
Median	33,285	48,150	
IQR	26,230; 49,640	32,560; 71,120	
Laboratory costs			0.2
Median	8500	8500	
IQR	6500; 11,000	6500; 10,500	
Hospitalization costs			0.085
Median	8000	15,000	
IQR	6000; 18,000	8000; 21,000	
Total expenses			**0.013**
Median	55,040	72,250	
IQR	41,000; 75,000	48,550; 101,685	

[1]Wilcoxon rank sum test.

4. Discussion

The aim of this study was to determine the average cost of managing a VOC. The cost is relatively high, with a median expenditure of 64,130 XOF (€97.77) for a single painful VOC episode requiring an average hospital stay of 3.1 days. This cost exceeds the financial means of most of the Togolese population, where the

minimum wage has been set at 52,500 XOF (€80) since January 2023.

Table 5. Median cost (XOF) of a VOC based on the presence of a comorbidity.

	Presence of a comorbidity		p-value[1]
	Yes, N = 12	No, N = 288	
Prescription costs			0.7
Median	45,360	42,645	
IQR	33,695; 72,080	28,925; 61,595	
Laboratory costs			0.7
Median	8000	8500	
IQR	8000; 12,500	7500; 10,500	
Hospitalization costs			0.8
Median	15,000	12,000	
IQR	8000; 18,000	8000; 15,000	
Total expenses			0.8
Median	69,125	60,630	
IQR	46,175; 96,100	41,770; 89,370	

[1]Wilcoxon rank sum test; IQR = Interquartile range.

During this study, laboratory tests included a complete blood count, malaria testing (thick smear or rapid diagnostic test), renal function tests, liver function tests, and lactate dehydrogenase levels. No imaging tests, such as X-rays or abdominal ultrasounds, were performed.

Sickle cell disease (SCD) is a public health priority in several African countries, and the direct costs of managing its acute complications have attracted the attention of many researchers. Studies by Ngolet L. O. *et al.* in the Democratic Republic of Congo (2013) [7], Kafando E. *et al.* in Burkina Faso (2017) [6], and Fiawo *et al.* in Togo (2020) [3] evaluated the direct costs of managing acute SCD complications (VOC, infections, acute anemic crises, etc.).

In the DRC, the average cost of managing a simple VOC (mono- or bifocal pain without fever, lasting less than 5 days) was 67,095 XOF (€102.43), while a severe VOC (multifocal pain with fever, anemia aggravation, lasting more than 5 days) cost 199,365 XOF (€304.37) [7]. Kafando *et al.* reported an average hospital stay of 4.5 days for VOC and 7.5 days for infections, with an average patient expenditure of 125,616 XOF (€191.50) [6]. At the Sylvanus Olympio and Campus University Teaching Hospitals in Lomé, Fiawo M. *et al.* estimated the average direct cost of hospitalization for acute SCD complications at 231884.6 ± 175547.03 XOF (€353.5 ± €267.62).

These studies consistently demonstrate high expenses (exceeding the minimum wage in all three countries) for an episode of acute SCD complications, confirming the financial burden on affected individuals.

Only 11.33% (n = 34) of our patients had a stable monthly income above 100,000 XOF (€152). This highlights the economic challenges faced by patients and their families in managing painful VOC. Gbadoe A. D. *et al.* have described the difficulties encountered by low income countries in managing chronic diseases, due to low health budgets and the precarious socio-economic conditions of their populations [10]. The same observations of the financial burden of sickle cell disease on families have been observed in Nigeria [8] and Gabon [11].

The median cost at the CNRSD (64,130 XOF) is lower than the costs reported by other studies, which could be explained by two factors. First, CNRSD fees are generally reduced by 30% - 50% compared to public hospital rates in Togo, a measure intended to improve financial accessibility for patients at the country's only SCD care and research center. Second, our study focused on the direct costs of managing painful VOC, while other authors evaluated the costs of managing all acute complications, such as infections, thrombotic events, and acute anemic crises, which are typically more expensive [12].

As in other studies, most of our patients (61.33%; n = 184) were under 20 years old. This reflects the increased frequency of VOC during childhood and teenage [13]. The cost of managing a painful VOC varied with age and hemoglobin phenotype but was not influenced by the presence of comorbidities. This is likely due to the longer hospitalization durations observed in patients with the SS phenotype and the higher medication requirements in adults.

5. Conclusion

VOC, the leading cause of hospitalization in SCD patients, imposes significant financial burdens, increasing the vulnerability of affected individuals. During hospitalization for a painful VOC, pharmacy costs constitute the largest expense, followed by diagnostic tests. The relatively high cost of VOC management can lead to delayed consultations. We call on public authorities to provide support that facilitates access to quality care for acute SCD complications in general and painful VOCs in particular.

Conflicts of Interest

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

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Appendix 1: Table A1

Table A1. Selected fees charged at the CNRSD during the study period.

Service	Cost (XOF)	Cost (€)
Consultation	1500	2.29
Overnight hospitalization (single room)	3000	4.57
Overnight hospitalization (cabin)	10,000	15.24
Complete blood count (CBC)	2500	3.81
SGOT (AST) test	1000	1.52
SGPT (ALT) test	1000	1.52
Total bilirubin test	1000	1.52
Direct bilirubin test	1000	1.52
Urea test	1000	1.52
Creatinine test	1000	1.52
Lactate dehydrogenase (LDH) test	1000	1.52
Blood grouping (ABO/Rhesus)	2000	3.05
Electrolyte panel (blood ionogram)	4500	6.86
Manual phlebotomy	1500	2,29

Appendix 2: Quiz

Quiz for survey

Datasheet N˚ Investigator name:

Date: ---- /---- /----

A- Social and demographic information

I- Surname: First name:

Age: Sex: F M

II- Are your biological parents alive?:

2.1- Father Yes No

2.2- Mother Yes No

III- Who pays for this hospitalization?

3.1- Father Yes No

3.2- Mother Yes No

3.3- Both parents Yes No

3.4- Yourself Yes No

IV- What is your occupation?

4.1 = civil servant 4.3 = worker

4.2 = craftsman 4.4 = unemployed

4.5 = Other (please specify)

V- What is your father's occupation?

5.1 = civil servant 5.3 = worker

5.2 = craftsman 5.4 = unemployed

5.5 = Other (please specify)

VI- What is your mom's occupation?

6.1 = civil servant 6.3 = worker

6.2 = craftswoman 6.4 = unemployed

6.5 = Other (please specify)

VII- What is your average monthly income?

7.1: No income 7.2: less than 52,500

7.3: from 52,500 to 100,000 7.4: From 100,000 to 150,000

7.5: from 150,000 to 200,000 7.6: more than 200,000

7.7: variable

VIII- How much does Dad earn on average per month?

8.1: No income 8.2: less than 52,500

8.3: from 52,500 to 100,000 8.4: from 100,000 to 150,000

8.5: from 150,000 to 200,000 8.6: more than 200,000

8.7: variable

IX- How much does Mom earn on average per month?

9.1: No income 9.2: less than 52,500

9.3: from 52,500 to 100,000 9.4: from 100,000 to 150,000

9.5: from 150,000 to 200,000 9.6: more than 200,000

9.7: variable

B- Medical information

10- Do you have an abnormality other than sickle cell?

10.1- Yes No

If yes to the previous question, please specify.

10.2 Asthma

Diabetes

High blood pressure

Other (please specify)

11- What kind of sickle cell disease do you have?

11.1: SS 11.2: SC 11.3: SBêta-thalassemia

12- How many hospitalizations do you have on average per year? .....

13- Where do you have pain?

13.1- limbs 13.2- spinal column 13.3- pelvis bones

13.4- ribs 13.5- stomach ache 13.6- skull

13.7- Other (please specify) ……..

C- Hospitalization-related expenses

Total amount =
Prescriptions (drugs and medical consumables) =
Medical tests =
Hospitalization fees =
Number of days in hospital: ……