Hemoglobin status in children attending paediatric clinics in Lomé, 2022.

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Short Report

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Abstract

Aim: to estimate the prevalence of sickle cell disease among children and adolescents in the pediatric department of the Sylvanus Olympio University Hospital in 2022.

Methods: in this cross-sectional study, all children and adolescents attending the study site were proposed to participate and included if: i) aged between 18 months and 19 years, ii) present in pediatric consultations or hospitalizations and iii) provided assent or parental informed consent. A 4-5 ml blood sample was collected for hemoglobin electrophoresis on a cellulose acetate plate at alkaline pH. Sickle cell disease was defined as having either SS, SC, SF or Sß hemoglobin phenotype.

Results: A total of 317 children and adolescents aged 8 years (IQR: 4-12) in median were enrolled. Only in 7.3% of cases did both parents know their hemoglobin status. 68 children/adolescents had hemoglobin S (21.5%), 19 had sickle cell disease (6.0%). Approximately 15.6% of children and adolescents had sickle cell trait AS.

Conclusion: This study revealed a high SCD prevalence in an a priori naïve children/adolescents' population. We stress that policy makers should consider continued sensitization, genetic counseling and neonatal screening as prevention strategies in Togo.

Background

Every year, over 200,000 children are born with sickle cell disease (SCD) in Africa. Worldwide, the number of healthy carriers (having inherited a mutant gene from one parent) in certain regions leads to a high rate of newborns affected by this condition (1). Because of the significant health, social and economic impact of the disease, it is a major public health concern.

Early detection is one of the fundamental pillars in the fight against SCD, and helps to extend the life expectancy of patients. According to the 2020's World Health Organization (WHO) Afro report on progress in implementing the SCD strategy, early detection remains insufficient. Indeed, only twelve member states carry out early screening for SCD at sub-national level (2).

In a study realized in 2002 in Togo on 5604 samples, the main abnormal hemoglobins were the S (AS trait 15.8 to 16.7%) and C (AC trait 12.1 to 15.8%) variants. SS sickle cell disease was observed in 1.2 to 2% of subjects and SC sickle disease in 4.2% (3). The national health development program for the years 2017 to 2022, prioritized the fight against non-communicable diseases including SCD in the health policy and control component (4).

Togo, like most countries in the WHO Afro Region, lacks accurate and reliable data on the prevalence of SCD. In addition, data collection on SCD is hardly included in most national population surveys, such as STEPS and DHS (Demographic and Health Survey) (5). Furthermore, financial and geographical inaccessibility in southern countries makes it difficult to access screening for the disease. To bridge this screening gap, hospital-based studies can provide a means of recourse (6).

In order to provide up-to-date data, we aimed to estimate the prevalence of SCD among children and adolescents in the pediatric department of the Sylvanus Olympio University Hospital in 2022.

Methods

Design and study population

This was a descriptive cross-sectional study carried out from August to November 2022 in the pediatric wards of CHU-SO in Lomé. The hospital is tertiary care facility, which serves as a reference center for the Greater Lomé health region. This study was approved by the Bioethics Committee for Health Research of the Ministry of Health (N° 002/2021/CBRS).

All children and adolescents attending the study site were proposed to participate and included if: i) aged between 18 months and 19 years, ii) present in pediatric consultations or hospitalizations and iii) provided assent or parental informed consent.

Data collection

Data were collected using a digital questionnaire through a face-to-face interview. The collection tool was structured into five sections: (i) sociodemographic characteristics, (ii) clinical characteristics (iii) parents' self-reported hemoglobin status, (iv) children's hemoglobin status.

Biological samples and tests

A 4–5 ml blood sample was taken from all subjects under aseptic conditions. Samples were stored on site and transported to the laboratory within 5 hours for hemoglobin electrophoresis on a cellulose acetate plate at alkaline pH, on the Helena electrophoresis chain (7). Sickle cell disease was defined as having either SS, SC, SF or Sß hemoglobin phenotype.

Statistical analysis

R version 4.2.0 (The R Foundation for Statistical Computing Platform) was used for all statistical analyses. Categorical and quantitative variables were presented as numbers with their proportions and median with their interquartile range (IQR), respectively. SCD prevalence was estimated with its 95% confidence interval (95% CI). Categorical variables were compared using chi-2 tests or Fisher's exact test, and quantitative variables were compared using the non-parametric Wilcoxon test. The significance level was set at 5%.

Case management

Results were available within 7 days of inclusion from a pediatrician. All participants received counseling on the disease and its transmission for all parents, whatever the result. Participants who were found to have sickle-cell anemia were referred to the *Centre National De Recherche et de Soins aux Drepanocytaires* (CNRDS), the SCD reference center in Togo.

Results

Socio-demographic characteristics

A total of 317 children and adolescents aged 8 years (IQR: 4–12) in median were enrolled. Approximately 44.5% (n = 138) of the children and adolescents were girls. Most patients were seen in medical consultation (63.9%) and 48.3% (n = 152) had reached primary school level. For 81.4% patients, the parents did not know their hemoglobin status. Details of the socio-demographic data are summarized in Table 1.

Table 1
Sociodemographic characteristics and parent's hemoglobin phenotypes

	Sex			
Variable	**Female**	**Male**	**Overall**	**p-value**[2]
	N = 138[1]	N = 179[1]	N = 317[1]	
Age (y), Median (IQR)	8 (4–12)	7 (4–11)	8 (4–12)	0.469
Age classes (y)				0.389
< 5	41 (29.7)	47 (26.3)	88 (27.8)	
5–9	39 (28.3)	67 (37.4)	106 (33.4)	
10–14	39 (28.3)	45 (25.1)	84 (26.5)	
15–19	19 (13.7)	20 (11.2)	39 (12.3)	
Type of patient				0.981
Outpatient	87 (64.0)	113 (63.8)	200 (63.9)	
Inpatient	49 (36.0)	64 (36.2)	113 (36.1)	
Missing data	2	2	4	
Study level				0.252
No formal education	38 (27.9)	43 (24.0)	81 (25.7)	
Primary	57 (41.9)	95 (53.1)	152 (48.3)	
Secondary	32 (23.5)	33 (18.4)	65 (20.6)	
University	9 (6.6)	8 (4.5)	17 (5.4)	
Missing data	2	0	2	
Father's hemoglobin phenotype				0.215
AA	9 (6.6)	15 (8.4)	24 (7.6)	
AC	0 (0.0)	2 (1.1)	2 (0.6)	
AS	2 (1.4)	8 (4.5)	10 (3.2)	
Unknown	126 (91.3)	154 (86.0)	280 (88.3)	
SBThal	1 (0.7)	0 (0.0)	1 (0.3)	
Mother's hemoglobin phenotype				0.079
AA	9 (6.5)	18 (10.0)	27 (8.5)	

	Sex			
AC	1 (0.7)	1 (0.6)	2 (0.6)	
AS	3 (2.2)	13 (7.3)	16 (5.0)	
Unknown	125 (90.6)	147 (82.1)	272 (85.9)	
Parents' knowledge of their hemoglobin status				0.031
None	117 (84.8)	141 (78.8)	258 (81.4)	
One	17 (12.3)	19 (10.6)	36 (11.4)	
Both	4 (2.9)	19 (10.6)	23 (7.2)	

[1]Median (25%-75%); n (%)

[2]Wilcoxon-Mann-Whitney test; Fisher's exact test; chi-square test of independence

Distribution of patients according to hemoglobin status

Of the 317 children and adolescents screened for phenotyping, 68 had hemoglobin S (21.5%), 19 had SCD (SS/SC/SF/Sβ status), representing a prevalence of 6.0% [95% CI: (3.7–9.4)]. The prevalence of SCD was significantly higher in boys than in girls (8.5% vs 2.9%, p = 0.039). Approximately 15.6% of children and adolescents had sickle cell trait AS (Fig. 1).

Parents' haemoglobin status and children/adolescents SCD prevalence

Only in 7.3% (23/317) of cases did both parents know their hemoglobin status. SCD prevalence was 17.4% in children/adolescents whose parents' hemoglobin status was known, versus 5.1% in subjects whose parents did not know their own hemoglobin status. However, this difference was not statistically significant (p = 0.074) (Table 2).

Table 2
Prevalence of sickle cell disease according to sociodemographic characteristics and parent's knowledge of their hemoglobin status

Variable	N	n	%	95%CI	p-value[2]
Age classes (y)					0.532
< 5	88	5	5.7	2.1–13.4	
5–9	105	4	3.8	1.2–10.0	
10–14	83	7	8.4	3.7–17.1	
15–19	39	3	7.7	2.0–22.0	
Sex					**0.039**
Female	138	4	2.9	0.9–7.7	
Male	177	15	8.5	7.6–20.6	
Parents' knowledge of their hemoglobin status					0.074
None	256	13	5.1	2.8–8.7	
One	36	2	5.6	0.9–20.0	
Both	23	4	17.4	5.7–39.5	

[1]Median (25%-75%); n (%)

[2]Fisher's exact test

*Sickle cell disease = SS/SC/SF phenotype

Discussion

This was a cross-sectional study, with the aim of estimating the hospital prevalence of SCD in children and adolescents consulting or hospitalized in the paediatric department of the CHU SO in Togo in 2022. The prevalence of SCD was 6.0% (n = 19/317) and 3 times higher in subjects whose parents' hemoglobin status was known (17.1% vs 5.1%) even though this difference was not statistically significant.

In 1999, Segbena *et al* reported a prevalence of SCD ranging from 1.1% (SS) to 2.3% (SC) in newborns recruited in three maternity hospitals in the city of Lomé (Togo) (3, 8). According to the available literature, the prevalence of SCD ranges from 0.5–2.26% in West Africa. For instance, In Mali and Senegal in 2005 respectively 0.8% and 0.5% prevalence was reported (9). In the Democratic Republic of Congo, Batina *et al* and Tchilolo *et al* reported in 2009 a prevalence of SCD of 0.96% and 1.4% respectively (10, 11). This prevalence was 2.26% in Côte d'Ivoire in 2020 (12) and 1.67% in Burkina Faso in 2014 (13).

In view of these various results, on one hand the prevalence of SCD has doubled since the first studies in Togo, and on the other hand the prevalence of SCD remains very high in Togo compared with other African countries. This increase in prevalence can be explained by a lack of information about the disease and the absence of a national mass screening program and specifically neonatal screening. However, we cannot exclude the fact that the prevalence we estimated in hospital settings could be overestimated.

As found in our study, more than eight in ten parents were unaware of their hemoglobin status, which prevented them from receiving appropriate genetic counseling. Similarly, Mombo *et al* in Gabon in 2021, reported that only 6% of pregnant women knew their hemoglobin status (14). These data first reveal the need of community awareness concerning SCD in order to improve adult's knowledge of their hemoglobin status and thus their ability to take objective decision concerning the reproduction life. It secondly shows that updated population-based data is needed in order to assess the current burden of the disease and refine control policies. Finally it lead us to question the need of genetic counseling and neonatal screening, which are the two main prevention strategies for SCD, in our context (15).

Indeed, genetic counseling is a communication process by which the counselor ensures clients gain a detailed understanding of genetic diseases while carefully considering their emotional state (16). During counseling, genetic counselors analyze information on personal and family health history and determines the chances of a person or his/her family member inheriting SCD. The counselor can then help individuals decide which genetic test to undergo for a confirmed diagnosis (17).

Newborn screening pilot initiatives for hemoglobinopathies were being implemented in Angola, Nigeria, Ghana, the Democratic Republic of Congo, and the Republic of Benin (18). The cost of testing, lack of sufficient and accessible medical records, and inadequacy in healthcare infrastructure pose significant challenges in bridging the gaps in newborn screening (18). In the absence of neonatal screening, we propose early systematic screening of children during pediatric consultations starting from 6 months of age as an alternative method to facilitate prompt management of sickle cell children and raise awareness among parents. In both these options, the use of accurate point-of-care diagnostic tests that demonstrated high performance even on newborn cord blood (19, 20), should be seriously considered.

Our study provides updated data on the prevalence SCD in Togo, the last study dating back to 2002 (3). Moreover, the study is based on data from screening in patients who were a priori unaware of their hemoglobin status. The main limitation is that it is a hospital survey, and the data cannot be extrapolated to the national level. It then seems urgent to carry out a national study to confirm the trend reported in this study.

Conclusion

This study revealed a high SCD prevalence in an a priori naïve children and adolescents' population. In addition, more than eight in ten parents were unaware of their hemoglobin status. We therefore stress that continued sensitization is needed to improve the hemoglobin status awareness at a community

level. Even though more population-based data is needed, policy makers should begin to think of genetic counseling and neonatal screening as prevention strategies in Togo.

Declarations

- **Ethics approval and consent to participate:** This study was approved by the Bioethics Committee for Health Research of the Ministry of Health (Number 002/2021/CBRS). Informed consent and assents from parents/care takers and patients were compulsory prior to inclusion.
- **Consent for publication:** The informed consent form contained a section on consent to publication. All participants whose data are reported here gave their consent.
- **Availability of data and materials:** Data may be obtained from corresponding author upon reasonable demand.
- **Competing interests:** The authors declare they have no competing interest.
- **Funding:** This study was supported by the Center for Training and Research in Public Health, Lomé, Togo.
- **Authors' contributions:** YRK and DKE conceived the study, developed the protocol and contributed to the study design. OIWA, KFS and OET collected the data. FAL performed, verified and supervised biological procedures for hemoglobin status detection under the supervision of MK. Statistical analysis was performed by OIWA and YRK. HRK, KHG drafted the manuscript. All the authors reviewed the manuscript.
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Figures

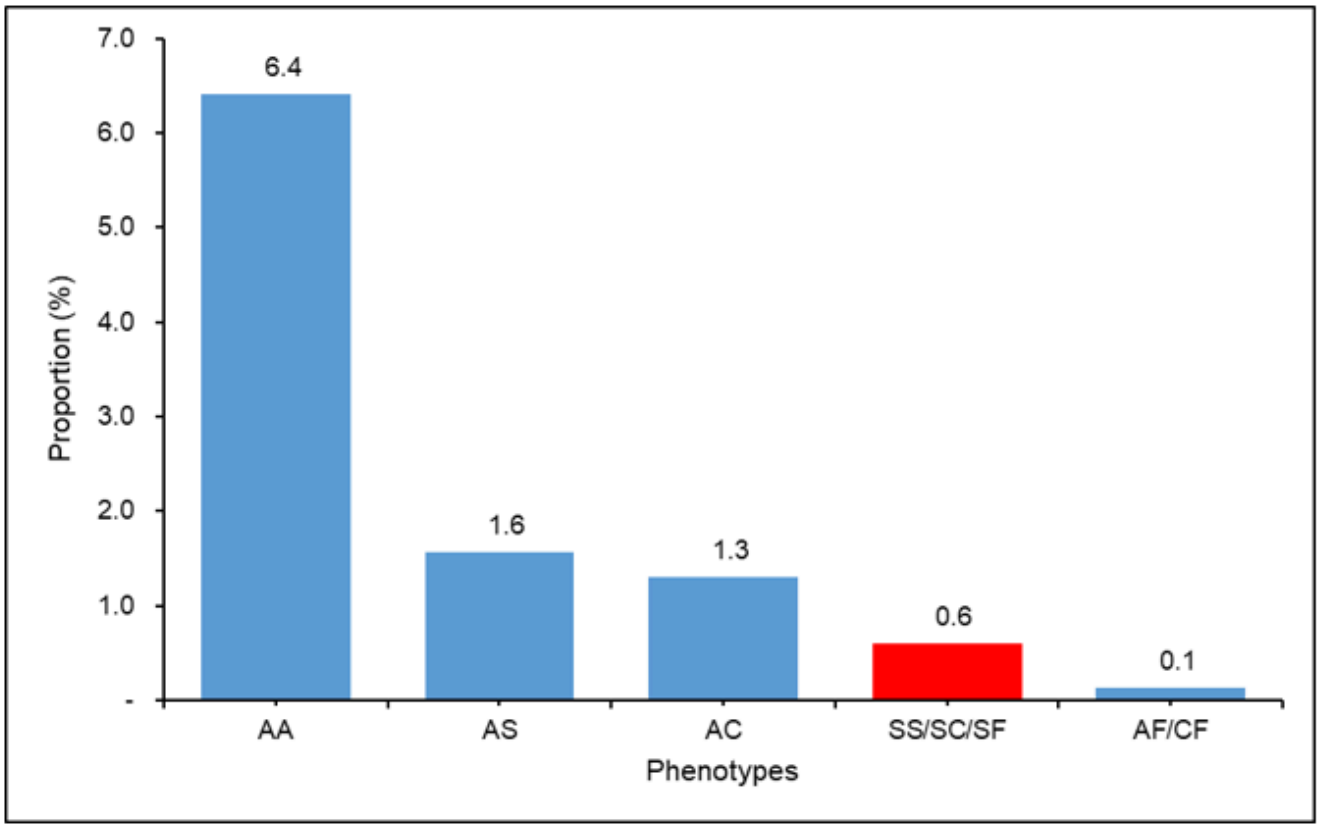

Figure 1

Prevalence of sickle cell phenotypes