ORIGINAL ARTICLE

A PICTOGRAM INNOVATION FOR SICKLE CELL DISEASE PREVENTION IN BENIN, DREPASTOP

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ABSTRACT

Background: The prevalence of sickle cell trait carriers (AS) is about 30% in some areas of Intertropical Africa and 40% in Central Africa. In Benin, the prevalence of sickle cell trait was estimated at 24%, of which 4.8% had the severe form of the hemoglobinopathy. Despite these alarming statistics, consequent preventive measures are slow to materialize. The present study aimed to develop a strategy for population sensitizing on Sickle Cell Disease (SCD). **Methods**: The study was carryout in the commune Sô-Ava in southern Benin. It is a lacustrine town of 218 km^2 with 118.497 populations. Samples were collected in EDTA. Hemoglobin in the sample was separated by electrophoresis and resulting patterns were scanned on a scanning densitometer. ABO blood groups were determined manually using monoclonal anti-A and anti-B. **Results**: A pictogram called "Drepastop" was made and used for results expression. Of the 6156 participants, 4403 (71.52%) were non-carriers of SCD traits, 1624 (26.38%) were heterozygous and 129 (2.10%) were homozygous. Of the 1624 heterozygous subjects, 1140 (18.52%) were AS and 484 (7.86%) AC. Among homozygous SCD carriers, 71 (1.15%) were SC, 39 (0.63%) SS and 19 (0.32%) CC. The majority of the study participants, 3167 (51.44%) were blood group O, followed by 1499 (24.35%) group B, 1239 (20.13%) blood group A and 251 (04.08%) blood group AB. **Conclusion**: The study provided 4403 Green/Green card, 1140 Green/Red, 484 Green/Yellow, 71 Red/Yellow, 39 Red/Red and 19 Yellow/Yellow to the population of Sô-Ava. Our innovation has helped to raise awareness and demystify sickle cell disease. It allowed the population to link "Drepastop" to the choice of spouse.

Keywords: Sickle Cell Disease, pictogram, prevention, Drepastot, Benin.

1. INTRODUCTION

Sickle Cell Disease (SDC), characterized by a sickle hemoglobin S (HbS) ou C (HbC), is one of the most important single gene disorders in humans and results from the substitution of glutamic acid for valine at position 6 (HbS) or lysine (HbC) on the b-globin molecule. In Africa, SCD is reported to be associated with 50% to 90% of childhood mortality [1, 2]. SCD prevalence is about 2% worldwide, 30% in some areas of intertropical Africa [3] and 40% in Central Africa [4]. In Benin, the prevalence of SCD was estimated to 22.3% [5]. In African, the burden of SCD increases with population growth, with serious consequences for public health and socio-economic status. Despite the recent high level of interest in the disease, investments in the prevention and management of SCD remain inadequate [6]. Therapeutic approaches are expensive, often inefficient and inaccessible to low-income populations [7, 8]. Recently, a pilot program in Benin has shown that with newborn screening and good follow-up care, it is likewise possible to reduce mortality among African children with SCD to the same level as other children [9]. However, this approach is difficult to achieve because of lack of resources. Benin is a poor country where more than 70% of the population is illiterate. Women and children, especially girls, who pay the heaviest SCD tribe are not well involved in current disease prevention efforts. This study aims to reduce the number of pregnancies at risk of giving birth to children with SCD. To achieve this goal, we proceeded by (i) a thorough education-awareness on SCD, (ii) systematic screening for SCD, (iii) provided the results as a pictogram based on the cultural connection of the population with color and (iv) refer patients for medical care.

2. MATERIALS AND METHODS

2.1. Study population

The study was carryout in the commune of Sô-Ava that is located in southern Benin. It is a lacustrine town and tourist place. Sô-Ava covers an area of 218 km2 with a population of 118.497 inhabitants with a density of about 544 inhabitants per km² and about 4.4 children per woman [10]. It is also one of the communes where the prevalence of SCD and malaria is very high. Mobile audiences (large gatherings with local language audience), community radios, posters and flyers were used to raise awareness.

Three teams of 3 missionaries (including at least one woman) were trained on basic education and ethics issues on SCD. The mission of these teams was to sensitize the population and prepare them for SCD screening. Sample

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collecting was done by 05 experienced nurses and laboratory screening tests were made by 5 medical laboratory technicians. A team of 2 experienced medical laboratory technicians was in charge of validation, transcription and encoding of the results before their transcription on results cards. Results rendering and their interpretation to the population was done by the team of missionaries.

2.2. Sample analysis

Blood collection equipment included tubes, needles, cotton, alcohol, gloves and various handling equipment. Semi-automated electrophoresis system from Alere (Helena Biosciences, Europe). Samples were collected in EDTA along with clinical details. Hemolysate of the sample was prepared and the hemoglobin of the hemolysate was adjusted to 2-3 g/dl. Very small quantity (35 ul) of samples of hemolysates prepared from whole blood were applied to sample tray, the applicator automatically applies the samples to the ready to use Alkaline Hb Gel (Agarose in a Tris/ EDTA/ Glycine buffer with Sodium Azide). The hemoglobin in the sample were separated by electrophoresis (200 volts, 30 minutes) using an alkaline buffer (pH 8.2-8.6) and were stained with Acid Blue Stain. The patterns were scanned on a scanning densitometer, and the relative percent of each band was determined and interpreted as per the manufacturer's instructions.

ABO blood groups were determined manually by using monoclonal anti-A and anti-B against the participant' red cells suspended in saline tubes at room temperature and ready for agglutinations after 15 min incubation in accordance with standard procedures and manufacturer's guidelines [11].

2.3. Statistical analysis

Data were analyzed by SigmaPlot statistical analysis software 2014 (Systat Software, Inc. San Jose, CA, USA). Means and standard errors of the mean (SEM) of data were calculated. If Normality Test (Shapiro-Wilk) is correct, Student's t-test was used to ascertain difference between group's characteristics, if not, Mann-Whitney Rank Sum Test was used. The Chi-square test was used to compare the means of the qualitative variables. A p-value of <0.05 was deemed significant.

3. RESULTS

3.1. Pictogram interpretation

We designed a card with the colors of the national flag of Benin to give the SCD screening results to the population. This formula was adopted because of the illiteracy of the target population. The card designed was a pictogram called "Drepastop" (Figure 1). It was a set of colored cards with Green color symbolizing HbA, Yellow HbC and Red Hb S. Each card was divided into two parts so that the results of the hemoglobin electrophoresis test can be read in genotype. Thus, a complete Green card (Green/Green) means a genotype AA, Green/Red: AS, Green/Yellow: AC, and Red/Red: SS, SC, CC. Each Card also indicated people ABO blood group and Rhesus (Figure 1).

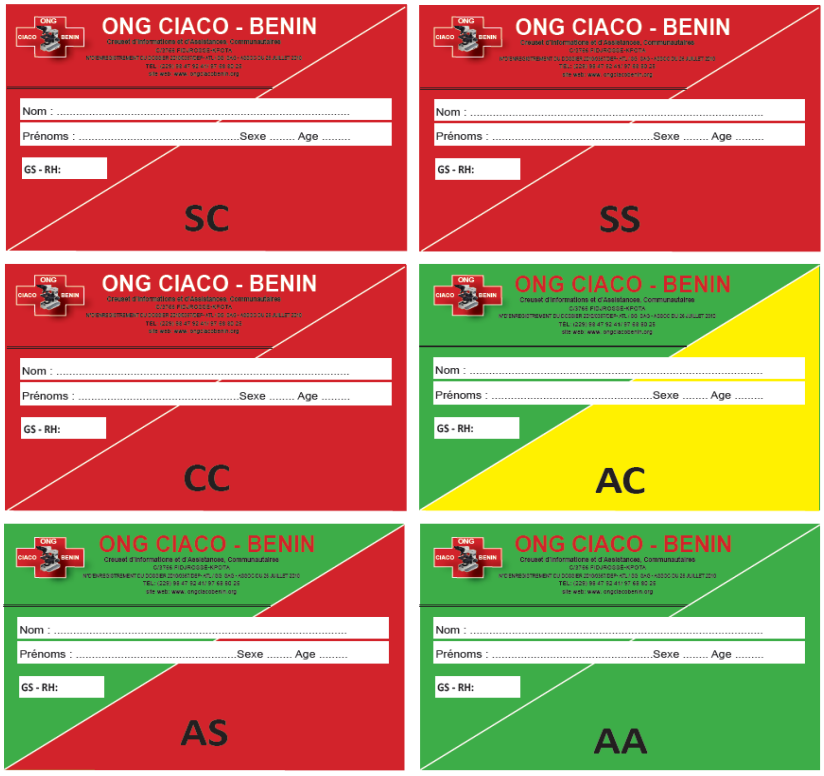

Figure 1: the figure presents the "Drepastop"; card with the colors of the national flag of Benin to give the SCD screening results to the population.

An innovation for preventive fight against sickle cell disease in illiterate populations regions in Benin.

3.2. Hemoglobin electrophoresis results: A total of 6156 subjects of all ages and sexes were screened in the municipality of Sô-Ava. Of this population, 4403 (71.52%) had no sickle cell trait. There were 1624 (26.38%) heterozygous sickle cell trait carriers and 129 (2.10%) homozygous carriers (Table 1).

Table 1: Study population according to Sickle cell status.

Statut	Enrolment	Frequency (%)
Non carrier	4403	71.52
Heterozygous carrier	1624	26.38
Homozygous carrier	129	2.10
Total	6156	100.00

The number and proportion of homozygous carrier subjects of Sickle Cell Disease (SCD), heterozygous carriers and non-carriers of SCD were determined.

Of the 1624 heterozygous subjects, 1140 (18.52%) were of AS genotype compared to 484 (7.86%) of AC genotype (Table 2). All three possible homozygous genotypes carrying sickle cell traits were identified with 71 (1.15%) SC genotype subjects, 39 (0.63%) SS subjects, and 19 (0.32%) CC subjects (Table 2). The result cards were made and distributed to the population based on these genotypic results.

Table 2: The table presents the study population according to genotype.

Genotype	Enrolment	Frequency (%)
AA	4403	71.52
AS	1140	18.52
AC	484	7.86
SC	71	1.15
SS	39	0.63
CC	19	0.32

Green/Green: means a genotype AA; **AS:** Green/Red; **AC:** Green/Yellow; **Red/Red:** SS, SC, CC. (Each Card also indicated people ABO blood group and Rhesus (Figure 1)).

All study participants were divided into groups according to their genotype obtained from the Hb electrophoresis test. The percentage of each group was also calculated.

3.3. Association of Blood group and Sickle cell status

The majority of the study participants were blood group O with a total of 3167 (51.44%), followed by 1499 (24.35%) group B subjects, 1239 (20.13%) blood group A subjects (Table 3) and AB blood group subjects were the least with 251 (04.08%) subjects. There was no association between blood group and the carriage of sickle cell trait (p = 0.89) (Table 3).

Table 3: The table presents the sickle cell status according ABO Blood Group.

Statut	Blood Group				Chi-square test
	A	B	AB	O	
Non carrier	894 (14.52%)	1066 (17.32%)	176 (02.86%)	2267 (36.82%)	p = 0.89
Carrier	345 (05.61%)	433 (07.03%)	75 (01.22%)	900 (14.62%)	
Total	1239 (20.13%)	1499 (24.35%)	251 (04.08%)	3167 (51.44%)	

A, B, AB and O: Blood group.

Sickle Cell Disease carrier and non-carriers subjects were divided according to their blood group. The results are presented as the number of participants and the corresponding proportion in parenthesis.

4. DISCUSSION

In this study carryout in Sô-Ava among general population, the prevalence of S and C sickle cell trait carriers was 20.30% and 9.33%, respectively. Our results are similar to those previously reported from national wide study in Benin (22.3% and 10.1% respectively) by Latoundji *et al.,* (1991) [12].

However, our finding was different from results reported by Noudamadjo et al. in infants in 2013 (14.64% and 14.20%) [13], and in Togo by Segbena et al. in newborns (16.4% S sickle cell and 15.8% C sickle cell) [14]. These results suggest that SCD prevalence is different in newborns and infants compared to general population. The 63rd session of the United Nations (UN) General Assembly in December 2008 adopted a resolution on the "recognition of Sickle-cell anaemia as a public health problem," and urged Member States and UN organizations to raise awareness of SCD on June 19 of each year [15].

Despite the fact that the UN has called for global efforts "to bring the disease out of the shadows," relatively little attention has been given to assessing the burden of SCD and how to reduce it in Africa, where about 85% of children with SCD are born [16]. In 2010, the WHO Regional Office for Africa proposed a SCD strategy in official recognition of the fact that SCD is an important cause of child mortality in many African countries [6]. Enough is already known to justify investment in public health SCD programs, such as those already in place for other conditions like HIV or malaria, for promoting widespread screening, health education, treatment to prevent or manage SCD complications and most importantly the prevention of the genetic transmission of the disease.

Early diagnosis of SCD will allow rapid management of disease-related attacks in children and pregnant women. It can also help raise awareness about risk marriages and limit the birth of children with SCD. In the present study, we screen a total of 6156 individuals for SCD. All of them have received their card that could be kept longer than the usual paper transcript result. Results showed in our study were close to those carried out in Algeria population by Zaoui et al., (2007) and in Nigeria by Okon *et al.,* (2008) [17,18]. We showed that ABO blood group distribution among study population was in the order O>B>A>AB. Similar result was reported by Sagir *et al.,* (2014) [19]. The proportions of SCD among participants were consistent with the frequencies of ABO blood groups in the study population and no significant difference was noticed between participants with Blood group O and those with non-O Blood groups in this study. Our finding contradicted results from Alagwu et al., (2016) who reported that Blood group O is most commonly associated with genotype SS of SCD, followed by blood group B, then A group and the least prevalence is AB [20].

5. CONCLUSION

In this study, we used language that is accessible to the populations in order to put her at the center of a disease prevention strategy. Since the population is illiterate, screened people have got their result in the form of a card, easier to keep than paper. At the end, the card will be essential for the choice of spouse. The results obtained in this study will help for the monitoring/evaluation and care of the most vulnerable population (pregnant woman, newborn and young girl).

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