

# Effect of Health Education Intervention on Knowledge of Sickle Cell Disease and Practice of Voluntary Genotype Counselling and Testing among Students of a Tertiary Institution in Sokoto State, Nigeria.

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## ABSTRACT

**Background:** Knowledge of sickle cell disease (SCD) among students of tertiary institutions is known to influence their practice of genotype voluntary counseling and testing (VCT). This study aimed to assess the effect of health education intervention on the knowledge of SCD and practice of voluntary genotype counseling and testing among the students of a tertiary institution in Sokoto State, Nigeria. **Methods:** A quasi-experimental non-controlled study with pre- and post-test design was conducted among 111 students of a tertiary institution selected by multistage sampling technique. A set of semi-structured self-administered questionnaire was used to collect data on the research variables. A health education session was held and free genotype screening was offered to the participants. Data were analyzed using the IBM SPSS version 20 statistical package. **Results:** The proportion of participants with good knowledge of SCD increased significantly ( $p < 0.05$ ) from 49.54% at pre intervention to 87.38% at post intervention. The proportion of participants with good practice of voluntary genotype counseling and testing also increased significantly from 27.0% at pre-intervention to 73.0% at post-intervention. Fifty (45.0%) of the 110 participants who have never done genotype testing did so after the health education intervention. **Conclusion:** Health education intervention was effective in improving the knowledge of SCD and practice of genotype VCT among the participants. Sensitization of the public on SCD through the mass media and its inclusion in the school curriculum are crucial to improving the students' knowledge of the disease and acceptance of premarital genotype counseling and testing by them later in life.

**Keywords:** Knowledge, practices, Sickle cell disease, screening, health education intervention.

## INTRODUCTION

Sickle cell disease (SCD) is a group of inherited disorders of hemoglobin (Hb) in which the sickle Hb is present in association with abnormal Hb.<sup>[1]</sup> Inherited haemoglobin disorders (sickle-cell disorders and thalassaemias) were initially confined to the tropics and subtropics but are now common worldwide due to migration of people.<sup>[2]</sup>

Sickle cell haemoglobinopathies have different genotypes, the archetypal sickle cell disease is the haemoglobin SS disease, otherwise called sickle cell anaemia, and other sickle cell disease phenotypes include the compound heterozygous states such as

haemoglobin SC disease and Haemoglobin S-Thalassaemia syndromes.<sup>[3]</sup>

Worldwide SCD contributes a significant burden that is not amply addressed.<sup>[4]</sup> It is estimated that 312,000 children with SCD are born worldwide annually.<sup>[5]</sup> The greatest burden of the disease is in sub-Saharan Africa, where 75% of the global cases of sickle cell disease occur.<sup>[6]</sup> Nigeria alone accounts for 50% of the sickle cell disease (SCD) cases worldwide and about 2.3% of her population suffer from SCD with 25% being healthy carriers.<sup>[7,8]</sup>

Sickle cell disease contributes to an equivalent of 5% of under five deaths in the African continent, and more than 9% of such deaths are in West Africa.<sup>[9]</sup> Haemoglobinopathies have become important public health problems worldwide; according to the World Health Organization (WHO), approximately 240 million people are carriers of this genetic disease, and at least 200,000 affected individuals are born annually.<sup>[9]</sup> The prevalence of the disease is rising in the society, creating more stress despite the difficulties

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people encounter in life.<sup>[9]</sup> The methods of preventing the disease include premarital screening and genetic counseling, prenatal diagnosis, preconception diagnosis and implantation of normal embryos after in vitro fertilization and in vitro therapy using stem cell transplantation.<sup>[10]</sup>

However, prevention of the disease through carrier identification and genetic counseling remains the only realistic approach to reduce the impact of the disease and allow better use of available resources in low-income countries where the condition is most prevalent.<sup>[10]</sup> With the increasing prevalence of genetic diseases in developing countries e.g. Nigeria, there is the need to assess the level of knowledge of SCD and practice of premarital voluntary genotype counseling and testing as a way of reducing and/or preventing the occurrence of genetic diseases especially sickle cell.<sup>[11]</sup>

A study carried-out to assess knowledge and attitude of secondary school students in Jos, Nigeria, on sickle cell disease, showed that about 54% knew that the disease can only be diagnosed through blood test.<sup>[11]</sup> In another study conducted to assess the knowledge of SCD and pre-marital screening and marital decision among Local Government workers in Ile-Ife, Nigeria, reported that, 69% of the respondents had poor knowledge of SCD.<sup>[12]</sup>

A similar study done to assess the knowledge, attitude and practice of pre-marital counseling and testing for SCD among youths in Yaba, Nigeria, revealed that, 80% of the respondents had good knowledge, 86% had positive attitude and 65% had engaged in practices related to SCD and premarital counseling.<sup>[13]</sup> Another study carried-out to explore the knowledge and attitude of nursing students about premarital screening for sickle cell disease in Sokoto state, Nigeria, revealed that only about a third (34.1%) of respondents had good knowledge of SCD, and about 34.3% of them have had premarital screening for SCD.<sup>[14]</sup>

A related study conducted to assess the effect health education intervention on the knowledge and attitude of youth corps members to SCD and its screening in Lagos state, Nigeria, showed that, at baseline, the proportion of the respondents with good knowledge of SCD was low (25%), while at post- intervention, the level of knowledge of SCD among the respondents increased significantly to 64.1% and the proportion of those who did genotype screening increased significantly by (11.9%) only in the intervention group ( $p < 0.05$ ).<sup>[15]</sup>

A similar study conducted to assess the knowledge, attitude and control practices of sickle cell disease among youth corps members in Benin-city, Nigeria, showed that, only 17.8% of the respondents had good knowledge of SCD but up to 94.6% of the respondents knew their SCD carrier status.<sup>[16]</sup>

In another study carried out to determine the effect of health education intervention on the knowledge and attitude to sickle cell disorder and screening practices

among the students of State School of Nursing, Sokoto, Nigeria, it was found that, the mean knowledge score of the respondents was (80.9 +/- 22.8) at baseline and it increased significantly to 91.8 +/- 9.4 at post intervention ( $p < 0.001$ ).<sup>[17]</sup>

## MATERIALS AND METHODS

### Study Area, Design and Population

This was a quasi- experimental study among 111 students of Shehu Shagari College of Education, Sokoto, Nigeria. The institution was established in 1970 and runs preliminaries studies and basic National Certificate of Education (NCE) programme as well as degree programmes which are affiliated to Usmanu Danfodiyo University, Sokoto and Ahmadu Bello University, Zaria, Nigeria. The NCE program has a total of five schools namely; School of Sciences, Education, Arts and Social Sciences, Vocational and Technical, and School of Languages. Each school is divided into departments with a total of 27 departments. There are a total of 9548 students in the NCE program. The NCE program runs for a period of three academic sessions while the degree programme runs for 4 academic sessions (levels).

**Sample size estimation and Sampling Technique**  
The sample size was estimated at 111 using the statistical formula for calculating sample size for intervention studies involving only 1 group (i.e., no control group) with pre- and post-tests.<sup>[18]</sup> Based on a 55.5% prevalence of good knowledge of SCD observed at base line in a previous study, a precision level of 5% and an anticipated response rate of 90%.<sup>[19]</sup>

The eligible participants were selected by a multistage sampling technique. At the first stage, 3 out of 5 schools were selected by simple random sampling using balloting procedure (School of Sciences, Education, Arts and Social Sciences were selected). At the second stage 1 department was selected from each of the 27 departments of the selected schools by simple random sampling using balloting procedure making total 3 departments selected for the study. Stratification of each selected department by levels (i.e. level 1, 2 and 3) was done. A list of the students was obtained from the class attendance list for all the 3 levels in the selected departments and then proportionate allocation was done based on the total number of students from each of the level selected. At the third stage selection of the study participants was done from the class attendance list of each of the selected levels (which constituted the sampling frame) by systematic sampling technique.

### Data Collection

A semi-structured, self-administered questionnaire was developed and used to obtain information on the participants' socio-demographic characteristics, knowledge of the sickle cell disease and voluntary

genotype counseling and testing, as well as their practice of voluntary genotype counseling and testing (at pre and post-interventions). It was reviewed by researchers in the Department of Community Health, Usmanu Danfodiyo University, Sokoto, Nigeria. Corrections were made based on their inputs on content validity. The questionnaire was pretested on 10 students of Usmanu Danfodiyo University Sokoto, Nigeria. The post intervention data was collected 12 weeks after the first health education session from the same participants.

### **Procedure of Health education Intervention**

The health education intervention was carried out immediately after the baseline data collection and repeated 4 weeks later. It was multi-phased and comprised of an organized lecture for the participants, and exposure of participants to wall mounted information, posters and hand bills to reinforce the lectures given. The lectures focused on relevant topics of sickle cell disorder namely: sickle cell disease and how it is transmitted, the magnitude of the problem, its clinical features, complications, pre – natal diagnosis of sickle cell disorder, definition and importance of voluntary genotype counseling and testing. Attendance at the lecture was ensured through establishment of rapport on the need and importance of the study; also, advocacy visit was paid to the management of the institution to sensitize them on the objectives of the study. The post intervention data was collected 12 weeks after the second intervention from the same participants using the same data collection instrument that was used for baseline data collection. The voluntary genotype testing was carried out immediately after the post- intervention data collection.

### **Data analysis**

Data were analyzed using IBM SPSS version 20 computer statistical software package. The Chi-square test was used for bivariate analysis involving categorical variables. All levels of significance were set at  $P < 0.05$ .

Scoring and Grading of Participants Knowledge of SCD and Practice of voluntary genotype counselling and testing was done.

Each correct response was allocated 1 mark while wrong or no response was scored zero.

Greater or equal to 50% of the scores on knowledge was considered as good knowledge and less than 50% of the scores on knowledge was considered as poor knowledge. Similarly, greater or equal to 50% of the expected practice scores on voluntary genotype counseling and testing was considered as good practice and less than 50% of the practice scores on VCT was considered as poor practice. The total score was determined by calculating the total correct responses divided by the total number of expected correct responses multiplied by one hundred for both knowledge of SCD and practice of

genotype VCT. Knowledge of SCD and practice of voluntary genotype counseling and testing were scored and converted into categorical variables (good and poor knowledge and practice respectively).

### **Ethical Consideration**

Approval for the study was obtained from the Ethical Committee of the Usmanu Danfodiyo University Teaching Hospital Sokoto. Permission to carry out the study was sought from the management of Shehu Shagari College of Education (SSCOE). Written informed consent was also obtained from the study participants.

## **RESULTS**

### **Socio-demographic Characteristics of Participants**

All the questionnaires administered to the participants at pre and post-interventions were adequately completed and found suitable for analysis, giving a response rate of 100%. The ages of the participants ranged from 15 to 39 years with a mean age of  $22.44 \pm 3.53$  years. Majority, 78 (70.3%) of the 111 participants were males 78(70.3%). Majority of participants were of Hausa/Fulani ethnic group 68 (61.2%), followed by Yoruba 20 (18.0%) and Ibo 13 (11.7%) ethnic groups. Ninety-six (86.4%) were single, 11 (9.9%) were married, while 4 (3.6%) were separated; and majority of participants (66.7%) were Muslims [Table 1].

**Table 1: Socio-demographic characteristics of participants**

Variables	Number (%)n = 111
<b>Age group (years)</b>	
15- 19	16(14.4)
20-24	74(66.7)
25 -29	16(14.4)
30 – 34	4(3.6)
35-39	1(0.9)
<b>Sex</b>	
Female	33(29.7)
Male	78(70.3)
<b>Ethnicity</b>	
Hausa/Fulani	68(61.2)
Yoruba	20(18.0)
Igbo	13(11.7)
Others	10(9.0)
<b>Religion</b>	
Christianity	35(31.5)
Islam	74(66.7)
Others	2(1.8)
<b>Marital status</b>	
Married	11(9.9)
Single	96(86.4)
Separated	4(3.6)

Effect of intervention on the participants' knowledge of the various aspects of SCD and voluntary genotype counseling and testing

There was an increase in the proportion of respondents who knew the nature of SCD from 75 (67.6%) to 89 (80.2%) at pre- and post-interventions

respectively, and the increase was statistically significant ( $p < 0.03$ ).

**Table 2: Effect of intervention on the participants' knowledge of the various aspects of SCD and voluntary genotype counseling and testing**

Variables	Pre-intervention n=111 Number (%)	Post-intervention n=111 Number (%)	Test of significance
Knowledge of nature of SCD	75(67.6)	89(80.2)	$\chi^2 = 4.574$ $p = 0.032$
Mode of transmission of SCD	47(42.3)	87(78.4)	$\chi^2 = 30.122$ $p = 0.0001$
Typical complain of patients with SCD	27(24.3)	62(55.9)	$\chi^2 = 22.975$ $p = 0.0001$
Causes of SCD	37(34.3)	76(69.7)	$\chi^2 = 27.414$ $p = 0.0001$
Curability of SCD	23(20.7)	47(42.3)	$\chi^2 = 12.018$ $p = 0.001$
Conditions that can worsen SCD	47(42.3)	69(62.12)	$\chi^2 = 8.738$ $p = 0.003$
Genotype counseling is a health education program in which genotype testing is done willingly	74(66.7)	98(88.3)	$\chi^2 = 14.869$ $p = 0.0001$
Significance of genotype voluntary counseling and testing in the control of SCD.	75(67.6)	97(84.7)	$\chi^2 = 12.494$ $p = 0.0001$

**Table 3: Distribution of respondents' overall knowledge of SCD by phase of study**

Knowledge grade	Pre-intervention Number (%) n = 111	Post-intervention Number (%) n = 111	Test of significance
Good	55 (49.54)	97 (87.4)	$\chi^2 = 36.805$ $p = 0.001$
Poor	56 (50.45)	14 (12.6)	

Only 47 (42.3%) of the 111 respondents knew the mode of transmission of SCD at pre-intervention as compared to 87 (78.4%) at post-intervention, and the difference was statistically significant ( $p < 0.001$ ).

The proportion of respondents who knew the typical complains of a patient with SCD increased from 27(24.3%) at pre-intervention to 62 (55.9%) at post-intervention. The increase was statistically significant ( $p < 0.001$ ).

There was an increase in the proportion of the respondents who knew the causes of SCD from 37(34.3%) at pre-intervention to 76 (69.7%) at post-intervention, and the increase was statistically significant ( $p < 0.001$ ).

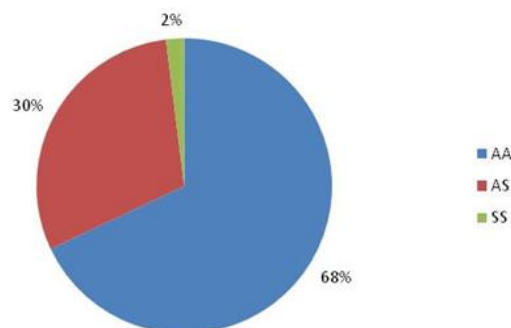
At pre-intervention, less than half 47 (42.3%) of the respondents knew the conditions that can worsen SCD compared to 69 (62.12%) at post-intervention. The increase was statistically significant ( $p < 0.003$ ). The respondents who correctly mentioned the cure of SCD increased from 23 (20.7%) at pre-intervention to 47 (42.3%) at post-intervention, and the increase was statistically significant ( $p < 0.001$ ) as shown in [Table 2].

The proportion of respondent who knew that genotype counseling is a health education program in which genotype testing is done willingly increased from 74 (66.7%) at pre-intervention to 98 (88.3%) at post intervention, and the increase was statistically significant ( $p < 0.001$ ).

There was an increase in the proportion of the respondents who correctly mentioned the significance of genotype voluntary counseling and testing in the control of SCD from 75 (67.6%) at pre-intervention to 97 (84.7%) at post-intervention; the increase was also statistically significant ( $p < 0.001$ ) as shown in [Table 2].

**Table 4: Effect of intervention on participants' practice of voluntary genotype counseling and testing**

Variable	Pre-intervention Number (%) n=111	Post-intervention Number (%) n=111	Test of significance
Did genotype test	30 (27.0)	80 (73.0)	$\chi^2 = 45.049$ $p = 0.0001$



**Figure 1: Distribution of the hemoglobin genotype of the participants that were tested post-intervention**

Overall, the proportion of the respondents with good knowledge of SCD increased from 55 (49.5%) at pre-intervention to 97 (87.4%) at post-intervention and the increase was statistically significant ( $p < 0.001$ ) as shown in [Table 3].

#### Effect of Health education intervention on participants practice of voluntary genotype counseling and testing:

At the pre-intervention phase of the study less than a third 30 (27.0%) of the 111 participants reported to have ever done genotype testing. Following the health education intervention, an additional 50 participants volunteered to do genotype testing making a total of 80 (73.0%) participants who have

had voluntary genotype counseling and testing done at post-intervention, and the increase was statistically significant ( $p < 0.001$ ) as shown in [Table 4].

Of the 50 participants that had genotype testing done after the intervention, majority of them 34 (68.0%) had AA genotype, about a third 15 (30.0%) had AS genotype, while only 1 (2.0%) had SS genotype as shown in [Figure 1].

## DISCUSSION

The mean age of the respondents was  $22.44 \pm 3.53$  and majority of them 74(66.7%) were aged between 20 to 24years. This is similar to the finding in a study conducted to determine the level of awareness and acceptance of pre-marital genetic screening among the youths in Plateau state, Jos, Nigerian, where majority (75%) of the respondents were aged between 20 and 30years.<sup>[11]</sup> It is also in consonance with the finding in a study done to assess the knowledge, attitude and control practices regarding sickle cell disease among youth corps members in Benin City, Nigeria in which most (85%) of the study participants were aged 22 - 29 years.<sup>[16]</sup>

A larger proportion 78(70.3%) of the respondents in this study were males; this is in agreement with the finding in a study done to assess the knowledge, attitude and practice of pre-marital counseling for SCD among youths in Yaba, Nigeria, which reported 164 (59.0%) of the respondents to be males.<sup>[13]</sup>

A larger proportion 96(86.4%) of the respondents were single, this finding is not surprising because the study was carried out among young students who are more likely to marry after graduating from the school. Furthermore the fact that most of the respondents were single made the study very appropriate for the participants because the respondents need to be aware of the importance of premarital genotype screening before they get married. This Finding is similar to the finding in a study conducted in Yaba, Lagos state, Nigeria where most (87%) of the study participants were un-married youths.<sup>[13]</sup> But it is in contrast to the finding in a study done in Ile-Ife, Nigeria where significant proportion of the respondents (61.0%) were married.<sup>[12]</sup> The preponderance of Muslims among the respondents in this study 74 (66.7%), and with a larger proportion being Hausa/Fulani 68(61.2%) could be due to the fact that the study was conducted in northern Nigeria where the Hausa/Fulani constitute the major ethnic group and they are predominantly Muslims.

The proportion of respondents with good knowledge of SCD at baseline was 55(49.54%), this is closely related to the finding in a study conducted to assess the knowledge of SCD among nursing students in Sokoto state, Nigeria, which revealed a baseline level of knowledge of 34.1%

among the participants.<sup>[14]</sup> It is also in consonance with the finding in a study conducted to assess the knowledge of SCD and pre-marital screening, and marital decision among Local Government workers in Ile-Ife, Nigeria, which reported the proportion of respondents with good knowledge of SCD to be 31%.<sup>[12]</sup>

Also in agreement with the finding in this study is the finding in a study conducted to assess the knowledge, attitude and control practices of sickle cell disease among youth corps members in Benin city, Nigeria, which revealed only 17.8% of the respondents had good knowledge of SCD.<sup>[16]</sup>

But the finding in this study is in contrast to the finding in a study done to assess the knowledge, attitude and practice of pre-marital counseling for SCD among youths in Yaba, Nigeria, which reported that 80% of the respondents had good knowledge.<sup>[13]</sup> It is also in contrast to the finding in a study carried-out to assess the knowledge and attitude of secondary school students on sickle cell disease, in Jos, Nigeria, which reported that more than half (54.0%) of the respondents knew that sickle cell disease can be diagnosed through blood test.<sup>[11]</sup>

In this study the proportion of respondents with good knowledge of SCD increased from 55(49.54%) at pre intervention to 97 (87.38%) following the health education intervention ( $p < 0.05$ ). This is similar to the finding in a study carried-out to assess the effect of health education intervention on the knowledge and attitude related to SCD among youth corps members in Lagos state, Nigeria, which reported that at pre intervention, the proportion of the respondents who had good level of knowledge of sickle cell disease was low (25%), but following the health education intervention, the level of knowledge increased significantly ( $p < 0.001$ ) to 64.1%.<sup>[15]</sup>

It is also in agreement with the finding in a study carried-out among the students of State School of Nursing Sokoto, Nigeria, where the mean knowledge score of the respondents was (80.9 +/- 22.8) at baseline and increase significantly ( $p < 0.001$ ) following health education intervention to 91.8 +/- 9.4.<sup>[17]</sup>

This study also recorded a low level (27.0%) of good practice of voluntary genotype counseling and testing among the respondent at baseline. This finding is in consonance with the finding in a study conducted on premarital screening for sickle cell disease among the students of Sokoto State School of Nursing in which only 34.3% of respondents had good practice of premarital screening for SCD at baseline.<sup>[14]</sup>

But it is in contrast to the finding in a study conducted among the Local government workers in Ile-Ife, Nigeria, which reported that most (86.7%) of the respondents to had done pre-marital screening for SCD.<sup>[12]</sup>

It is also in contrast to the finding in a study conducted to assess the knowledge, attitude and control practices regarding sickle cell disease among youth corps members in Benin city, Nigeria, which showed that about 94.6% of the respondents had previously done genotype testing for SCD.<sup>[16]</sup>

Following the health education intervention in this study the practice of voluntary genotype counseling and testing increased significantly from 30 (27.0%) at pre-intervention, to 80 (72.0%) at post-intervention ( $p < 0.05$ ). This is similar to the finding in a study conducted to assess the effect of health education intervention on the knowledge and attitude of youth corps members to sickle cell disease and its screening in Lagos state, Nigeria, which reported that the proportion of respondents who knew their genotypes increased (11.9%) significantly only in the intervention group ( $p=0.000$ ).<sup>[15]</sup>

It is also in agreement with the finding in a study carried-out among the students of Sokoto State School of Nursing, Sokoto, Nigeria, which reported that, the health education intervention made a significant impact on the respondents' uptake of screening test for SCD ( $p < 0.001$ ).<sup>[17]</sup>

## CONCLUSION

Although, the levels of knowledge of SCD and practice of voluntary genotype counseling and testing were poor among the participants in this study at baseline, the health educational intervention effected significant improvement in knowledge and practice. There is need for structured, school-based public awareness campaign about sickle cell disease and genotype counseling and testing. In addition, genotype screening for SCD should be made a pre-requisite for admission into educational institutions and for solemnization of marriage.

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