

Sickle cell trait screening in students in a Ugandan university: a cross-sectional study

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Abstract

Objective: To determine the uptake, knowledge level and attitude towards sickle cell trait screening in students aged 18 to 35 years in a Ugandan university.

Methods: This was a university-based, cross-sectional study of students aged 18 to 35 years who were students at the Busitema University Faculty of Health Sciences. We used a simple random sampling technique to recruit participants. We conducted multivariable logistic regression to establish the association between factors such as age, year of study, marital status and uptake of sickle cell trait screening (SCTS) services.

Results: A total of 315 students participated in the study. The uptake rate of SCTS was 24.4%. The knowledge level regarding sickle cell disease/SCTS was 93.7%, and 73.3% of respondents had a positive attitude towards SCTS, with a mean score of 23.32 ± 5.84 . A multivariate analysis showed that those aged 25 to 29 years were 7.8 times more likely to have SCTS, while married respondents were 1.3 times more likely to be screened.

Conclusion: The uptake of SCTS services was low relative to the total number of participants recruited in this study. Therefore, the uptake of SCTS needs to be encouraged in students at universities.

Keywords

Sickle cell disease, sickle cell trait, student, university, screening, Uganda

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Introduction

Sickle cell disease (SCD) is an autosomal recessive inherited disorder characterized by production of abnormal hemoglobin within erythrocytes.^{1,2} SCD is one of the primary disorders of hemoglobin in addition to beta-thalassemia in the broad group of haemoglobinopathies,³ in which inherited disorders result in abnormal production in one of the beta chains that forms hemoglobin.⁴ SCD is characterized by repeated episodes of severe acute pain and acute chest syndrome, and other complications including stroke, chronic pain, nephropathy, retinopathy, avascular necrosis, priapism and leg ulcers.⁵

Sickle cell trait (SCT) refers to an inherited blood disorder where a person inherits one sickle cell gene “S” from one parent and a normal hemoglobin “A” from another parent. This person develops no symptoms of sickle cell disease but is a carrier and is able to transfer this gene to the next generation.^{6,7}

Worldwide, in 2010, 5,788,000 neonates were estimated to be affected by hemoglobin S, and 5,476,000 were heterozygous and 312,000 were homozygous.⁸ While the overall survival rate among children with SCD has improved, pediatric rates of hospitalization and mortality from complications remain high.⁹ The World Health Organization has shown that SCD has become a burden, with the greatest burden in sub-Saharan Africa, where 75% of SCD occurs and is expected to rise by 2050.^{10,11} In Africa, approximately 150,000 to 300,000 children die of sickle cell anemia annually counting for 5% to 10% of child mortality.^{12,13} This situation in African regions indicates that current national policies and plans are inadequate, and appropriate facilities and trained personnel are scarce.¹⁴ In Uganda, the prevalence of SCD and SCT is distributed depending on the district with a total prevalence of 0.7% and 13.3% of SCD and SCT, respectively.¹⁵ Additionally, 15,000 neonates are born every

year with SCD, and 805 die before reaching 5 years of age.¹⁵ According to a survey on the prevalence of SCT in eastern and western Uganda, the prevalence in eastern Uganda (Mbale and Sironko) was 17.5% with positivity for Hb As, and that of western Uganda (Bundibugyo and Mbarara/Ntungamo) was 13.4% and 3%, respectively.¹⁶

Many students in universities are sexually active and at an age of identifying partners with whom they can bear children, which makes them a suitable target group for preventing SCD. Therefore, this study aimed to determine the uptake, knowledge level and attitude of sickle cell trait screening (SCTS) in students aged 18 to 35 years who were students at the Busitema University Faculty of Health Sciences in Eastern Uganda. Having knowledge and a good attitude towards SCTS is vital because they could lead to an increased uptake of SCTS services. This would enable students to understand their sickle cell status, resulting in a reduction in the number of children born with SCD. The findings of this study will be used to inform students about the relevance of SCTS and how its uptake reduces the incidence, prevalence, comorbidities and mortality of SCD. Additionally, our findings could be useful for the Ministry of Health and stake holders to create policies to promote SCTS and for researchers as a basis for further research on SCTS.

Materials and methods

Study design

This was a university-based, cross-sectional study of students aged 18 to 35 years. The information in this study was reported using the STROBE guidelines.¹⁷

Study setting

The study was conducted in Busitema University, Faculty of Health Sciences

(BUFHS), Eastern Uganda between October and November 2021. BUFHS is a public university located in Mbale City in Eastern Uganda, approximately 225 km by road from the capital city Kampala.

Study participants

All undergraduate students aged 18 to 35 years at BUFHS, Mbale Campus were eligible for the study. We excluded those who were critically ill, mentally unstable and not available during the study. All of the participants' details were de-identified, informed consent was sought from each participant and participants were randomly selected. Ethical approval was obtained from Mbale Regional Referral Hospital Research and Ethics Committee (REC) (approval number: MRRH-2021-87; date: 2 November 2021). Administrative clearance was obtained from the MRRH hospital director. Written consents were obtained from all participants in the study before data collection.

Variables

The dependent (outcome) variable of this study was the uptake of SCTS in students at BUFHS, Mbale Campus. The independent variables comprised knowledge and attitude towards SCTS.

Sample size

We considered that we needed a proportion of 24.7% of students who had SCTS on the basis of a similar study performed in Jinja with 95% confidence intervals, a margin of error of 5% and a non-response rate of 10%.¹⁸ These conditions resulted in a required sample size of 315 participants.

Data collection

Data were obtained using a questionnaire that was administered to participants at BUFHS. An electronic data collection and

entry (storage) tool, which was a Google form with closed ended questions (accessible at: https://docs.google.com/forms/d/e/1FAIpQLSfuAYePoIP9cZnNr8ohatXGKNEeX_OMVPRVA_oGs4RfCKWLXQ/viwwform?usp=pp_url), was administered by a researcher to the participants. The questionnaire had four sections. The first section collected sociodemographic information of the participants, such as age, sex, marital status, year of study, program of study and others. The second section assessed the knowledge level of participants regarding SCD/SCT and had nine items, with each item awarded one mark if it was correct and zero if it was wrong. This was then scored using Bloom's cut off score, where $\geq 50\%$ was scored as good knowledge and $< 50\%$ as poor knowledge. The third section assessed the attitude towards SCD/SCTS and had seven items, which were answered as strongly agree, agree, neutral, strongly disagree and disagree. The responses were scored using the 5-point Likert scale, where strongly disagree was scored as 1, disagree as 2, neutral as 3, agree as 4 and strongly agree as 5. A mean score of ≤ 20 was interpreted as negative knowledge and that of ≥ 21 as positive attitude out of a total score of 35. The last section determined the uptake of SCTS.

Pretesting of the questionnaire

The questionnaire was pretested on 10 students aged 18 to 35 years from Mbarara and Gulu Universities, and the reliability and validity of the questionnaire were assessed before data collection of the study. Preliminary data were analyzed to identify any anomalies. Questions were re-adjusted depending on the concerns noted during the process.

Statistical analysis

Data were analyzed using Stata version 15 (Stata Corp LLC, College Station, TX,

USA). Categorical variables are summarized as frequencies and proportions. The Pearson chi-square test was used to determine significant differences between independent variables and the uptake of SCTS with a level of statistical significance set at $p < 0.05$. We conducted a multivariate logistic regression to determine the factors that are associated with the uptake of SCTS in students while controlling for cofounders. Factors with a p value < 0.05 in a bivariate analysis and those known to affect SCTS uptake from the literature were included in the multivariate analysis. Adjusted odds ratios, 95% confidence intervals and p values were calculated at a statistical significance of $p < 0.05$.

Results

Sociodemographic information of the study

The total number of students who responded was 315. Of the 315 students, 193 (61.3%) were men and 122 (38.7%) were women. The majority (57.1%) of these students were within the age group of 18 to 24 years and the rest were aged from 25 to 29 and 30 to 35 years. Most students were Christian (92.7%) while the rest were Muslim (7.3%). Students studying medicine and surgery responded more than those studying nursing and anesthesia. The dominant class of respondents was year 4 and the least was year 5. More than two thirds of the respondents were single, while only approximately 20% were married. More details regarding the sociodemographic information are shown in Table 1.

Uptake of SCTS services in students

Only one quarter (77, 24.4%) of the students had SCTS at the time of the study and the remaining students (238, 75.6%) were not screened. Among those who were

Table 1. Sociodemographic characteristics of the participants.

Demographic characteristics	Frequency (n = 315)	%
Sex		
Male	193	61.3
Female	122	38.7
Age (years)		
18–24	180	57.1
25–29	64	20.3
30–35	71	22.5
Religion		
Christian	292	92.7
Muslim	23	7.3
Course of study		
Medicine and surgery	204	64.8
Nursing	68	21.6
Anesthesia	43	13.7
Year of study		
Year 1	67	21.3
Year 2	63	20.0
Year 3	57	18.1
Year 4	84	26.7
Year 5	44	14.0
Marital status		
Single	254	80.6
Married	61	19.4

screened, 10 (13.0%) were diagnosed with an SCT, and the majority (88.3%) were screened from hospital and the rest from school (6.5%), the clinic (3.9%) and a health camp (1.3%). Of 315 respondents, only 49 (15.6%) reported being aware of family members being diagnosed with SCD/SCT as shown in Figure 1.

Knowledge of SCD/SCTS in students

Knowledge regarding SCD/SCTS was scored using the mean of correctly answered questions, where every correct option was awarded one mark, and a wrong option was designated as zero. The following scale was used: those who score $< 50\%$ have poor knowledge and those who score $\geq 50\%$ have

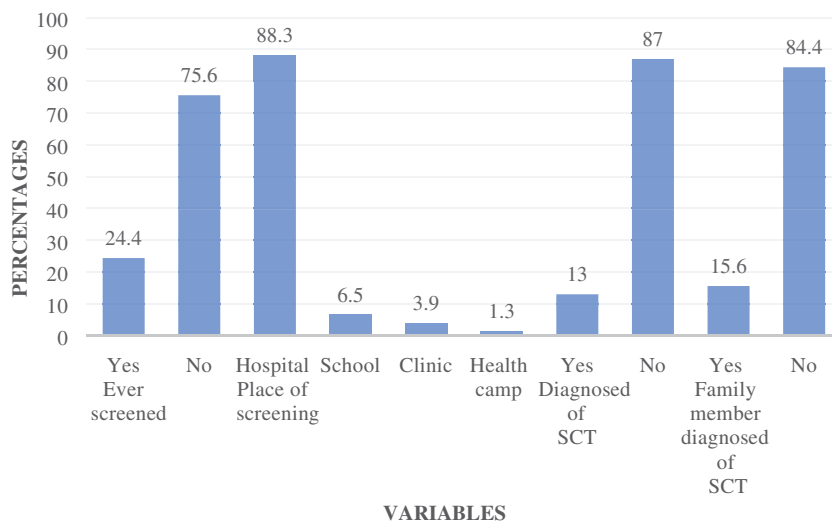


Figure 1. Uptake of sickle cell trait screening services by participants aged 18 to 35 years at Busitema University Faculty of Health Sciences.

good knowledge. Most (93.64%) of the respondents had good knowledge and only 6.35% had poor knowledge (Figure 2).

Attitude towards SCTS in students

Regarding the benefits of SCT screening, most (249, 82.3%) of the participants agreed that screening for SCT is useful, while 254 (80.7%) replied that they would encourage their partners to screen for SCT in case they were found to be carriers.

With regard to the barriers of SCT screening, more than three quarters reported that knowing they were at risk of giving birth to a child with SCD influenced their marital plans. However, only a small proportion of participants reported that screening centers were rarely accessible, and the screening procedure was expensive for them. More than two thirds reported that they would feel stigmatized if they turned out to be positive, while approximately one third of participants said that breaking up with their partners would be difficult if both of them were carriers.

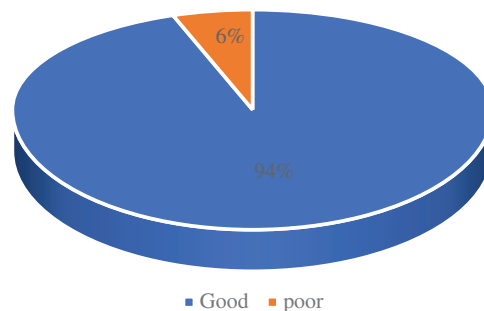


Figure 2. Participants' knowledge regarding sickle cell disease/sickle cell trait screening.

Some (107, 34%) of the respondents replied that they would be fearful of being involved in a marriage (Table 2).

Using a 5-point Likert scale for attitude, a mean score of ≤ 20 was interpreted as a negative attitude and that of ≥ 21 as a positive attitude out of a total score of 35. The majority (73.3%) of the participants had a positive attitude, while only 26.7% had a negative attitude. The median score was 24, the minimum score was 8 and the maximum score was 35 (Table 3).

Table 2. Participants' attitude towards SCT screening.

Variables	Agree	Neutral	Disagree
<i>Perceived benefits of sickle cell trait screening</i>			
Was it useful to know if you had sickle cell trait?	249 (80.3)	27 (8.6)	29 (9.2)
Would you encourage your partner to test for SCT if you were found to be a carrier?	254 (80.7)	30 (9.5)	31 (9.6)
<i>Perceived barriers of sickle cell trait screening</i>			
Would knowing that you were at risk of having a child with SCD/SCT affect your marital plans?	236 (74.9)	39 (12.4)	40 (12.7)
Screening centers were rarely accessible, and the procedure was expensive	29 (9.2)	73 (23.2)	213 (67.6)
Fear of stigma when results turned out to be positive	127 (40.3)	68 (21.6)	120 (38.1)
Would it be hard to break up with your partner if both of you were found to be carriers?	100 (31.8)	78 (24.8)	137 (43.5)
Fear of being married if you knew you were a carrier	107 (34.0)	66 (21.0)	142 (45.5)

Values are n (%).

Agree represents agree and strongly agree responses, and disagree represents disagree and strongly disagree responses. SCT, sickle cell trait; SCD, sickle cell disease.

Table 3. Participants' attitude scores.

Variables	Frequency (n = 315)	%		
<i>Attitude towards sickle cell trait screening</i>				
Positive	231	73.3		
Negative	84	26.7		
<i>Total scores of participants' attitudes</i>				
Mean	SD	Minimum	Maximum	Median
23.32	5.84	8	35	24

SD, standard deviation.

Associations between sociodemographic characteristics and uptake of SCTS

More men were screened than women, but this difference was not significant. Generally, in all age categories, there was poor uptake of SCTS, where screening was highest among those aged 25+ years and less in those aged <25 years ($p < 0.001$). Among those who had SCTS and followed a religion, most were Christians and only a few were Muslims. The majority of the screened participants were studying medicine and surgery.

According to the year of study, years 4 and 5 had significantly higher numbers of those who were screened than the rest of the years ($p = 0.002$). Single participants were screened significantly more frequently than married participants ($p = 0.003$, Table 4).

Association between knowledge and attitude towards uptake of SCTS

Of the 315 respondents, 70.1% who were screened for SCT had a positive attitude and 29.9% had a negative attitude. The majority (74.4%) of respondents who were not screened for SCT had a positive attitude, while 25.6% had a negative attitude. Additionally, 96.1% of those who were screened had good knowledge, while only 3.9% had poor knowledge regarding SCD/SCT screening (Table 5).

Association between knowledge and attitude towards SCTS

The majority (73.2%) of the respondents who had good knowledge had a positive attitude towards SCTS, while only 26.8%

Table 4. Association between sociodemographic characteristics and uptake of SCTS by the participants.

Demographic characteristics	Uptake of SCTS (n = 315), n (%)		p value
	Screened	Never screened	
Sex			
Male	44 (57.1)	149 (62.6)	0.392
Female	33 (42.9)	89 (37.4)	
Age (years)			
18–24	18 (23.4)	162 (68.1)	<0.001
25–29	31 (40.3)	33 (13.9)	
30–35	28 (36.4)	43 (18.1)	
Religion			
Christian	70 (90.9)	222 (93.3)	0.487
Muslim	7 (9.1)	16 (6.7)	
Course of study			
Medicine and surgery	55 (71.4)	149 (62.6)	0.362
Nursing	13 (16.9)	55 (23.1)	
Anesthesia	9 (11.7)	34 (14.3)	
Year of study			
Year 1	14 (18.2)	53 (22.3)	0.002
Year 2	8 (10.4)	55 (23.1)	
Year 3	12 (15.6)	45 (18.9)	
Year 4	23 (29.9)	61 (25.6)	
Year 5	20 (26.0)	24 (10.1)	
Marital status			
Single	53 (68.8)	201 (84.5)	0.003
Married	24 (31.2)	37 (15.6)	

SCTS, sickle cell trait screening.

Table 5. Association between knowledge and attitude towards uptake of SCTS.

Variables	Uptake of SCTS (n = 315), n (%)		p value
	Screened	Never screened	
Attitude towards SCTS			
Positive	54 (23.4)	177 (76.6)	0.465
Negative	23 (27.4)	61 (72.6)	
Knowledge about SCD/SCTS			
Good	74 (25.1)	221 (74.9)	0.424
Poor	3 (15.0)	17 (85.0)	

SCTS, sickle cell trait screening; SCD, sickle cell disease.

had a negative attitude. Of the 20 respondents who had poor knowledge, 75% had a positive attitude and only 25% had a negative attitude ($p = 0.062$) (Table 6).

Multivariate analysis of factors associated with uptake of SCTS

Multivariate logistic regression showed that age, year of study and marital status were significantly associated with the uptake of SCTS ($p < 0.05$ at the 95% confidence interval). Respondents who were aged 25 to 29 years were 7.8 times more likely to get screened for SCT ($p < 0.001$, 95%

Table 6. Association between knowledge and attitude towards SCTS.

Variables	Attitude towards SCTS		p value
	Positive	Negative	
Knowledge about SCD/SCTS			
Adequate	216 (93.5)	15 (6.5)	0.862
Inadequate	79 (94.0)	5 (6.0)	

SCTS, sickle cell trait screening; SCD, sickle cell disease.

CI = 3.7–16.5), whereas those aged 30 to 35 years were 5.1 times more likely to get screened for SCT ($p < 0.001$, 95% CI = 2.1–12.6). Respondents in year 4 were 2.6 times more likely to get screened for SCT ($p < 0.05$, 95% CI = 1.0–6.6), while those in year 5 were 3.4 times more likely to get screened for SCT ($p < 0.05$, 95% CI = 1.2–9.3). Married participants were 1.3 times more likely to get screened for SCT ($p < 0.05$, 95% CI = 0.5–2.9) (Table 7).

Discussion

In this study, participants aged older than 25 years had a better screening uptake than those aged younger than 25 years. The reason for this may be because an age older than 25 years is the age where most students plan to be involved in stable marriage relationships and plan for future children. This situation could have encouraged them perform screening before planning to have children. Our results are similar to a previous report.¹⁹ Participants in years 4 and 5 had a higher uptake than those in lower years of study. This finding could be because fourth- and fifth-year students are junior and senior clerks with reasonable clinical knowledge about SCD. Our results are similar to those from a study in Nigeria.⁴ A married status was associated with SCTS, which could have been due to being influenced by genetic counselling during antenatal care.⁴

Table 7. Multivariate analysis of significant variables at the bivariate level for the uptake of sickle cell trait screening.

Variables	COR (95% CI)	AOR (95% CI)
Age (years)		
18–24	/	/
25–29	8.8 (4.4–17.6)***	7.8 (3.7–16.5)***
30–35	5.9 (3.0–11.7)***	5.1 (2.1–12.6)***
Year of study		
Year 2	/	/
Year 1	1.81 (0.7–4.7)	2.6 (0.9–7.1)
Year 3	1.83 (0.7–4.9)	2.3 (0.8–6.6)
Year 4	2.59 (1.1–6.3)*	2.6 (1.0–6.6)*
Year 5	5.73 (2.2–14.8)***	3.4 (1.2–9.3)*
Marital status		
Single	/	/
Married	2.53 (1.4–4.6)**	1.3 (0.5–2.9)*

COR, crude odds ratio; CI, confidence interval; AOR, adjusted odds ratio.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The uptake of SCTS services (24.4%) in this study was low. Possible reasons for this low uptake could be the negative attitude of these students towards screening, despite the finding that most of these students had good knowledge. This good knowledge was probably because they were taking classes in a medical school. The good attitude among the rest of the students could be why they took time to be screened. Our findings were similar to those in a study conducted in Jinja regarding SCT testing in which 24.7% of students were screened.¹⁸ However, the findings in our study are in contrast to those in a study performed in Ghana, which showed that 39.1% of students had screened for SCT, possibly because it was free and was a requirement for admission into their institution.²⁰ Therefore, if SCTS is made mandatory in every institution, there could be good uptake of screening.

The knowledge of students regarding SCD and SCTS was generally good in this study. This finding could be because these students were in a medical school where

they were taught in lectures and obtained experience about SCD from clinical practice. Similar findings were found in a study performed in married couples in Nigeria.²¹ However, our findings are in contrast to those in a study performed at Kampala International University, which showed that most of the students had poor knowledge.²² The reason for this discrepancy between studies could be a lack of exposure to testing among the students in the previous study.

Generally, the attitude of most respondents was positive towards SCTS, despite some students who had a negative attitude. The reason for this finding could be that these students had good knowledge about the disease and knew how important screening is for prevention, which might have influenced their positive attitude. Our findings are in agreement with a study performed in Jinja on SCT testing in which students had a positive attitude towards SCT testing as a way of preventing SCD, with an overall cumulative mean of 4.0394/5.¹⁸ However, our findings are in contrast to those in a study performed in Ghana regarding the awareness of sickle cell status.¹

A strength of this study is that our findings provide a powerful indicator to guide policy-making regarding SCTS, and it could serve as a benchmark for other studies. Limitations of this study include a reduced time of contact with the study participants because of the coronavirus disease 2019 pandemic. Additionally, there may have been selection bias where the findings may not be generalizable to the whole community of Busitema University because this study only included undergraduate students at the Faculty of Health Sciences.

On the basis of our findings, we recommend the following. 1) The government should create policies that promote SCTS among students and emphasize on the availability of these services for free,

which could probably increase its uptake among students. 2) Tertiary institutions should add sickle cell genotype screening as part of their admission criteria. 3) Other studies on the uptake, knowledge and attitudes of students towards SCT screening are recommended in other areas of Uganda and at institutions. Specifically, studies examining the knowledge and attitude of students towards SCTS should be performed, which may address the gaps related to poor uptake of these SCTS services.

Conclusion

The uptake level of SCTS services was low relative to the total number of participants who were recruited in this study. Therefore, SCTS should be encouraged in students who are yet to bear children as a prevention strategy.

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Author contributions

This work was collaboratively carried out among all of the authors. EK, YG and BJB conceived, designed and supervised the study, analyzed the data and wrote the first draft of manuscript. All authors read and approved the final version of the manuscript.

Availability of data and materials

Raw data can be obtained from the corresponding author upon reasonable request.

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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