

Sickle Cell Gene Transmission: Do Public Servants in Tamale, Ghana Have the Right Knowledge and Attitude to Curb It?

Evans Paul Kwame Ameade^{1*}, Baba Sulemana Mohammed¹, Gideon Kofi Helegbe¹, Sualisu Yakubu²

¹Department of Human Biology, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana

²Savelugu District Hospital, Savelugu, Ghana

Email: sokpesh@yahoo.com

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Abstract

Introduction: Sickle cell disease (SCD) is exerting enormous public health and economic burden on many countries. To reduce these effects, the World Health Organization is urging countries, especially those in Africa, to increase public awareness of this disease. This study assessed whether public servants in Tamale, Ghana possess adequate knowledge and positive attitude towards SCD. **Method:** A total of 320 public servants within the Tamale Metropolis were invited to complete a questionnaire in a cross-sectional study. Data were analyzed using GraphPad 5.01. Association between different variables was tested. **Results:** The media was the main source of information for a majority of the 94.2% of respondents who had ever heard of SCD. Knowledge of respondents on transmission and testing of SCD was above 70% but they recorded less than 40% in SCD's incurability, prevalence, effect of SCD on life span and pregnancy. The mean knowledge score of respondents was $(11.1 \pm 5.11)/22$ or 50.7%. Only about a quarter knew their sickling status or that of their spouses before marriage or first child. Although 78.0% of respondents would call off marriages if they became aware of genetic incompatibility, the overall mean attitude, $(2.857 \pm 1.97)/7.0$ or 40.8% was poor. There was a positive and significant correlation between the knowledge of respondents and their attitude towards SCD ($r = 0.494$, $p < 0.0001$) hence respondents working in the health sector and those with tertiary level education had better attitudes towards SCD. **Conclusion:** Public servants in Ghana have moderate knowledge of SCD but their attitude towards the disease was poor. Public servants least considered genetic incompatibility before entering conjugal relationships. This poor attitude means the campaign for the reduction of sickle cell gene transmission must be intensified. Governments need to increase their investment on educational campaigns aimed at changing attitude of persons through provision of more knowledge about SCD.

*Corresponding author.

Keywords

Sickle Cell Disease, Public Servants, Knowledge, Attitude, Tamale

1. Introduction

The human red blood cells are very important components of the human circulatory system necessary for the exchange of gases in the body and it is when these cells undergo structural changes leading to their malfunctioning that Sickle Cell Disease (SCD) may occur [1]. SCD is a hereditary condition of several different variants with the most common type being Haemoglobin S (Hb S) which is different from the normal haemoglobin usually designated as Hb A. In Hb S, glutamic acid, an amino acid situated at the sixth position of the beta globin chain in the normal haemoglobin molecule is substituted by valine [2]. Individuals with two Hb S genes suffer a chronic blood disorder referred to as Sickle Cell Anaemia [2] [3]. Persons who carry one normal gene and one Hb S gene are said to have the sickle cell trait (SCT) and referred to as carriers are usually asymptomatic and unaware of their genetic makeup [4]. Clinical manifestations in persons with SCD crises include arthralgia, anorexia, fatigue, splenomegaly as well as destructive and painful bone and joint problems [2]. The World Health Organization estimated that 5.2% of the world's population and more than 7% of pregnant women present variants of SCD of which 40% is the Hb S type [5]. Also, a screening of newborns in Ghana revealed that 1.9% of them had at least one Hb S gene [6]. Socioeconomic impact of SCD on affected persons, families, communities and nations is enormous since recurrent sickle cell crises adversely affects the patient's life, in relation to education, work and psychosocial development. For instance, the management of a sickle cell patient in a hospital in the Democratic Republic of Congo cost US \$1000, an amount way beyond the income of majority of Africans [5]. There is currently no cure for SCD hence experts have suggested various strategies to control this disease which include among others, prenatal diagnosis (PND), selective abortion, preconception/premarital genetic testing and counselling, education for SCT parents as well as a holistic management of persons with SCD [5] [6]. Although there are no figures on the comparative cost analysis on the management of SCD in Ghana, for developing countries, preconception genetic screening and counselling seems the cheapest option [6]. This suggestion is emphasized by the SCD strategy for the WHO African Region which seeks to increase individual and community awareness about SCD and strengthen primary prevention, reduce disease incidence, morbidity and mortality and improve quality of life [5]. For persons to readily opt to undergo genetic screening and counseling, they must in the first place possess good knowledge of SCD and its effects which will enable them appreciate the full consequences of having children who may suffer SCD [7]. It is reported that about 30% or 5 million out of the total of about 25 million Ghanaians carry the Sickle Cell Trait [8] [9]. This is a significant number who must be provided with enough information to make the most desirable choices in relation to conception and marriage, so as to reduce future transmission and hence incidence of SCD. Although some studies have been conducted in several countries that measured the awareness and knowledge on SCD among sections of their population, there is no literature on such a study in Ghana. This study therefore assessed the knowledge level and attitude towards SCD among married public servants in Tamale, a city in northern Ghana.

2. Method

2.1. Study Design and Setting

The study setting was Tamale, the Northern regional capital which is the fourth largest city in Ghana with a population of 371,351 [10]. Married public servants who were twenty years or older were invited to partake in a cross-sectional survey between March and July, 2012. The study was modelled on the theory of planned behaviour which suggests that the likelihood of behavioural change is dependent on the amount of control persons have over both a given behavior and their determination to change it [11]. There was no available data on the number of public servants in Tamale metropolis so; a purposive sampling of 320 participants was undertaken among public servants mainly working in education, health, security, finance institutions where majority of public servants are employed. Public servants were the focus of this study since they are considered the most edu-

cated class in Ghana hence results from this study would provide an insight into the knowledge and attitude level one would expect among the general populace with regards to SCD.

2.2. Study Variable Determination and Measurements

The questionnaire made up of four sections provided information about the respondents' socio-demographic characteristics, knowledge level, and attitude towards SCD. A 5-point Likert scale also assessed their knowledge of the disease. Although there was no validation of the questionnaire, there was a pre-test involving 20 respondents which ensured ambiguities are avoided in the final questionnaire. Respondents involved in the pretesting were excluded when the revised and final questionnaires were administered. After the appropriate permissions were obtained from the heads of institutions, qualified respondents who were present at their work places at the time of visit of the field researcher were invited to partake in the completion of the questionnaire. Before administering the questionnaire, verbal informed consent was obtained, and confidentiality assured. Respondents who were unable to complete their questionnaire on the same day were reminded during subsequent visits by the field researcher leading to the retrieval of completed questionnaires. Fourteen (14) questions assessed the knowledge of respondents about SCD. Seven of the questions were closed ended questions requiring choosing between "Yes" or "No" or choosing from listed options. In addition to these closed ended questions were seven 5-point Likert scale questions ranging from strongly agrees, agrees, don't know, disagrees and strongly disagrees. For the "yes" or "no" questions, a correct answer scores 1 while a respondent choosing hereditary as the mode of transmission of SCD also scores 1. Ticking of one, two or three of the listed signs and symptoms of joint pains, fever and fatigue as signs and symptoms of SCD crises scores 0.5, 1 and 2 respectively. For the 5-point Likert scale questions, if the answer is in the affirmative, strongly agrees scores 2 while agrees goes for 1 point. Strongly disagree, disagree or don't know scores 0. If the correct answer is negative, strongly disagrees scores 2 whilst disagree scores 1 with the others making no score. The maximum score for knowledge assessment is 22. Seven closed ended questions of "yes" or "no" assessed the attitude of respondents towards SCD with a correct attitude of a "yes" or "no" scoring 1 while the opposite scores nil. The maximum attitude assessment score is 7.

Knowledge was categorized as poor when scores were below 11.0 or 50%, moderate for scores between 11.0 and 17.6 (50% to 80%) while above 17.6 or 80% were considered excellent. For attitude, scores less than 3.5 or 50% were considered negative or poor while above 3.5 or 50% were good or positive.

2.3. Ethical Consideration

Prior approval for this study was obtained from the Ethics Committee of the School of Medicine and Health Sciences of the University for Development Studies.

2.4. Statistical Analysis

Data were entered into Microsoft Excel, and analyzed using GraphPad Prism, Version 5.01 (GraphPad Software Inc., San Diego CA). Independent t-test and one-way ANOVA were used to test for any significant associations, assuming statistical significance at $p < 0.05$ and a confidence interval of 95%.

3. Results

3.1. Socio-Demographic Profile of Respondents

Out of the 320 questionnaires administered, 295 were retrieved and considered complete for this study which therefore gave a response rate of 92.2%. The socio-demographic characteristics of respondents are shown in **Table 1**. Majority of respondents were females, 153 (51.9%), had tertiary level education, 209 (70.8%) and were followers of the Islamic religion, 178 (60.3%). Also, most respondents worked in education related institutions, 94 (31.9%); were between the ages of 30 and 39 years, 116 (39.3%); had been married for at most 4 years, 138 (46.8%) and had one child, 85 (28.8%).

3.2. Respondents' Knowledge about SCD

The mean knowledge score of the respondents was 11.1 ± 5.11 over 22% or 50.7%. Results of statements that

Table 1. Socio-demographic characteristics of public servants.

Variable	Subgroups	Number of respondents	Percentages
Age (years)	20 - 29	89	30.2
	30 - 39	116	39.3
	40 - 49	63	21.4
	50 - 59	22	7.5
	60 and above	5	1.7
Gender	Male	141	47.8
	Female	153	51.9
Religious affiliation	Christianity	117	39.7
	Islam	178	60.3
Duration of marriage (years)*	0 - 4	138	46.8
	5 - 9	59	20.0
	10 - 14	45	15.3
	15 - 19	14	4.7
	≥20	36	12.2
Sector	Health	80	27.1
	Education	94	31.9
	Financial	46	15.6
	Security	45	15.3
	Others	30	10.2
Highest level of education	Nil	4	1.4
	Basic	19	6.4
	Secondary	63	21.4
	Tertiary	209	70.8
Number of children*	0	51	17.3
	1	85	28.8
	2	74	25.1
	3	48	16.3
	4 or more	35	11.9
Initial source (s) of information on SCD**	School	86	29.2
	Friends	47	15.9
	Media	135	45.8
How respondents got to know their sickling status n = 125***	Health workers	111	37.6
	Request from health worker	65	52.0
	Mandatory screening	6	4.8
	Screening prior to blood transfusion	27	21.6
	Voluntary request	27	21.6

*Some percentages do not add to 100% because of missing responses. **For sources of information on SCD, some respondents selected more than one source. The percentage for each was based on n = 295. ***These respondents only knew their sickling status after first child or marriage (n = 125).

assessed respondents' knowledge on SCD were shown in **Table 2**. Majority of respondents (94.2%) had ever heard of SCD before, with the media composed of television, newspapers, radio and the internet being their initial

Table 2. Knowledge scores of respondents about Sickle Cell disease.

Statement	Variable (Assigned score)	Number of respondents	Correct knowledge score	Percentage
Ever heard of SCD?	Yes (1)	278	0.942	94.2
	No	17		
Know how a person gets SCD?	Yes (1)	231	0.778	77.8
	No	64		
How is SCD transmitted	Hereditry (1)	220	0.746	74.6
	Others (Environment, etc)	11		
Are there different types of SCD	Yes (1)	119	0.403	40.3
	No	25		
	Don't know	151		
Know signs and symptoms of SCD crises	Yes (1)	206	0.698	69.8
	No	89		
Three (3) symptoms of SCD crises	Joint pains or fatigue or fever (0.5)	65	0.924	46.2
	Joint pains and fatigue or joint pains and fever or fever and fatigue (1)	42		
	Joint pains, fatigue and fever (2)	99		
Test for confirmation of SCD	Blood test (1)	222	0.753	75.3
	Others (urine test, impossible, don't know)	73		
Children likely to be SC carriers or suffers if both parents are carriers or sufferers of SCD	Strongly agree (2)	163	1.403	70.2
	Agree (1)	88		
	Don't know, disagree and strongly disagree	44		
SCD is most common in Africa and among blacks	Strongly agree (2)	35	0.525	26.3
	Agree (1)	85		
	Don't know, disagree and strongly disagree	175		
SCD can be cured	Strongly agree, agree and don't know	147	0.756	37.8
	Disagree (1)	73		
	Strongly disagree (2)	75		
Comparatively, persons with SCD die younger	Strongly agree (2)	42	0.556	27.8
	Agree (1)	80		
	Don't know, disagree and strongly disagree	173		
Comparatively, SCD sufferers do not cope well with life	Strongly agree (2)	29	0.627	31.4
	Agree (1)	127		
	Don't know, disagree and strongly disagree	139		
Pregnant SCD sufferers are prone to preterm or low birth weight babies	Strongly agree (2)	45	0.753	37.6
	Agree (1)	132		
	Don't know, disagree and strongly disagree	118		
SCD in population be reduced if SCT or SCD persons are prevented from marrying	Strongly agree (2)	151	1.22	61.0
	Agree (1)	75		
	Don't know, disagree and strongly disagree	69		
Total knowledge score (22)			11.1	50.7

source of information as indicated in **Table 1**. Also, the knowledge scores of respondents in relation to SCD being an inherited condition and its diagnosis confirmed with a blood test were 74.6% and 75.3% respectively. Respondents scored below 50% for questions on the incurability of SCD (37.8%), presence of variants of SCD (40.3%), high prevalence of SCD among persons of African descent (26.3%), decrease in life span of sufferers compared to the non-sickling population (27.8%) and increased chances of preterm or low birth weight babies in pregnant women with SCD (37.6%). The score for believing that SCD in the population can be reduced if SCT or SCD persons are prevented from marrying was 61.0%

3.3. Attitude of Respondents towards SCD

Table 3 showed the attitude of the respondents towards SCD. Minority of respondents, 12.2% had premarital counseling on SCD before marriage. Less than a third knew their own sickling status, (27.1%) or that of their spouses, (24.4%) before marriage or their first child. A higher percentage of 38.1% however knew their children's sickling status. Majority of respondents, 78.0% would have abandoned marriage intentions if premarital screening had shown that they and their current spouses had sickle cell traits. For persons ($n = 54$) who would still have proceeded with marriage despite knowledge of genetic incompatibility, their reasons include; love, 21 (38.9%); not all children would have SCD, 9 (16.7%); will seek treatment, 5 (9.3%), God will be in control of the situation, 3 (5.6%), will adopt a child, 2 (3.7%) and others, 11 (20.4%). The overall mean attitude score of respondents towards SCD was 2.857 ± 1.97 or 40.8%.

3.4. Relationship between Socio-Demographic Characteristics of Respondents and Their Knowledge and Attitude Scores

Relationship between the socio-demographic characteristics of respondents and their level of knowledge of SCD and attitude towards SCD is shown in **Table 4**. Stratifying respondents according to sex using a student's t-test, has shown that females possessed statistically significant higher knowledge (11.75 vs 10.5; $p = 0.037$) than the males. Again, the females exhibited a better attitude towards SCD than the males although the difference was not significant (3.06 vs 2.64; $p = 0.068$). Christians scored better for knowledge (11.62 vs 10.83; $p = 0.2$) and attitude (2.94 vs 2.8; $p = 0.561$) than followers of Islam but the differences were not significant. One way

Table 3. Attitude score of respondents towards Sickle Cell Disease.

Statement	Variable (Assigned score)	Number of respondents	Positive attitude score	Percentage
Ever involved in premarital counselling on SCD	Yes (1)	36	0.122	12.2
	No	259		
Did you or your partner know your sickling status before marriage or first child?	Yes (1)	80	0.271	27.1
	No	215		
Do you currently know your sickling status	Yes (1)	185	0.627	62.7
	No	110		
Do you currently know your spouses' sickling status	Yes (1)	147	0.498	49.8
	No	148		
When did you get to know your spouse sickling status	Before marriage (1)	72	0.244	24.4
	After marriage	75		
	Not yet known	148		
Will you marry spouse if both of you have SCT	Yes	65	0.78	78.0
	No (1)	230		
Do you know your children's status ($n = 244$)	Yes (1)	93	0.381	38.1
	No	151		
Mean attitude score (7)			2.857	40.8

Table 4. Relationship between demographic characteristics of respondents and their knowledge and attitude scores.

Variable	Socio-demographic characteristics	Knowledge scores	p-values	Attitude scores	p-value
Age (years)	20 - 29	11.62	0.099	3.21	0.211
	30 - 39	11.09		2.83	
	40 - 49	9.87		2.48	
	50 - 59	12.52		2.82	
	60 and above	13.90		2.20	
Gender	Male	10.50	0.037*	2.64	0.068
	Female	11.75		3.06	
Religious affiliation	Christianity	11.62	0.2	2.94	0.561
	Islam	10.83		2.8	
Duration of marriage (years)	0 - 4	11.59	0.06	3.1	0.256
	5 - 9	10.63		2.95	
	10 - 14	9.88		2.49	
	15 - 19	9.54		2.64	
	≥20	12.68		2.47	
Sector	Health	14.82	<0.0001*	4.40	<0.0001*
	Education	10.15		2.52	
	Financial	10.40		2.50	
	Security	9.49		2.07	
	Others	8.08		2.07	
Highest level of education	Nil	7.13	0.007*	2.00	0.011*
	Basic school	9.08		2.26	
	Secondary/High school	9.96		2.29	
	Tertiary	11.77		3.10	
Number of children	0	12.04	0.557	2.56	0.022*
	1	11.28		3.41	
	2	11.23		2.91	
	3	10.27		2.46	
	4 or more	11.03		2.46	

*Statistically significant.

ANOVA analysis did not show any significant difference between the knowledge of SCD among the various age brackets although respondents 60 years and above had better knowledge (13.90 vs 9.87 - 12.52; $p = 0.099$) than their younger colleagues. Respondents 60 years and above however exhibited poorer attitude when compared with the younger ones (2.2 vs 2.48 - 3.21; $p = 0.211$). Increasing duration of marriage ($p = 0.06$) and number of children ($p = 0.557$) did not significantly influence the knowledge of respondents on SCD. Meanwhile, respondents with fewer number of children, ($p = 0.022$) exhibited a statistically significant better attitude towards SCD than those with a lot more children but no significant difference in attitude ($p = 0.256$) with respect to the duration of marriage of respondents. Higher academic qualification significantly influenced the knowledge and attitude of respondents with persons possessing tertiary level education obtaining higher knowledge (11.77 vs 7.13 - 9.96; $p < 0.007$) and attitude scores (3.1 vs 2.0 - 2.29; $p < 0.011$) than those with no or lower academic qualifications. Also respondents working in health institutions exhibited better knowledge

(14.82 vrs 8.08 - 10.15; $p < 0.0001$) and attitude (4.4 vrs 2.07 - 2.52; $p < 0.0001$) than those working in education, security, financial and other institutions with these differences being statistically significant.

3.5. Correlation between Knowledge and Attitude of Respondents

Correlation analysis between knowledge and attitude of respondents towards SCD recorded a positive correlation coefficient between them which was also statistically significant ($r = 0.494$; $p < 0.0001$).

4. Discussion

Sickle cell disease causes serious emotional, psychosocial, and economic problems for sufferers and their parents or caregivers [3] [12] [13]. The results of this study showed that majority of respondents have heard of SCD mainly through the mass media but health workers and family were the first source of information on SCD in the Middle East countries of Oman and Saudi Arabia [14] [15]. Cultural differences may account for this difference. Ghana, being a secular country permits free discussion of issues of sexuality in the mass media unlike in Islamic states of Saudi Arabia and Oman. The moderate overall knowledge score of 50.7% is higher than those recorded among Nigerian local government workers in Ile Ife and youth corps in Lagos [16] [17]. Other studies in the UK and Nigeria recorded higher knowledge level between 75% - 86% [7] [18] [19]. Gender, level of education and type of working institution were the socio-demographic factors that significantly influence knowledge of respondents. The effects of gender on knowledge of SCD could be attributed to the fact that females while attending antenatal clinics during pregnancy were tested and educated on SCD. For respondents working in health related institutions to possess better knowledge on SCD is understandable since they may have acquired this knowledge at school or in their working environment. A study in Saudi Arabia reported health science female university students possessed higher knowledge on SCD than their non-science counterparts [15].

This study recorded only 12.2% of respondents undergoing premarital screening and counseling on SCD and also just about a third of respondents knew their own sickling status or that of their spouses before marriage or first child. Again less than half of respondents knew their own status or that of their children at the time of the study. Even for those who later knew their status after marriage, only 21.6% was by voluntary request. The overall attitude of respondents towards SCD of 40.8% is rather poor. Similar poor attitudes towards SCD were reported in Oman, US and Nigeria [12] [14] [20]. Age, gender, religious affiliation just as reported in other countries did not influence a person's attitude towards SCD [16] [21] [22]. Several reasons could be responsible for the poor attitude of respondents in this study despite their moderate knowledge level. Critical knowledge areas that may change the behaviour of the respondents such as the epidemiology, incurability, adverse effect of disease on life expectancy of SCD sufferers were knowledge areas respondents were most deficient in. This study therefore showed that prospective Ghanaian couples are negligent and do not consider the consequences of having children with blood disorder. Just as was reported in Oman and Nigeria, factors such as love, beauty, ethnicity, parental influence, and socioeconomic status rather greatly influence the choice of partners, relegating issues of genetic incompatibility to the background [18] [21] [22].

Possessing knowledge about a disease is said to influence behaviour adaptation if it is paired with the belief that a behaviour change will positively contribute to good health [23]. The positive correlation between knowledge and attitude in this study was clearly demonstrated in respondents from the health sector and those with tertiary education possessing better attitude towards SCD. Therefore, provision of more information on SCD through the media, empowering religious leaders with appropriate knowledge to influence their followers' marriage decisions in relation to SCD, training of health workers and provision of accessible testing and counseling centres; strategies recommended by the WHO if adopted by countries will reduce the incidence of SCD among the population. For some respondents to decide to continue with relationships even when genetic incompatibility is detected due to love emotions means, public education alone would not lead to the drastic reduction of this disease but some compulsory and fee free premarital counseling and screening must be pursued by all nations especially those in Africa since mandatory Pre-marital counselling and screening programme have reduced the incidence of SCD in several countries [14]. Although 75.6% of respondents just as reported in Saudi Arabia strongly agreed or agreed to the suggestion of not allowing two SCD or SCT persons to marry to reduce SCD prevalence, genetic testing and separation of prospective couples due to genetic incompatibility can be emotionally stressful [15] [24]. To reduce this stress of separating persons who may have dated for years and close to marriage, intense education and testing should be directed towards early adolescent stages before individuals

begin conjugal relationships. Compulsory presentation of certificate of genotype compatibility before marriages at our law courts, churches, mosques, marriage registries or anywhere marriages can be contracted would also support the drive towards the reduction in SCD cases.

This study had some limitations. The use of closed questions requiring respondents to choose among the options did not permit them to explain their answers hence the introduction of some bias. This study involved the use of self-administered questionnaire rather than interviews hence reliability of answers could not be verified. This study was conducted among only public servants in Tamale; hence the result might not represent the knowledge and attitude towards SCD among the Ghanaian population.

5. Conclusion

This study showed that although public servants had moderate knowledge about Sickle Cell disease, their overall attitude towards the disease was poor. Majority of respondents did not know their personal or spousal premarital sickling status with half of them still unaware of spouses' status after marriage. A positive correlation exists between the knowledge and attitude; hence persons working in the health sector and with tertiary education who exhibited better knowledge of SCD had a more positive attitude towards it. Since the media was the most common source of information on SCD, its role in the effort to reduce the incidence of SCD and its attendant morbidity and mortality across the world and especially Africa is crucial.

Competing Interest

Authors have no conflict of interests, and the work was not supported or funded by any person or organization.

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