World Journal of Advanced Pharmaceutical and Medical Research

Journal homepage: https://zealjournals.com/wjapmr/

ISSN: 2799-0656 (Online)

(RESEARCH ARTICLE)

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Pattern of time of discovery of personal and partner genotype among predominantly reproductive age parents of children with sickle cell disease in Enugu, South East Nigeria

Sunday Gabriel Mba *

Department of Obstetrics and Gynaecology, Enugu State University of Science and Technology (ESUT) Teaching Hospital/ESUT College of Medicine Parklane Enugu, Nigeria.

World Journal of Advanced Pharmaceutical and Medical Research, 2026, 10(02), 001-010

Publication history: Received on 28 January 2026; revised on 23 March 2026; accepted on 26 March 2026

Article DOI: https://doi.org/10.53346/wjapmr.2026.10.2.0012

Abstract

Background: Sickle cell disease is associated with lots of morbidity and mortality. To guide efforts towards prevention of new cases of SCD, this study assessed pattern of time of discovery of personal and partner genotype and their determinants among parents of children with SCD in Enugu, Nigeria

Objective: To determine the pattern of time of discovery of personal and partner genotype and their determinants among predominantly reproductive age parents of children with sickle cell disease in Enugu, Nigeria

Materials and Methods: Seventy-two biological parents of children with SCD were interviewed with semi-structured questionnaire following consent at Paediatric Haematology outpatient clinic of ESUT Teaching hospital Parklane, Enugu. Convenient sampling method was used. Data obtained was entered into SPSS version 26 and later exported to SPSS version 27 with which it was analyzed.

Results: Of the 72 respondents assessed, 67(93.1%) were aware that their genotype was AS while 63% of the respondents were aware that the genotype of their partners was AS. Majority of them discovered their personal genotype 34(50.7%) and partner genotype 32(50.8%) after marriage following the diagnosis of SCD on their sick child.

Conclusion: Majority of the respondents were aware of personal and partner's genotype but their discovery was more after marriage following the diagnosis of SCD on their sick child. To prevent new cases of SCD concerted effort must be made to encourage the citizens to do pre-marriage genotype test and to insist on genotype compatibility that rules out the possibility of giving birth to children with SCD.

Keywords: Sickle cell disease; Pattern of discovery of genotype; Determinants; Prevention of SCD

1. Introduction

Sickle cell disease (SCD) is a preventable but irreversible non communicable, genetically transmitted autosomal recessive blood disorder of significant public health importance in many parts of the world including but not limited to South America, the Caribbean, Central America, Saudi Arabia, India, Mediterranean, and especially in Sub Saharan Africa [1]. Worldwide, it is estimated that nearly 100 million people are affected by sickle cell disease and over 300, 000 babies are borne annually with SCD with Sub-Saharan Africa contributing over 70% of these newborns with SCD [1,2]. Regrettably, report has shown that 50 -90% of these babies born with SCD in Sub-Saharan Africa die before their fifth birthday [3]. SCD has also been reported to account for 20% of neonatal mortality and 5% of under-five mortality in

* Corresponding author: Kartik Sharma

African continent [4,5]. Also, among women of reproductive age living with SCD in Sub-Saharan Africa, it has been reported to contribute to several obstetric complications and high maternal mortality [6,7].

Currently, report suggest Nigeria is the country with the highest burden of SCD globally [8] with 2-3% of the population affected [1] and with sickle cell trait prevalence of 24% [2]. Nigeria has also been reported to account for up to 50% of global new cases of SCD [9-11] and annual infant mortality of 100,000 from sickle cell disease representing 8% of infant mortality in the country [2].

In the light of the above, there is the need to increase effort towards prevention of new cases of this disease that is associated with so much morbidity and mortality. Since the disease is genetically transmitted from carrier parents to offsprings, one very good approach towards prevention of new cases of SCD is to try as much as possible to prevent individuals with sickle cell trait from coming together to reproduce. This is only possible if the members of the society are made to embrace the practice of pre-marriage testing for sickle cell genotype and insisting on sickle cell genotype compatibility that rules out the possibility of giving birth to children with SCD. This will definitely require a lot of evidence-based counselling and education of members of the society as well as policies by government, religious and other non-governmental organizations that are directed towards promoting the determinants of pre-marriage discovery of both personal and partner's genotype. These interventions will be required to move away from the current trend where a reasonable number of parents only get to know their own sickle cell genotype when their sick child is diagnosed with SCD [12]. Ezenwosu and colleagues interviewed 155 parents of children with sickle cell disease with a focus on the knowledge and awareness of personal sickle cell genotype among these parents of children with sickle cell disease in southeast Nigeria. Among other things, they found out that up to 45% of the parents of children with SCD interviewed discovered their own sickle cell genotype following the birth of a child with sickle cell disease [12]. The desired change is consistent pre-marriage testing for sickle cell genotype and avoidance of marriage between individuals with sickle cell trait. With these in view, there is need for more research into the pattern of time of discovery of sickle cell genotype and the determinants of the time of discovery. This will help policy makers with information needed to formulate policies that will drive the desired change.

It is against this background that this study assessed the pattern of time of discovery of personal and partner sickle cell genotype and their determinants among predominantly reproductive age parents of children with sickle cell disease in Enugu, Nigeria. It is hoped that the outcome of this study will guide efforts towards reduction of new cases of SCD in the right direction.

2. Materials and Methods:

The data for this study was extracted form a bigger body of data collected for a study on the alternative reproduction options for reducing the risk for having children with sickle cell disease among parents of children with sickle cell disease that accessed care at Paediatric Haematology Outpatient Clinic of ESUT Teaching Hospital, Parklane Enugu during the study period. The study was a cross-sectional study and spanned from September 2022 to July 2024. ESUT Teaching hospital is located in the center of Enugu metropolis. It serves as a referral center for most states in the South East Nigeria. The department of Paediatrics is one of the four major departments of the hospital and Paediatric haematology clinic is one of the outpatient clinics in the department of Paediatrics. The Paediatric haematology clinic takes care of patients up to 18years of age and runs from 8:00 a.m. to 4:00 p.m. every Monday. The clinic is managed by a consultant paediatric haematologist, resident doctors, nurses, and other allied health workers. Haematology outpatient clinic is a fairly busy clinic; other paediatric cases other than haematology cases are also managed in the clinic.

The target population for this study was biological parents of sickle cell disease children who received care at the outpatient clinic over the study period. Specifically, only biological parents of sickle cell disease children who were married at the time of the study or had been married before the time of the study were included in this particular study. Convenient sampling method was used to select study participants. Written informed consent was obtained from all the respondents and they were reassured of the confidentiality of the information provided. Data was obtained using an interviewer-administered semi-structured questionnaire after obtaining consent. The data relevant to this study which was extracted from the main body of data included sociodemographic variables of the respondents, awareness of both personal and partner sickle cell genotype as well as the time of discovery of both personal and partner sickle cell genotype. The questionnaire was pretested and all ambiguity removed. Ethical clearance for the study was obtained from the ethics committee of ESUT Teaching Hospital Parklane, Enugu.

Data collected were entered into SPSS version 26 and later exported to SPSS version 27 with which it was analyzed. Data cleaning was performed to ensure completeness and accuracy prior to analysis. Categorical variables, including

awareness of genotype, pattern of genotype and time of discovery of genotype were summarized using frequencies and percentages.

Test for associations between categorical variables such as time of discovery of personal as well as partner's sickle cell genotype and respondents' characteristics were examined using Fisher's exact test with statistical significance set at p <0.5.

3. Results

Seventy-two respondents were assessed. The mean age of the respondents was 39.8 ± 8.6 years, with ages ranging from 25 to 63 years. Majority of the respondents were between the ages of 30 -50 years. Also, majority of the respondents were females 64(88.9%), urban dwellers 61(84.7%) and of the Igbo tribe 71(98.6%). All the respondents were Christians with majority of them belonging to the Catholic denomination 45(62.5%). The rest of the sociodemographic characteristics of the respondents were as outlined on Table 1 below.

Table 1 Socio-demographic characteristics of the respondents

Respondents' characteristics	**Variables**	**Frequency (n=72)**	**Percentage (%)**
Age	20 - < 30 years	8	11.1
	30 - < 40 years	26	36.1
	40 - < 50 years	30	41.7
	50 years and above	8	11.1
Sex	Male	8	11.1
	Female	64	88.9
Residence	Rural	11	15.3
	Urban	61	84.7
Tribe	Igbo	71	98.6
	Others	1	1.4
Christian denominations	Catholics	45	62.5
	Anglicans	7	9.7
	Pentecostals	18	25
	Others	2	2.8
Educational status	Primary education	6	8.3
	Secondary education	36	50
	Tertiary education	26	36.1
	Postgraduate education	4	5.6
Employment status	Unemployed	7	9.7
	Trader	38	52.8
	Artisan	8	11.1
	Civil servants	14	19.4
	Professionals	1	1.4
	Others	4	5.6
Marital status	Married	64	88.9
	Separated	2	2.8

	Widow	6	8.3
Duration of marriage	Less than 5 years	7	9.7
	5 years - < 10 years	19	26.4
	10years - < 15 years	19	26.4
	15 years - < 20years	13	8.1
	20 years and above	14	19.4
Number of children	≤2	23	31.9
	≥3	49	68.1

Table 2 Impact of SCD on respondent families

Respondents' characteristics	Variable	Frequency (n=72)	Percentage (%)
Number of children with SCD	< 2	59	81.6
	≥ 2	13	18.1
Child died of SCD	Yes	17	23.6
	No	55	76.4

As shown on table 2 above, majority of the respondents 59(81.9%) had only one child affected by SCD while up to 13(18.1%) had at least 2 children with SCD. Also, as many as 17 respondents had lost at least a child to SCD

Table 3 Awareness, pattern and time of discovery of respondents' personal genotype

Respondents' Characteristics	Variable	Frequency	Percentage
Aware of personal genotype (n=72)	Yes	67	93.1
	No	5	6.9
Pattern of respondents' Genotype (n=67)	AS	67	100
Time of discovery of personal genotype of the respondents (n=67)	Before marriage	21	31.3
	After marriage and before first pregnancy	2	3
	When I/my wife was pregnant with our first child	7	10.4
	After my child was diagnosed with SCD	34	50.7
	Others	3	4.5
Respondents whose pre-marriage genotype test result came out as AA but repeat test after child was diagnosed with SCD showed AS. (n=67)	Yes	15	22.4
	No	52	77.6

As shown on table 3 above as many as 93.1% of the respondents were aware of their genotype with majority of those who were aware (50.7%) discovering their genotype after their child was diagnosed with SCD. All those who were aware

reported their genotype to be AS. About 22.4% of the respondents who were aware of their personal genotypes reported that they had a pre-marriage genotype test which came out as AA only for a repeat test after their child was diagnosed with SCD to show they were AS.

Table 4 Awareness, pattern and time of discovery of respondents' partner genotype

Respondent's characteristics	Variable	Frequency	Percentage
Aware of partner's genotype (n=72)	Yes	63	87.5
	No	9	12.5
Pattern of respondents' Partner genotype (n=63)	AS	63	100
Time of discovery of partner's genotype by the respondents (n=63)	Before marriage	21	33.3
	After marriage and before first pregnancy	1	1.6
	When I/my wife was pregnant with our first child	7	11.1
	After my child was diagnosed with SCD	32	50.8
	Others	2	3.2
Respondents whose partner's pre-marriage genotype test result came out as AA but repeat test after child was diagnosed with SCD showed AS. (n=63)	Yes	4	6.3
	No	59	93.7

As shown on table 4 above, 87.5% of the respondents were aware of their partners genotype with majority of those who were aware (50.8%) discovering their partner's genotype after their child was diagnosed with SCD. Also, all those who were aware reported their partners genotype to be AS. About 6.3% of the respondents who were aware of their partner's genotype reported that their partners had a pre-marriage genotype test which came out as AA only for a repeat test after their child was diagnosed with SCD to show that their partners were AS.

The time of discovery of the respondents' personal and partner genotype was also assessed from the perspective of whether it was before or after marriage and the outcome were as shown below:

Table 5 Proportion of respondents that discovered their genotype before and after marriage

Time of Discovery	Frequency (n = 67)	Percentage (100%)
Before Marriage	21	31.3
After Marriage	46	68.7

As shown in table 5 above majority of the respondents who knew their genotype discovered their genotype after marriage.

Table 6 Factors associated with respondents' time of discovery of personal genotype

Respondents' characteristics	variable	Before marriage		After marriage		p-value
		Frequency (n=21)	Percentage (%)	Frequency (n=46)	Percentage (%)	

Age	20 - < 30 years	0	0	7	10.4	0.095
	30 - < 40 years	5	7.5	17	25.4	
	40 - < 50 years	13	19.4	17	25.4	
	50 years and above	3	4.5	5	7.5	
Sex	Male	0	0	8	11.9	0.049*
	Female	21	31.3	38	56.7	
Residence	Rural	1	1.5	8	11.9	0.254
	Urban	20	29.5	38	56.7	
Tribe	Igbo	21	31.3	45	67.2	1.000
	Others	0	0	1	1.5	
Christian denomination	Catholics	14	20.9	29	43.3	0.330
	Anglicans	0	0	6	9	
	Pentecostals	6	9	10	14.9	
	Others	1	1.5	1	1.5	
Educational status	Primary education	3	4.5	3	4.5	0.426
	Secondary education	9	13.4	23	34.3	
	Tertiary education	9	13.4	16	23.9	
	Postgraduate education	0	0	4	6	
Employment status	Unemployed	1	1.5	6	9	0.538
	Trader	10	14.9	26	38.8	
	Artisan	3	4.5	5	7.5	
	Civil servants	5	7.5	7	10.4	
	Professionals	1	1.5	0	0	
	Others	1	1.5	2	3	

Of all the sociodemographic characteristics, only sex showed statistically significant association with time of discovery of personal genotype (p = 0.049). All respondents who discovered their genotype before marriage were female, suggesting that women were more likely than men to know their genotype prior to marriage.

Table 7 Proportion of respondents that discovered their partner's genotype before and after marriage

Time of Discovery	Frequency (n=63)	Percentage (100%)
Before Marriage	21	33.3
After Marriage	42	66.7

Again majority (66.7%) of the respondents discovered their partner's genotype after marriage.

Table 8 Factors associated with respondents' time of discovery of partner's genotype

Respondents' characteristics	variable	Before marriage		After marriage		p-value
		Frequency (n=21)	Percentage (%)	Frequency (n=42)	Percentage (%)	
Age	20 - < 30 years	2	3.2	4	6.3	0.583
	30 - < 40 years	9	14.3	12	19.0	
	40 - < 50 years	7	11.1	21	33.3	
	50 years and above	3	4.8	5	7.9	
Sex	Male	3	4.8	5	7.9	1.000
	Female	18	28.6	37	58.7	
Residence	Rural	3	4.8	6	9.5	1.000
	Urban	18	28.6	36	57.7	
Tribe	Igbo	21	33.3	41	65.1	1.000
	Others	0	0	1	1.6	
Christian denomination	Catholics	11	17.5	29	46	0.008*
	Anglicans	5	7.9	0	0	
	Pentecostals	5	7.9	11	17.5	
	Others	0	0	2	3.2	
Educational status	Primary education	2	3.2	4	6.3	0.032*
	Secondary education	5	7.9	24	38.1	
	Tertiary education	11	17.5	13	20.6	
	Postgraduate education	3	4.8	1	1.6	
Employment status	Unemployed	2	3.2	3	4.8	0.643
	Trader	9	14.3	26	41.3	
	Artisan	4	6.3	4	6.3	
	Civil servants	5	7.9	6	9.5	
	Professionals	0	0	1	1.6	
	Others	1	1.6	2	3.2	

Of all the respondents' characteristics only Christian denomination and educational status showed statistically significant association with respondents' time of discovery of their partner's genotype.

4. Discussion

Sickle cell disease is associated with lots of morbidity and mortality across all age groups but more among children and pregnant women living with the disease. It imposes high economic burden on both the affected individuals and their care givers [13]. SCD also places enormous financial and emotional burden on the caregivers and families of affected individuals often negatively impacting on their quality of life [14,15]. Though bone marrow transplantation holds a

promise of potential cure for SCD high costs and procedural complexities remains a barrier [16]. As such, any effort geared towards preventing the introduction of new cases of SCD into the population is definitely a step in the right direction. It was against this background that this study assessed pattern of time of discovery of personal and partner genotype and their determinants among predominantly reproductive age parents of children with sickle cell disease in Enugu, Nigeria with the aim of generating more evidence to guide efforts towards prevention of new cases of SCD.

The mean age of the respondents (39.8 ±8.6 years) as found in this study is similar to that reported by Ezenwosu and colleagues (39.2 years) [12]. The similarity may have resulted from the fact that the target population in both studies was parents of children with sickle cell disease. Majority of the respondents were females and this is also similar to the report by Ezenwosu and colleagues [12]. This is in keeping with role expectations of parents in the study environment where mothers are expected to be more involved with taking care of the children including accompanying the child to hospital while fathers are expected to be more involved with economic activities in order to provide for the family [17]. The study center is located in the center of Enugu metropolis hence the immediate catchment areas are all urban and this might explain why majority of the respondents reported residing in urban area. The finding of majority of the respondents being of the Igbo tribe is understandable since the dominant ethnic group in Enugu the city where the study was done is Igbo. Also, the finding of all the respondents belonging to the Christian religion is in line with the reality on ground as Christianity is the dominant religion in the whole of south east Nigeria [18].

Awareness of personal genotype among the respondents in this study was up to 93.1% and this is slightly higher than that reported by Ezenwosu and colleagues (87.1%). The increase in proportion of parents of children with sickle cell disease who are aware of their sickle cell genotype is a good development as this may lead to more of them taking steps to avoid giving birth to more children with SCD. Sadly, more than 50% of those who were aware of their genotype only discovered their sickle cell genotype after their child was diagnosed with SCD. This is also similar to report by Ezenwosu and colleagues (45.2%) [12]. All the respondents who reported being aware of their personal sickle cell genotype revealed that they were AS. However, the limitation of self-reported sickle cell genotype is well acknowledged as Burnham-Marusich and colleagues following a related study reported that only 50% of participants provided an accurate self-report of sickle cell genotype [19]. A little less than 90% of the respondents were aware of their partners' sickle cell genotype. Unfortunately, more than 50% of those who were aware only discovered their partner's genotype after their child was diagnosed with SCD. All those who were aware reported the sickle cell genotype of their partners to be AS.

Another very unfortunate finding is that 22.4% of the respondents who were aware of their personal genotype reported that they actually did a pre-marriage genotype test and the result came out as AA. Based on this they married their partners who they knew were AS only for repeat test done after their children were diagnosed with SCD to show they were AS. Similarly, 6.3% of the respondents who were aware of their partner's genotype also reported that their partner actually did a pre-marriage genotype test and the result came out as AA. Based on this they married them despite knowing their genotype was AS only for repeat test after their children were diagnosed with SCD to show they were AS. This is similar to the report by Adekunle and colleagues in Lagos, Nigeria following a related [20].

These findings appear to explain why majority the respondents gave birth to children affected by SCD. Had all the respondents discovered their sickle cell trait status as well as that of their partners correctly prior to marriage they would have had the opportunity of making better decision of avoiding marriage between two individuals with sickle cell trait so as to avoid giving birth to children with SCD. As such there is need for increase in enlightenment campaign. There is also the need for policies by government, religious organizations as well as other non-governmental organizations geared towards encouraging members of the society to do their sickle cell genotype test before marriage to ensure sickle cell genotype compatibility that rules out the possibility of giving birth to children with SCD. Also, there is the need for strict regulation and oversight activities by the relevant agencies to ensure that medical diagnostic facilities and the personnels that work in them across the nation maintain excellent standards to avoid misleading results.

On the whole a little less than seventy percent of the respondents who were aware of their personal sickle cell genotype discovered their status after marriage. Of all the sociodemographic characteristics, only sex showed statistically significant association with time of discovery of personal sickle cell genotype status of the respondents ($p= 0.049$). All the respondents who discovered their sickle cell genotype status before marriage were female, suggesting that women were more likely than men to know their genotype prior to marriage. The explanation for this appears unclear however this appears to suggest that while there is the need for increase in general enlightenment campaign, there is even more need for increased targeted effort towards educating the men on the need for pre-marriage discovery of personal sickle cell genotype.

Also, two third of the respondents who were aware of their partner's sickle cell genotype discovered their partner's status after marriage. Of all the respondents' sociodemographic characteristics, only Christian denomination (p=0.008) and educational status (p=0.032) showed statistically significant association with time of discovery of the respondents' partner sickle cell genotype status. This is understandable because some Christian denominations insist on pre-marriage sickle cell genotype test alongside other medical tests. On the other hand, the higher the educational status of an individual the more likelihood of knowing the advantages of pre-marriage sickle cell genotype test.

5. Conclusion

Majority of the respondents knew both their personal and partners' sickle cell genotype, however majority of those who were aware only discovered both their personal and their partner's sickle cell genotype after marriage following the diagnosis of SCD on their sick child. The desired change is a shift towards pre-marriage discovery of both personal and partner's sickle cell genotype status. To drive the desired change, policy makers at all levels including government, religious and other non-governmental organizations all need to join hands to increase awareness on the need for pre-marriage sickle cell genotype test and also the need to insist on sickle cell genotype compatibility that rules out the possibility of giving birth to children with SCD. While every member of the society should be targeted in this awareness campaign, effort to reach out to men and boys should be intensified as findings from this study suggest males were less likely to discover their genotype prior to marriage compared to females. Policy makers should aim at making education more accessible and affordable. Religious denominations should be actively mobilized in the campaign to ensure pre-marriage sickle cell genotype testing. Findings from this study suggest that these interventions can impact positively on pre-marriage discovery of sickle cell genotype. Government agencies responsible for ensuring excellent standards in medical diagnostic facilities across the nation should ensure that the needful is done to avoid misleading medical laboratory results especially that of sickle cell genotype test.

Compliance with ethical standards

Acknowledgments:

The author hereby acknowledges and appreciates the guidance and encouragement from Prof. Samuel Ajogwu Robsam Ohayi and Prof. Uchenna Ekwochi in the course of this work.

Disclosure of conflict of interest

The author declares that there is no conflict of interest.

Statement of ethical approval

Ethical clearance for the study was obtained from the ethics committee of ESUT Teaching Hospital Parklane Enugu, Enugu State Nigeria

Statement of informed consent

The author declare that written informed consent was obtained from all the respondents.

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