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Sociodemographic and Clinical Predictors of Blood Transfusion among Adults with Sickle Cell Disease in Northwestern Nigeria

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ABSTRACT

Background: Blood transfusion remains a vital part of care for patients with sickle cell disease (SCD), especially for preventing and managing both acute and chronic complications. However, the factors predicting transfusion needs among adults with SCD in low-resource settings are not well studied. Therefore, this study aimed to identify the sociodemographic and clinical factors that predict blood transfusion among adults with sickle cell disease attending a tertiary hospital in Northwestern Nigeria.

Methods: The study was a cross-sectional design conducted at Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto. A total of 206 patients with sickle cell disease were recruited using a systematic sampling method. Data on blood transfusions were collected from questionnaires and case notes. Statistical analysis was performed using SPSS version 25. Chi-square and binary logistic regression were used to assess associations and predictors of blood transfusion

Results: The mean number of blood transfusions (in units of blood) per year was 3.2 ± 1.5. Almost one in two individuals received at least one unit of blood in the past 12 months. There was a statistically significant association between blood transfusion in the past 12 months and tribe, socio-economic status, religion, and the genotype of patients with haemoglobin S homozygous (HBSS), who received more transfusions. Socio-economic status and genotype remained predictors of blood transfusion.

Conclusion: Low socioeconomic status and HbSS genotype independently predict blood transfusion in adults with SCD. These findings may assist clinicians in identifying high-risk patients and optimising transfusion planning and resource allocation.

Keywords: Blood transfusion, Sickle cell disease, Nigeria, Sickle cell anaemia.

INTRODUCTION

Sickle cell disease remains a significant global health problem affecting millions of people. Sickle-cell disease is a severe genetic blood disorder caused by a mutation in the HBB gene, which encodes the beta-globin subunit of haemoglobin, resulting in abnormally shaped red blood cells that can obstruct blood flow and lead to serious health problems.[1] In 2021, approximately 7.74 million individuals worldwide were affected by sickle-cell disease, with about 515,000 new cases at birth, most of which occurred in sub-Saharan Africa.[1] This region bears nearly 80% of the global burden.[1] Sickle-cell disease contributes significantly to mortality among children under five, with an estimated 81,100 deaths in 2021, ranking it as the 12th leading cause of death in this age group based on overall mortality burden.[1]

Red blood cell (RBC) transfusion is a crucial treatment for sickle cell disease (SCD), as it improves blood oxygen delivery by reducing the percentage of haemoglobin S (HbS%) and lowering blood viscosity.[2] Blood transfusion continues to play a key role in the care and treatment of individuals with sickle-cell disease. It remains a widely used method for preventing and managing both acute and long-term complications of sickle-cell disease.[3,4]

SCD patients have a special need for blood transfusion due to the high incidence of red blood cell (RBC) alloimmunization.[5] Some studies have identified factors as predictors of blood transfusion among patients with sickle cell disease. Certain demographic factors affect the utilisation of blood transfusions among patients with SCD. Age is a key determinant, with children often receiving transfusions for stroke prevention and acute complications, while adults more frequently require transfusions due to cumulative disease-related organ damage.[6,7] Sex, socioeconomic status, geographic location, and access to specialised healthcare services also influence transfusion utilisation, particularly in low- and middle-income settings where late presentation and limited preventive care are common.[8,9]

Disease severity, frequency of vaso-occlusive crises, baseline haemoglobin levels, history of stroke or acute chest syndrome, splenic dysfunction, and the presence of comorbidities such as infections or organ failure were identified as clinical predictors.[7] Also shown to influence transfusion requirement were laboratory indicators such as severe anaemia, elevated hemolysis markers, and abnormal transcranial Doppler findings in children.[7] Furthermore, treatment-related factors such as limited response to hydroxyurea therapy may increase the need for transfusion support.[7]

Recognising how these clinical and demographic factors interact is vital for refining transfusion strategies, improving patient outcomes, and informing effective allocation of resources in sickle-cell disease care. Despite this, contemporary data on sociodemographic and clinical predictors of blood transfusion among patients with sickle cell disease are lacking in our environment. Therefore, this study aimed to identify the sociodemographic and clinical predictors of blood transfusion among adults with sickle cell disease who attended a tertiary hospital in northwestern Nigeria.

MATERIALS AND METHOD

This hospital-based cross-sectional study was conducted in the Department of Haematology and Blood Transfusion at the Usmanu Danfodiyo University Teaching Hospital (UDUTH) in Sokoto, Nigeria. Over six months (December 2022 to May 2023), 206 patients with sickle cell disease were recruited through systematic random sampling. The sickle cell clinic was held once weekly, for a total of 24 clinic days. Each day averaged 20 patients, and with a sample size of 210, approximately 9 participants were recruited per day, yielding a sampling interval of 2 patients. On each clinic day, the first eligible participant was selected by ballot from the first two patients. Then every second eligible patient was recruited until the daily quota was met. Patients who had been interviewed before were excluded.

Inclusion criteria comprised adults aged ≥18 years with a confirmed diagnosis of sickle cell disease who attended the clinic during the study period, provided informed consent, and did not have any severe mental or physical conditions that could hinder participation. Ethical clearance was obtained from UDUTH, Sokoto (UDUTH/HREC/2022/1151/V2). Data on blood transfusions were collected from questionnaires and case notes. Participants were further divided based on transfusion status into those who had at least one transfusion in the last 12 months and those who had not. Additionally, the number of units transfused was recorded. Statistical analysis was performed using SPSS version 25 (IBM SPSS

Statistics for iOS, Version 25.0, Armonk, NY: IBM Corp.). Chi-square and binary logistic regression were employed to assess associations and predictors of blood transfusion.

RESULTS

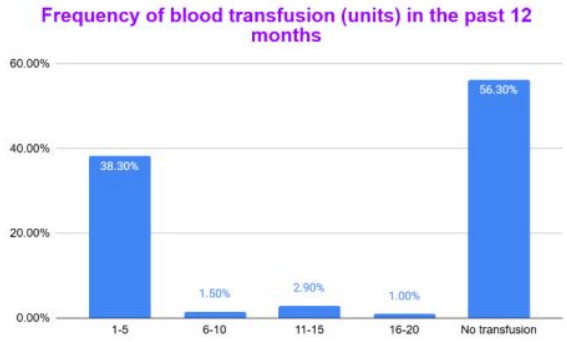


Figure 1 shows that 56.3% of participants did not have a blood transfusion in the past year. Of those who did, 38.3% received 1-5 units, and only 5.4% received more than five units (including 1.5% with 6-10, 2.9% with 11-15, and 1.0% with 16-20 units).

This suggests blood transfusion is common among adults with sickle cell disease, but most need only a few units, and few require multiple transfusions.

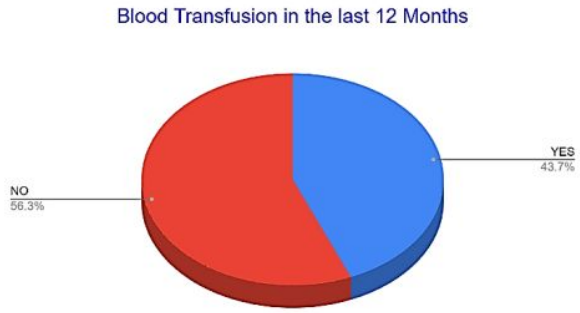


Figure 2 shows that 56.3% did not receive a transfusion, indicating that most respondents did not receive a transfusion despite a significant number having been transfused

Sociodemographic Factors Associated with Blood Transfusion

From Table 1 below, there was a statistically significant association between blood transfusion in the past 12 months and Tribe, with those from the Hausa/Fulani tribe receiving more transfusions.

Additionally, socioeconomic status showed a similar pattern, with participants from lower social classes receiving more transfusions. Likewise, religion showed a similar pattern: respondents of the Islamic faith had more transfusions. Employment status was also associated with more transfusions among students. Other sociodemographic variables did not show statistically significant relationships.

Table 1: Sociodemographic Factors Associated with Blood Transfusion

Variable	Transfusion: Yes (%)	Transfusion: No (%)	X^2	Df	P-value
Age Category					
18–32	90.0%	91.4%	2.154	2	0.444
33–47	10.0%	6.9%			
48–62	0.0%	1.7%			
Gender					
Male	37.8%	38.8%	0.022	1	0.886
Female	62.2%	61.2%			
Marital status					
Single	67.8%	69.8%	0.138	2	0.955
Married	30.0%	28.4%			
Divorced	2.2%	1.7%			
Tribe					
Hausa/Fulani	97.8%	87.9%	7.469	3	0.041
Yoruba	0.0%	2.6%			
Igbo	0.0%	2.6%			
Others	2.2%	6.9%			
Religion					
Islam	98.9%	91.4%	5.654	1	0.025
Christianity	1.1%	8.6%			
Socioeconomic status					
Low	53.3%	44.0%	7.385	2	0.026
Medium	38.9%	34.5%			
High	7.8%	21.6%			
Employment					
Employed	14.4%	8.6%	12.619	4	0.009
Retired	0.0%	1.7%			
Unemployed	27.8%	12.1%			
Business	8.9%	12.9%			
Student	48.9%	64.7%			
Level of education					
Secondary and below	58.9%	45.7%	3.535	1	0.068

Above secondary	41.1%	54.3%			
Family type					
Monogamous	44.4%	42.2%	0.100	1	0.778
Polygamous	55.6%	57.8%			
Social support					
Poor	6.7%	1.7%	3.369	2	0.202
Moderate	13.3%	12.9%			
Good	80.0%	85.3%			

P< 0.05

Clinical Factors Associated with Blood Transfusion From Table 2 below, there was a statistically significant association between blood transfusion in the last 12 months and the genotype of patients with haemoglobin S homozygous (HbSS), who had more transfusions.

Table 2: Clinical Factors Associated with Blood Transfusion

Variable	Transfusion: Yes (%)	Transfusion: No (%)	X^2	df	P-value
Comorbid condition					
Yes	50.0%	43.1%	0.970	1	0.398
No	50.0%	56.9%			
Insurance coverage					
Yes	25.6%	20.7%	0.681	1	0.503
No	74.4%	79.3%			
Type of haemoglobin					
HbSS	97.8%	82.8%	11.984	1	<0.001
HbSC	2.2%	17.2%			
Hydroxyurea use					
Yes	33.3%	31.9%	0.048	1	0.881
No	66.7%	68.1%			
Steady State Packed Cell Volume					
Low	52.3%	39.7%	3.217	1	0.088
High	47.7%	60.3%			

P< 0.05

Predictors of blood transfusion.

In multivariable logistic regression, socioeconomic status and haemoglobin type independently predicted blood transfusion in adults with sickle cell disease. Participants from higher socioeconomic groups had lower odds of transfusion (OR = 0.245, p = 0.009). Those from low socioeconomic groups were more likely to need transfusions. Compared with HbSS patients, HbSC patients had lower odds of transfusion (OR = 0.093, p = 0.002), indicating that HbSS patients are more likely to need blood transfusions—Table 3.

Table 3: Predictors of blood transfusion.

Determinant*	Wald	Sig.	Exp(B)	95% Confidence Interval Lower	Upper
Religion	0.128	0.720	1.820	0.069	48.220
Socioeconomic Status	6.790	0.009	0.245	0.085	0.706
Employment	0.248	0.619	0.781	0.294	2.071
Tribe	1.903	0.168	0.202	0.021	1.961
Hemoglobin Type	9.186	0.002	0.093	0.020	0.432

DISCUSSION

Our index study found that sociodemographic factors, such as tribe, religion, socioeconomic status, and employment, are associated with higher rates of blood transfusion among patients with sickle cell disease. Clinically, the genotype notably influences transfusion needs, with patients homozygous for haemoglobin S (HBSS) requiring more transfusions. Nonetheless, only socioeconomic status and genotype emerged as significant predictors of blood transfusion.

Tribe and religion showed a strong link to higher blood transfusion rates among sickle cell disease patients in our survey. This may be due to the sociodemographic makeup of our respondents, as over 90% identified as Hausa/Fulani and Muslim, mirroring the area's mainly Hausa/Fulani and

Muslim population. In our research, age and gender were not significantly associated with increased blood transfusion. A similar study by Drasar et al. also found that age was not a significant factor in the frequency of blood transfusions among sickle cell patients.[10] The study by Alsharari et al. also did not find a statistically significant association between transfusion frequency and age, gender.[7] However, the findings from Sharma et al. were contrary to ours; age and gender were significant factors in blood transfusion among patients with sickle cell disease.[6]

In our study, sickle cell disease patients from a low socioeconomic background are more likely to require RBC transfusions compared to those from wealthier backgrounds. Sharma et al. reported a contrary finding.[6] This may be attributed to socioeconomic differences within the study population. While our research was conducted in a low-income African setting, theirs was from a higher-income Western society. Employment status also played a significant role in determining the transfusion rate among sickle cell patients. Students showed an increased rate of blood transfusion, which may warrant further investigation.

A patient's genotype in sickle cell disease is a crucial factor in determining the blood transfusion rate. We found that those homozygous for haemoglobin S (HBSS) had more transfusions than HBSC, with a statistically significant difference between the two groups. Individuals with Hb SS typically exhibit more pronounced hemolysis and lower haemoglobin levels than patients with Hb SC or $S\beta^+$-thalassemia.[11,12] In line with this, complications associated with increased hemolytic activity, such as leg ulcers and priapism, occur more frequently among those with Hb SS disease.[11,12] In our multivariate analysis, we identified socio-economic status and genotype only as the predictors of blood transfusion.

Conclusion

This study identified socioeconomic status and haemoglobin genotype as independent predictors of blood transfusion among adults with sickle cell disease. These findings highlight the importance of early clinical monitoring and improved socioeconomic support to reduce transfusion burden among patients with SCD.

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