Determinants of Blood Donor Retention in a Nigerian Tertiary Health Care Blood Transfusion Facility: A Pilot Quality Improvement Initiative

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ABSTRACT

Background: Many hospitals in Nigeria and the rest of sub Saharan Africa continue to grapple with scarcity of units of blood for transfusion. Developing appropriate actionable plans geared towards the retention of a pool of voluntary blood donors may be helpful in addressing this trend in the health care industry. **Objective:** To ascertain the proportion of repeat blood donors in a Nigerian tertiary care blood bank and identify factors that influence their retention. **Materials and Methods**: An interviewer-administered questionnaire was administered to 212 prospective blood donors. The primary outcome was the re-donation frequency, while secondary outcome variables were the self-reported deterrents to repeat donation. **Results:** Seventy-six participants (67.86%) donated blood more than once in the last 2 years, while only 3 donors (2.68%) donated blood up to 3-4 times in a year. The general fear of the blood donation process and size of the blood bag needle (25% respectively) were the predominant self-reported deterrents to repeat donation. **Conclusion:** Our re-donation rate is lower than the recommended average yearly donation frequency; fear of the entire donation process as well as the blood bag needle size appeared to deter blood donors from re-donation.

Keywords: Blood donors; Blood donor retention; Blood transfusion sufficiency.

INTRODUCTION

Timely administration of safe blood units remains a time-tested lifesaving medical intervention globally. In spite of the well documented benefits of blood transfusion in clinical medicine, the practice is not without its fair share of challenges and obstacles that often threaten the smooth administration of this therapeutic intervention. Over the years therefore, a number of impediments to the effective procurement, processing and distribution of blood units have been identified. These range from inadequate sourcing and screening/testing of donor units, poor infrastructural support for blood fractionation to challenges with the storage and distribution of whole blood (or fractionated) units to areas they are most needed. [1]

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Continuous refinement and improvement of blood transfusion policies and standards are therefore needed to ensure that the transfusion process remains safe for both the donor and recipient. These refinements include (but not limited to) more elaborate testing for transfusion transmissible infections (TTIs), more stringent donor selection criteria, monitoring of donor and recipients for transfusion related adverse reactions and increased attempt at maintaining a reliable pool of voluntary, non-remunerated blood donors. [2, 3]

A number of African countries have over the years enacted policies and guidelines to boost the availability of safe blood and blood products, unfortunately the aim of these interventions have remained largely unrealized. [4] On a global scale, the World Health Organization (WHO) has rolled out a number of quality improvement measures and directives aimed at ensuring global blood transfusion sufficiency. [5] In fact it had projected the year 2012 as a prospective date for most countries in Sub-Saharan Africa to achieve self-sufficiency in blood transfusion, based on the judicious and consistent implementation of its set guidelines and standards, both nationally and regionally. [5, 6] The lofty aims of the WHO notwithstanding, attainment of blood transfusion sufficiency continues to be elusive to a number of countries, especially those in sub-Saharan Africa, where health infrastructure is weak and health related policies are not usually appropriately managed to bring optimal results. In its report of 2013, the WHO had shown that of 167 countries evaluated, only 122 (73%) had a form of written policy document on the regulation of clinical blood transfusion. [5] In addition, only about 41% of countries in the low-income bracket and 64% in the middle-income economic categories from the above figure had promulgated appropriate legislation and necessary legal framework to back the practice of clinical blood transfusion in their respective domains. [5]

In Nigeria, the blood transfusion narrative is not remarkably different from what obtains in other parts of sub Saharan Africa. According to document from the National Blood Transfusion Service (NBTS), the country collects about 500,000 units of blood yearly from both private and public sources, this is against an estimated annual need of 1.5 million units to cater for the health of its citizens. [7] With a population of over 150 million people, this approximates to less than a pint of blood per person and further highlights a very poor blood supply chain in the country. This grim observation therefore clearly shows a gross deficiency in the blood transfusion services in the country as the present procurement and distribution dynamics cannot bridge the nation's blood supply deficit. In fact, addressing this may well prove to be the lifeline that will ensure the survival and sustenance of the National blood transfusion policy, which is aimed at boosting transfusion safety in the country. [7]

In most developed countries of the world that have achieved total or near total blood transfusion sufficiency, the concept of retaining pools of regular altruistic and non-remunerated blood donors is a key driving force to this attainment. [8] Unfortunately, this does not seem to be the case in a number of developing countries. In an earlier study in Jos, North Central Nigeria, the frequency of repeat blood donation among 30,264 donors was a paltry 11,198 (37.0%), consisting of 10,130 (90.5%) regular and 1068 (9.5%) lapsed donors. [2] The situation appears similar in Central Africa where an alarming 72.8% of first time blood donors that formed the inventory of a blood transfusion center were lost over a 3-year period. [9] There is an urgent need to understudy reasons for the loss as well as put measures in place to retain repeat voluntary blood donors.

This pilot quality improvement study was designed to evaluate the re-donation frequency as well as some of its determinants among blood donors at a Nigerian tertiary hospital based blood bank, with the aim of finding out how the blood transfusion process could be strengthened for a more robust performance, in line with globally accepted standards.

MATERIALS AND METHODS

Study design

This was a descriptive, cross sectional study carried out among 212 prospective blood donors who presented to the Blood Bank of the Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi.

Study area

The NAUTH, Nnewi is a tertiary health care facility as well as a major referral center in Anambra State, South East Nigeria; on the average it attends to up to 4,000 blood donors annually.

Study population

For the purposes of this quality improvement effort, blood donors who came to donate blood at NAUTH blood bank were consecutively recruited over a period of 4 months.

Inclusion criteria included

- Negative screening result for the transfusion transmissible infections (TTIs).
- Hemoglobin concentration above the recommended donation threshold. [10]

The method of screening for TTIs was by the 4th generation enzyme linked immunosorbent assay (ELISA) test. Each participant provided a written informed consent at the point of recruitment for the study.

Recruitment of participants

Donors were randomly selected and an interviewer-administered questionnaire was administered by the researchers to those who had consented to participate in the study. The questionnaire which had been pretested among random blood donors in our blood bank before the commencement of the study was used to obtain the sociodemographic details and information related to blood donation from each participant. The research questionnaire gathered information on the frequency and motivation for blood donation and also explored the possible deterrents to repeat blood donation among the study participants.

Outcome measures

The primary outcome variable was the re-donation frequency, while secondary outcome variables were the self-reported deterrents to repeat donation. Repeat donation was defined as any donation frequency that was more than once in one calendar year. [9]

Data analysis

Data was analyzed using SPSS version 25. Sociodemographic details, motivation for and deterrents to blood donation were presented as frequencies (and percentages) while association between study related variables and the re-donation frequency was explored using the Chi-square. *P* values < 0.05 were considered as statistically significant.

RESULTS

A total of two hundred and twelve (212) potential blood donors participated in the study. The blood donor's age ranged from 17-56 (mean age of 27.84± 7.09) years, with the 17-31 age bracket having the predominant age distribution (76.64%). One hundred and eighty-three donors (86.32%) were males, 160 (79.92%) were unmarried, while 145 (68.72%) were family replacement donors (Table 1).

One hundred and twenty-one (56.81%) study participants reported having donated blood at least once in a life time, while 91 (43.19%) where first time donors at the time of this study. Of those that had donated blood at least once in a lifetime, 76 (67.86%) reported donating more than once in the preceding 2 years.

In terms of the annual blood donation frequency among repeat donors, 72 (64.29%) donated between 1-2 times in one year, while only 3 donors (2.68%) donated up to 3-4 times in one year. Regarding the expressed willingness to re-donate among all donors, 190 (91.35%) were willing to come back to donate blood after the index exercise, while 18 donors (8.65%) expressed their non-desire to come back at any other time for re-donation (Table 2) The predominant motivation behind blood donation among the research participants was the 'desire to help people', while monetary compensation ranked least among the motivating factor towards the donation process.

With regards to the self-reported deterrents to blood donation among the study participants, the general fear of the donation process and concerns about the size of the blood bag needle (25% respectively) were the predominant reported barriers. Correspondingly,

anxiety about possible side effects (especially fainting), concerns about one's state of health, general dislike for the donation process and perceived discomfort and poor treatment by the blood bank staff were the least self-reported deterrents to blood donation by the participants (8.33%, respectively, Table 3).

There was no statistically significant association between donor age distribution, sex, marital status, donor type, previous blood donation experience and the likelihood to re-donate blood, P values all > 0.05, (Tables 4 and 5). Similarly, the frequency of donation in the last 2 years was not significantly different in family replacement, commercial and voluntary donors (P value > 0.05).

Table 1: Sociodemographic variables among the study population

Variable	Frequency	Percentage (%)
Sex *(n=212)*		
Female	29	13.68
Male	183	86.32
Age (years)		
17-31 years	164	76.64
32-46 years	47	21.96
47-61 years	3	1.40
Mean age (±SD)	27.84± 7.09 years	
Range	17-56 years	
Marital status *(n=208)*		
Married	48	23.08
Single	160	76.92
Donor type *(n=211)*		
Commercial	31	14.69
Family replacement	145	68.72
Voluntary	35	16.59

Table 2 : Reported willingness to re-donate among the study population

Are you willing to come back and donate after today's donation?	Frequency	Percentage (%)
No	18	8.65
Yes	190	91.35
Total	**208**	**100**

Table 3: Self -Reported Deterrents to Blood Donation

Deterrents:	Percentage (%)
Fainting in the blood bank	8.33
Fear of the process of blood donation	25.00
For health reasons	8.33
I just don't like donating	8.33
Pain from Venipuncture	16.67
Poor treatment at the blood bank	8.33
The blood bag needle size	25.00
Total	**100**

Table 4: Association between sociodemographic variables and willingness to re-donate

Variable	Total (%)	Willingness to re-donate? (%)		χ^2-value	p-value
		No (n=18)	Yes (n=190)		
Sex					
Female	29 (14.2)	3 (16.7)	26 (14.0)	0.097	0.755
Male	175 (85.8)	15 (83.3)	160 (86.0)		
Age (years)					
17 -31 years	157 (76.2)	10 (55.6)	147 (78.2)		
32 -46 years	46 (22.3)	8 (44.4)	38 (20.2)	5.711	0.058
47 -61 years	3 (1.5)	0	3 (1.6)		
Marital status					
Married	47 (23.4)	7 (38.9)	40 (21.9)	2.653	0.103
Single	154 (76.6)	11 (61.1)	143 (78.1)		
Donor type					
Commercial	29 (14.3)	2 (11.1)	27 (14.6)		
Family replacement	141 (69.5)	14 (77.8)	127 (68.6)	0.657	0.720
Voluntary	33 (16.3)	2 (11.1)	31 (16.8)		

Table 5: Association between first time donation, number of times donated and willingness to re-donate

Variable	Total (%)	Willingness to re-donate? (%)		χ^2-value	p-value
		No (n=18)	Yes (n=190)		
Is this the first time you are donating blood? *(n=204)*					
No	114 (55.9)	7 (41.2)	107 (57.2)	1.626	0.202
Yes	90 (44.1)	10 (58.8)	80 (42.8)		
If no, how many times have you donated in the last 2 years? *(n=109)*					
Once	34 (31.2)	2 (25.0)	32 (31.7)		
Twice	42 (38.5)	3 (37.5)	39 (38.6)		
Thrice	20 (18.4)	1 (12.5)	19 (18.8)		
Fourth	6 (5.5)	1 (12.5)	5 (4.9)	4.334	0.632
Fifth	3 (2.7)	1 (12.5)	2 (2.0)		
Sixth	3 (2.7)	0	3 (3.0)		
Tenth	1 (0.9)	0	1 (1.0)		

DISCUSSION

The age and gender distribution of the donor population in this study is similar to previous reports in Nigeria and represents the well observed skewed donor demographics towards young adults and males in Nigeria. [2,3] While this pattern of blood donor distribution appears to subsist in most of sub-Saharan African countries, it differs remarkably from what obtains in other parts of the world. In North America, particularly Canada, the blood donor age distribution includes older blood donors who are well into their 70th birthdays. [11] In fact, it appears that older blood donors constitute important drivers of the Canadian blood transfusion service since they have over the years become quite accustomed and well adapted to the blood donation process and account for up to 45% of the Canadian blood inventory. [12] Interestingly, the Biomedical Excellence for Safer Transfusion (BEST) Collaborative report recently provided a robust argument in support of the retention of older blood donors, averring that their exclusion because of 'fears about donor related adverse reactions' was unwarranted. [13]

Correspondingly, gender-based disparity in blood donors does not appear to be as marked in other countries of the world compared with what obtains in Nigeria and some countries in sub-Saharan Africa. A recent study that was conducted in a blood transfusion center in Spain showed that a significant population of first-time blood donors were females (52.3%). [14] The authors believed that women tended to be more altruistically inclined to present to the transfusion center for blood donation, especially for the first time, compared to men. [14] Additionally, similar studies in the United Kingdom and Finland showed that an impressive 53% and 55% respectively of the blood donor pool were females. [15,16] While a number of factors ranging from educational, religious to cultural misconceptions about the blood donation process may underlie the paucity of female blood donors in Nigeria (and Africa), [17] it is important that recruitment efforts that target especially the female donor be intensified to bridge the increasing demand-supply gap that exists in most parts of Africa. This idea becomes even more attractive when considered in the light of the report of Ngunza *et al* in the Democratic Republic of Congo, which showed that women and older blood donors (aged at least 46 years) were more likely to be retained and become regular blood donors compared to their male and younger counterparts. [9]

An earlier study that evaluated the prevalence of transfusion transmissible infections (TTIs) in blood donors in our facility noted that commercial blood donors had the highest representation in our donor set, followed by family replacement donors (62.8% and 36.0% respectively). [18] This observation was worrisome to stakeholders in the hospital as it runs contrary to the WHO recommendation on the recruitment of only voluntary blood donors for blood transfusion. [19] Consequently, hospital-wide corrective interventions were instituted towards discouraging potential blood recipients from patronizing commercial donors, while at the same time ramming up sensitization campaigns to the surrounding communities on voluntary blood donation. Interestingly, these interventions appear to have started yielding some marginal dividends as there were more family replacement donors (68.72%), followed by voluntary donors (16.59%) in the present study; commercial donors constituted the least number (14.67%). Similarly, an impressive 91.35% of participants in this study expressed a willingness to come back for re-donation, with the predominant motivation for the donation being 'a desire to help people'. Further highlighting a possible attitudinal shift among our blood donors, monetary compensation ranked the lowest in the strata of variables that served as motivation for blood donation in this study. As marginal as this improvement may appear, it adds the much needed gusto to our donor mobilization initiatives as well as our medium and long term plans of making voluntary blood donors the only source of donated blood in our hospital, in line with the WHO recommendation. [19]

The proportion of donors that donated blood more than once in this study appeared higher compared to the study by Damulak *et al* in Jos, North Central Nigeria (67.86% vs. 37.00%). [2] While this

observation may be related to locally prevailing cultural/tribal differences that could underpin the behavior of the study participants towards blood donation, it is important to note that the latter study had larger sample size and used a more objective source of data (the NBTS data base) in its analysis. Ngunza *et al* studied the details of 387 donors out of 773 blood donation records from 2015 to 2017 in the Democratic Republic of Congo and showed that only 23.8% of the donors continued to donate from the onset of the study to its end (in 2017). [9] The authors reported a very significant donor attrition (72.8%) in the study participants who had initially donated at the onset of the study in 2015. [9] It is therefore imperative to note that while efforts at scouting for and recruiting new blood donors are very noble and commendable, the retention of a larger proportion of the donors is equally important to ensure sustainability in blood availability and supply. In fact, the WHO in its report of 2001 strongly recommended that blood transfusion centers should assiduously work towards retaining a significant number of their first time donors. [20] This is indeed a lofty target which deserves universal endorsement, especially in sub Saharan Africa, where attaining sufficiency in blood transfusion is still hugely challenged.

The generally recommended average inter-donation frequency among blood donors should be every 3-4 monthly. [21] This recommendation was primarily designed to protect the donor from donation induced iron depletion and anemia thereby ensuring that the potential recipients do not receive blood with low haematocrit. [22, 23] Indeed, significant iron depletion in repeat blood donors has been shown to occur in 66% and 45% of female and male blood donors respectively in the United States of America. [24] Correspondingly, in a report by Benedict *et al* in 2012 in Benin City, Nigeria, the mean haematocrit of blood units (that were sourced from commercial donors) was 28.8 ± 8.5%. [23] These units were no doubt sourced from donors with pre-existing anemia, most probably iron deficiency anemia that resulted from past (unregulated) blood donations. In the event of the transfusion of such poor quality donor units to patients, the expected post transfusion hemoglobin increment may not occur. It is therefore extremely important that donors observe these established donation intervals to protect themselves as well as the potential recipients of the blood units. In this study, only 2.68% of participants followed the recommended yearly blood donation interval (of 3-4 times in one year), this is in contrast with an earlier report in Jos, Nigeria that posted a remarkable 85% of repeat donors observing the recommended inter donation guideline. [2] The impressive result from the Jos study might be related to the fact the study was conducted at the North Central Zonal Center of the NBTS, where more stringent donor selection criteria were probably applied, compared to what might be the practice in most tertiary hospital-based blood banks.

Some factors have been identified as critical deterrents to blood donation in Africa, these include haemoglobin deferral, fear of needles and pain, social exclusion, lack of awareness, negative attitudes and accessibility problems. [25] Correspondingly, some factors have been reported to specifically influence the retention of a pool of voluntary blood donors in parts of Africa and globally. Ngunza *et al*, in a study that involved Central African blood donors, showed that variables such as older age, being a woman and working in the formal sector were associated with repeat blood donations. [9] In the same vein, Charbonneau *et al* in a study population that involved Canadian blood donors reported 'time constraints related to work or study' as the predominant factor that deterred donors from repeat donations. [8] In the present study, the predominant self-reported deterrents to re-donation were size of the blood bag needle and 'general fear of the blood donation process'. This is an important finding which hospital-based blood banks, the NBTS and other policy makers in the health care space could leverage on to enhance donor retention and possibly improve the dynamics of blood demand and supply.

Some studies had suggested that age, gender and the number of previous blood donations were associated with the likelihood of becoming a regular blood donor. [9,26] The argument was that older age and previous donation experience could obviate the anxiety that tends to be associated with blood donation, thus significantly aiding the decision to re-donate. This observation was not replicated in the

present study as there were no statistically significant association between donor characteristics such as age, gender, marital status, donor type and previous blood donation experience with the likelihood of becoming a regular blood donor (P values all > 0.05. Apart from small sample size, the skewed donor demographics in this study (towards young adults, being a male and single) may explain this discrepancy. The strength of the study was that this is the first report that explored the variables that influence blood donor retention in South-East Nigeria. Despite this strength, this study has a number of limitations. This being a pilot quality improvement initiative, the minimum sample size calculation was not done which might have guaranteed the involvement of larger number of participants. Some participants did not have their complete details captured and so this limited the number of variables that were analyzed in the results section of the manuscript.

CONCLUSION

The re-donation frequency in this study, though moderately high, falls short of the recommended average yearly donation interval; fear of the entire donation process as well as the blood bag needle size appeared to deter donors from re-donation. Strategies aimed at addressing these observations could increase donor retention as well as blood donation frequency, with projected positive impact on blood supply dynamics in the health care industry.

Conflicts of Interest

None.

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Author contributions

1. JCA - conceptualization of research idea, research design, manuscript preparation, critically reviewed manuscript for intellectual content, approved the version to be sent for publication.
2. CGC data analysis, critically reviewed manuscript for intellectual content.
3. EPO - research design, data analysis, critically reviewed manuscript for intellectual content.
4. CEA - research design, administration of questionnaire and collation of results, critically reviewed manuscript for intellectual content.
5. UJC - research design, administration of questionnaire and collation of results, critically reviewed manuscript for intellectual content.
6. CCE - manuscript preparation, critically reviewed manuscript for intellectual content.
7. TUE - research design, administration of questionnaire and collation of results, critically reviewed manuscript for intellectual content.
8. CBA - data analysis, manuscript preparation, critically reviewed manuscript for intellectual content.

Data availability

The data used to support the findings of this study are available from the site publicly.

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Conflict of interest

None declared.

Ethical approval

The study was approved by the Institutional Ethics Committee.

REFERENCES

1. Aneke JC, Okocha CE. Blood Transfusion Safety; Current Status and Challenges in Nigeria. Asian J Transf Sci. 2017; 11: 1 5.
2. Damulak OD, Adediran AA, Ogbenna AA, Bodunde T, Bolorunduro SA, Smith O. Voluntary Blood Donor Retention in Jos, New Transfusion Transmissible Infections: The Implications for a Resource Dependent Setting. Int J Curr Res. 2014; 6:10593-10597.
3. John CA, Theodora UE, Gloria AN, Chika EA. Adverse reactions to blood donation: A

descriptive study of 3520 blood donors in a Nigerian tertiary hospital. Med J DY Patil Univ. 2017;10:36-40.
4. Schneider WH. History of Blood Transfusion in Sub-Saharan Africa. Transfus Med Rev 2013; 27: 2128.
5. World Health Organization. Blood Safety. WHO | Regional Office for Africa 2019. Available at https://www.afro.who.int/health-topics/blood-safety. Last accessed March 18, 2022).
6. Weimer A, Tagny CT, Tapko JB, Gouws C, Tobian AAR, Ness PM *et al*. Blood transfusion safety in sub-Saharan Africa: A literature review of changes and challenges in the 21st century. Transfusion (Paris) 2019; 59: 412427.
7. National Blood Transfusion Service, Federal Ministry of Health [Nigeria]. The National Blood Policy. Abuja: National Blood Transfusion Service, Federal Ministry of Health; 2006.
8. Charbonneau J, Cloutier M, Carrier E. Why do blood donors lapse or reduce their donation frequency? Transf Med Rev. 2015; 30:1-5.
9. Ngunza SM, Munyashongore C, Nshobole G, Latine D, Aujoulat I. Low retention rate of voluntary blood donors: contribution of an original method based on a composite classification (results of a monocentric study in the Democratic Republic of Congo). Pan Afr Med J. 2020;36:296. Available at: https://pubmed.ncbi.nlm.nih.gov/33117490/.
10. Hemoglobin Screening/Iron Management. Available at: https://www.aabb.org/regulatory-and-advocacy/regulatory-affairs/regulatory-for-blood/donor-safety-screening-and-testing/hemoglobin-screening-iron-management. Last accessed 17th April, 2022.
11. Goldman M, Fournier E, Cameron-Choi K, Steed T. Effect of changing the age criteria for blood donors. Vox Sang. 2007;92:368-372.
12. "Canadian Blood Services to ease requirements for older donors" Available at https://www.cbc.ca/news/health/canadian-blood-services-to-ease-requirements-for-older-donors-1.3113605. Last accessed on 14th April, 2022.
13. Goldman M, Germain M, Grégoire Y, Vassallo RR, Kamel H, Bravo M *et al*. Biomedical Excellence for Safer Transfusion Collaborative (BEST) Investigators. Safety of blood donation by individuals over age 70 and their contribution to the blood supply in five developed countries: a BEST Collaborative group study. Transfusion. 2019;59:1267-1272.
14. Prados Madrona D, Fernández Herrera MD, Prados Jiménez D, Gómez Giraldo S, Robles Campos R. Women as whole blood donors: offers, donations and deferrals in the province of Huelva, south-western Spain. Blood Transfus. 2014. Available at: https://pubmed.ncbi.nlm.nih.gov/23245721/. Last accessed on 14th April, 2022.
15. NHS Blood and Transplant, 2007 United Kingdom. Available at http://www.blood.co.uk. Last accessed on 14th April, 2022.
16. Annual Report 2008 Finland Red Cross. Available at: www.bloodservice.fi. Last accessed on 14th April, 2022.
17. Erhabor O, Isaac Z, Abdulrahaman Y, Ndakotsu M, Ikhuenbor DB, Aghedo F *et al*. Female Gender Participation in the Blood Donation Process in Resource Poor Settings: Case study of Sokoto in North Western Nigeria. J Blood Disorders Transf. 2013: 5; 176. doi: 10.4172/2155-9864.1000176.
18. Okocha EC, Aneke JC, Ezeh TU, Ibeh NC, Nwosu GA, Okorie IO *et al*. The epidemiology of transfusion-transmissible infections among blood donors in Nnewi, South-East Nigeria. African Journal of Medicine and Health Sciences. 2015: 14; 125 129.
19. World Health Organization & International Federation of Red Cross and Red Crescent Societies.)2010(. Towards 100% voluntary blood donation: a global framework for action. World Health Organization. Available at :https://apps.who.int/iris/handle/10665/44359. Last accessed on 14th April, 2022.
20. Strategies for Blood Donor Recruitment. Report of an Intercountry Workshop Dhaka, Bangladesh, 24-28 September 2000. World Health Organization Regional Office for South-East Asia New Delhi, June 2001. Available at:

https://apps.who.int/iris/bitstream/handle/10665/206405/B3390.pdf;sequence=1. Last accessed on 14th April, 2022.

21. Blood Donor Selection: Guidelines on Assessing Donor Suitability for Blood Donation. Geneva: World Health Organization; 2012. 4, General donor assessment. Available from: https://www.ncbi.nlm.nih.gov/books/NBK138219/. Last accessed on 14th April, 2022.
22. Armstrong KL. Blood donation and anemia. *Can Fam Physician*. 2016;62:730-731.
23. Benedict N, Augustina AO, Nosakhare BG. Blood donation in Nigeria: standard of the donated blood. *J Lab Physicians*. 2012;4:94-97.
24. Cable RG, Glynn SA, Kiss JE, Mast AE, Steele WR, Murphy EL *et al*. Iron deficiency in blood donors: the REDS-II Donor Iron Status Evaluation (RISE) study. Transfusion. 2012;52:702711.
25. Klinkenberg EF, Huis In't Veld E, de Wit PD, van Dongen A, Daams JG, de Kort W *et al*. Blood donation barriers and facilitators of Sub-Saharan African migrants and minorities in Western high-income countries: a systematic review of the literature. Transfus Med. 2019;29:28-41.
26. Schlumpf KS, Glynn SA, Schreiber GB, Wright DJ, Randolph Steele W, Tu Y *et al*. National Heart, Lung, and Blood Institute Retrovirus Epidemiology Donor Study. Factors influencing donor return. Transfusion. 2008;48:264-272.