TRANSFUSION TRANSMISSIBLE INFECTIONS AMONG BLOOD DONORS IN A TERTIARY HOSPITAL, SOUTHEAST NIGERIA: ANY CHANGE OVER TIME?

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Abstract

Background: Transfusion-transmissible infections (TTIs) remains a global issue and great health concern. There is need for continuous monitoring, stringent donor testing and selection to ensure downward trend in the prevalence of TTIs and make progress in blood transfusion safety.

Aim: To evaluate the changing trend in prevalence of TTIs among blood donors in a Nigerian Tertiary Hospital.

Materials and Methods: This is a retrospective study of results of donor screening within the study period. Relevant data from the donor register were retrieved and entered into Excel spreadsheet after obtaining ethics clearance. These include demographics, donor type and chemiluminescent microparticle immunoassay results for human immunodeficiency virus (HIV), hepatitis B surface antigen (HBsAg), hepatitis C virus (HCV) and syphilis (venereal disease research laboratory). Statistical analysis was performed using ?STATA-20. Chi-square and regression analysis was used to test for associations and the level of significance was set at P-value < 0.05.

Results/Conclusion: A prevalence rate of 4.8% transfusion-transmissible infections was found amongst the blood donors with prevalence rate of 1.2% for HIV, 1.5% each for HCV and HBsAg, and 1.0% for Syphilis. The trend in prevalence of TTIs, donor type and other demographics remains unchanged in the. This can be attributed to the deep rooted beliefs, myth, cultural perception and practice of the locales.

Key words: Blood donor type, changing trend, transfusion transmissible infections, chemiluminescent micro-particle immunoassay

Introduction

Blood transfusion practice remains an important aspect of patient management and a large number of pints of blood are transfused daily in the hospitals. Even though blood transfusion saves lives, it can also be a source of threat to life due to adverse events such as haemolytic transfusion reaction, anaphylaxis and transmission of infectious blood-borne pathogens.[1,2]

Transfusion transmissible infections is the commonest adverse event of blood transfusion and exposes the recipient to the complications of the infectious agents such as chronic hepatic failure, other organ damage and even death.[3] It is a global public health concern,[4] and concerted effort geared towards continuous awareness and enlightenment together with advancement in screening and donor selection to ensure downward trend in the incidence of TTIs and make progress in blood safety is the key to completely eliminate the problem.[5,6] To minimize these adverse outcomes, stringent rules are applied to ensure that safe blood is provided for the recipient which includes stringent screening for transfusion-transmissible infections.

There are different types of blood donation which include voluntary non-remunerated, autologous, family replacement, commercial or paid blood donation.[7] The WHO and various national blood transfusion agencies emphasize on voluntary non-remunerated donors as it is the best approach to safe and regular blood supply to meet the blood supply needs.[8,9,10] Another safe approach is autologous blood donation which is the method in which the patient donates his or her blood to be re-used in future. It has several advantages of eliminating most of the adverse transfusion reactions seen in homologous blood transfusion as well as closing the gap in supply demand.[11] In a study done in some parts of Nigeria, autologous blood transfusion was effective in meeting the blood demand need.[12]However, this practice is yet to receive wide acceptability especially in developing countries as most hospitals and blood banks in sub-Saharan Africa that rely on paid donors, who are at risk population, for a large pool of donated blood.

The main component of an integrated strategy for blood safety include collection of blood only from voluntary, non-remunerated blood donors, screening for all transfusion transmitted infections and reduction of unnecessary transfusions. According to World Health Organization (WHO), in 2006 more than 75% of the blood donations were received from different families of patient but other 25% were received from the professional blood donors on payment.[13,14] However, in some developed regions, there is increase in voluntary blood donations (77%) as against (23%) who were familial/replacement donors as in the case of research data from western turkey study.[15]

The WHO recognizes and emphasizes blood donation from only voluntary non-remunerated donors, however in Nigeria as shown by some studies, the vast majority of donors are from family (replacement) donors and commercial (paid) donors mainly due to our cultural belief and understanding which made voluntary donations difficult to be widely acceptable as well as our extended family system practice, hunger and poverty which fuel demand for gratification for blood donation.[16,17]

In a national survey on blood transfusion conducted in Nigeria in 2006, it was found that in the public sector, 75% of the donor population was made up of replacement donors while 25% were commercial donors. Voluntary unpaid donors were negligible. It was even a worst case scenario in the private sector with 75% of the donor population being commercial donors and 25% of replacement donors. Voluntary unpaid donors were insignificant.[18,19]

The national blood transfusion service in Nigeria was established in 2006 [18] and was renamed national blood transfusion commission with a law enacted in 2021 with the mandate to change this narrative and promote safe and effective blood transfusion practice in Nigeria.
The different types of blood donors carry different risks of transmitting TTIs but voluntary blood donors remain the safest way of ensuring reduced transmissibility. However, some studies have reported varying prevalence of TTIs even among voluntary blood donors.

A study done in Faisalabad found a high rate of transfusion transmissible infections among voluntary blood donors at 11.55% with positivity rate of 6.97%, 2.02%, 0.01% and 2.43% for hepatitis C, HBV, HIV and syphilis respectively.[20] compared to lower prevalence of 0.24% for HIV infections, 0.38% for Hepatitis B infections, 0 for Hepatitis C and 0.04% for Syphilis in an Indian hospital study.[21]

A review of epidemiology of TTIs among the different categories of blood donors(both voluntary and commercial donors) has been carried out previously in our center by Okocha et al[19] and TTI prevalence rates of 3.7%, 2.0%, 2.0% and 0.1% were detected for HIV, HBsAg, HCV and Syphilis in the study respectively. Since then, certain measures were put in place from the year 2019 towards increasing voluntary blood donation and reducing risk of TTIs in line with global best practices. A separate unit called blood donor recruitment unit was created with the mandate of creating awareness, mobilization and recruitment of voluntary donors, organizing blood drive, donor club and blood donor day celebrations. This unit is well staffed and is given support by the hospital management in carrying out their function.

This study assessed the impact of these interventions and provide current data on seroprevalence of the common transfusion transmissible infections in our environment namely HIV, HBsAg, HCV and VDRL which will aid health policy makers in decision-making and intervention.

Methods

Study area

This study was conducted at the Blood Bank Unit of the Department of Haematology and Blood Transfusion, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State, Nigeria, a 500-bed public teaching hospital that offers tertiary health services to the people of Anambra state and environs. The blood bank caters for the blood transfusion needs of the entire patients from different departments in the hospital and has qualified staff who man the blood bank. All the testing for TTIs are done using the chemilumnescent microparticle immunoassay method.

Study design and Data collection

This is a descriptive, cross-sectional retrospective study of all potential blood donors who visited the blood bank between September 2020 and May, 2022 to donate blood. The archived donor screening registers were retrieved and relevant data such as age, sex, PCV, screening status, donor type and blood group were extracted. The potential donor must meet the inclusion criteria for blood donation.[22]

Transfusion Transmissible Infection screening for HIV, HBsAg, anti-HCV and VDRL were performed using chemiluminescent microparticle immunoassay with kits from Autobiod Diagnostics Ltd and according to manufacturer's instructions. Positive samples were again re-tested on the following day for confirmation. The samples and blood bag were discarded for which the pilot sample was positive, according to standard procedure and corresponding donors notified. They were consequently referred to infectious diseases or gastroenterology units or IHVN center of the institution as the case may be for Western Blot confirmation and other tests. High-level confidentiality was maintained at every step.

Data analysis

The data collected for this study were thoroughly cleaned and analyzed using the Python 3.10.0 programming language. Summary statistics were used to describe the parametric numerical variables, including means and standard deviations, while non-parametric variables were presented using medians and interquartile ranges. Categorical variables were analyzed in terms of frequencies and percentages to reflect their distributions.

Prior to comparing two numerical variables, normality and variance assumptions were checked. Parametric numerical subsets were assessed using Student's t-test and ANOVA, while non-parametric indices were analyzed using Wilcoxon and Kruskal-Wallis tests. Pearson correlation analysis was employed to investigate the relationships between two numerical variables of interest. Additionally, potential predictive variables for the severity of transfusion-transmitted infections in blood donors were evaluated using linear regression analysis. A significance level of $p<0.05$ was considered statistically significant for this study.

Results

The total number of potential donors who were screened for blood donation between September 2020 and May 2022 was 2,672, with 2,280 (85.3%) males and 392 (14.7%) females. The median age of the donors was 26.0 (IQR 23.0 – 34.0) years, ranging from 18 to 70 with male preponderance. Young adults (18-28 years) made up the largest group (58.5%), while those above 50 years made up the smallest group (1.8%). (Table 1). Males were also found to be more than the females in the younger age group 29 – 39 years with a higher median age of 27years compared to 25 years in females which was found to be statistically significant (P-0.0001). Males were also found to have a statistically significant higher mean PCV level (41L/L) than females (37L/L) and more as family replacement donors (P-0.0001).

Regarding the distribution of donors' ABO blood types, blood group O was the highest 1,984 (74.3%) followed by A 495 (18.5%), B 185 (6.9%), and the least was AB blood type 8 (0.3%). Majority of the donors were Rhesus positive (86.2%) while Rhesus negative donors accounted for 13.8%. In this study, commercial donors form the bulk of the donor pool accounting for 69.35% of the donors. The rest were made up of 675 (25.3%) familial replacement, 134 (5.0%) volunteer donors and 11 (0.4%) autologous blood donors.

A total of 127 (Because a total number of 11[eleven] donors were exposed to more than one TTIs) donors were exposed to at least one agent making it a prevalence rate of 4.8% transfusion-transmissible infections. Among them, 32 (1.2%) tested positive for HIV, 39 (1.5%) each for HCV and HBsAg, while 28 (1.0%) for Syphilis. (Table 2). Among the commercial donors, there were a total of 93 instances of TTIs, including 29 (1.6%), 23 (1.2%), 20 (1.1%), and 21 (1.1%) cases of HBA total number of 11 donors were exposed to more than one TTIs.

Also, sAg, HCV, Syphilis, and HIV, respectively. The incidence of TTIs among the family replacement donors was 40 (6%), with 10 (1.5%), 12 (1.8%), 8 (1.2%) and 10 (1.5%) reactive instances of HBsAg, HCV, Syphilis, and HIV, respectively. Four of the volunteer donors had transfusion transmissible infections, with HCV and HIV reactive cases making up 3 (2.2%) and 1 (0.7%) respectively of those cases and only one case (9.1%) of HCV reactivity was recorded among autologous blood donors.

In terms of the prevalence of TTIs associated with blood types, the study recorded 105 (82.7%), 12 (9.4%), 9 (7.1%) and 1 (0.8%) among O, A, B and AB blood types respectively with Rhesus positivity accounting for 119 (93.7%) and Rhesus negative 8 (6.3%).

After adjusting for age, gender and PCV, O positive blood group emerged as the significant predictor of TTI among blood donors in our center.

Table 2: Prevalence of Transfusion Transmissible Infections

Total TTI	Frequency	Percentage (%)
Negative	2545	95.2
Positive	127(138)	4.8
HIV		
Negative	2640	98.8
Positive	32	1.2
HBsAg		
Negative	2633	98.5
Positive	39	1.5
HCV		
Negative	2633	98.5
Positive	39	1.5
VDRL		
Negative	2644	99.0
Positive	28	1.0

Table 3: Association between Gender and other variables

	Total (n=2672)	Male (n = 2280)	Female (n = 392)	p-value
Age	26.0 (23.0-34.0)	27.0 (24.0-35.0)	25.0 (21.0-30.0)	0.0001
Age Category				
18-28	1564 (58.5)	1284 (56.3)	280 (71.4)	
29-39	760 (28.4)	688 (30.2)	72 (18.4)	0.0001
40-50	299 (11.2)	264 (11.6)	35 (8.9)	
Above 50	49 (1.8)	44 (1.9)	5 (1.3)	
PCV	40.0 (38.0-42.0)	41.0 (39.0-43.0)	37.0 (36.0-39.0)	0.0001
Blood group				
A	495 (18.5)	423 (18.6)	72 (18.4)	
AB	8 (0.3)	5 (0.2)	3 (0.8)	0.25
B	185 (6.9)	162 (7.1)	23 (5.9)	
O	1984 (74.3)	1690 (74.1)	294 (75.0)	
Rhesus factor				
B Negative	370 (13.8)	326 (14.3)	44 (11.2)	
Positive	2302 (86.2)	1954 (85.7)	348 (88.8)	0.122
HIV				
Negative	2640 (98.8)	2251 (98.7)	389 (99.2)	
Positive	32 (1.2)	29 (1.3)	3 (0.8)	0.548
HBsAg				
Negative	2633 (98.5)	2247 (98.6)	386 (98.5)	
Positive	39 (1.5)	33 (1.4)	6 (1.5)	1
HCV				
Negative	2633 (98.5)	2246 (98.5)	387 (98.7)	
Positive	39 (1.5)	34 (1.5)	5 (1.3)	0.92
VDRL				
Negative	2644 (99.0)	2256 (98.9)	388 (99.0)	
Positive	28 (1.0)	24 (1.1)	4 (1.0)	1
Type of donor				
Autologous	11 (0.4)	9 (0.4)	2 (0.5)	
Family replacement	675 (25.3)	535 (23.5)	140 (35.7)	0.0001
Paid	1852 (69.3)	1634 (71.7)	218 (55.6)	
Voluntary	134 (5.0)	102 (4.5)	32 (8.2)	
Total TTI				
Negative	2545 (95.2)	2170 (95.2)	375 (95.7)	
Positive	127 (4.8)	110 (4.8)	17 (4.3)	0.771

Table 4: Association between Donor Type and other Variables

	Total	Autologous	Family replacement	Paid	Voluntary	p-value
N	2672 (100)	11 (0.4)	675 (25.3)	1852 (69.3)	134 (5.0)	-
Age	26.0 (23.0-34.0)	38.0 (30.0-43.0)	31.0 (25.0-39.0)	26.0 (23.0-31.0)	30.0 (25.0-38.75)	0.0001
Age Category						
18-28	1564 (58.5)	3 (27.3)	282 (41.8)	1221 (65.9)	58 (43.3)	
29-39	760 (28.4)	3 (27.3)	241 (35.7)	472 (25.5)	44 (32.8)	0.0001
40-50	299 (11.2)	5 (45.5)	126 (18.7)	143 (7.7)	25 (18.7)	
Above 50	49 (1.8)	0 (0.0)	26 (3.9)	16 (0.9)	7 (5.2)	
PCV	40.0 (38.0-42.0)	39.0 (37.0-42.0)	40.0 (38.0-42.0)	40.0 (38.0-42.0)	41.0 (39.0-45.0)	0.0001
Gender						
Female	392 (14.7)	2 (18.2)	140 (20.7)	218 (11.8)	32 (23.9)	
Male	2280 (85.3)	9 (81.8)	535 (79.3)	1634 (88.2)	102 (76.1)	0.0001
Blood group						
A	495 (18.5)	0 (0.0)	136 (20.1)	330 (17.8)	29 (21.6)	
AB	8 (0.3)	0 (0.0)	4 (0.6)	1 (0.1)	3 (2.2)	0.0001
B	185 (6.9)	1 (9.1)	53 (7.9)	117 (6.3)	14 (10.4)	
O	1984 (74.3)	10 (90.9)	482 (71.4)	1404 (75.8)	88 (65.7)	
Rhesus factor						
Negative	370 (13.8)	0 (0.0)	76 (11.3)	278 (15.0)	16 (11.9)	
Positive	2302 (86.2)	11 (100.0)	599 (88.7)	1574 (85.0)	118 (88.1)	0.045
HIV						
Negative	2640 (98.8)	11 (100.0)	665 (98.5)	1831 (98.9)	133 (99.3)	
Positive	32 (1.2)	0 (0.0)	10 (1.5)	21 (1.1)	1 (0.7)	0.829
HBsAg						
Negative	2633 (98.5)	11 (100.0)	665 (98.5)	1823 (98.4)	134 (100.0)	
Positive	39 (1.5)	0 (0.0)	10 (1.5)	29 (1.6)	0 (0.0)	0.513
HCV						
Negative	2633 (98.5)	10 (90.9)	663 (98.2)	1829 (98.8)	131 (97.8)	
Positive	39 (1.5)	1 (9.1)	12 (1.8)	23 (1.2)	3 (2.2)	0.107
VDRL						
Negative	2644 (99.0)	11 (100.0)	667 (98.8)	1832 (98.9)	134 (100.0)	
Positive	28 (1.0)	0 (0.0)	8 (1.2)	20 (1.1)	0 (0.0)	0.642
Total TTI						
Negative	2545 (95.2)	10 (90.9)	637 (94.4)	1768 (95.5)	130 (97.0)	
Positive	127 (4.8)	1 (9.1)	38 (5.6)	84 (4.5)	4 (3.0)	0.437

Table 5: Association between TTI status and other variables

	Total (n=2672)	Negative (n = 2545)	Positive (n = 127)	p-value
Age	29.16 ± 8.13	29.15 ± 8.15	29.38 ± 7.7	0.757
Age Category				
18-28	1564 (58.5)	1495 (58.7)	69 (54.3)	
29-39	760 (28.4)	715 (28.1)	45 (35.4)	0.278
40-50	299 (11.2)	287 (11.3)	12 (9.4)	
Above 50	49 (1.8)	48 (1.9)	1 (0.8)	
PCV	40.49 ± 2.96	40.48 ± 2.95	40.72 ± 3.11	0.361
Gender				
Female	392 (14.7)	375 (14.7)	17 (13.4)	
Male	2280 (85.3)	2170 (85.3)	110 (86.6)	0.771
Blood group				
A	495 (18.5)	483 (19.0)	12 (9.4)	
AB	8 (0.3)	7 (0.3)	1 (0.8)	0.041
B	185 (6.9)	176 (6.9)	9 (7.1)	
O	1984 (74.3)	1879 (73.8)	105 (82.7)	
Rhesus factor				
Negative	370 (13.8)	362 (14.2)	8 (6.3)	
Positive	2302 (86.2)	2183 (85.8)	119 (93.7)	0.017
Type of donor				
Autologous	11 (0.4)	10 (0.4)	1 (0.8)	
Family replacement	675 (25.3)	637 (25.0)	38 (29.9)	0.437
Paid	1852 (69.3)	1768 (69.5)	84 (66.1)	
Voluntary	134 (5.0)	130 (5.1)	4 (3.1)	

Table 6: Univariate Logistic Regression of Predictors associated with Transfusion Transmissible Infections

Predictors	OR	p-value	95th CI
Age	1.003	0.7566	0.982 - 1.025
Age Category			
18-28 (ref)	-	-	-
29-39	1.364	0.1153	0.927 - 2.006
40-50	0.906	0.757	0.484 - 1.694
Above 50	0.451	0.4345	0.061 - 3.318
PCV	1.028	0.3613	0.969 - 1.09
Gender			
Female (ref)	-	-	-
Male	1.118	0.6751	0.663 - 1.885
Blood Group			
A (ref)	-	-	-
AB	5.75	0.1145	0.655 - 50.469
B	2.058	0.1084	0.853 - 4.969
O	2.249	0.0087	1.228 - 4.121
Rhesus Factor			
Negative (ref)	-	-	-
Positive	2.467	0.0146	1.195 - 5.09
Type of Donor			
Voluntary (ref)	-	-	-
Family Replacement	1.939	0.2154	0.68 - 5.526
Paid	1.544	0.4032	0.558 - 4.277
Autologous	3.25	0.3118	0.331 - 31.894

Table 7: Multiple Logistic Regression of Predictors associated with TTI

Index	OR	**p-value**	**95th CI**
Age Category			
18-28 (ref)	**-**	-	-
29-39	1.269	0.2331	0.858 - 1.878
40-50	0.833	0.5696	0.444 - 1.564
Above 50	0.420	0.3947	0.057 - 3.098
PCV	1.022	0.5007	0.959 - 1.089
Gender			
Female (ref)	-	-	-
Male	1.059	0.8426	0.602 - 1.861
Blood group			
A (ref)	-	-	-
O	2.203	0.0108*	1.2 - 4.044
B	2.079	0.1046	0.859 - 5.031
AB	6.275	0.1008	0.7 - 56.278
Rhesus Factor			
Negative (ref)	-	-	-
Positive	2.469	0.0148*	1.194 - 5.106

Discussion

Transfusion transmissible infections remain a major concern in blood transfusion practice, patient management, hence deserves all attention and effort to improve the practice. This study is a way of further strengthening the knowledge base in the field of medicine. The WHO advocates for stringent donor screening to ensure blood safety and adopted by national blood transfusion services, hospitals and blood bank centers.[2,4,18] The potential donors are usually apparently healthy and unaware that they are carriers of the infective agents which can be detected for the first time during screening for blood donation hence, they pose a risk of transmitting the virus to the recipient if not properly screened. In this study, those recruited into the TTI screening were those who met the requirements for age, weight, haematocrit/packed cell volume as well as absence of chronic disease condition.[22] Seropositivity to any of the TTIs may be the only exclusion criteria in the potential donor.

Similar studies have been conducted around the globe and there were similarities and differences found with this present study. In this study, the majority of the donors, 2280 (85.3%) were found to be males and young adults, 1564 (58.5%) between the ages of 18 years and 28 years which is similar to other local studies as well in other parts of the world. [8,15,19,22,23] This is understandable as this age group is the most active and likely healthy group, willing to donate blood, either induced or voluntarily and that may not be burdened by co-morbidities. However, they are more likely be infected by the TTIs as seen in this study because they are more likely to engage in risky sexual behavior as almost all the TTIs are known to be sexually transmitted.

This study revealed a higher prevalence of commercial (paid) donors 1,852 (69.3%) and low voluntary donors 134 (5.0%) with no significant differences when compared to the previous study by Okocha et al [19] in the same study site despite the efforts put in the place to increase awareness, donor drive and recruitment. This may be attributable to the deep rooted beliefs, myth, cultural perception and practices of the locales.[7,24]

These same factors also mitigate against voluntary blood donations in addition to misconceptions of ill-health and death following blood donation, lack of awareness, understanding and prevalent nutritional anaemia in low and middle-income countries. [7,25]

In some other studies done previously in other parts of Nigeria, similar high prevalence of commercial donors was observed.[8,26] however, commercial donors are non-existence or very few in some countries, especially high income countries that have attained WHO mandate of 100% voluntary blood donation.[15,27]

The overall prevalence of TTI in this study was found to be 4.8% which is low when compared to studies done in Calabar, South-South Nigeria with 14.96%[26] and some African countries like Ghana which recorded a prevalence of 18.3% in their study,[28] but higher in study done in Serbia (0.38%),[27] and Bangladesh (1.2%).[29] This can be attributed to the high number of paid donors when compared to the studies that have predominant voluntary and family replacement donors. HIV positivity of 1.2% was found to be lower than national prevalence of 1.36%.[30] The prevalence of Hepatitis C and B viral reactivity of 1.5% each was recorded in this study which was slightly lower than 2.0% recorded in the previous study by Okocha et al [19] while Syphilis contributed 1.0% as against 0.0% in the previous study.

These slight changes may be due to improved screening method employed. Rapid tests were used in the previous study while chemiluminescent immunoassay which has better sensitivity and specificity was used in the present study.

In terms of donor type, TTI was found to be higher in commercial or paid donors than in voluntary donors though not statistically significant and is similar to some other studies done in Nigeria. [8, 26] This finding supports the evidence that voluntary donors are safer to donate blood than paid donors as they have better health seeking behavior.[31]

In this study, the only significant predictive factor associated with TTI is blood group O positive and similar to findings in study done in Telangana, India.[22] Age, sex, donor type nor haematocrit level had no influence on predicting presence of TTI.

Limitation

Nucleic Acid Amplification Technology (NAAT) which is more sensitive for detecting window periods in HIV infection was not used in donor screening due to non-availability and this could have affected the prevalence of HIV. The prevalence rate found in female donors cannot be extrapolated to the general population because of the few number of female donors encountered in this study

Conclusion

The study demonstrated a continued heavy reliance on paid donors and family replacement with male predominance in our center. This clearly demonstrates significant risk exposure to the patient with adverse consequences. A lot of efforts is still needed in Nigeria at national, state and local government level to change the narrative of blood transfusion practice in the country. The National Blood Transfusion Commission should be adequately funded and supported by government in their efforts to bringing about positive change in blood transfusion practice in Nigeria.

Potential donors who pose a high risk of infection should be identified and disqualified from the blood donation process by employing self-exclusion form and review of their medical histories as well as stringent testing protocol.

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