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The Seroprevalence of Transfusion-Transmissible Pathogens: A Retrospective Study in Port Harcourt, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Blood transfusion is a vital medical intervention which has over the years, saved a lot of lives worldwide. However, uncertainties over the safety of blood for transfusion remains a major public health concern across sub-Saharan Africa particularly, Nigeria. The inadequacies of national blood transfusion policies and related factors have contributed to making blood for transfusion unsafe. Blood meant to save lives, may thus become vehicles for dissemination of transfusion transmissible pathogens such as hepatitis B virus HBV, hepatitis C virus (HCV), human immunodeficiency virus (HIV) and syphilis. This study was aimed at determining the prevalence of transfusion transmissible pathogens among blood donors in Port Harcourt, Nigeria.
Methodology: This is a retrospective cross sectional descriptive study involving a review of laboratory records of 554 blood donors at Diagnostix and Scientifique Research Laboratories, Port Harcourt, Nigeria between January 2019 and December 2022. It involved the extraction of relevant

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data including age, gender, category of donor and the results of the screening tests for hepatis B virus, hepatitis C virus, Human immunodeficiency virus and syphilis.
Results: The overall seroprevalence of the transfusion transmissible pathogens as observed in this study was 11.7%. The seroprevalence for males was 11.9% and that for females was 7.2%. The highest seroprevalence for the age groups was observed with the >40 age bracket (25.5%), the least was 18-25 (7.0%), Among the categories of donors, the Commercial (Paid) donors had a prevalence of 12.2%, Family (Replacement) Donors (7.1%) and Voluntary, (Unpaid Donors) 16.3%. The prevalence of HBV was 6.0%, HCV 0.7% HIV 4,0% and syphilis 1.1%.
Conclusion: The prevalence rates observed in the pathogens are unacceptable. Blood for transfusion must meet the highest standards of safety and everyone has to contribute towards ensuring that blood for transfusion is made to be safer.

Keywords: Blood transfusion; transfusion transmissible infections; HBV; HCV; HIV; syphilis.

1. INTRODUCTION

The transfusion of whole blood or its components have contributed immensely in saving the lives of millions of people over the years; particularly for such high-risk populations as pregnant women during childbirth, sick or malnourished infants, persons with sickle cell disease, victims of accidents, war and terrorism among others. This is more so in developing countries, where anaemia is reported to account for 15% of child deaths in Africa [1]. It is therefore clear that the important roles of blood transfusion as a lifesaving intervention cannot be over-emphasized in such situations as anemia, bleeding, plasma clotting factor deficiency, thrombocytopenia, and hypoalbuminia [1].

A major challenge of blood transfusion as a medical procedure stems from its nature as biological material derived from humans; it is thus prone to contamination with microbial pathogens associated with human microbiomes, hence the transfusion transmissible infections (TTIs) such as hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and syphilis malaria parasites and others [2,3]. Transfusion transmissible diseases pose great threats to public health because of the associated morbidity, mortality and costs in human and economic resources. This is more so in sub-Saharan Africa due to deficient or virtually non-existent national blood transfusion regulations, services, infrastructure, qualified manpower, and financial resources [4].

Globally, concerted efforts have been made to combat the scourge of TTIs, with the World Health Organization (WHO) strongly calling for obligatory TTIs screening for all blood meant for transfusion, which is now an accepted and mandatory practice in all blood banks. This is part of measures aimed at safeguarding recipients of transfused blood from being infected with TTIs. These have however not been able to eradicate the challenge of these infections especially in resource challenged countries of sub-Saharan Africa [5,6]. The importance of safe blood and blood components for transfusion is underscored by the fact that transfusions are usually given during periods of ill-health; when the immune system is compromised and the patient is most vulnerable to the virulence of pathogens [7]. The transfusion transmissible pathogens are known to cause chronic, and life-threatening diseases in healthy persons, but the condition in blood recipients is worsened by the relatively high dosage of pathogens inoculated with transfused blood coupled with the vulnerable health status.

The first stage in the transfusion of safe blood is the selection of a healthy donor [8]. A healthy blood can only be obtained from a healthy donor, while an infected donor can only give infected blood. Thus, the selection of healthy donors and screening of the blood for pathogens prior to bleeding a donor are indispensable in the transfusion of safe blood. There are three identified categories of blood donors in Nigeria, namely commercial or paid donors, family or replacement donors and the voluntary donors [9].

The parlous state of blood transfusion in Nigeria is mirrored by the fact that commercial “money-for blood” donors are the prevalent class of donors in the country. Commonly known as blood touts, they are mostly unemployed young men between the ages of 18 and 30, unemployed or engaged in low-paying jobs, who need the money paid by blood banks for feeding or indulging in behaviours that may be high risk for

recipients. Family or replacement donors are family members, friends, associates or co-worshippers who donate blood to assist a recipient. It may be to save money, or avoid giving "unknown" person's blood or some other reasons. It is usually unremunerated though some members of a family may appreciate the donor in one way or the other. The voluntary donor is a public-spirited individual providing blood for the purely altruistic reason of saving lives without any remuneration. The voluntary non-remunerated blood donors are preferred donors due to low risk of TTIs, but are the least common category in Nigeria and usually follow after mobilization campaigns for voluntary donation.

This study was aimed at determining the prevalence of HBV, HCV, HIV and syphilis at a medical laboratory facility in Port Harcourt.

2. MATERIALS AND METHODS

2.1 Study Area

The study area is Port Harcourt, the capital and major city of Rivers state, Nigeria. It is located on Latitude: 4°46′38″ N Longitude: 7°00′48″ E on an Elevation of 16mm above sea level, lying along the Bonny River and named after Lewis Harcourt, its former colonial secretary. The metropolis has a "tropical monsoon climate with a lengthy and heavy rainy season and very short dry season". Harmattan (dusty winds) prevalent in most part of the country is relatively suppressed; December is the hottest and driest month; September witnesses the heaviest rain falls. The atmospheric temperatures are fairly stable around 25°C - 28°C. As a major city in the oil rich Niger Delta region, the economy of Port Harcourt primarily revolves around the petroleum and gas industry, with much of the urbanization and modernization in the town proceeding from its associations with the oil industry.

2.2 Study Design

This is a retrospective cross sectional descriptive study involving a review of laboratory records of 554 blood donors who came to donate blood at Diagnostix and Scientifique Research Laboratories, Port Harcourt, Nigeria between January 2019 and December 2022. The review involved the extraction of relevant data such as the age, gender, and the results of the screening tests for hepatis B virus, hepatitis C virus, Human immunodeficiency virus and syphilis

2.3 Records of Screening tests for Transfusion Transmissible Pathogens

The procedure for screening tests were contained in the standard operating procedure (SOP) manual and World Health Organization recommendations.

Screening for Hepatitis B surface antigen (HBsAg), antibodies for Hepatitis C and *Treponema pallidum*.

The serological analyses for the detection Hepatitis B surface antigen (HBsAg), the relevant antibodies for Hepatitis C and *Treponema pallidum* were carried out using one-step HBsAg test strip (SD Bioline), one-step HCV test strip (SD Bioline), and one-step *Treponema pallidum* test strip (SD Bioline), respectively, following the manufacturer instructions.

2.3.1 Screening for HIV 1 and 2

The serum samples were screened for HIV-1/2 using Determine (Abbott Diagnostics Medical Company, Japan). Positive samples were retested with Uni-Gold (Trinity Biotech) or Statpack following the manufacturers' instruct-tions

2.4 Data Analysis

Data were cleaned using Excel spreadsheet 2016, and analyzed using IBM SPSS Statistics version 25. Descriptive and inferential statistics were employed in results presentation and interpretation. Associations between possible risk factors namely, gender, age category and the TTIs infections were determined using Pearson's Chi-Square test of independence and Fisher exact test at significance levels below 0.05.

3. RESULTS

This study involved the review of blood transfusion records of 554 donors who donated blood at Diagnostix and Scientifique Laboratories, a medical laboratory offering services to private and public healthcare facilities in Port Harcourt Nigeria between January 2020 and December 2023. There were 540 (97.5%) males and 14 (2.5%) females. The ages of the donors ranged from 18 to 59 years; the mean age was 31.06 ± 6.706 years, the median is 31 years and the mode is 34 years. There are 492

(88.8%) paid donors, 56 (10.1%) replacement donors and 6 (1.1%) unpaid donors.

3.1 Seroprevalence of Four Transfusion Transmissible pathogens (HBV, HCV, HIV and Syphilis) among Blood Donors

The seroprevalence of the combined pathogens as observed in this study was 11.7%. The seroprevalence for males was 11.9% and that dor females was 7.2%. The seroprevalence for the age groups were as follows: 18-25 (7.0%), 26-30 (7.2%) 31-35 (12.4%), 36-40 (18.3%) >40 (25.5%). Among the three categories of donors. The Commercial (Paid) donors had a prevalence of 12.2%, the Family (Replacement) Donors (7.1%) and Voluntary, (Unpaid Donors 16.3%). (Table 1).

3.2 Seroprevalence of HBV among Blood Donors

The seroprevalence of hepatitis B among the blood donors was 6.0% The seroprevalence for males was 6.0% and that for females was 0.7%. The seroprevalence for the age groups were as follows: 18-25 (28.5%), 26-30 (4.6%) 31-35 (5.9%), 36-40 (7.0%) >40 (14.9%). Among the three categories of donors. The Commercial (Paid) donors had a prevalence of 6.0%, the Family (Replacement) Donors (5.4%) and Voluntary, (Unpaid Donors 16.7%). (Table 2).

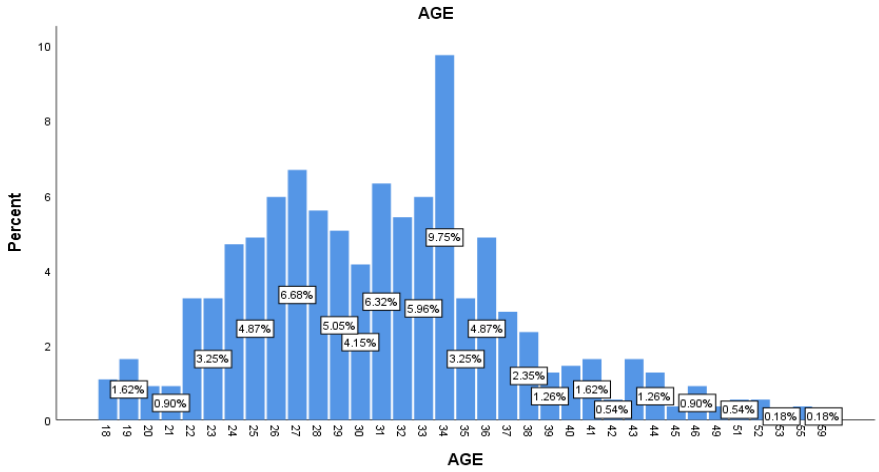

Fig. 1. distribution of the ages of blood donors

Table 1. Seroprevalence of four transfusion transmissible pathogens (HBV, HCV, HIV and Syphilis) among Blood Donors

Characteristics	Frequency	Prevalence	Percent
Age Group			
18-25	114	8	7.0
26-30	152	11	7.2
31-35	170	21	12.4
36-40	71	13	18.3
>40	47	12	25.5
Gender			
Male	540	64	11.9
Female	14	1	7.2
Category			
Commercial	492	60	12.2
Family	56	4	7.1
Voluntary	6	1	16.7
Total	554	65	11.7

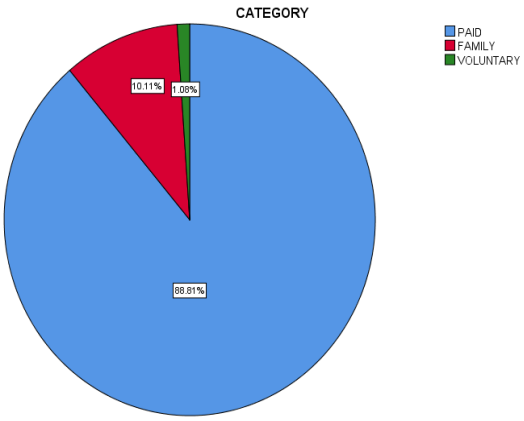

Fig. 2. The distribution of categories of blood donors

Table 2. Seroprevalence of hepatitis B virus infections among blood donors

Characteristics	Frequency	Prevalence	Percent
Age Group			
18-25	114	4	28.5
26-30	152	7	4.6
31-35	170	10	5.9
36-40	71	5	7.0
>40	47	7	14.9
Gender			
Male	540	32	5.9
Female	14	1	0.7
Category			
Commercial	492	29	6.O
Family	56	3	5.4
Voluntary	6	1	16.7
Total	554	33	6.0

3.3 Seroprevalence of HCV Among Blood Donors

The seroprevalence of hepatitis C among the blood donors was 0.7% The seroprevalence for males was 0.7% and that for females was 0.0%. The seroprevalence for the age groups were as follows: 18-25 and, 26-30 had zero prevalence, 31-35 ((0.6%), 36-40 (1.4%) >40 (4.8%) The Commercial (Paid) donors had a prevalence of 0.7%, the Family (Replacement) Donors and Voluntary, zero prevalence apiece. (Table 3).

3.4 Seroprevalence of HIV Among Blood Donors

The seroprevalence of Human Immunodeficiency Virus (HIV) among the blood donors was 4.0% The seroprevalence for males was 4.1% and that for females was 0.0%. The seroprevalence for the age groups were as follows: 18-25, 26-30 had prevalence 2.6% apiece, 31-35 ((4.3%), 36-40 (4.1%) >40 (4.3%) The Commercial (Paid) donors had prevalence of 4.3%, and the Family (Replacement) donors (1.8%), while Voluntary donors, had zero prevalence. (Table 4).

3.5 Seroprevalence of Syphilis Among Blood Donors

The seroprevalence of Syphilis among the blood donors was 1.1% The seroprevalence for males was 1.2% and that for females was 0.0%. The seroprevalence for the age groups were as follows: 18-25 (0.7%) 26-30 (0.0%), 31-35 ((2.1%), 36-40 (1.4%) >40 (2.1%) The Commercial (Paid) donors (0.0%), and the Family (Replacement) donors (1.8%), while zero prevalence was observed among voluntary donors. (Table 5).

Table 3. Seroprevalence of hepatitis C virus infections among blood donors

Characteristics	Frequency	Prevalence	Percent
Age Group			
18-25	114	0	0.0
26-30	152	0	0.0
31-35	170	1	0.6
36-40	71	1	1.4
>40	47	2	4.8
Gender			
Male	540	4	0.7
Female	14	0	0.0
Category			
Commercial	492	4	0.8
Family	56	0	0.0
Voluntary	6	0	0.0
Total	554	4	0.7

Table 4. Seroprevalence of Human immunodeficiency virus infections among blood donors

Characteristics	Frequency	Prevalence	Percent
Age Group			
18-25	114	3	2.6
26-30	152	4	2.6
31-35	170	7	4.1
36-40	71	6	8.5
>40	47	2	4.3
Gender			
Male	540	22	4.1
Female	14	0	0.0
Category			
Commercial	492	21	4.3
Family	56	1	1.8
Voluntary	6	0	0.0
Total	554	22	4.0

Table 5. Seroprevalence of syphilis infections among blood donors

Characteristics	Frequency	Prevalence	Percent
Age Group			
18-25	114	1	0.7
26-30	152	0	0.0
31-35	170	3	2.1
36-40	71	1	1.4
>40	47	1	2.1
Gender			
Male	540	6	1.1
Female	14	0	0.0
Category			
Commercial	492	6	1.2
Family	56	0	0.0
Voluntary	6	0	0.0
Total	554	6	1.1

3.6 Statistical Analysis

Pearson's Chi-square test of independence and Fisher's exact test were used to ascertain the existence of associations between the age brackets, gender, and category of donors on one hand and the prevalence of HBV, HCV, HIV and syphilis on the other side. The associations between HBV/gender, HBV/category, HCV/ age bracket, HCV/gender, HIV/age brackets, HIV/gender, HIV/category, syphilis /age brackets, syphilis /gender, and syphilis /category, were found not be statistically significant, given that the p values were not less than 0.05, we therefore fail to reject the null hypothesis which state that the variables are independent. In other words, there was no sufficient evidence to conclude that a significant association exists between these factors and the transfusion-transmitted infections among the blood donors.

On the other hand, the associations between HBV/ age bracket, and HCV/categories of blood donors were found to be statistically significant, given that the p values were less than 0.05, we therefore reject the null hypothesis which state that the variables are independent. In other words, there was sufficient evidence to conclude that a significant association exists between these factors and the sexually transmitted pathogens.

4. DISCUSSION

This study has been able to determine the prevalence of four transfusion transmissible pathogens, namely HBV, HCV, HIV, and syphilis among blood donors in Port Harcourt. The cumulative prevalence of 11.7% reported for the pathogens was slightly less than the overall prevalence of 14.96% reported at a tertiary healthcare facility in nearby Calabar in Nigeria [3]. It is comparable to the some overall results reported elsewhere in Africa and beyond. However, there are wide variations across countries. In Kenya, an overall prevalence of 14.1% was reported for TTIs in a regional blood transfusion centre and a mission hospital [10]. Other studies with high prevalences were in Ethiopia, 12.4% [11], Uganda 13.8% [12] China 8.96% [13], and Malawi 10.7% [14].

A study in Lagos reported an overall prevalence of *9.30%* [15,16], while in Makkah, Saudi Arabia a prevalence of 7.4% was reported in blood donors at a specialist hospital. Studies where low prevalences were reported include Somalia 2.99% [17] Rwanda 2.1% [18,19]. Algeria 0.8%18 and Pakistan 4.61% [20]. The prevalences of TTIs in blood donors appear to align closely with the prevailing prevalence of the general population of the area.

Hepatitis B virus is the most prevalent of the TTIs in many parts of Africa. In this study and other studies particularly in Africa, HBV tends to be the leading TTI. High incidence of TTIs is more critical in developing countries particularly in sub-Saharan Africa, where paid blood donors form the major source of blood for transfusion [11,12,14,18,20]. The prevalence of HBV as found in this study is 6.0%, which is close to most of the findings in other studies such as 5.6% reported in Kenya,10 6.0% in Gabon21 6.6% in Ethiopia [11,21]. It is also close 6.2% reported among abattoir workers in port Harcourt Nigeria, which was the prevalence in the general population [22].

The prevalence of 0.7% for HCV also aligns closely with reported prevalences in other studies. In Lagos, a prevalence of 0.72% was reported in two hospital-based transfusion centres.15 and 0.4% in Saudi Arabia.16 The prevalence of 4.0% observed for HIV is also in line with findings elsewhere. In Malawi, a prevalence of 2.4% was reported.14 and Calabar, Nigeria, 4.2%3 and Uganda 4.1%. The prevalence of 1.1% for syphilis also similar to finding in other studies. In Uganda, a prevalence of 2.8%12 was reported, and Saudi Arabia 0.34%16 the prevalence rate for of syphilis low, bu the population was much larger, which may account for the disparity. The prevalence rate of TTIs appear to be on a decline, when compared with reports of earlier studies, such as a study in south west Nigeria with the following prevalence rates: HBsAg 18.6%, HCV 6.0%, HIV 3.1% and syphilis 1.1% [23].

In this study, the commercial or paid donors constitute over 88% of the sources of blood supply, and more than 90% of the transfusion transmissible pathogens. This is mostly attributable to the class of people who are involved in the commercial blood donation. They are more than any other group of donors, more likely to be engaged in risky behaviours that constitute predisposing factors to TTIs. It is noteworthy that paid donors are the only category where all the TTIs were found, this poses some risks to the blood recipients given that blood borne pathogens can survive in stored blood for some time and have long window

period and incubator time. It is thus possible that persons who are newly infected may get through with the screening while they appear healthy. The study show that being a male, commercial donor between the ages of 30 to 40 years carries a statistical implication of being a risky blood donor, especially with respect to transmission of HBV and HCV infections. This is closely corroborated by some previous studies, including systematic review and meta-analysis studies of previous research reports [12,18,21,24,25].

The limitations of the study are largely the same as those associated with retrospective studies in general. It is limited in the number of sociodemographic characteristics to those in the laboratory records. The processing of specimens limited to what can done for the timely diagnosis for the treatment of patients. More in-depth analysis like genomics are not available because of costs and time, and here are no personal interactions with the participants. Some information that may enrich the study are therefore not captured. Future studies may be designed to overcome these limitations

5. CONCLUSION

This study has determined the seroprevalence of transfusion transmissible infections within Port Harcourt, Nigeria. Every people deserve safe, available, affordable and assured blood whenever and wherever it is needed for the treatment of medical conditions that calls for blood transfusion. The seroprevalence of TTIs as found in this study makes blood unsafe. The predominance of Paid commercial donors in the supply of blood to our healthcare facilities is unacceptable. This is a call for action for everyone to put more effort in ensuring that our blood for transfusion is free from pathogens. This study has determined the seroprevalence of transfusion transmissible infections within Port Harcourt, Nigeria. Every people deserve safe, available, affordable and assured blood whenever and wherever it is needed for the treat of medical conditions that calls for blood transfusion. The seroprevalence of TTIs as found in this study makes blood unsafe. The predominance of Paid commercial donors in the supply of blood to our healthcare facilities is unacceptable. This is a call for action for everyone to put more effort in ensuring that our blood for transfusion is free from pathogens. It appears there were no follow-up counselling and treatment programmes for persons who tested positive to TTIs particularly in private medical laboratories. It is highly advised that such programmes are instituted as part of efforts to curtail the spread of the pathogens.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

CONSENT

It is not applicable.

ETHICAL APPROVAL

This study was reviewed and approved by the ethical review committee of the Faculty of Medial Laboratory Science, Federal University, Otuoke, Nigeria. The approval of the management of the management of Diagnostix and Scientifique Laboratories, Port Harcourt, was sought and obtained before the commencement of the study.

COMPETING INTERESTS

Authors have declared that there was no existing competing interests.

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