


## Original Article

# Risk of Transfusion Transmissible Infections: Our Experience in a Tertiary Health Care Facility in North-central, Nigeria

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 <https://doi.org/10.46912/wjmb.17>

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Article Metrics

Date submitted: 29/07/2020

Date Accepted: 23/10/2020

Date Published: November, 2020



## ABSTRACT

The risk of transfusion transmissible infections (TTIs) is a challenge in most developing countries. We investigated the risk of transfusing infected blood following screening with the rapid diagnostic test (RDT) technique. Blood donors were initially screened for human immune-deficiency virus, hepatitis B virus, hepatitis C virus and syphilis using the rapid diagnostic test. Five hundred and forty (540) of them negative to the RDT for the four agents were subsequently screened with Enzyme linked immunosorbent assay (ELISA). A total of 72 (13.3%) prospective donors that tested negative to RDT for the TTIs tested positive to the ELISA technique. Further analysis showed that twenty-three (4.3%) donors were positive to HIV, 23 (4.3%) to hepatitis B, 20 (3.7%) to hepatitis C and 6 (1.1%) to VDRL. Three donors (0.6%) were found to be positive to both HIV/HBV, 3 (0.6%) to HIV/HCV, 2 (0.4%) each to HIV/VDRL, HBV/HCV and HBV/VDRL. There were no correlations of ELISA positivity with gender, age, marital status, blood group and the packed cell volume of the donors. The risk of transfusing infected blood using rapid diagnostic test (RDT) technique for screening is high. This can be significantly reduced by using ELISA testing techniques for screening blood for transfusion. All blood transfusion centres in Nigeria should as a matter of urgency commence the screening of blood donors with ELISA in order to curb the spread of these infectious agents.

**Keywords:** ELISA, Rapid Diagnostic Testing Technique, Risk, Transfusion Transmissible Infections.

## INTRODUCTION

**B**lood transfusion service is an essential component of quality health care delivery in modern medical practice. It is associated with drawbacks which include the transfusion of transmissible diseases. Practitioners have continuously improved on this over the years by inventing very strict donor recruitment strategies and highly sensitive methods of screening of donors.

Transfusion transmissible infections (TTIs) are part of the leading causes of morbidity and mortality worldwide.<sup>1</sup> Approximately 360 million people are infected worldwide

with the hepatitis B virus,<sup>2</sup> 300 million with the hepatitis C virus<sup>3</sup> and 37.9 million people with HIV.<sup>4</sup>

In screening blood donors, Enzyme-Linked Immunosorbent Assay (ELISA) and Nucleic Acid Testing (NAT) methods are considered to be more reliable than the rapid testing technique. As a result, the World Health Organization (WHO) has now mandated that blood donors must be tested for antibodies to HIV, Syphilis, HBV and HCV using the ELISA technique.<sup>5</sup>

Despite this advocacy from WHO, most developing countries still use the rapid test methods in screening blood donors due to unavailability of the facilities for ELISA and

NAT techniques.

Serological window period- which maybe up to 12 weeks- remains a source of residual risk for transmission of TTIs using the rapid screening test for blood donors.

As a result of this, the risk of transfusion transmissible infections is still a big challenge in most developing countries including Nigeria. Blood safety in sub-Saharan Africa is also jeopardized by multiple and diverse factors, including the predominance of high-risk family/replacement donors against voluntary donors and the high prevalence of transfusion-transmissible infections (TTIs).<sup>6</sup>

ELISA is a very sensitive immunochemical technique which is used to access the presence of specific protein (antigen or antibody) in a given sample. An enzyme conjugated with an antibody reacts with a colorless substrate to generate a colored reaction product. A number of enzymes have been employed for ELISA, including alkaline phosphatase, horseradish peroxidase, and  $\beta$ -galactosidase.<sup>7</sup> ELISA is more reliable than the rapid test because it more sensitive and has the capacity to reduce the window period of the infections significantly compared to the rapid screening tests. We carried out this research work to investigate the risk of transfusing infected blood after screening donors with the rapid diagnostic test (RDT) technique only. This objective was achieved by subjecting all the negative rapid test results to ELISA tests.

## MATERIALS AND METHODS

This was a prospective study conducted in a tertiary hospital in North-central, Nigeria from April to October, 2019. The authorization for this study was obtained from the management of the Hospital. Informed consent was also obtained from the participants of the study. The study population comprised prospective blood donors who were mainly family replacement donors. Persons who were disqualified from blood donation or did not give consent were excluded. The sample size was calculated using the formula for cross sectional studies for qualitative variables. The participants were recruited consecutively as they present for blood donation, until the target sample size was reached. Three (3mls) of blood was aseptically collected from the donors into an EDTA tube. Plasma from this sample was tested initially with the rapid diagnostic kit for HIV I and II antibodies, hepatitis B surface antigen, hepatitis C antibody and antibody to treponema palladium. The following rapid test kits were used according to the manufacturer's specifications for the initial screening:

Skytec rapid test kits from USA for HBsAg, HCV and Syphilis tests, and Determine by Alere Japan for HIV I/II test. The donors that tested negative to all the agents were allowed to donate a unit of blood. Subsequently, the donated blood units were screened for the same agents using the ELISA technique with reagent from Bio-rad, California, USA. The bio data, blood groups, haematocrits of the donors and the results of rapid diagnostic and ELISA tests were tabulated and fed into the Statistical Package for Social Science (SPSS) and analyzed. Proportions were expressed in percentages. Pearson-moment correlation was used to assess relationships among the variables and statistical significance was set at  $p < 0.05$ .

## RESULTS

Five hundred and fifty-six (556) candidates were screened using the RDT during the period of the study. Sixteen (16) candidates were excluded on the basis of positivity to one or more infectious agents. The remaining 540 RDT negative donors were made up of 517 males and 23 females with an average age and haematocrit of  $31.7 \pm 7.5$  years and  $44.6 \pm 3.5\%$  respectively. This and other demographic characteristics of participants are as shown in table 1.

A total of 72 (13.3%) donors that tested negative with RDT for the four infectious agents tested positive with the ELISA technique. Twenty-three (4.3%) donors were positive for HIV, 23 (4.3%) for hepatitis B, 20 (3.7%) to hepatitis C and 6 (1.1%) to VDRL. Three donors (0.6%) were found to be positive to both HIV/HBV, 3(0.6%) to HIV/ HCV, 2 (0.4%) each to HIV/VDRL, HBV/ HCV and HBV/VDRL. (Table 2)

There were no correlations between ELISA positivity with the gender, age, marital status, blood group and the packed cell volume of the donors.

Table 1: Demography of our participants

Demography	Number	Percentage (%)
Gender		
Male	517	95.7
Female	23	4.3
Marital status		
Married	271	50.2
Single	269	49.8
Age group (years)		
18-31	260	48.1
32-45	220	40.7
46-60	60	11.2
Blood group		
O	336	62.2
A	127	23.5
B	68	12.6
AB	9	1.7
Haematocrit (%)		
36-44	281	52.0
45-53	251	46.5
54-59	8	1.5

Table 2: Result of screening with ELISA technique

Infective agents	Positive n (%)	Negative n (%)
HIV	23 (4.3)	517 (95.7)
HBV	23 (4.3)	517 (95.7)
HCV	20 (3.7)	520 (96.3)
VDRL	6 (1.1)	534 (98.9)
<b>Total</b>	<b>72 (13.3)</b>	<b>468 (86.7)</b>
HIV*HBV	3 (0.6)	
HIV*HCV	3 (0.6)	
HIV*VDRL	2 (0.4)	
HBV*HCV	2 (0.4)	
HBV*VDRL	2 (0.4)	
HCV*VDRL	0 (0.0)	

## DISCUSSION

The highest burden of human immunodeficiency virus (HIV) and hepatitis B virus (HBV) has been reported in the sub-Saharan Africa.<sup>8</sup> This, with poverty in a vicious manner compounds the list of problems of this region.

Despite being essential in modern medical practice, blood transfusion carries a potential risk for transmissible diseases,<sup>9,10</sup> especially HIV, HBV, HCV and syphilis. Limited access to voluntary blood donors and the lack of advanced testing techniques render blood safety a major public health concern in the developing world. In contrast, safety of blood units is high in developed countries largely due to the availability of voluntary non-remunerated donors and the use of more sophisticated methods of screening.

About 10% of HIV transmission in Africa is through unsafe blood transfusion, with 25% of maternal and 15% of childhood deaths, partially caused by blood transfusion not being available when required.<sup>11</sup>

In our study, a total of 72 (13.3%) donors that tested negative with RDT technique for the TTIs tested positive with the ELISA method of screening. Of this, 23 (4.3%) donors were positive for HIV, 23 (4.3%) for hepatitis B virus, 20 (3.7%) to hepatitis C and 6 (1.1%) to VDRL. Three donors (0.6%) were found to be positive to both HIV/HBV, 3(0.6%) to HIV/ HCV, 2 (0.4%) each to HIV/VDRL, HBV/HCV and HBV/VDRL.

The implication of this result is that using the RDT technique alone, 13.3% of patients transfused with these units of blood that initially tested negative with the RDT would have been infected with one or more infective agents. Before the ELISA testing equipment was donated to our centre, testing had always been by RDT technique and this is what is still obtainable in many centres in sub-Saharan Africa. This may have contributed to the spread of these infectious agents in our society. This assertion is supported by other studies, where it was established that, in places where effective screening programmes exist, the risk of transmission of transfusion-transmissible infections (TTIs) has progressively and significantly decreased.<sup>12-14</sup>

Just like in our study, inferior performance of RDTs in comparison to ELISA was also reported in another study from India where both the modalities were used to screen healthy blood donors for HIV infection. In that study, the RDT missed 17 of 30 samples confirmed reactive by ELISA.<sup>15</sup> The above result is disturbing, as the RDT gave a false negative result in more than half of the study sample. The researchers attributed this discordance to low antibody

titres especially in recent infections where the levels may well be below the detection limit of RDTs but are picked up by the more sensitive enzyme immunoassay and its spectrophotometric format of result analysis. They therefore suggested that a false negative RDT results may occur quite often leading to unknown silent transmission of HIV in the population.

In another study by Mehra *et al*,<sup>16</sup> RDT gave a sensitivity result of 77.5%, leading them to conclude that RDTs fare poorly compared to ELISA as screening assays and that result by RDTs needs to be confirmed by western blot for serodiagnosis of HIV infection.

Klarkowski *et al*<sup>17</sup> and Aghokeng *et al*<sup>18</sup> reported that false-negative RDT results also represent a challenge, which is worsened by poor staff training and subjectivity in interpreting faint RDT results.

Some other researchers have also reported that discrepancies between results obtained by the two techniques are common.<sup>19,20</sup> In these studies, the researchers observed that RDT based algorithm as the initial test fared poorly compared to ELISA and missed a large proportion of HIV, HBV, and HCV infections.

Contrary to our observation, some studies have suggested that the diagnostic performance of RDTs is comparable to that of ELISA.<sup>21,22</sup> A report revealed RDT to be 100% sensitive and equivalent in its diagnostic performance characteristics to ELISA.<sup>22</sup> They attributed this to the observation that RDT perform differently under different field conditions.

False positive results with RDT have also been observed,<sup>23,24</sup> leading some researchers to conclude that unreliable RDT results are a matter of concern, making patients receiving a reactive report to believe that they may or may not be positive.

The value of ELISA in blood transfusion cannot be over emphasized; however major constraints on the use of ELISA are cost, manpower, and longer turnaround time.

## CONCLUSION

All blood screening programmes have limitations therefore absolute safety, in terms of freedom from infection risk, cannot be guaranteed. However, our study, like many such studies has demonstrated that ELISA is superior to RDT for screening of blood donors. It has also highlighted that undetermined levels of transmission of TTIs are taking place in centers that still rely on RDT. This has contributed to the spread of these infections in our society. We therefore encourage the government and funding agencies to procure

ELISA testing equipment for all healthcare providers involved in blood transfusion. We also advocate for legislation to make screening with ELISA mandatory for all health facilities in the country.

### Acknowledgements

I wish to thank the Nigerian Centre for Disease Control and the APIN Public Health initiative for donating ELISA equipment to our centre.

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