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SERO-PREVALENCE OF HEPATITIS B VIRUS, HEPATITIS C VIRUS AND HUMAN IMMUNODEFICIENCY VIRUS INFECTIONS AMONG BLOOD DONORS IN WESTERN KENYA: A CROSS SECTIONAL STUDY

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ABSTRACT

Background: **Hepatitis B virus (HBV), Hepatitis C virus (HCV) and Human Immunodeficiency Virus (HIV) infections are transfusion transmissible infections that cause life-threatening infections. The prevalence of these infections is not well reported among the blood donor population in western Kenya. This study aimed to determine the sero-prevalence of HIV, HCV, HBV and the trend over a three-year period among donors in western Kenya's Regional Blood Transfusion Center located in Eldoret.**

Methods: **A retrospective cross-sectional study was conducted on consecutive blood donor records from the Eldoret Regional Blood Transfusion Centre (RBTC) over a three-year period: 2010-2012. After collection of donated blood, samples are taken for screening for HIV, HBV and HCV infections using ELISA technique for anti-HIV-1 antibody, HBsAg (Hepatitis B surface antigen), and anti HCV-antibody. Data was analyzed using STATA version 13.1 for windows.**

Results: **A total of 68,404 blood donors aged between 16-60 years in western Kenya donated blood between 2010 and 2012. The male to female ratio was 3:1. A total of 1,068(1.56%) donors had HBV, HCV or HIV infection. The prevalence of HBV, HIV and HCV was 754 (1.10%), 175(0.26%) and 176 (0.26%) respectively for the three years. There was no demonstrable change in the prevalence of any of the infections over the three-year period. Eleven (1.03%) of the infected donors had co-infection most commonly HBV/HIV (n= 21)**

Conclusion: **Blood donors are a highly selected population with low risk of transmissible viral infections, HBV, HIV and HCV in western Kenya**

INTRODUCTION

World Health Organization (WHO) estimates that 35 million people were living with HIV, 240 million people with chronic HBV infection and 170 million persons with chronic HCV at the end of 2013[1-3]. HBV, HCV and HIV are chronic, transfusion-transmissible infections that affect safety of blood recipients[4, 5]. Blood transfusion has previously been estimated to be the means of new HIV infection in 5-10% of incident cases in sub-Saharan Africa [6]. Jayaraman, et al estimates the median overall risks of becoming infected with HIV, HBV and HCV from a blood transfusion in sub-Saharan Africa at 1, 4.3 and 2.5 infections per 1000 units, respectively [7].

Hepatitis B and C viral infections cause acute and chronic hepatitis, liver cirrhosis and hepatocellular carcinoma, which cause significant burden to healthcare systems due to high morbidity, mortality and cost of treatment [8]. Both HBV and HCV infections can co-exist with HIV.[9, 10].

The Kenya National Blood Transfusion Services (KNBTS) is entrusted with the responsibility of managing blood collection and transfusions in Kenya. It has six regional blood transfusion centers and nine satellite centers around the country. The Eldoret regional blood transfusion center serves most of the western region of the country which has an estimated population of 10 million people[11, 12]. The KNBTS has established protocols designed to ensure blood safety.

Many blood donors are healthy but may have undetected chronic viral hepatitis or HIV as these infections can be relatively asymptomatic. There is a paucity of information on the prevalence of HIV, HBV, and HCV among healthy blood donors in Western Kenya. The purpose of this study was to establish the sero-prevalence of HBsAg, anti-HCV antibodies and HIV among healthy blood donors and assess for any trend over a three-year period.

METHODS

Study design: This was a retrospective cross-sectional study of consecutive blood donor records for the period between Jan 1, 2010 and Dec 31,2012.

Study site and population: The study site was Eldoret Regional Blood Transfusion Centre (RBTC) in Kenya that serves the Western region of Kenya. This RBTC receives and stores blood donated either as "replacement" or "voluntary" blood donors. Replacement donors give blood to substitute that given to their relatives or friends and they are usually encouraged to donate while their relatives/friends are in need and there are shortages at the blood bank. Voluntary donors usually give blood of their own free will and without remuneration. The RBTC is located in Eldoret Town near Moi Teaching and Referral Hospital.

Study procedures: Replacement and voluntary donors' blood records were reviewed. Blood donors weighing more than 50 kg are interviewed for disease symptoms and risk factors before being allowed to donate blood. Symptoms that may exclude donors include yellow eyes, recent illness, recent transfusions and chronic illnesses or pregnancy and breastfeeding. Risk factors include multiple

sexual partners, use of intravenous drugs, needle stick injuries, sexual contact with persons with yellow eyes and history of tattooing or other body piercings. Any donor who has any one of these symptoms or risk factors is excluded from donation.

Demographic data such as age, sex and occupation was also collected from the records. After collection of donated blood, samples are taken for screening of HIV, HBV and HCV infections using ELISA technique for anti-HIV-1 antibody, HBsAg, and anti HCV-antibody respectively and Rapid Plasma Reagin (RPR) test for syphilis infection. If negative for all four serological tests mentioned above, the blood is stored in refrigerator and delivered for patients who need blood transfusion. In the Unit, every blood sample is given a unique code and recorded. All donor data is entered into a database at the RBTC. Donors of infected blood are informed of their status and advised to seek further care. Such donors are not allowed to donate blood again.A data collection sheet was used to collect socio-demographic variables (age, sex, residence and occupation); laboratory test result for HBsAg, anti-HCV antibody, HIV-1 antibody tests from the blood bank registry.

Data analysis: Data analysis was done using STATA version 13.1 for windows. Categorical variables were summarized as frequencies and corresponding percentages. Age, the only continuous variable, was summarized as median and median absolute deviation, because the distribution was skewed. The test for the assumption of Gaussian distribution was done using Shapiro Wilks test for normality. Age was categorized at ten-year intervals. The prevalence values were reported alongside their corresponding 95% Confidence Intervals (95% CI).

Ethical consideration: Approval was received from the Institutional Research and Ethical Committee (IREC) of Moi University/Moi Teaching and Referral Hospital and the Kenya National Blood Transfusion Services. This study was minimal risk, non-invasive and retrospective.

RESULTS

A total 68,404 donor records were reviewed; 47,541 (70%) were males; the median age was 24 years (range 16-65 years). Most of the donors, 38,531(56%) were aged 16-20 years while the 51 – 65-year age group had the fewest number of people, 453(0.7%). The largest number of donors of 25,333 (37%) was realized in year 2012. (Table 1) but no specific reason for this was identified.

A total of 1,068(1.56%, 95% CI: 1.47, 1.65) donors had HBV, HCV or HIV infection. Of those infected, 69%were students and 29.3%were repeat donors. 754 individuals were found to have HBV (1.10%, 95% CI: 1.02, 1.18), 175 were found to have HIV, (0.26%, 95% CI: 0.22, 0.29) and 176 had HCV (0.26%, 95% CI: 0.22, 0.30). This includes co-infected individuals. Table 1 summarizes prevalence by age, sex and year. Thirty-six (1.03%, 95% CI: 0.42, 1.64) of the infected donors had co-infections with the most common being HBV/HIV (n=21 (1.97%, 95% CI: 1.13, 2.80)). HCV/HIV co infection was found in 5 individuals (0.007%, 95% CI: 0.00, 0.01), HBV/HCV co infection in 10 (0.015%, 95% CI: 0.0, 0.03) and 1 individual (0.001%) had triple co infection. The frequency of the HBV, HCV, and HIV infected blood donors did not significantly vary over the 3 year period as shown in Figure 2.The highest infection rate was noted in 2011: 260 (1.27%) HBV infected, 60 (0.29%) HCV infected, 55 (0.27%) HIV infected and 14 (0.07%) co infected.

Table 1

Characteristics of blood donors in the study population

Characteristics		Total	%	HBV	%	HCV	%	HIV	%	Co-infection*	%
Age	16-20	38531	56.33	375	0.97	99	0.26	52	0.13	13	0.04
	21-30	23616	34.52	222	0.94	45	0.19	48	0.20	8	0.03
	31-40	4203	6.14	86	2.05	12	0.26	33	0.79	11	0.26
	41-50	1601	2.34	34	2.12	4	0.25	9	0.56	4	0.25
	51-65	453	0.66	7	1.55	0	0	6	1.32	0	0
	Total	**68404**	**100**	**724**	**1.06**	**160**	**0.23**	**148**	**0.22**	**36**	**0.05**
Sex	Male	47541	69.50	587	1.23	105	0.22	108	0.22	26	0.05
	Female	20863	30.50	137	0.67	55	0.26	40	0.19	10	0.05
	Total	**68404**	**100**	**724**	**1.06**	**160**	**0.23**	**148**	**0.22**	**36**	**0.05**
Year	2010	22639	33.08	188	0.83	37	0.16	34	0.15	11	0.05
	2011	20432	29.87	260	1.27	60	0.29	55	0.27	14	0.07
	2012	25333	37.04	276	1.09	63	0.25	59	0.23	11	0.04
	TOTAL	**68404**	**100**	**724**	**1.06**	**160**	**0.23**	**148**	**0.22**	**36**	**0.05**

**Excluded from HBV/HCV and HIV prevalence calculated in this table*

Risk factors explored for their associations with the occurrence of HBV, HCV or HIV infection were age and gender (Table 2). Persons aged between 31- 40 years were 50% less likely (OR 0.5 95% CI; 0.4 – 0.6, p <0.001) to be HBV infected, 80% (OR 0.2 95%CI; 0.1 – 0.3 P<0.001) less likely to be HIV infected and 90% (OR 0.1 95%CI; 0.1 – 0.3 P<0.001) less likely to be co infected compared to those aged less than 30 years. HCV infection did not vary significantly with age. Females had higher odds of HBV infection compared to males (OR 1.9, 95%CI; 1.6 – 2.3 P<0.001). The odds (OR 0.8 95%CI; 0.6 – 1.2 p= 0.3) of HCV infection among women was less compared to men although this was not significant. There was a higher odds of HIV (OR 1.2 95%CI; 0.8 – 1.7 p=0.4) and co infection (OR 1.1 95%CI; 0.5 – 2.7 p=0.7) among women although these ORs were also not significant).

Tables and figures

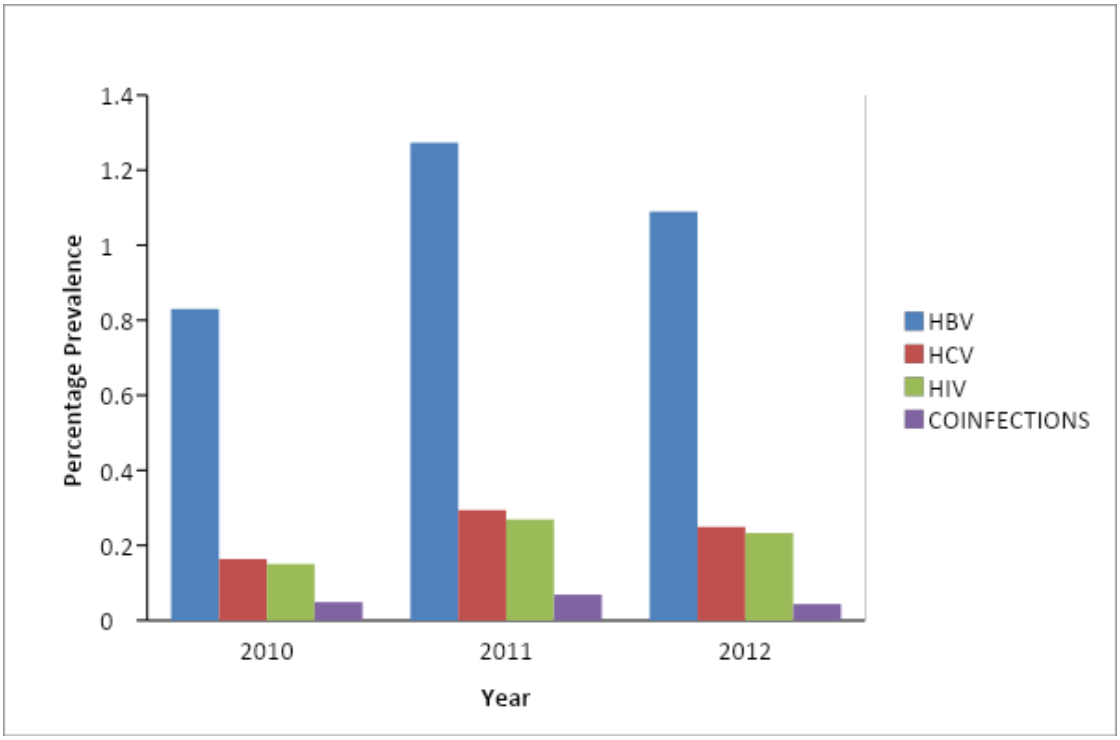

Figure 1: Prevalence of HBV, HCV, HIV and co infections among blood donors

Table 2

Association between age and sex and risk of infections

Risk factor	Hepatitis B		Hepatitis C		HIV Positive		Co infection	
	OR (95% CI)	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**	**OR (95% CI)**	**P**
Age:								
16-20	1(reference)		1(reference)		1(reference)		1(reference)	
21-30	1.0 (0.9-1.2)	0.7	1.3 (0.9-2.0)	0.1	0.7 (0.5-1.1)	0.1	1.0 (0.4-2.8)	1.0
31-40	0.5 (0.4-0.6)	0.001	0.9 (0.5-1.8)	0.7	0.2 (0.1-0.3)	0.001	0.1 (0.1-0.3)	0.001
41-50	0.5 (0.3-0.7)	0.001	1.0 (0.4-3.8)	0.1	0.3 (0.1-0.6)	0.001	0.1 (0.1-0.6)	0.001
51-65	0.6 (0.3-1.6)	0.2	-		0.1 (0.1-0.3)	0.001	-	
Sex:								
Male	1(reference)		1(reference)		1(reference)		1(reference)	
Female	1.9 (1.6-2.3)	0.001	0.8 (0.6-1.2)	0.3	1.2 (0.8-1.7)	0.4	1.1 (0.5-2.7)	0.7

DISCUSSION

Blood transfusion centers are tasked with the responsibility of ensuring safety of blood for transfusion. Morbidity and mortality resulting from unsafe blood transfusion is costly at individual level as well as to the wider society [13].

The prevalence of HBV (1.1%), HCV (0.3%) and HIV (0.3%) was found to be low among this low risk donor population. There was no significant change in the trend of infection over the three years. Blood donors are considered a low risk population compared to the general population as they undergo prescreening questions on their health and risk behavior before they are allowed to donate. Donors with risk factors and previous medical history suggesting liver disease are excluded from donating blood. Blood donors who had no identifiable risk factors still had a prevalence of 1.1 % of Hepatitis B infection; this may be due to the fact that HBV infection can be asymptomatic or occult. Sociodemographic characteristics of blood donors in other settings showed that most donors were aged between 17-25 years and were predominantly male which was consistent with this study[4, 14, 15].

The prevalence of HIV, HBV and HCV infections found by this study was also low compared to previous studies in Kenya which showed prevalence of 3.0% HBV infection, 0.8% HCV and 1.3% HIV infection among blood donors in 2007[16]. There is a wide variation in the prevalence of transfusion transmissible infections (TTI) in different regions in Africa. Compared to other regions, Western Kenya also has much lower prevalence of TTIs; the prevalence in Tanzania in 2006: 8.8% HBV, 1.5% HCV and 3.8%HIV infection[17]; Uganda in 2009: 10.3% HBV, 4.1% HIV and 1.8% HCV[18];Northwest Ethiopiain 2010, the prevalence of HBV, HCV and HIV was found to be 4.7%, 1.3% and 3.8% respectively [4]. Most African countries have adopted US Center for Disease Control (CDC) and World Health Organization (WHO) screening protocols for testing of blood donors and standardized tools for risk assessment.

Other blood donor studies have shown that males are more at risk of hepatitis B infection compared to females but there has been no significant difference in HCV prevalence between male and females. [19, 20]. This study showed higher positivity of HBV and HIV infections, national reports and other studies show a higher prevalence of HIV infection among women compared to men [1, 4].

This study is the largest in the region and provides useful information about the prevalence of HBV, HIV and HCV infection in a low risk population. Results from this study also serve to assure that the process of screening blood donors is rigorous and very few infected individuals are able to donate. A high participation rate was recorded since all donors were included in the analysis.

LIMITATIONS

This analysis was carried out retrospectively on routinely collected data and this was a challenge when it came to data cleaning. Records found to be inaccurate or missing had to be manually traced. We were unable to meaningfully use the data on repeat blood donors to calculate incidence rate of the transfusion transmissible infections and data available on these repeat donors was obtained from summary records; there was no way to identify and link to specific individuals who donated previously.

CONCLUSION

Blood donors in Western Kenya are at a low risk for HBV, HIV and HCV infection. The regional prevalence is lower than other regions in Kenya and in the world.

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