

Seroprevalence of Hepatitis B, Hepatitis C, Human Immunodeficiency Virus and Syphilis in Donated Blood in Kenya, 2016: Situation Analysis

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Abstract

Background and Objective: Blood transfusion is a prevalent life-saving intervention that replaces blood or blood-products lost in severe malnutrition, infections, during surgical procedures, obstetrical emergencies and blood disorders or trauma. Transfusion of infected blood remains a public health concern. With all interventions aimed at reducing transfusion transmissible infections (TTIs), it's imperative to review the Kenyan current situation. This presents TTIs prevalence among volunteer blood donors in Kenya 2016, and, relationship between volunteer blood donors' health and risk characteristics and TTIs in donated blood.

Materials and Methods: This adopts cross-sectional design for data collected for ten months in 2016. Only 17.8% of 20,230 volunteer blood donors recruited through mobile phone application, text for life (T4L), whose blood test results were uploaded into T4L and had complete data on TTI tests was included. Kenya National Blood Transfusion Services pre-screening assessment used prior to voluntary blood donation provided variables of interest for analysis. Descriptive frequencies, association test and odds ratio was performed using Stata V14.2.

Result: Four in every five voluntary blood donors were male, and, had no or primary education. Hepatitis B, Hepatitis C, Human immunodeficiency viruses and Syphilis prevalence was 0.7%, 1.2%, 6.2% and 1.0% respectively. Having "disease" or "sexual" does not infer having any TTI but "stab" increases odds of having syphilis two fold (AOR=2.03, 95%CI=0.27-15.15, p=0.000).

Conclusion: Excluding individuals who self-report as having had stab wounds could reduce the chances of having TTIs. Individuals found to be having TTIs should receive appropriate referrals for care and support.

Keywords: Blood transfusion; Transfusion transmissible infections; Prevalence; Voluntary blood donor

Introduction

Blood transfusion is the transfer of human blood or blood products into another human's bloodstream through an intra-venous medical procedure specifically in healthcare settings. It is a prevalent life-saving intervention that mainly replaces blood or blood products that are lost during surgical procedures, obstetrical emergencies, blood disorders, trauma, through severe malnutrition or infections. Transfusion of infected blood has been one of the major adverse reactions in blood transfusion, and, continues to be a public health priority. Therefore interventions aimed at reducing infections from transfusion transmissible infections (TTIs) should be emphasized. In lieu of this, the WHO [1] recommendations on screening of donated blood for TTIs compels every government to uptake the five strategies that ensures safe and timely blood transfusion to match up the patient population.

Bihl et al. [2] suggests that in recent times, there is lower risk of TTI, than ever before but supply of safe blood and blood products remains

subject of contamination. Diro, Alemu, and Yohannes [3] argues that safe and timely blood transfusion saves millions of human lives worldwide but, unsafe transfusion practices expose millions of human beings to dangers of having TTIs. Bhawani et al. [4] corroborates the same argument by stating that TTIs exists as asymptomatic diseases in the hosts, and therefore donated blood should be wholly screened for high-risk behavior related diseases prior to transfusion. The overarching advantage of comprehensive screening of donated blood for the TTIs is that it helps to understand the spread of these TTIs within the population. These TTIs include agents such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and syphilis.

In moving closer home, the Matee et al. [5] cross-sectional study in Tanzania among 1,599 blood donors at Muhimbili National Hospital between April 2004 and May 2005 indicated very high prevalence of HBV at 8.8%, HIV at 3.8%, HCV at 1.5% and 4.7% for syphilis. In Kenyan context, Herrera et al. [6] study on voluntary blood donation indicated that the prevalence of HBV was 4.0%, HIV was 1.7% and syphilis was 0.7%. Additionally, a study by Kimani et al. [7] which was comparing voluntary blood donors and family replacement blood donors found that HIV had the highest prevalence of 2.6% and 7.4% in

the two groups respectively. Recently, Kamande et al. [8] study in Nyeri satellite blood transfusion center among 250 voluntary blood donors aged 16 to 45 years showed that HIV was the most common TTI with a prevalence of 5.2%, followed by HCV with 3.2%, HBV with 2.4% and syphilis with 1.2%. Based on these studies, there is evidence of high prevalence of TTIs and blood safety is a major issue in sub-Saharan Africa.

The Kenya ministry of health established Kenya National Blood Transfusion Service (KNBTS) in 2001. KNBTS manages blood donations through collection, processing, storage and distribution of adequate safe blood and blood products in Kenya. As KNBTS endeavors to achieve the assigned mandate, she partners with stakeholders to innovate digital strategies that take advantage of ubiquity of mobile phones in Kenya so as to communicate with potential blood donors and eventually increase blood donation. Cognizant that eight in every ten Kenyans own a mobile phone and almost all (92%) have access to a mobile phone [9], this lays a very fundamental foundation to utilize mobile phones for reaching the masses.

The Text for Life (T4L) is an innovative mobile phone application that was developed by mHealth Kenya in 2010 through a partnership with KNBTS and Bloodlink Foundation with financial and technical support from Center for Disease Control and Prevention. The T4L platform is built to run either on a mobile phone (smart or otherwise) through short message service (SMS) or on a browser on connection to internet. KNBTS creates awareness by urging Kenyan people to register in the T4L platform either through accessing their website or by KNBTS sending introductory or blood donation appeal messages -with an option of selecting "STOP" receiving messages - to mobile phone owners. Once a participant is registered in the system, this opens an avenue for one way communication from KNBTS to the blood donor. With the adoption of the T4L platform, KNBTS is enabled to manage and interact with the existing blood donor population base, recruit a wider audience with an aim of converting them into potential blood donors, and to send messages. These messages include blood appeals (emergency or normal blood drives), informational, congratulatory and personal such as happy birthday and results notifications. Prior to introduction of T4L platform, KNBTS used paper records to track donor retention and results' notification to donors and this made referral to care and treatment for those whose blood has infections a decimated exercise. In Kenya, blood screening for hepatitis B (HBsAg), Hepatitis C (Anti HCV), HIV-1/HIV-2 (HIV Ag/Ab) and Syphilis are done using chemiluminescent micro particle immunoassay (CMIA) method on Architecti2000 (Siemens Diagnostics, Germany). A repeat action using same sample and same method for results which become reactive is performed for confirmation.

The many studies done in Kenya and in Africa on donated blood delves mostly on seroprevalence of TTIs. While this paper adds more information on the seroprevalence of TTIs from voluntary blood donors at national level, it also estimates the odds of having TTI with respect to blood donors' health and risk characteristics. Specifically, the estimates will give the national HBV, HCV, HIV and Syphilis prevalence rates in voluntary donated blood and investigate the relationship between presence of TTIs in donated blood and voluntary blood donor's health and risk characteristics.

Methods

By utilizing the data collected through the T4L platform under custodian of KNBTS, this analysis adopts a cross-sectional study design cognizant that the data was collected at different time points from voluntary blood donors nationally over 10 months. For the purpose of the analysis, if a donor donates more than once, this is treated as an incident unlike being a repeat voluntary blood donor.

The inclusion criteria was; individuals who registered through the T4L platform, voluntarily donating blood, blood tests results' uploaded into the T4L platform and having complete data on status of HBV, HCV, HIV and syphilis tests. The T4L platform had recruited 20,230 of whom 17,693 (87.5%) voluntarily donated blood between March and December 2016. The rest were either deferred (1%) because of healthy reasons, and, others were classified as future potential donors (11.5%). However, only 7,881 (44.5% of donated blood) results were uploaded into the T4L platform and more importantly, only 3,590 (45.6% of uploaded results) had complete data on TTIs (reactive or non-reactive). This sample (3,590) is equivalent to 20.3% of all blood donated by voluntary blood donors or 17.7% of all individuals recruited through T4L platform.

The KNBTS has a pre-screening questionnaire in which the volunteer blood donor is assessed prior to blood donation. Some of the screening questions include basic demographic characteristics, health and risk assessment. From the pre-screening questionnaires, three distinct entities/variables not mutually exclusive were defined. A variable "disease" was created for any individual who answered "yes" to any health assessment questions which included; ever fainted, ever been on treatment or medication, had any injections or immunization, received blood transfusion, any heart or lung problem, any bleeding, any diabetes, cancer, epilepsy, tuberculosis, asthma, or any long term illness in the last 12 months. A variable "sexual" included any individual who answered "yes" to; had sexual intercourse, rape or sodomy, ever received goods or money in exchange for sex, have multiple sex partners, or had sexually transmitted diseases in the last one year. A variable "stab" was created for any individual who answered "yes" to having exposure to other blood fluids through needle stick injuries, stab, tattoo, hematoma or injections for non-medical drugs in the last one year. And lastly a variable "TTI" which is a combination of all individuals whose donated blood was reactive to HBV, HCV, HIV or syphilis tests.

The data was abstracted from the KNBTS database in a readable format, exported and analyzed using Stata Version 14.2. To have estimates that portray a national outlook, post stratification weights was done by using the sample and population of each county in the data. Gender was not used because some counties did not have female volunteer blood donors in the dataset. The population for each county was obtained from Kenya population and households' census done in 2009 (KNBS, 2009). Descriptive statistics, bivariate (tests of association) and multivariate analysis (odds ratio using logistic regression) were computed at 95% level of confidence and the associated p-values <0.05 were considered significant in all analysis.

Results

The sample has participants drawn from 32 of the 47 counties in Kenya. For the purpose of this analysis, counties are clustered, into four tiers based on HIV estimates report by National STIs Control Program [10]. Tier 1 has 5, Tier 2 has 14 and Tier 3 has 8 and the remaining one is Tier 4. Based on the Table 1, close to two in every five

(37%) were from Tier 2, four in every five were male (80%), about three in every four (74%) had attained secondary education, seven in every ten (70%) were below 20 years and almost all (93%) were single.

Category		Weighted N	Unweighted N	Weighted %
County Tier classification based on HIV prevalence (NAS COP)	Total	28,708,864	3,604	100
	Tier1 (High)	4,949,582	1,356	17.2
	Tier2 (Medium)	10,638,440	263	37.1
	Tier3 (Low)	6,887,634	377	24
	Tier4	6,233,208	1,608	21.7
Gender	Male	22,860,456	2,280	79.6
	Female	5,848,408	1,324	20.4
Education#	None/ Primary	252,354	71	0.9
	Secondary	21,223,892	2,031	73.9
	Tertiary	4,498,076	1,127	15.7
Age#	below 20	19,796,674	1,571	69.5
	20 to 29 years	5,932,544	1,336	20.8
	30 to 39 years	1,484,691	424	5.2
	40 to 49 years	1,084,093	159	3.8
	50 to 59 years	138,213	43	0.5
	60+	38,580	13	0.1
Marital status#	Single	25,549,822	2,916	93.4
	Married	1,757,694	540	6.4
	Divorced/ Separated	35,532	16	0.1

NB: #missing values for education (375); Age (58) and marital status (132) are not included.

Table 1: Demographic characteristics of the voluntary blood donors.

Table 2 in the appendix shows the seroprevalence of hepatitis B, hepatitis C, human immunodeficiency virus and syphilis.

Nationally, HBV prevalence was 0.7% (se=0.001, 95% CI 0.4-1.0), HCV prevalence was 1.2% (se=0.002, 95% CI 0.9-1.6), HIV prevalence was 6.2% (se=0.004, 95% CI 5.4-7.0) and syphilis prevalence was 1.0% (se=0.002, 95% CI 0.7-1.3). The HIV prevalence result corroborates the findings by NASCOP 2014 report which estimated the national HIV prevalence as 5.6% among people aged 15-49.

With respect to HIV, the highest prevalence within counties was associated with Tier 2 counties at 15.9% (se=0.023, 95% CI 11.5-20.4). Within gender, the highest prevalence is among men at 7.7% (se=0.006, 95% CI 6.6-8.8). With respect to education, the highest prevalence was among those with secondary education with one in every twelve (8.2%, se=0.006, 95% CI 7.0-9.4).

The median age of the respondents was 18.7 and categorizing the ages into ten year age brackets, the highest prevalence was among those aged below 18 years at 8.8% (se=0.007, 5% CI 7.4-10.2). Within

the marital status, the prevalence was 6.9% (se=0.005, 95% CI 6.0-7.8) among those who are single.

For bivariate analysis between presence of any transfusion transmissible infections and health and risk characteristics of the voluntary blood donor, chi-square test of association was done and results are shown in Table 3. There is a significant association when one has a “disease” to having HBV, HCV and syphilis.

There is no significant association of having had sexual interaction in the last 12 months to having any of the TTIs. Being exposed to a “stab” has a significant association to having HCV, HIV and syphilis.

Multivariate analysis using logistic regression was done while treating disease, sexual or stab as dependent variable iteratively against all individual TTIs as independent variables while controlling for basic demographic characteristics. The results indicate that having “disease” does not infer having either HBV (AOR=3.24 95%CI=0.53-19.69, p=0.202), HCV (AOR=0.22 95%CI=0.02-2.25, p=0.204) or syphilis (AOR=0.34 95%CI=0.06-1.9, p=0.219).

The variable HIV is collinear to disease hence eliminated in this model. Similarly, having “sexual” does not infer having syphilis (AOR=3.67 95%CI=0.54-24.7, p=0.181). Since none of those who had “sexual” had HBV, HCV or HIV, these variables were dropped in this

second model. However, having a stab significantly increases the odds of having syphilis by two folds (AOR= 2.03 CI 95% 0.27-15.15, p=0.000).

Category	Any TTI-Yes			Any HBV-Yes			Any HCV-Yes			Any HIV-Yes			Any Syphilis-Yes		
	Weighted %	95% LCI	95% UCI	Weighted %	95% LCI	95% UCI	Weighted %	95% LCI	95% UCI	Weighted %	95% LCI	95% UCI	Weighted %	95% LCI	95% UCI
National	9	8.1	10	0.7	0.4	1	1.2	0.9	1.6	6.2	5.4	7	1	0.7	1.3
Tier 1	3.1	2.2	4.1	1.5	0.8	2.1	0.7	0.3	1.2	0.5	0.1	0.9	0.5	0.1	0.9
Tier 2	17.9	13.2	22.6	0.5	-0.4	1.4	0.1	-0.3	0.4	15.9	11.5	20.4	1.4	0	2.8
Tier 3	5.6	3.2	7.9	0.8	-0.1	1.7	4.4	2.3	6.5	0.5	-0.2	1.2	0.2	-0.2	0.6
Tier 4	2.4	1.7	3.2	0.4	0.1	0.7	0.2	0	0.4	0.3	0	0.5	1.6	0.9	2.2
Male	10.8	9.5	12.1	0.7	0.4	1	1.4	0.9	1.9	7.7	6.6	8.8	1.2	0.7	1.6
Female	2.1	1.4	2.9	0.8	0.3	1.3	0.4	0.1	0.8	0.6	0.2	1	0.4	0	0.7
None/Primary	0.9	-1.4	3.2	0	0	0	0	0	0	0	0	0	0.9	-1.4	3.2
Secondary	11.2	9.8	12.5	0.4	0.2	0.7	1.5	1	2	8.2	7	9.4	1.2	0.7	1.7
Tertiary	3.8	2.7	5	2	1.2	2.9	0.4	0.1	0.8	0.9	0.4	1.5	0.4	0	0.8
below 20	11.8	10.2	13.4	0.4	0.1	0.6	1.6	1	2.2	8.8	7.4	10.2	1.3	0.7	1.9
20 to 29 years	3	2.1	3.9	1.7	1	2.4	0.4	0.1	0.8	0.6	0.2	1.1	0.2	0	0.5
30 to 39 years	3.4	1.6	5.1	1.2	0.1	2.2	0.7	-0.1	1.5	1.1	0.1	2.1	0.4	-0.2	1.1
40 to 49 years	1.3	-0.5	3.1	0.6	-0.6	1.9	0	0	0	0.2	-0.5	0.9	0.4	-0.6	1.5
50 to 59 years	4.8	-1.9	11.4	3.1	-2.4	8.6	0	0	0	0	0	0	1.7	-2.4	5.8
60 and above	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single	9.8	8.7	10.9	0.7	0.4	1	1.3	0.9	1.7	6.9	6	7.8	1.1	0.7	1.4
Married	4.2	2.5	5.9	1.6	0.5	2.7	0.8	0	1.5	1.2	0.2	2.1	0.7	0	1.4
Divorced/ Separated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2: Demographic characteristics and seroprevalence of HBV, HCV, HIV and Syphilis.

	Weighted N	HBV-Yes		HCV-Yes		HIV-Yes		Syphilis-Yes	
		%	χ ²	%	χ ²	%	χ ²	%	χ ²
Disease(Yes)	1,861,943(351)	2.7	21.08***	0.2	0.26***	0.0	NA	0.4	0.15***
Sexual (Yes)	90,623(29)	0.0	0.98	0.0	0.93	0.0	0.26	0.0	0.51
Stab (Yes)	556,884(57)	0.4	0.003	0.8	0.1***	1.4	2.9***	26.8	0.86***

NB * =Sig at 90%; ** =Sig at 95%; *** =Sig at 99% and Number in brackets are unweighed

Table 3: Test of association between each TTI and donors’ health and risk characteristics

Discussion

In many studies done regarding blood donation and transfusion, voluntary blood donation has been regarded as the safest practice owing to the perception that the volunteer blood donor is deemed to be in good health, having morally upright behaviour and have intention to help patients unknown to them unlike when blood is sought through replacement. In this sample, most of the volunteer blood donors for this analysis were from Tier 2 (medium HIV burden), aged below 20 years, were single and had completed primary education. This constitutes the young population who are mostly in their last years for completion of secondary education, are possibly born from parents who were/ are HIV positive and therefore contracted the HIV through mother-to-child transmission of HIV, and getting stabs through indulgence in risky behaviours during their teenage life. Nationally, four in every five voluntary blood donor are male. Possibly, the female individuals could shy away from blood donation in fear of share of their blood with their monthly menstruation periods. For gender balance to be achieved, sensitization through providing sufficient educative medical information on benefits of blood donation should be done to ensure both gender equally participate in the voluntary blood donation. Almost all the volunteer blood donors had secondary education and above, hence considered literate and this can be construed to mean that they made informed decision of voluntarily donating blood cognizant of benefits associated with voluntary blood donation especially in saving lives.

The T4L digital platform aims at easing the management and monitoring of increased accessibility to safe blood, recruitment and retention of voluntary blood donors, increased blood donor awareness of processes and logistics for donating blood, improved communication between donors and KNBTS, increased diagnosis and referral of HIV positive patients to care and treatment, increased rate of blood donor results collection and reduction in wastage of donated blood. The adoption of T4L platform by KNBTS has born fruits by easing the mechanisms of management of blood donations. To accrue full benefits from this innovative, KNBTS should complete the whole processes of entering the required data of all blood donated in the T4L platform as this digital platform substitutes the traditional pen and paper and also can substitute personnel shortages.

The prevalence of TTIs in donated blood as reported in this paper are congruent to other results obtained in other studies in Kenya and even in the sub-Saharan Africa [5-7,11]. According to the 2013 national HIV estimates report by NASCOP [12], the HIV prevalence among Kenyan population aged 15- 49 years was 6% in 2013, spread at 5.6% and 7.6% between male and female respectively. The HIV prevalence in Kenya varies within counties with Homa Bay (Tier 1) leading with 27.1% and Wajir (Tier 4) with the least prevalence at 0.2%. As per the results of this paper, the national HIV prevalence in the voluntary donated blood is 6.2%. This prevalence rate varies within county tier classification with Tier 2 having the highest (15.9%). The voluntary blood donors, whose blood tested HIV positive, were oblivious of the HIV positive status. Therefore, discarding their blood and failing to inform them of their HIV positive status does more harm than good. This is because incognizant of their HIV positive status, they will continue with their normal live, are not be linked to care and treatment and therefore participate increasing the HIV spread.

A major finding of this paper is that having a ‘disease’ or having ‘sexual’ activity in the last one year is not a defining moment for

having a transfusion transmissible infection. However, having a ‘stab’ in the last one year are necessary and sufficient condition for having an infection in the blood.

Conclusion

The adoption of the T4L platform by the KNBTS has born fruits in their blood donation and transfusion management process. KNBTS should enhance a cost-effective awareness program on giving information and benefits of blood donation especially reaching out to the female population. Excluding individuals who self-report as having had stab wounds could reduce the chances of having TTIs and those individuals found to be having TTIs should receive appropriate referrals for care and support.

Declaration of Conflict of Interest

The author declares no conflict of interest in writing this paper. The author did not receive any funding while collating, developing and analyzing the data for this paper. The authors, being an employee of mHealth Kenya Limited, there was informed consent for use of the data from KNBTS for use in publication. The opinion in this paper is solely those of the authors and not for KNBTS, Bloodlink Foundation, CDC and mHealth Kenya Limited.

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