PAMJ Clinical Medicine
Pan African Medical Journals

Research

Seroprevalence of transfusion-transmissible infections among blood donors in the Hohoe Municipal Hospital, Ghana: 2015-2016: a retrospective hospital-based cross-sectional study

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Received: 14 Oct 2019 - Accepted: 15 Jan 2020 - Published: 19 Jan 2020

Domain: Health information system management, Public health, Counseling

Keywords: Blood donors, Ghana, Hohoe municipal hospital, transfusion-transmissible infections

Abstract

Introduction: unsafe blood remains a major threat to the global spread of transfusion transmissible infections (TTIs). Blood is usually tested for four TTIs: Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Syphilis before transfusion. This study determined the trends of transfusion-transmissible infections among blood donors in the Hohoe Municipal Hospital, Ghana from 2015 to 2016. **Methods:** a total of 3,173 blood donor records were reviewed for the presence of anti-HIV 1/2 IgG/IgM, HBV, anti-HCV IgG/IgM, and anti-Treponema pallidum IgG/IgM/IgA, using commercial ELISA kits following standard protocols. Statistical analysis was performed using Stata version 14.0 at the level 0.05. **Results:** seroprevalence of HIV, HBV, HCV and Syphilis were 3.9% 5.0%, 4.2% and 5.2% respectively. Females were 30% less likely to be infected with Syphilis (OR=0.3; 95% CI: (0.15-0.69); p=0.004); donors aged 20-29 years were 60% less likely to be infected with HIV than those less than 20 years (OR=0.6; 95% CI: (0.04-0.99); p=0.049), while those aged 30-39 years were 90% more likely to be infected with Syphilis than those less than 20 years (OR=1.9; 95% CI: (1.23-3.20) p=0.005) and those aged 40-49 years were 2 times more likely to get infected with HBV than those less than 20 years (OR=2.2; 95% CI: (1.17-4.04); p=0.013). **Conclusion:** males presented higher prevalence of Syphilis and all TTIs were recorded highest among young adults. It is important to continue screening donated blood with highly sensitive tests and to sensitize young adults, especially females on the importance of blood donation.

Research | Volume 2, Article 12, 19 Jan 2020 | 10.11604/pamj-cm.2020.2.12.20658

Available online at: https://www.clinical-medicine.panafrican-med-journal.com/content/article/2/12/full

Introduction

Globally, more than 81 million units of blood are donated every year of which 18 million are not screened for an infection that is potentially capable of being transmitted by blood transfusion called a transfusion-transmissible infection (TTI) [1]. The transfusion of contaminated blood causes up to 16 million new infections with Hepatitis B, and 5 million new infections with Hepatitis C every year [2]. Annually, the worldwide infection rate of HIV through blood transfusion alone ranges from 80,000 to 160,000 [3]. In sub-Saharan Africa (SSA), blood transfusion accounts for 5-10% of HIV transmission. Similarly, 12.5% of patients who receive blood transfusion are at risk of post-transfusion Hepatitis [4].

In Ghana, the issue of TTIs is still on the rise especially among blood donors. The prevalence of Hepatitis B infection among blood donors ranges between 9.6% and approximately 12.0% in urban areas, and as high as 21% in rural communities. The seroprevalence of Hepatitis C infection has also been reported to be between 1.3% and 8.4% among blood donors, while the prevalence of HIV is between 1.5% and 3.8% among blood donors [3]. According to the 2014 Hohoe Municipal Hospital Blood Bank (HMHBB) annual performance report in Ghana, the hospital recorded 301 voluntary blood donations and 912 units of blood transfused but there is no data on the proportion screened before transfusion [5]. To curb this risk of transmission, it is recommended that all donated blood should be screened for Hepatitis B virus (HBV), Hepatitis C virus (HCV), Human Immunodeficiency Virus (HIV) and Syphilis [6]. Screening for TTIs is a critical part of the process of ensuring transfusion of safe blood that is not contaminated with any blood-borne disease - such as HIV, Hepatitis, Malaria or Syphilis is a universal right [7,8].

Evaluation of data on the prevalence of TTIs among blood donors permits assessment of the accurate estimate of the risk of TTIs, which helps in the creation of long-term strategies to improve public health and to prevent the spread of disease in the local population. Most hospitals in Ghana engage in blood transfusion as part of their life-saving measures, including Hohoe municipal hospital. However, this issue of blood transfusion needs critical attention. Therefore, this study was to determine the seroprevalence of HIV, HBV, HCV and Syphilis infections in blood donors in Hohoe Municipal Hospital, Ghana.

Methods

Study site description: Hohoe is one of the seven Sub-Districts in the Hohoe Municipality and at the same time the municipal capital. It is located about 78 kilometers away from Ho, the Volta Regional capital and 220 kilometers from Accra, the nation´s capital. The Municipal has a total land surface area of 1172km^2 and is located within longitude 0 degrees 15´E and 0 degrees 45´E and latitude 6 degrees 45´N and 7 degrees 15´N and lies almost in the heart of the Volta region. There are ten Community-based Health Planning and Services (CHPS) zones, one Reproductive and Child Health (RCH), one Health Centre and one Government Hospital, which serve a total population of 58,130 people in 33 communities in Hohoe.

Study setting and population: this study was conducted at the laboratory unit of the Hohoe Municipal Hospital. All available archived results (from January 2015 to December 2016) on blood donation from the hospital´s laboratory were reviewed manually. Data comprising socio-demographic variables and results of HBV, anti-HCV, HIV and Syphilis were reviewed.

Study design: the study adopted a retrospective hospital-based cross-sectional design using secondary data at the Laboratory Unit of Hohoe. Due to the short interval of time for

data collection, we opted for this design, which is less expensive and faster to collect.

Sample size determination: all data captured in the blood donors´ register within the two-year period (January 2015 to December 2016) was the sample size.

Sampling methods: the Hohoe Municipal Hospital was purposively selected for the study because this is the only health hospital with a blood bank in the entire Hohoe. So, the data needed for this study could only be found in the blood bank records of the hospital.

Data collection procedure: this involved the review of blood donors´ records in a two year period, from January 2015 to December 2016. Data from the blood donors´ register (age, sex and results of HBV, anti- HCV, anti-HIV and Syphilis test on blood donors) in the blood banks within the specified period was retrieved and reviewed manually. The screening for HIV was done by ELISA using kits (Monozyme; J. Mitra, India). HBsAg was detected by ELISA (Transasia, India and J. Mitra, India). Anti-HCV test was done by ELISA (Monozyme, J Mitra, India and Transasia, India). Test for syphilis was done by RPR (Mediclone, India and Tulip, India). Five milliliters of blood were collected and sera from all the blood donors were then checked for the presence of Hepatitis B surface antigen (HBsAg) and the antibodies to HIV-1/2, HCV and Syphilis using the automated system i1000SR immunoassay (abbot) following the manufacturer's instructions. Similarly, antibodies to HTLV-1/2 were detected using ELISA technique (HTLV-1/2 ELISA 4.0, CE MARK, MP Biomedicals, France) according to the manufacturer's instructions.

Data analysis: data were captured using Microsoft office excel 2016. Data collected were validated using Epi data version 3.1. STATA version 14.0 was used to analyze the data collected. Chi-square test was used to determine the association between categorical variables and logistic regression was used to test the strength of the associations. The results were displayed in frequency tables and charts. The probabilities inferior to 0.05 were considered statistically significant.

Ethical issues: ethical approval for the study was obtained from the Ghana Health Service (GHS) Ethics Review Committee (ERC) with approval number GHS-ERC: 56/05/17, through the University of Health and Allied Sciences. Permission to conduct the study was sought from the Hohoe Municipal Hospital. Confidentiality of the data was guaranteed, that under no circumstance will the names of the patients or any other identity be associated with the data analysis and the dissemination of the findings of the study. Data, which were obtained from the blood donors´ register in this study were kept strictly confidential and were not disclosed to any other person.

Results

Demographic characteristics: a total of 3,173 blood donors were reviewed from hospital records within the period 2015-2016. The mean age of donors was 25.4±8.2. Majority 2,802 (88.3%) of them were males and more than half, 1,789 (56.4%) were aged 20-29 years (Table 1).

Prevalence of transfusion-transmissible infections: Table 2 presents the prevalence of TTIs from 2015 to 2016. Out of the 3,173 donors reviewed for the various TTIs, majority 1,939 (61.1%) were screened in 2016. The year 2016 recorded similar prevalence for all the various TTIs while the figures were different in 2015.

Odds for HIV, HBV, HCV and syphilis status and sex and age: Table 3 presents the likelihood of a donor becoming infected with any of the TTIs. Females were 30% less likely to be infected with Syphilis than males (OR=0.3 (95% CI: (0.15-

0.69); p=0.004). In the same vein, blood donors within the age group 20-29 were 60% less likely to be infected with HIV compared to those aged less than 20 years (OR=0.6 (95% CI: (0.04-0.99); p=0.049), while, those within the age group 30-39 were 90% more likely to be infected with Syphilis (OR=1.9 (95% CI: (1.23-3.20) p=0.005). Those aged between 40 and 49 were 2 times more likely to be infected with HBV compared to those less than 20 years (OR=2.2 (95% CI: (1.17-4.04); p=0.013).

Discussion

In the current study, the overall seroprevalence of the four TTIs in the blood bank of the Hohoe Municipal Hospital Ghana, in general, stood at 18.3%. This high prevalence of TTIs among blood donors in the Hohoe Municipal Hospital could be because majority of the donors are family replacement donors who have a higher risk of TTIs than voluntary non-remunerated donors. This prevalence is higher compared to the prevalence reported in Ethiopia (11.5%) [9] but lower compared to that reported in Burkina Faso (19.3%) [10] and Nigeria (19.3%) [11]. The TTI prevalence in the current study is close to what was found in a tertiary health care facility among blood donors in the Kintampo North Municipality of Ghana (19.5%) [3]. The different rates of TTIs in these countries can be explained by the different exposing factors of TTIs in these different countries as well as the differences of health systems [12].

The seroprevalence of HIV of (3.9% (95% CI: 3.26 to 4.61)) is similar to the prevalence reported in various towns in Nigeria: Sokoto (4.6%) [13], and Kaduna (3.8%) [14] and Calabar (4.2%) [12]; but higher than the prevalence found in Ethiopia (0.1%) [9] and Burkina Faso (2.2%) [10]. The higher prevalence in this study compared to reported in Burkina Faso and Ethiopia could be due to the differences in behavioural characteristics between donors of the current study and those of the other studies and also to the recruitment process of the donors. The current study may have used mostly family replacement donors whereas those of Ethiopia and Burkina Faso might have used more of voluntary unpaid donors.

The seroprevalence of HBV in the current study (5.0%), is much lower when compared to what was found by Adjei *et al.* among prisoners in Ghana (25.5%) [15] and 8.8% in Tanzania [16]. The prevalence is relatively higher than what was reported in India (0.88%) [17] and in Nepal (0.47%) [18]. The possible reason for the high rate of HBV is a high prevalence in the general population owing to the high infection rate of the virus. The seroprevalence of Hepatitis C virus of (4.2% (95% CI: 3.61 to 5.01) is similar to what was found in general in Ghana (4.4%) [19] but higher than figures found in Ethiopia (0.4%) [9], and lower than that reported in Burkina Faso (8.6%) [10]. These discrepancies, apart from geographical differences due to each setting-specific feature, can be due to the tests used in the different studies, as well as collection sites and types of donors in these studies.

Syphilis rate of (5.2% (95% CI: 4.4 to 5.99) was lower than that reported in Accra (7.5%) [19], but higher than those reported in some others settings in Nigeria [20,21]. The higher prevalence of Syphilis in the current study compared to that of Nigeria could be due to concerted TTI prevention interventions that have taken place in Nigeria. However, the lower prevalence recorded in this study compared to the Accra study could be due to an increase in TTI prevention interventions that have taken place in Ghana from 2003 till date, through increased awareness of the disease and prompt treatment which is cheap and effective. Antenatal screening and treatment for syphilis might also have contributed to the low prevalence of syphilis.

Gender showed a predominance of males 2802 (83.3%) compared to females 371 (16.7%) donors. All four TTIs showed a significant difference in prevalence between males and

females (Table 3). Similar findings have been reported previously regarding the number of males among blood donors [3,22,23]. It was established that the motives for donating blood differ between males and females in SSA. While females donate blood for altruistic reasons, males, on the other hand do so for both altruism and remuneration benefits [24]. Thus, to fulfil these two motivations of blood donations, more male donors are found to be paid donors [24]. Furthermore, males are also exposed to several risk factors of TTIs while the women are confined at home, thus the significantly higher prevalence rate of Syphilis for males [2,25].

The overall distribution of TTIs across ages showed that youths are the largest group of blood donors and those aged 20-49 years the most infected with TTIs (Table 2). This is in line with the finding of a study conducted among blood donors in the Kintampo Municipal Hospital, Ghana [3], which showed that the majority of blood donors are among those aged 20-49 years. In the current study, donors aged 50 years and older had overall lower infection rates for the various TTIs. This reflects the low exposure to the commonest mode of infection for TTIs, related to a decrease in sexual activities in this group. However, due to the small number of donors recorded in this age group as a result of the selection criteria of blood donors, these findings call for further investigations to clarify this relationship. Determinants of TTIs were done using logistic regression. However, due to few socio-demographic dependent variables (age and sex only) as well as the specific objective of the study we did not elaborate much to these.

However, in the current study, donors aged 30-39 were 2 times more likely to be infected with Syphilis than those less than 20 years; donors aged 20-29 years were 60% less likely to be infected with HIV than those less than 20 years; donors aged 40-49 were 2 times more likely to be infected with HBV than those less than 20 years. Female donors were 30% less likely to be infected with Syphilis than male (Table 3). The reasons female donors were less likely to be infected with Syphilis could be because the infection is easy and cheap to treat, and females who are infected with the disease are more likely to be diagnosed and treated during routine ANC visits, hence lower prevalence compared to male donors. The higher prevalence of HBV among relatively older donors in the current study indicates that most of these donors may have been infected at an earlier stage of their life.

Limitations: some parameters were missing from the blood donor´s registers such as the location, marital status, religion and level of education of the blood donors, thereby making it impossible to associate these factors with the TTIs status. The few socio-demographic variables used in this study (gender and age) did not allow the elaboration of more determinants of these TTIs nor the determination of confounders, which could shed more light during the elaboration of strategies to prevent these TTIs among blood donors in Hohoe. Missing data is a well-known weakness of retrospective studies. Also, the inability of the study to differentiate between paid donors, voluntary and family donors, repeat or first donors, decreased our ability in inferring some findings as evidence has established the different risk among these different groups of donors.

Conclusion

The prevalence of TTIs is high in Hohoe municipality among blood donors and a reason for great concern about blood safety. Factors associated with the risk of transmitting HIV, HBV, HCV and Syphilis were identified. This study calls for stiff selection criteria of blood donors and advocates the use of voluntary donors.

What is known about the topic

- Unsafe blood remains a major threat to the global spread of transfusion-transmissible infections (TTIs);

- Blood is usually tested for four TTIs: Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Syphilis before transfusion;
- In Ghana, the issue of TTIs is still on the rise, especially among blood donors.

What this study adds

- This article has huge importance in clinical practice especially in SSA where patients are in dire need for blood transfusion;
- The paper advocates for proper screening of donors' blood before transfusion due to the high prevalence of TTIs among blood donors;
- There is also the need for health promotion interventions among young people to minimize their risk of acquiring TTIs since the majority of blood donors are youthful.

Competing interests

The authors declare no competing interests.

Authors' contributions

FA conceived the study, reviewed literature, wrote and revised the manuscript; ET supervised the work, reviewed literature and also critically reviewed the manuscript. EA critically reviewed the manuscript. All the authors approved the final manuscript.

Tables

Table 1: demographic characteristics of blood donors

Table 2: prevalence of transfusion-transmissible infection

Table 3: odds for HIV, HBV, HCV and Syphilis status by sex and age group

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Table 1: demographic characteristics of blood donors

Variables	**Freq. [N=3173]**	**Percent (%)**
Mean Age (SD)	25.4(±8.2)	
Age group		
<20 years	640	20.2
20-29 years	1,789	56.4
30-39 years	516	16.3
40-49 years	170	5.3
50+ years	58	1.8
Sex		
Male	2,802	88.3
Female	371	11.7

Table 2: prevalence of transfusion-transmissible infections					
Variables	**Prevalence of TTIs**				
Years	Donors	HIV (%)	HBV (%)	HCV (%)	Syphilis (%)
2015	1,234(38.9)	18(1.5)	51(4.1)	39(3.2)	58(4.7)
2016	1,939(61.1)	105(5.4)	109(5.6)	96(5.0)	106(5.5)
Overall	3,173	123(3.9)	160(5.0)	135(4.2)	164(5.2)

Table 3: odds for HIV, HBV, HCV and Syphilis status by sex and age group												
Variables	HIV			HBV			HCV			Syphilis		
Sex	N (%)	OR (95%)	P-value	N (%)	OR (95%)	P-value	N (%)	OR (95%)	P-value	N (%)	OR (95%)	P-value
	(χ2=0.03p=0.860)			(χ2=0.11 p=0.744)			(χ2=4.27 p=0.953)			(χ2=9.18 p=0.002)		
Male	108(3.9)	Ref	Ref	140(5.0)	Ref	Ref	119(4.2)	Ref	Ref	157(5.6)	Ref	Ref
Female	15(4.0)	1.1(0.6-1.82)	0.860	20(5.4)	1.1(0.66-1.75)	0.744	16(4.3)	0.1(0.59-1.73)	0.953	7(1.9)	0.3(0.15-0.69)	0.004
Age group	(χ2=9.98 p=0.041)			(χ2=14.48p=0.006)			(χ2=4.27 p=0.371)			(χ2=24.04 p=0.000)		
<20	30(24.4)	Ref	Ref	31(19.4)	Ref	Ref	36(26.7)	Ref	Ref	30(18.3)	Ref	Ref
20-29	54(43.9)	0.6(0.04-0.99)	0.049	75(46.9)	0.9(0.55-1.32)	0.489	72(53.3)	0.7(0.46-1.06)	0.093	73(44.5)	0.9(0.56-1.33)	0.515
30-39	24(19.5)	0.9(0.57-0.72)	0.977	32(20.0)	1.3(0.78-2.15)	0.313	18(13.3)	0.6(0.34-1.08)	0.090	46(28.1)	1.9(1.23-3.20)	0.005
40-49	11(8.9)	1.4(0.69-2.87)	0.348	17(10.6)	2.2(1.17-4.04)	0.013	6(4.4)	0.6(0.25-1.48)	0.278	214(8.5)	1.8(0.94-3.52)	0.073
50+	4(3.3)	1.51(0.51-4.43)	0.457	5(3.1)	1.9(0.69-4.96)	0.220	3(2.2)	0.9(0.27-3.06)	0.886	1(0.6)	0.3(0.04-2.66)	0.315