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# Trend of Donor Rejection Due to the Incidence of Hepatitis B and C Viruses, Human Immunodefiency Virus (HIV 1&2) and *Treponema pallidum* in Ghana: A Retrospective Study

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Authors MA, SA and FJE designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors BBS and OKW managed the analyses of the study. Authors RA and EBA managed the literature searches. All authors read and approved the final manuscript.*

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## ABSTRACT

**Objectives:** This research sought to determine the annual trend of donor rejection due to the incidence of Hepatitis B Surface Antigen (HBsAg), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV 1&2) and *Treponema pallidum* (syphilis) among blood donors in Ghana.

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**Place and Duration of Study:** This retrospective study was conducted on all donors who presented for allogeneic blood donation from January 2014 to December 2017 at Ashanti Bekwai Municipal Hospital.
**Methods:** Laboratory records containing donors' information from January 2014 to December 2017 were reviewed. The annual incidence of Hepatitis B Surface Antigen (HBsAg), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV 1&2) and *Treponema pallidum* among the donors were statistically computed using Graphpad® Prism. The difference between the reactive and nonreactive groups was computed using two-way ANOVA followed by Bonferroni's post hoc test.
**Results:** In general, 18.1% (347/1922) tested positive for at least one of the infections, 5.98% (115/1922), 2.2% (42/1922), 2.3% (44/1922), 7.6% (146/1922) tested positive for HBsAg, HCV, HIV 1&2 and *Treponema pallidum* respectively. Specifically, from 2014-2017, the incidence of the individual diseases among the blood donors were as follows: HBsAg; 6.2, 7.5, 5.7, and 4.0%, HCV; 0.9, 2.4, 2.8 and 2.7%, HIV; 2.4, 1.7, 2.8 and 2.5%, and *Treponema pallidum*; 6.7, 9.5, 6.3 and 7.7% respectively.
**Conclusion:** The annual incidence of HBsAg, HCV, *Treponema pallidum* and HIV 1&2 among blood donors at Ashanti Bekwai Municipal hospital, Ghana is high. This warrant the need for healthcare authorities to consider implementing policies that will make it possible for the blood bank services to be able to reveal the cause of donor rejection to the deferred donor so that immediate interventions can be made to salvage them from the long-term effect of the infections and to also prevent them from communicating the infections to others.

*Keywords: Blood donors; Ghana; rejected donors; incidence; Treponema pallidum; HIV; HBsAg; HCV.*

## 1. INTRODUCTION

Blood transfusion is very vital in healthcare delivery as it offers supportive care for both surgical and medical patients [1]. Transfusion medicine has provided major breakthroughs in the management of most haematological conditions. For example, it is used in the management of coagulopathy related bleeding [2], therapeutic phlebomomy, Therapeutic Cytapheresis [3], Due to the limited supply of blood, family replacement of blood issued to patients is a common practice in sub-Saharan Africa. Also, donors are hired to donate blood for a fee paid by either the officials of the blood bank or individuals in need of the blood. In rare situations, organised groups such as churches, keep-fit clubs, associations, organised institutions and educational institutions walk into health facilities once a while to donate blood voluntarily [4]. The incidence of Transfusion-transmissible infections has made both blood bankers and health authorities overly cautious in obtaining safe blood products. Blood donors are expected to meet eligibility criteria through questionnaire before donation to ensure blood safety [5]. The process of blood donation involves the selection of blood donors by screening. The selection process consists of obtaining a medical history and performing physical examination and certain laboratory tests of the patient [6-8]. After filling out the informed consent and meeting the eligibility criteria, donor's blood is screened for only HIV-1 and -2, Hepatitis C Virus (HCV), Syphilis (VDRL) and Hepatitis B Virus (HBV) [9]. Screening of blood donor has substantially reduced the risk of Transfusion Transmissible Infections (TTIs) [9, 10]. Due to the fear that deferred donors might not return to donate as a result of the negative feelings resulting from their deferral, which in turn could impact negatively on the blood supply [11], positive blood tests are not revealed to the deferred donor. However, the threats that the disease conditions; HBsAg, HCV, HIV 1 & 2 and Syphilis pose to both the donor, their family and society are so great that it may warrant the need for Health Authorities to develop policies that will ensure that positive blood tests for any of the diseases conditions screened for, be revealed to the rejected donor.

Limited information are available regarding the annual incidence of HIV-1 and -2, Hepatitis C Virus (HCV), Syphilis (VDRL) and Hepatitis B Virus (HBV) infection in the general population and among blood donors in Ghana hence this study was conducted to determine the trend in donor rejection due to the presence of HIV-1 and -2, Hepatitis C Virus (HCV), Syphilis (VDRL) and Hepatitis B Virus (HBV) infection among blood donors in the Ashanti Bekwai Municipal hospital to serve as surveillance report and to also inform the authorities on the need to implement policies

that will make it possible for health facilities to counsel, reveal positive test results and offer treatment when needed to the rejected donors in order not to endanger their societies and families.

## 2. MATERIALS AND METHODS

This retrospective study was conducted on data of all donors who presented for allogeneic blood donation from 1st January 2014 to 31st December 2017 at the Ashanti Bekwai Municipal Hospital.

### 2.1 Demography of the Study Area

The population of Bekwai Municipality is 118,024 with males and females representing 47.1 percent and 52.9 percent respectively. The age structure of the population is dominated by young people, with about 41.0 percent under 15 years of age. The elderly population (65 years and above) accounts for 6.5 percent of the total population. The ethnic groups in the area is diverse with high in-migration from the Eastern, Western and Central regions. Akans are the predominant ethnic group, however, there are other ethnic groups of northern extraction like Dagarti, Kusasi and Kokomba. The household structure in both urban and rural communities are based on nuclear family ties. Biological children, household heads and spouse constitute the largest proportion (27.2%) of the household membership. The nuclear family household appears to be the most common household structure. However, the extended family household structure is still very significant (20.3%). The working population of the district is dominated by people with no formal education and those with primary and middle school (basic) education. Over 75 percent of the inhabitants are engaged in agriculture and related activities [12].

### 2.2 Data Collection

Laboratory records containing donor information; name, age, sex, blood group, haemoglobin concentration, and results of various serological tests; HIV 1 & 2, Hepatitis B surface Antigen (HBsAg), antibodies against Hepatitis C Virus (HCV) and Syphilis were reviewed.

As per the national blood banking policy, each potential blood donor undergoes extensive screening process which involves completing a questionnaire, undergoing physical medical examination and then providing informed consent to the donation process. After passing the preliminary investigations, and as per the standard operation procedure of the facility, 5 ml of venous blood were collected into an ethylene diamine tetra acetic acid (EDTA) Tube. Blood group of each patient were determined using the tile method. Haemoglobin concentration was estimated using Sysmex KX-21N automated complete blood count machine. Blood samples were then centrifuged at 2500 rpm for 3 minutes after which rapid diagnostic kits were used to screen for HBsAg, HCV, syphilis and HIV 1& 2. Donors who responded yes to having a history of chronic cough which could indicate tuberculosis, those with diabetes, epilepsy, goitre, hypertension and cardio-vascular or cerebro-vascular disease were excluded. All persons who met the eligibility criteria stated in Ghana National Blood Policy for the Health Sector, 2006 [6] but had donated blood within the past three months from the day of the visit were excluded. All pregnant women and those who have been pregnant within the previous year, people with bleeding conditions like piles, peptic ulcer, menorrhagia, and people with conditions associated with increased demands for iron were also rejected. Patients who tested positive for one or more of the following conditions; HBsAg, HCV, HIV and Syphilis were also rejected.

### 2.3 Statistical Analysis

Graphpad® Prism for Windows Version 7.0 (Graphpad Software, San Diego, CA, USA, 2016) was used for all statistical analysis. The difference between the reactive and nonreactive group was computed using two-way ANOVA followed by Bonferroni's post hoc test. $P < 0.05$ was considered statistically significant for all tests and in each case, $P < 0.0001$ was observed.

## 3. RESULTS

The results showed that from 1st January 2014 to 31st December 2017, a total of 1922 blood donors were screened for allogeneic blood donation. Out of the number, 347 (18.1%) were rejected based on the presence of one or more of the following conditions; HIV 1 and 2, HBsAg, HCV and Syphilis. The yearly breakdown of rejected donors due to the presence of a positive test for the individual serological tests conducted are indicated in Table 1. In 2014, out of the 465 donors that were screened, 75 (16.1%) were rejected. Out of this number of rejected donors, HBsAg accounted for 6.2% (n=29). HCV, Syphilis, HIV 1 and 2 accounted for 0.9% (n=4),

6.7% (n=31) and 2.4% (n=11) respectively. In 2015, a total of 115 (21.1%) of the 546 donors screened were rejected as a result of a positive for one or more the following diseases; HIV 1 and 2, HBsAg, HCV and Syphilis. Specifically, the number of donor rejection as a result of HBsAg, HCV, Syphilis and HIV 1 and 2 were 7.5% (n=41), 2.4% (n=13), 9.5 % (n=52) and 1.7% (n=9) respectively. In 2016, 507 donors were screened. A total of 89 (17.6%) were rejected for testing positive for one or more of the following; HIV 1 and 2, HBsAg, HCV and Syphilis. The contribution of HBsAg, HCV, Syphilis and HIV 1 and 2 to the total number of rejected donors were as follows. HBsAg 29 (5.7%), HCV 14 (2.8%), Syphilis 32 (6.3 %), HIV 1&2 14 (2.8%). Finally, in 2017, 404 donors were screened. 68 (16.8%) were rejected. A total of 16 (4.0 %) were rejected as a result of HBsAg. Furthermore, a total of 11 (2.7%), 31 (7.7%) and 10 (2.5%) were rejected as a result of HCV, Syphilis and HIV 1 and 2 respectively. A summary of the percentage of donors rejected on yearly basis due to the incidence of HBsAg, HCV, Syphilis and HIV are also presented in Table 1. Our blood donors composed largely of males. That is 1618 (81.2%) of all the overall donors (from 2014 to 2017) were males while the remaining 304 (17.8 %) were females. The age distribution of donors ranged from 16-57 (mean age, 29) years. Figs. 1-6 show the graphical representation of; 1) the overall donor rejection, 2) annual donor rejection due to HBsAg, 3) annual donor rejection due to Syphilis, 4) annual donor rejection due to HCV, 5) annual donor rejection due to HIV 1&2 and 6) Trend of Prevalence over the four year period.

Table 1 summarises the number of donors who were rejected due to HBsAg (Hepatitis B Surface Antigen), HCV (Hepatitis C Virus), *Treponema pallidum* (Syphilis), HIV (Human Immunodeficiency Virus) 1& 2 from 2014 to 2017. DRD = Donor Rejection Due to.

**Table 1. Summary of results for the trend of donor rejection (total number of donors screened and the number of donors who tested positive for each of the conditions) for the reviewed years**

| Year | Donors screened | Total number of donrs rejected | DRD HBsAg | DRD HCV | DRD Syphilis | DRD HIV 1 & 2 |
|---|---|---|---|---|---|---|
| 2014 | 465 | 75 (16.1%) | 29 (6.2%) | 4 (0.9%) | 31 (6.7%) | 11 (2.4%) |
| 2015 | 546 | 115 (21.1%) | 41 (7.5%) | 13 (2.4%) | 52 (9.5%) | 9 (1.7%) |
| 2016 | 507 | 89 (17.6%) | 29 (5.7%) | 14 (2.8%) | 32 (6.3%) | 14 (2.8%) |
| 2017 | 404 | 68 (16.8%) | 16 (4.0%) | 11 (2.7%) | 31 (7.7%) | 10 (2.5%) |

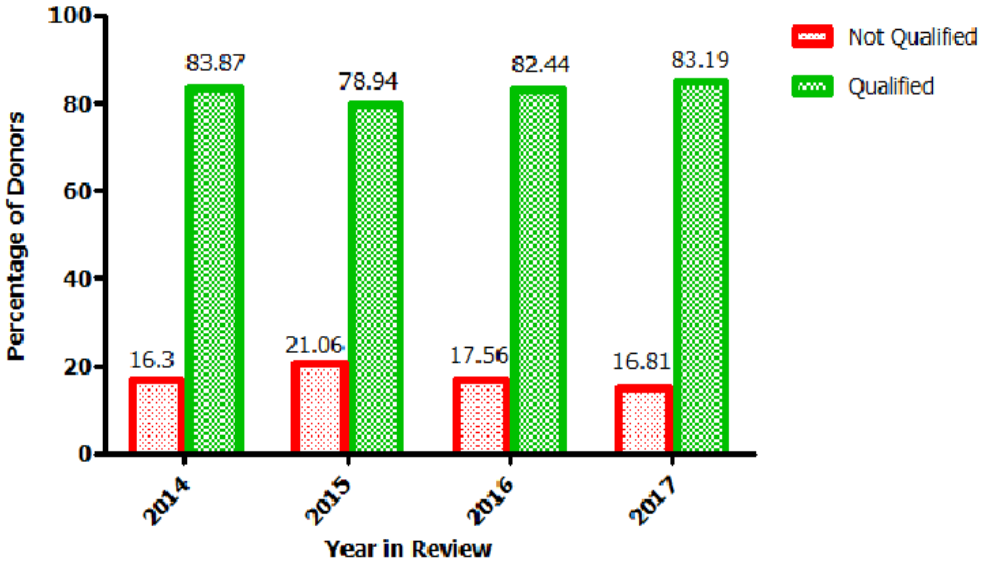


**Fig. 1. Overall donor rejection rates for the four consecutive years**

Fig. 1 shows the overall percentage of donor rejection due to the presence of one or more of the disease conditions. The red bars indicate the percentage of donors who were rejected due to presence of either one or more of the diseases while the green bars indicate the percentage of donors who qualified for donation.

Fig. 2 shows the annual trend of donor rejection due to HBsAg. The red bars indicate the percentage of donors who tested positive for HBsAg while the green bars indicate the percentage of donors who tested negative for the HBsAg.

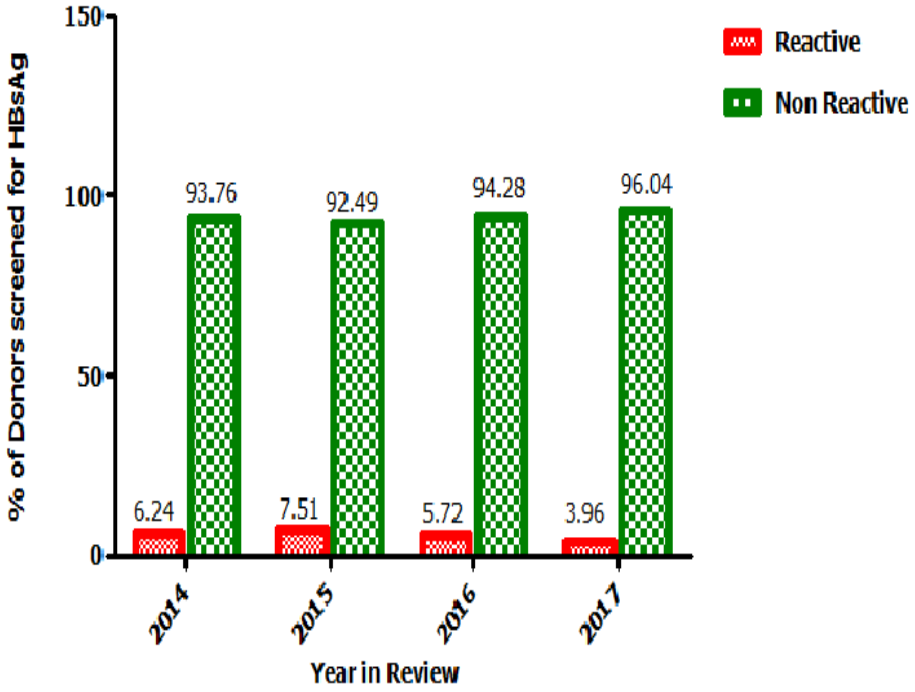


**Fig. 2. Donor rejection rates due to HBsAg**

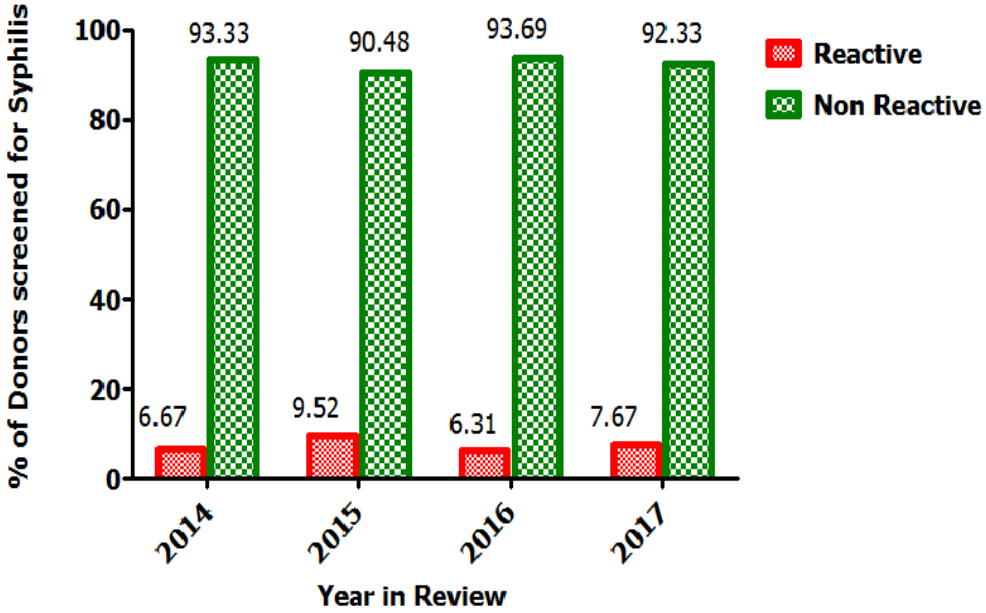


**Fig. 3. Donor rejection rates due to Syphilis infection**

Fig. 3 shows the annual trend of donor rejection due to Syphilis. The red bars indicate the percentage of donors who tested positive for Syphilis while the green bars indicate the percentage of donors who tested negative for the Syphilis.

Fig. 4 shows the annual trend of donor rejection due to HCV. The red bars indicate the percentage of donors who tested positive for HCV while the green bars indicate the percentage of donors who tested negative for the HCV.

Fig. 5 shows the annual trend of donor rejection due to HIV. The red bars indicate the percentage of donors who tested positive for HIV while the green bars indicate the percentage of donors who tested negative for the HIV.

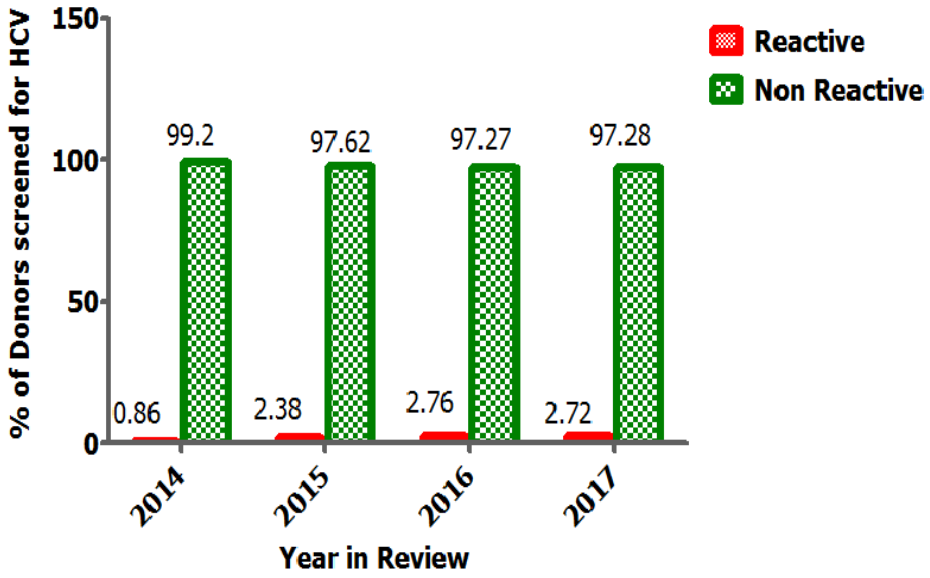


**Fig. 4. Donor rejection rates due to HCV**

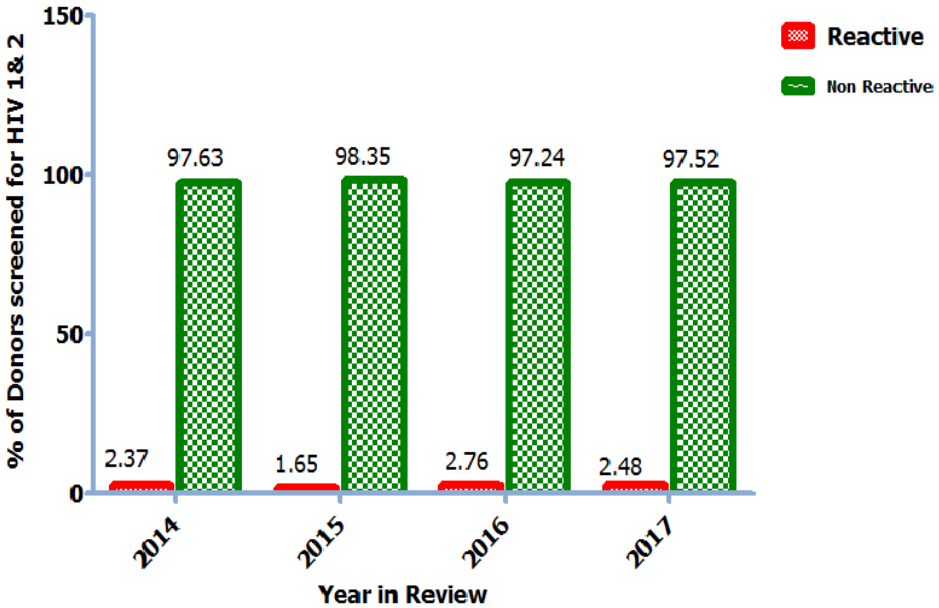


**Fig. 5. Donor rejection rates due to HIV 1&2**

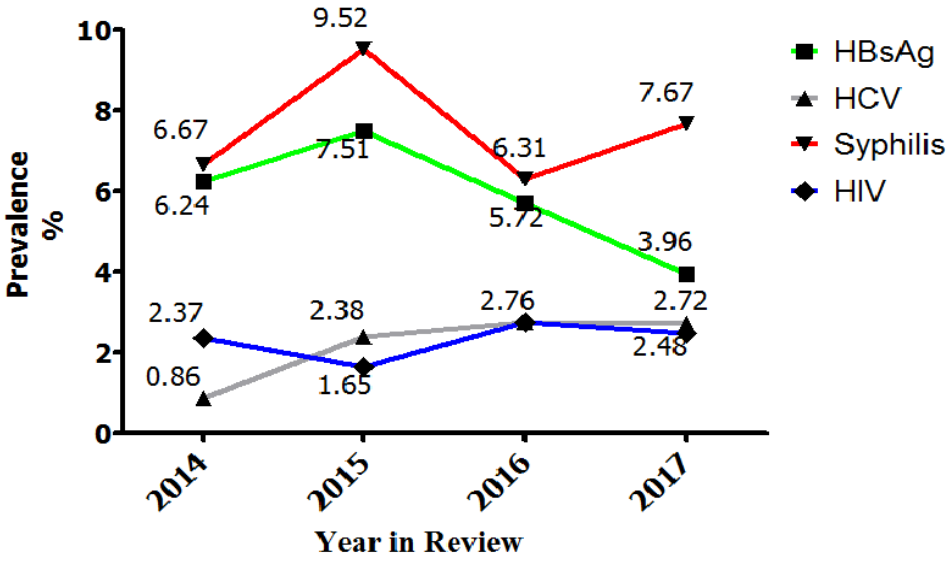


**Fig. 6. General overview of the incidence of each infection as the occurred from 2014-2017**

Fig. 6 shows a General overview of the incidence of each infection as the occurred from 2014-2017. That is the trend of incidence of each infection for the four consecutive years. The Green line represents HBsAg, the Gray line represents HCV, and the Red line represents Syphilis while the Blue line represents HIV 1&2.

## 4. DISCUSSION

The average percentage of donor rejection (18.1 %) observed in this study is significantly higher than the rates reported in Germany (6.2%) [13], France (10.8%) [14], USA (12.8%–15.6%) [15, 16], Japan (14%) [17], Singapore (14.4%) [18], Turkey (14.6%) [19], India (5.8%–16.4%) [20-24]. The incidence rate of HBsAg among the blood donors; 6.24, 7.51, 5.72, and 3.96% for 2014, 2015, 2016 and 2017 respectively observed in this study were relatively lower than the 9.6, 13.18, 10.8–11.6 and 15.0% that have been reported by studies [1,25-27]. The incidence rate recorded in this study was higher than those reported in Egypt 2.5 % [28] and Nahavand, Iran (2.3 %) [29]. On the contrary, the values were lower than those reported in Ethiopia 14.4 % [30] and Yemen 12.7 % [31]. Though the incidence of anti-HCV seemed to increase significantly, that is 0.86, 2.38, 2.76 and 2.72 % in 2014, 2015, 2016 and 2017 respectively, these values were lower than the 4.4, 8.0 and 7.4-11.6% that have been reported by studies [1,25,32].The values were higher than those reported in Tanzania where the prevalence of HCV was 1.5% [33]. On the contrary, the HCV incidence was lower than those reported in Georgia 6.9% [34] and Nigeria 6% [35]. The incidence of HIV fluctuated throughout the reviewed years but in all cases, the values recorded: 2.37, 1.65, 2.76 and 2.48% for 2014, 2015, 2016 and 2017 respectively were lower than the 4.9 and 4.5% that have already been reported by studies [1,25]. The rates were, however, lower than those reported in Nigeria 10.6% [36], Ethiopia 16.7% [30] and Kenyan 2-20% [37]. The prevalence of *Treponema pallidum* (syphilis); (6.67, 9.52, 6.31 and 7.67%) among blood donors at Bekwai Municipal Hospital for the four consecutive years (2014, 2015, 2016 and 2017) were comparable to the 7.5% reported by Adjei et al. [9]. However, the results were lower than the 15.3% reported by study Alomatu et al. [25]. The incidence of *Treponema pallidum* (Syphilis) observed in this study were lower than those reported in Ethiopia 12.8% [38], and Tanzania 12.7% [39]. On the contrary, the rates were lower than those reported in Nigeria 3.6% [40] and Georgia 2.4% [34]. The relatively low values observed in this research may be as a result of the fact that the available research papers or works on blood donors in Ghana from which this work was compared to were carried out long ago. It could also be that the unceasing efforts of Ghana AIDS commissions to 1) expand school-based HIV education campaign, 2) increase access to testing and counselling for STI, 3) Screen antenatal attendants for HIV, Syphilis and hepatitis B have yielded positive results by reducing the transmission of these diseases. The above assumptions may be true because

contrary to the observations that the values of this research were lower than reported ones, HCV infection among donors in Ashaniti Bekwai Municipal Hospital were comparable to the 2.6% value reported from a systematic review and meta-analysis research conducted in 2016 [41].

The significantly higher incidence of HBsAg, HCV, Syphilis and HIV 1 and 2 infections among healthy blood donors coupled with the inconsistencies in reports on the incidence of the above mentioned conditions among donors in Ghana calls for more questions than answers. For example: 1) what are the prevalence of HBsAg, HCV, Syphilis and HIV 1 and 2 among asymptomatic blood donors in Ghana? 2) With the rejected donors always kept in the dark, what dangers do they pose to the society and their families? 3) Since Ghana has adopted the policy to "Treat All HIV Positive Clients Irrespective of CD4 Count" [42], shouldn't the National Blood Banking Service be a fine avenue to isolate asymptomatic carriers, offer counselling and treatment as soon as possible to prevent complications?

## 5. CONCLUSION

The average (n = 4) annual incidence of HBsAg, HCV, HIV 1&2 and Syphilis among blood donors at Ashanti Bekwai Municipal hospital in Ghana are 5.98%, 2.19%, 2.29% and 7.60% respectively. With the relatively higher incidence of these infectious diseases among the healthy blood donors, the authors wish to recommend to the healthcare authorities to consider implementing policies that will make it possible for the blood bank services to be able to reveal the cause of donor rejection to the deferred donor so the quick interventions can be made to salvage them from the long-term effect of the infections and to also prevent them from communicating the infections to others. It will also be expedient for the disease control and prevention units to intensify their campaigns in sensitising the public on the mode of transmission of these infectious diseases given the fact that majority of the inhabitants in the municipality live in the nuclear or extended family houses where they interact so easily with each other.

## CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

Though this was a retrospective study which therefore posed little to no risk to the participants, confidentiality and privacy issues were strictly adhered to. No donor or third party had access to the laboratory results on the donors. Information were kept secret among only the Laboratory Staff who conducted the tests and the Researchers. Approval was received from the relevant agencies and departments before the research was conducted. Permission was also sought from the Head of Laboratory at the Hospital before the research was conducted.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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