

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.

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 Ghana.

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. 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 were 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 health care 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

30 donor so that immediate interventions can be made to salvage them from the long term effect
31 of the infections and to also prevent them from communicating the infections to others.

32 **Keywords:** *blood donors, Ghana, rejected donors, incidence, Treponema pallidum, HIV,*
33 *HBsAg, HCV.*

34 1. INTRODUCTION

35 Blood transfusion is very vital in healthcare delivery as it offers supportive care for both
36 surgical and medical patients [1]. Transfusion medicine has provided major breakthroughs in
37 the management of most hematological conditions. For example it is used in the management
38 of coagulopathy related bleeding [2], therapeutic phlebotomy, Therapeutic Cytapheresis [3],
39 Due to the limited supply of blood, family replacement of blood issued to patients is a
40 common practice in sub-Saharan Africa. Also, donors are hired to donate blood for a fee paid
41 by either the officials of the blood bank or individuals in need of the blood. In rare situations,
42 organized groups such as churches, keep-fit clubs, associations, organized institutions and
43 educational institutions walk into health facilities once a while to donate blood voluntarily
44 [4]. Incidence of Transfusion-transmissible infections have made both blood bankers and
45 health authorities overly cautious in obtaining safe blood products. Blood donors are
46 expected to meet eligibility criteria through questionnaire before donation to ensure blood
47 safety [5]. The process of blood donation involves selection of blood donors by screening.
48 Selection process consists of obtaining medical history, and performing physical examination
49 and certain laboratory tests of the patient [6-8]. After filling out the informed consent and
50 meeting the eligibility criteria, donor's blood is screened for only HIV-1 and -2, Hepatitis C
51 Virus (HCV), Syphilis (VDRL) and Hepatitis B Virus (HBV) [9]. Screening of blood donor
52 has substantially reduced the risk of Transfusion Transmissible Infections (TTIs) [9, 10]. Due
53 to the fear that deferred donors might not return to donate as a result of the negative feelings
54 resulting from their deferral, which in turn could impact negatively on the blood supply [11],
55 positive blood tests are not revealed to the deferred donor. However, the threats that the
56 disease conditions; HBsAg, HCV, HIV 1 & 2 and Syphilis pose to both the donor, their
57 family and society are so great that it may warrant the need for Health Authorities to develop
58 policies that will ensure that positive blood tests for any of the diseases conditions screened
59 for, be revealed to the rejected donor.

60 Limited information are available regarding the annual incidence of HIV-1 and -2, Hepatitis
61 C Virus (HCV), Syphilis (VDRL) and Hepatitis B Virus (HBV) infection in the general

62 population and among blood donors in Ghana hence this study was conducted to determine
63 the trend in donor rejection due to the presence of HIV-1 and -2, Hepatitis C Virus (HCV),
64 Syphilis (VDRL) and Hepatitis B Virus (HBV) infection among blood donors in the Ashanti
65 Bekwai Municipal hospital to serve as surveillance report and to also inform the authorities
66 on the need to implement policies that will make it possible for health facilities to counsel,
67 reveal positive test results and offer treatment when needed to the rejected donors in order not
68 to endanger their societies and families.

69 **2. MATERIALS AND METHODS**

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

73 **2.1 DEMOGRAPHY OF THE STUDY AREA**

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

88 **2.2 DATA COLLECTION**

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

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

110 **2.3 STATISTICAL ANALYSIS**

111 Graphpad® Prism for Windows Version 7.0 (Graphpad Software, San Diego, CA, USA,
112 2016) was used for all statistical analysis. The difference between the reactive and
113 nonreactive group were computed using two-way ANOVA followed by Bonferroni's post
114 hoc test. $P < 0.05$ was considered statistically significant for all tests and in each case, $P <$
115 0.0001 was observed.

116 **3. RESULTS**

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

124 for 0.9 % (n=4), 6.7 % (n=31) and 2.4 % (n=11) respectively. In 2015, a total of 115 (21.1 %)
 125 of the 546 donors screened were rejected as a result of a positive for one or more the
 126 following diseases; HIV 1 and 2, HBsAg, HCV and Syphilis. Specifically, the number of
 127 donor rejection as a result of HBsAg, HCV, Syphilis and HIV 1 and 2 were 7.5 % (n=41), 2.4
 128 % (n=13), 9.5 % (n=52) and 1.7 % (n=9) respectively. In 2016, 507 donors were screened. A
 129 total of 89 (17.6 %) were rejected for testing positive for one or more of the following; HIV 1
 130 and 2, HBsAg, HCV and Syphilis. The contribution of HBsAg, HCV, Syphilis and HIV 1 and
 131 2 to the total number of rejected donors were as follows. HBsAg 29 (5.7 %), HCV 14 (2.8
 132 %), Syphilis 32 (6.3 %), HIV 1&2 14 (2.8 %). Finally, in 2017, 404 donors were screened. 68
 133 (16.8 %) were rejected. A total of 16 (4.0 %) were rejected as a result of HBsAg.
 134 Furthermore, a total of 11 (2.7 %), 31 (7.7 %) and 10 (2.5 %) were rejected as a result of
 135 HCV, Syphilis and HIV 1 and 2 respectively. A summary of the percentage of donors
 136 rejected on yearly basis due to the incidence of HBsAg, HCV, Syphilis and HIV are also
 137 presented in table 1. Our blood donors composed largely of males. That is 1618 (81.2 %) of
 138 all the overall donors (from 2014 to 2017) were males while the remaining 304 (17.8 %) were
 139 females. The age distribution of donors ranged from 16-57 (mean age, 29) years. Figures 1-6
 140 show the graphical representation of; 1) the overall donor rejection, 2) annual donor rejection
 141 due to HBsAg, 3) annual donor rejection due to Syphilis, 4) annual donor rejection due to
 142 HCV, 5) annual donor rejection due to HIV 1&2 and 6) Trend of Prevalence over the four
 143 year period.

TABLES AND FIGURES

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	TOTAL NUMBER					
	DONORS SCREENED	OF DONORS 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%)

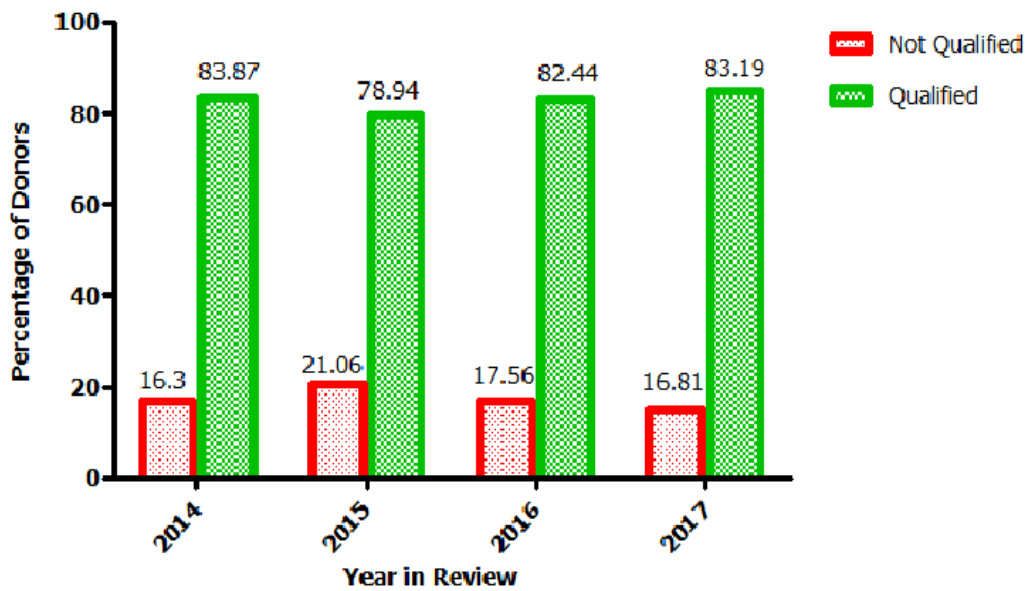
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145 Table 1 summarizes the number of donors who were rejected due to HBsAg (Hepatitis B
146 Surface Antigen), HCV (Hepatitis C Virus), *Treponema pallidum* (Syphilis), HIV (Human
147 Immunodeficiency Virus) 1 & 2 from 2014 to 2017. DRD = Donor Rejection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

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FIGURES

149 **Figure 1: Overall Donor Rejection Rates for the Four Consecutive Years.**

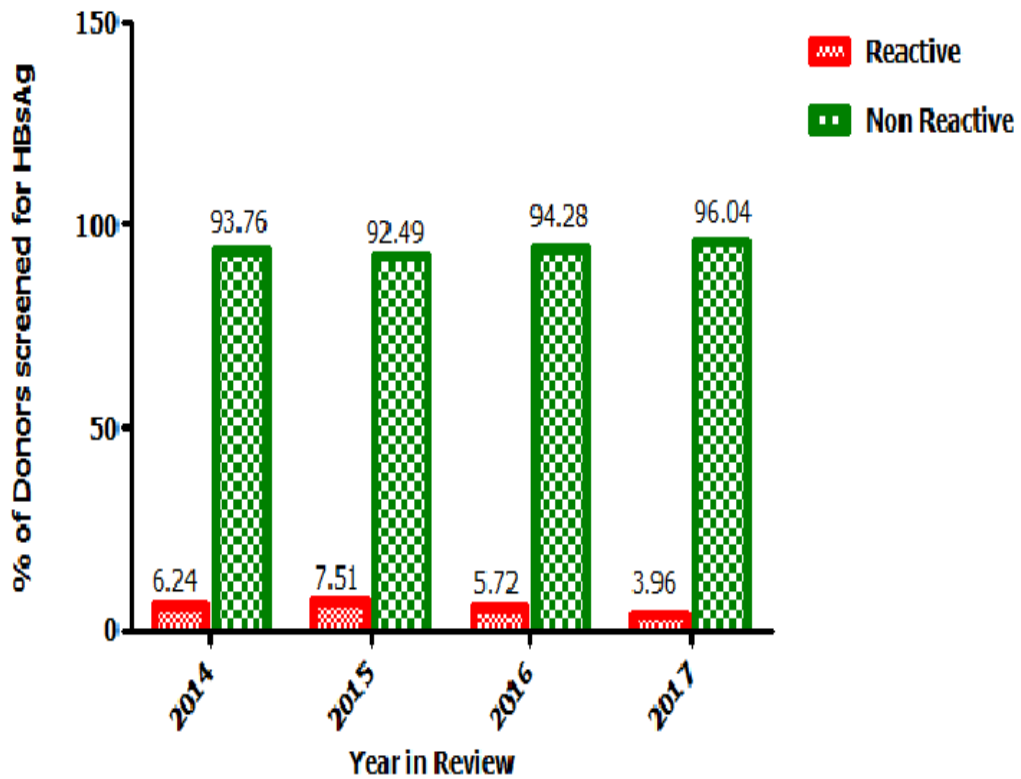


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151 Figure 1 shows the overall percentage of donor rejection due to the presence of one or more
152 of the disease conditions. The red bars indicate the percentage of donors who were rejected
153 due to presence of either one or more of the diseases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

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156 **Figure 2: Donor Rejection Rates Due to HBsAg.**



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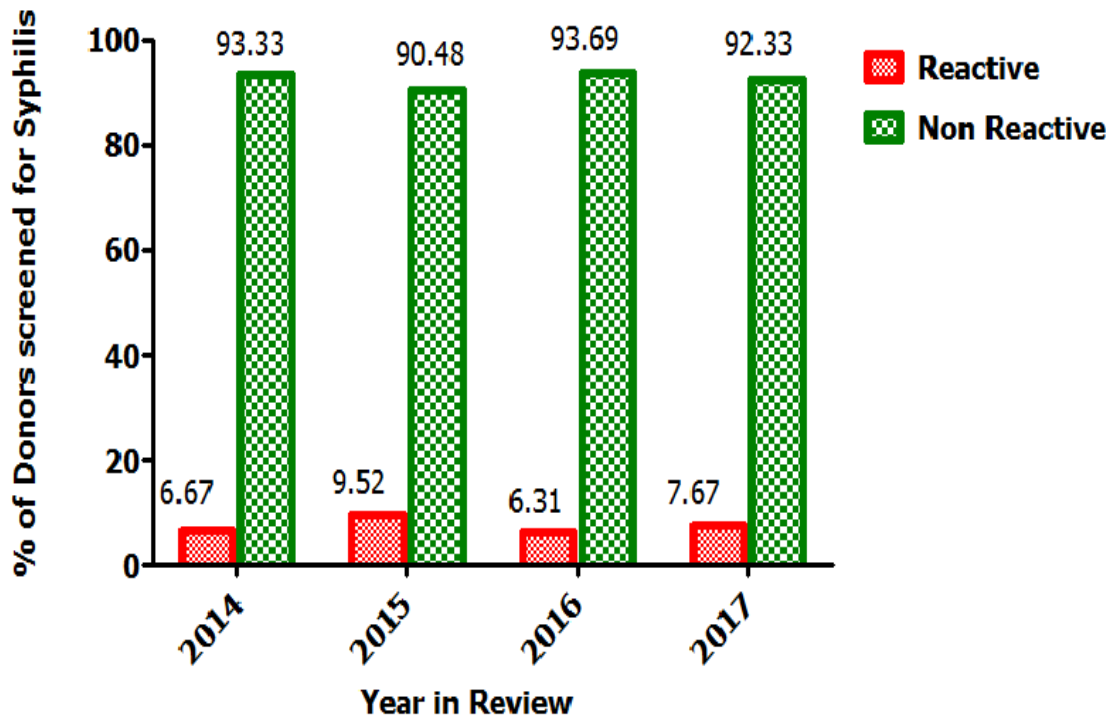
158 Figure 2 shows the annual trend of donor rejection due to HBsAg. The red bars indicate the
159 percentage of donors who tested positive for HBsAg while the green bars indicate the
160 percentage of donors who tested negative for the HBsAg.

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164 **Figure 3: Donor Rejection Rates Due to Syphilis Infection.**



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

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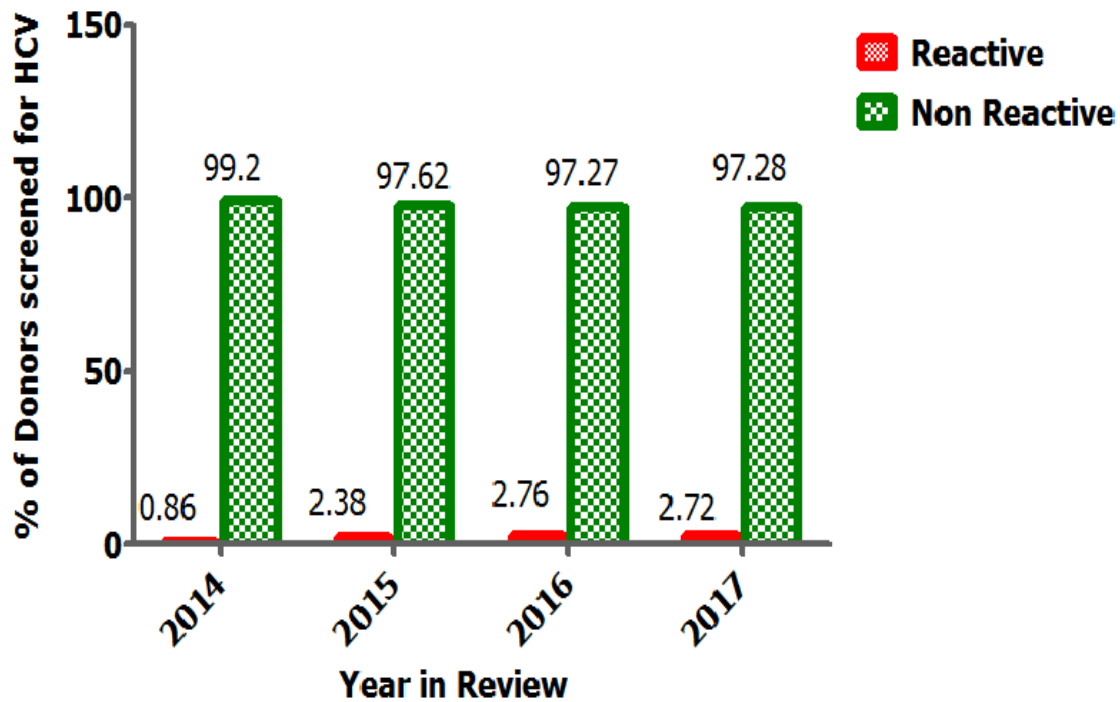
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179 **Figure 4: Donor Rejection Rates Due to HCV.**



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

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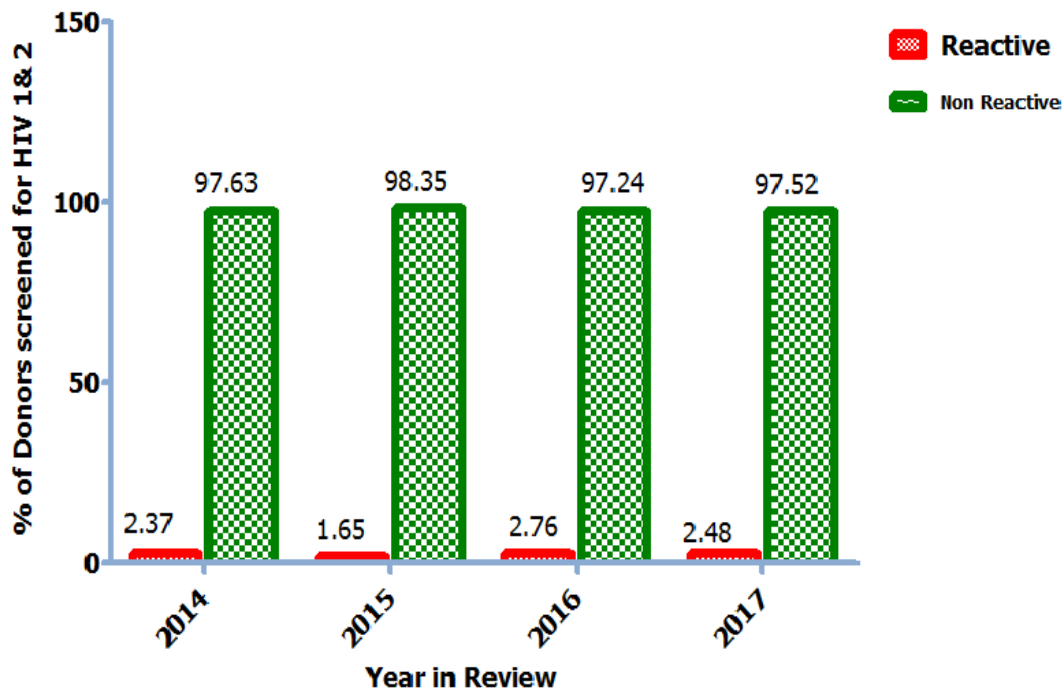
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194 **Figure 5: Donor Rejection Rates Due to HIV 1&2.**



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

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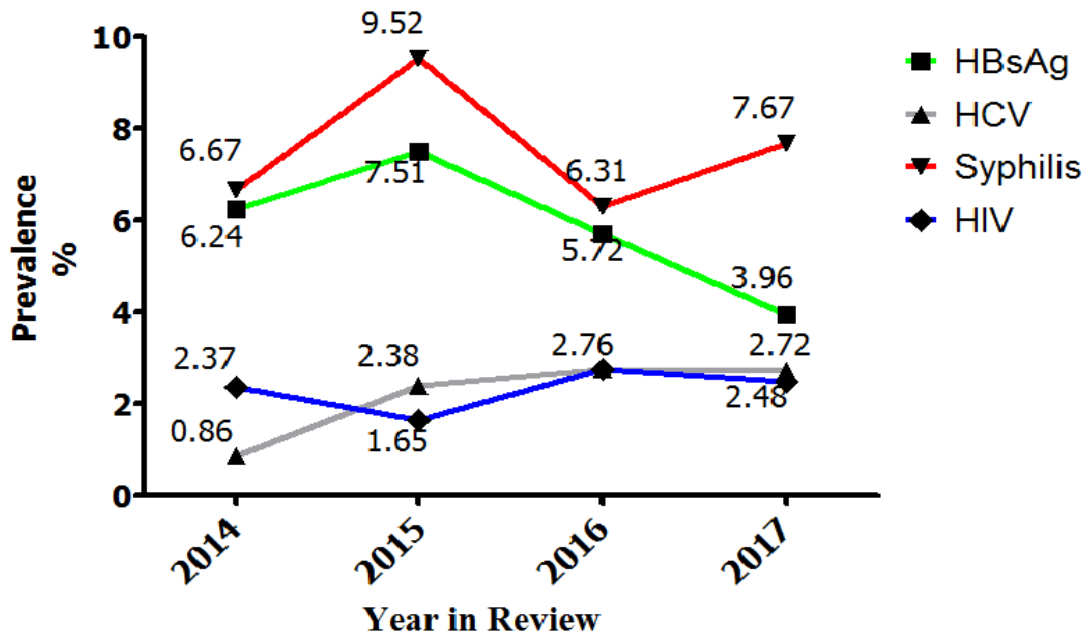
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208 **Figure 6: General overview of the incidence of each infection as the occurred from**
 209 **2014-2017**



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211 Figure 6 shows General overview of the incidence of each infection as the occurred from
 212 2014-2017. That is the trend of incidence of each infection for the four consecutive years.
 213 The Green line represents HBsAg, the Gray line represents HCV, and the Red line represents
 214 Syphilis while the Blue line represents HIV 1&2

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4. DISCUSSION

216 The average percentage of donor rejection (18.1 %) observed in this study is significantly
 217 higher than the rates reported in Germany (6.2%) [13], France (10.8%) [14], USA (12.8%–
 218 15.6%) [15, 16], Japan (14%) [17], Singapore (14.4%) [18], Turkey (14.6%) [19], India (5.8%–
 219 16.4%) [26-30]. The incidence rate of HBsAg among the blood donors; 6.24, 7.51, 5.72, and
 220 3.96 % for 2014, 2015, 2016 and 2017 respectively observed in this study were relatively
 221 lower than the 9.6, 13.18, 10.8–11.6 and 15.0 % that have been reported by studies [1, 25-27].
 222 The incidence rate recorded in this study was higher than those reported in Egypt 2.5 % [28]
 223 and Nahavand, Iran (2.3 %) [29]. On the contrary, the values were lower than those reported
 224 in Ethiopia 14.4 % [30] and Yemen 12.7 % [31]. Though the incidence of anti-HCV seemed
 225 to increase significantly, that is 0.86, 2.38, 2.76 and 2.72 % in 2014, 2015, 2016 and 2017
 226 respectively, these values were lower than the 4.4, 8.0 and 7.4-11.6 % that have been reported
 227 by studies [1, 25, 32]. The values were higher than those reported in Tanzania where the

228 prevalence of HCV was 1.5 % [33]. On the contrary, the HCV incidence were lower than
229 those reported in Georgia 6.9 % [34] and Nigeria 6 % [35]. Incidence of HIV fluctuated
230 throughout the reviewed years but in all cases, the values recorded: 2.37, 1.65, 2.76 and 2.48
231 % for 2014, 2015, 2016 and 2017 respectively were lower than the 4.9 and 4.5 % that have
232 already been reported by studies [1, 25]. The rates were however lower than those reported in
233 Nigeria 10.6 % [36], Ethiopia 16.7 % [30] and Kenyan 2-20 % [37]. The prevalence of
234 *Treponema pallidum* (syphilis); (6.67, 9.52, 6.31 and 7.67 %) among blood donors at Bekwai
235 Municipal Hospital for the four consecutive years (2014, 2015, 2016 and 2017) were
236 comparable to the 7.5 % reported by Adjei *et al.*, (2004) [9]. However, the results were lower
237 than the 15.3 % reported by study Alomatu *et al.*, (2017) [25]. Incidence of *Treponema*
238 *pallidum* (Syphilis) observed in this study were lower than those reported in Ethiopia 12.8 %
239 [38], and Tanzania 12.7 % [39]. On the contrary, the rates were lower than those reported in
240 Nigeria 3.6 % [40] and Georgia 2.4 % [34]. The relatively low values observed in this research
241 may be as a result of the fact that the available research papers or works on blood donors in
242 Ghana from which this work was compared to were carried out long ago. It could also be that
243 the unceasing efforts of Ghana AIDS commissions to 1) expand school based HIV education
244 campaign, 2) increase access to testing and counselling for STI, 3) Screen antenatal
245 attendants for HIV, Syphilis and hepatitis B have yielded positive results by reducing the
246 transmission of these diseases. The above assumptions may be true because contrary to the
247 observations that the values of this research were lower than reported ones, HCV infection
248 among donors in Ashaniti Bekwai Municipal Hospital were comparable to the 2.6 % value
249 reported from a systematic review and meta-analysis research conducted in 2016 [41].

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

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5. CONCLUSION

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The average (n = 4) annual incidence of HBsAg, HCV, HIV 1&2 and Syphilis among blood

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donors at Ashanti Bekwai Municipal hospital in Ghana are 5.98 %, 2.19 %, 2.29 % and 7.60

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% respectively. With the relatively higher incidence of these infectious diseases among the

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healthy blood donors, the authors wish to recommend to the health care authorities to

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consider implementing policies that will make it possible for the blood bank services to be

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able to reveal the cause of donor rejection to the deferred donor so the quick interventions can

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be made to salvage them from the long term effect of the infections and to also prevent them

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from communicating the infections to others. It will also be expedient for the disease control

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and prevention units to intensify their campaigns in sensitizing the public on the mode of

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transmission of these infectious diseases given the fact that majority of the inhabitants in the

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municipality live in the nuclear or extended family houses where they interact so easily with

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each other..

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ETHICAL APPROVAL

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Though this was a retrospective study which therefore posed little to no risk to the

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participants, confidentiality and privacy issues were strictly adhered to. No donor or third

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party had access to the laboratory results on the donors. Information were kept secret among

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only the Laboratory Staff who conducted the tests and the Researchers. Approval was

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received from the relevant agencies and departments before the research was conducted.

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Permission was also sought from the Head of Laboratory at the Hospital before the research

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was conducted.

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