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Trends in serological markers of transfusion transmissible infections in blood donations at the Bamenda Hospital-based Blood Service, Cameroon

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Abstract

Objectives: The rate and trend of transfusion transmissible infections (TTIs) in blood donations from 2012 to 2017 at the Bamenda Regional Hospital Blood Service (BRHBS), Cameroon was assessed.

Materials and Methods: A six-year retrospective study was conducted by reviewing the records of donors. Blood was screened for HIV, hepatitis B, hepatitis C and syphilis. Data was analyzed using IBM SPSS Statistics version 21. Differences in seropositivity rates for the four TTIs were analyzed using Chi-squared test or Fisher's exact test where appropriate. Associations between sociodemographic characteristics and the TTIs markers were assessed using multiple logistic regression analysis.

Results: A total of 12,115 blood donations was included in the study and of these, the overall seropositivity rate of the four conventional TTIs markers was 10.5% (n=1,273). Of the seropositive cases, 23.8% (n=303) showed reactivity with at least two of the markers combined. When the markers were assessed individually, HBsAg recorded the highest seropositivity rate (4.7%), followed by anti-HIV and anti-syphilis (2.2%), then anti-HCV (1.7%). A significant decrease in the trend of the combined serological markers, HBsAg and anti-syphilis was observed over the years ($p \leq 0.05$).

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Conclusion: There is a decrease in seropositivity rates of TTIs markers in this blood service. Ongoing efforts toward the prevention of these infections is encouraged and should be intensified to improve blood safety.

Keywords

sero-positivity; transfusion transmissible infections; blood donation; Cameroon

Introduction

Blood donation remains vital in the saving of life and improvement of health for millions of people worldwide. However, this therapy is associated with various adverse effects including the transmission of infectious diseases. In 2010, Choudhury reported a 1–2 per 1000 risk for blood recipients of contaminated blood to get viral, bacterial or parasitic infections [1]. Approximately, 4 million people globally have been infected with HIV by transfusing unsafe blood [2]. Therefore, recipients of transfused blood stand a high risk of potential infection from transfusion transmissible infections (TTIs). The main infections associated to blood transfusions are human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and syphilis and the spread of these infections progresses more in less developed countries [3,4]. Tagny et al. reported that approximately 25% of blood units donated in Francophone Africa are contaminated with blood borne pathogens [5]. Some studies on TTIs markers in some Cameroonian towns revealed a seroprevalence of 4.1% (HIV), 20.4% (HBV) 4.8% (HCV) and 8.1% for syphilis [6–8]. A steady decline in the prevalence of HCV and syphilis serological markers have been reported among blood donors in Yaoundé, Cameroon during a five-year period [9].

In an effort to improve the quality and safety of blood delivered at blood banks in Cameroon, various initiatives have been put in place by different structures. These bodies include the Ministry of Public Health (MoPH), the US Centers for Disease Control (CDC), the Safe Blood for Africa Foundation™ (SBFA), the World Health Organization (WHO), and the US CDC/PEPFAR (US President's Emergency Plan for AIDS Relief). Strategies employed by these bodies include education, sensitization, immunization and trainings. Awareness is being created through regular campaigns, continuous education and free screening for TTIs. With regards to improving blood safety at the blood transfusion centers, these structures provide technical support which encompasses situational assessment, blood collection, blood testing, quality assurance and training of personnel. These actions are geared at establishing sustainable blood services according to the guidelines and recommendations of WHO for developing countries [10–12]. In line with WHO recommendations, a National Blood Transfusion Program (NBTP) and a national policy on blood transfusion were established in Cameroon in 2003 to oversee activities related to safe blood donation [13].

Although different studies related to blood donations and prevalence of TTIs have been reported in Cameroon [6,8,9,14,15], none so far, has been reported for the Bamenda Regional Hospital Blood Bank (BRHBB). Additionally, no systematic monitoring of TTIs

markers has been conducted at this hospital which is a major transfusion center and one of SBFA initiative reference centers.

This study had as objective to provide novel data on the seropositivity rates and trend of serological markers of the four conventional TTIs in blood donations from 2012 to 2017 at the BRHBB.

Materials and Methods

Study design and site:

This was a retrospective cross-sectional study of all blood donations received at the Bamenda Regional Hospital Blood Bank (BRHBB), Cameroon. Data was collected spanning a six years duration from 2012 to 2017. Bamenda is the headquarters of the North West Region, one of the ten administrative Regions of the country. The Regional hospital is the largest government hospital in the region and serves as a referral hospital for approximately, two million people in the Region and beyond. This hospital is among the five that was chosen by SBFA with the expectation to serve as one of the reference blood transfusion centers in Cameroon. In line with guidelines, all potential donors go through an initial screening using a blood donor checklist. The hemoglobin concentration of those retained is measured before proceeding to test for TTIs. From the archives, we collected data on socio-demographic characteristics and screening test result. Files with incomplete records were excluded.

Serological testing and ethical issues:

Following the national algorithm for HIV testing for blood donations in Cameroon, all blood donations were screened for HIV infection using the rapid test, Determine® HIV-1/2 Ag/Ab Combo (Alere Medical Co., Ltd, Matsuhidai, Matsudo-Shi, China) for the first line. The ImmunoComb II HIV 1&2 BiSpot (Orgenics Ltd, Yavne, Israel) or the OraQuick (OraSure Technologies, Inc, Bethlehem) served for the second line, allowing for distinction between HIV 1 and 2. Sensitivity and specificity of these tests are respectively 100% and 98.93%. The screening of HBsAg was by Determine HBsAg Combo Rapid Test (Alere Medical Co., Ltd, Matsuhidai, Matsudo-Shi, Chiba) with reported sensitivity of 95.16% and specificity of 99.95%. Anti-HCV were screened using the Fastep Anti-HCV Test (Polymed Therapeutics, Inc, Houston, USA), while antibodies for syphilis was determined by the *Treponema pallidum* hemagglutination assay (Cypress Diagnostics, Langdorp, Belgium). Ethical approval for the study was got from the Regional Delegation of Public Health Review Board (N^0 023/APP/RDPH/RHB/IRB). During blood donation, the donors sign a consent form accepting that their specimen and/or results can be used for research. All data were fully anonymized before having accessed to them.

Statistical analysis:

Data was analyzed using IBM SPSS Statistics version 21. The seropositivity rates for HBsAg, anti-HCV, anti-HIV and anti-syphilis was represented as percentage among the different demographic characteristics of the donors. Chi square (χ^2) or Fisher's Exact test was used where appropriate. The trend of seropositivity rates of the four TTI markers over

time were examined using the Extended Mantel-Haenzel Chi-square test for linear trend. For univariate analysis, the association between the markers and factors was assessed using Odds ratios (ORs) with 95% confidence interval (CI). In order to adjust for confounding factors, multiple logistic regression was used, and the association was quantified using adjusted ORs with 95% CI. *P*-values less than or equal to 0.05 was considered statistically significant.

Results

General characteristics of blood donors and donations

Overall, there were 13,147 blood donations collected at the BRHBS during the six years' study period. Of these, 1,032 were ineligible for our study because of incomplete data. Out of the 12,115 that we retained, 85.2% (n=10,322) of the donations were males and, 52.9% (n=6,403) from 20–29 years-old donors. Age ranged from 19 to 64 years with mean age of 29.7±8.37 years. When marital status was assessed, 63.6% (n=7,704) of the donations were from singles and 30.9% (n=3,744) from students. Most (97.8%) of the donations (11,848) were from Christians and 83.9% were from people residing in the city of Bamenda (10,164).

Positivity rates of the individual markers of TTIs

a. HIV: The seropositivity rate of anti-HIV for the 12,115 donations was 2.2%. The highest rate was seen in 2012 (2.7%) and about a 2-fold drop observed in 2017 (1.7%). The odds of being HIV positive increased in 2013 [OR=1.6 (1.04–2.36)] and decreased in the latter years with the lowest odds recorded in 2017 [OR=1.0 (0.68–1.59)]. In the multivariate analyses, the ORs attenuated after adjusting for sociodemographic factors from [1.5 (1.01–2.32)] for 2012 to [1.1 (0.71–1.67)] for 2017. Table 1 shows the factors associated with HIV positivity rates. A statistically significant difference was seen in 2012.

b. HBV: This infection recorded the highest seropositivity rate of 4.7% (n=571/12,115) among the four markers. Of these 571 cases, the highest rate of 6.0% (n=146) was recorded in 2013 while the lowest rate of 3.4% (n=67) in 2016. The respective odds ratios and adjusted odds are detailed in Table 2. Figure 1 shows the trend of the four markers over the years. A significant decrease was observed with HBsAg (p=0.00003).

c. HCV: The overall seropositivity rate was 1.7% (n=202/12,115). The highest positivity rate of 2.2% for HCV was recorded in 2015 followed by a decrease to 1.3% in 2016. The odds of having an anti-HCV reactive test decreased in 2016 [OR=0.9(0.55–1.46)] Females, drivers and those with primary level of education had the highest reactivity to anti-HCV (Table 3).

d. Syphilis: A positivity rate of 2.2% (266/12,115) was noticed for anti-syphilis with the highest (3.8%) seen in 2015 and the least (1.5%) in 2017. Table 4 shows a significant difference in reactivity among the various age groups, marital status, level of education and occupation.

Positivity rates of the combined TTIs markers

Overall, the positivity rates of all the four markers among the 12,115 donations was 10.5% (n=1,273). A steady decline was observed from 2012 (12.1%) to 2014 (11.7%) followed by slight increase to 13.1% in 2015. There was a significant decrease (p=0.000) in the overall combined positivity rate for these markers over time. Of the 1,273 reactive cases, HIV/HBV co-infection recorded the highest (23.8%) while co-infection with HIV/HCV was the least (6%). Those co-infected with HIV, HBV and HCV were 436 (3.6%) followed by 290 (2.4%) for HBV, HCV and syphilis. Out of the 1,273 positive cases, 145 (1.2%) were reactive for all the four markers.

Discussion

We observed an overall decrease in the seropositivity rate of all the four markers with the decline being significant for HBsAg and anti-syphilis. A noticeable trend of decline in the positivity rate was also observed when these markers were combined. Remarkably, the highest positivity rate for all the combined markers was in 2015 after a gradual decrease from 2012 to 2014 while the lowest rate for the individual markers was observed in either 2016 (for HBV and HCV) or 2017 (for HIV and syphilis).

There was a 2-fold decrease in the seropositivity rate for HIV in 2017 when compared to 2012. Our observation in this study is slightly lower than those seen in Ethiopia [16,17] but higher than those in Yaoundé [15], Nigeria [18], Iran, Thailand, Australia and China [19–22]. Possible explanation for the observed decline could be the progressive increase in the number of campaigns on the prevention of HIV transmission by structures such as SBFA, the National AIDS Control Committee [14].

Our findings for HBsAg showed contradictory results to those of other studies. For example, we got a higher seropositivity rate compared to other studies in Africa and Asia [16–20,22], but lower when compared to studies conducted in other cities of Cameroon [7,9,23]. One of the reasons for the above observation could be the initiation of children immunization program against HBV which went operational in 2000. We noticed that drivers, those aged >50 years-old, and primary school attendants recorded the highest positivity rate of this infection. This may be due to several reasons: Firstly, the elderlies are prone to infection because of possible exposure to multiple sexual activities. Secondly, this observation could be linked to the consequence of a birth cohort effect reflecting the past expansion and contemporary restraint of this infection. Even though we did not classify the donors as either first time or repeated, we think that most of the elderly who were infected could be first time thus explaining our findings.

The positivity rate of HCV was the lowest among all the four markers of TTIs in this study though the decline trend was not significant over the years. Interestingly, this is also the lowest observed when compared to other studies in Cameroon [6,8,15], Kenya and Burkina Faso [25,26] although higher than the observation in other Africa countries [3,16–18,24]. HCV infection is linked to geographical distribution and cultural practices. This include tattooing, multiple sexual partners and scarification which are more common in villages

[27]. This could justify our observations which showed that those residing in the city recorded a lower positivity rate when compared to their counterparts from the rural areas.

Our observation on the trend of syphilis is consistent with other studies in Ethiopia and Nigeria [3,17,18]. The risk of sexually transmitted syphilis is higher in those who practice unprotected sex. This is associated with the level of knowledge and could partly justify why those living in villages, farmers and having attained only primary level of education recorded the highest positivity rate.

Almost a quarter of those who showed positive reaction to any of the serologic markers were co-infected with at least two. Our observation of HIV and HBV co-infections being the highest could be explained because these two viruses have the same route of transmission. Other causes of multiple infections in this study could be linked to combination of practices including behavioral, cultural inclinations such as shared use of invasive objects and level of awareness.

One limitation recognized in this study was the absence of confirmatory test of all the seropositive subjects. Therefore, seropositivity rate might be different if, in addition to these Enzyme Immuno Assays (EIAs) diagnostic methods used, a more sensitive method is employed. Nonetheless, being a retrospective study, we could only report on what was used which also reflects the method previously used by others in such related studies. In addition, the consistent use of the same method over the years in the study site provide dependable information suitable to assess trend without any bias.

Conclusion:

We have provided first-line data on the seropositivity rate of TTIs in blood donation units at the BRHBB. Overall, there is a significant decrease over time. Those who have attained only primary level of education recorded the highest seropositivity rate with all the serological markers. Efforts geared at the prevention of serological markers of TTIs in the community, is highly encouraged.

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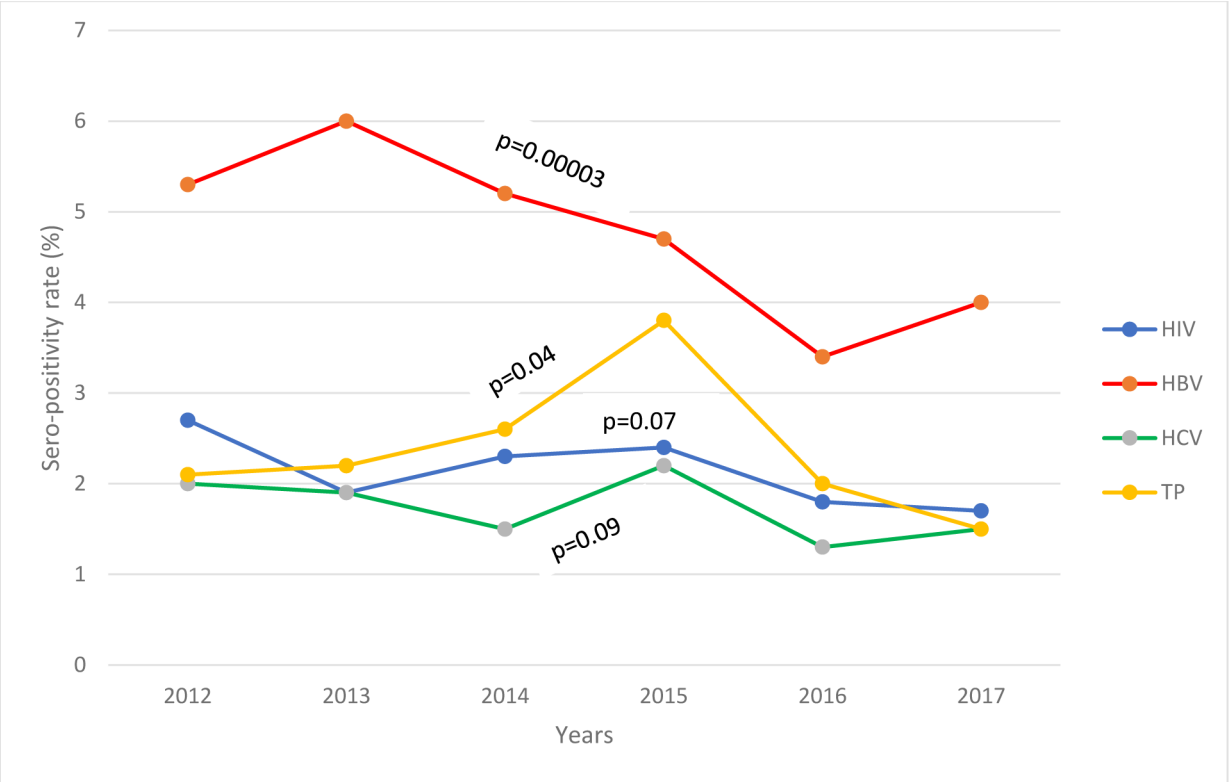

Figure 1:
Trend in seropositivity rate of individual TTID markers among 12,115 blood donations between 2012 – 2017 at the Bamenda Regional Hospital Blood Service

Table 1:

Bivariate and multivariate analyses of factors associated with HIV positivity rates among the 12,115 donations between 2012–2017 at the Bamenda Regional Hospital Blood Bank

Characteristics	Non Reactive (%)	Reactive (%)	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Gender (p = 0.08)						
Male	10101 (97.8)	222 (2.2)	1.4 (1.0–2.15)	0.08	1.3(0.83–1.90)	0.29
Female	1765 (98.5)	27 (1.5)	1		1	
Age range (in years; p = 0.51)						
<20	1135 (98.4)	19 (1.6)	0.8(0.35–2.00)	0.83	0.9(0.36–2.42)	0.89
20 – 29	6279 (98.1)	124 (2.0)	1.0(0.45–2.11)	0.98	1.0(0.45–2.21)	0.97
30 – 39	3011 (97.7)	72 (2.3)	1.2(0.54–2.60)	0.67	1.1(0.52–2.52)	0.74
40 – 49	1094 (97.6)	27 (2.4)	1.2(0.53–2.83)	0.64	1.2(0.51–2.73)	0.71
≥50	347 (98.0)	7 (2.0)	1		1	
Marital status (p = 0.56)						
Married	4249(97.8)	96(2.2)	0.7(0.17–2.99)	0.66	0.6(0.15–2.65)	0.53
Single	7553(98.0)	151(2.0)	0.6(0.15–2.64)	0.53	0.7(0.16–2.92)	0.61
Divorced/Widow	64(97.0)	2(3.0)	1		1	
Level of education (p = 0.06)						
Primary	3566 (97.6)	89 (2.4)	1.5 (1.07–2.14)	0.01	1.3(0.87–1.97)	0.19
Secondary	5149 (97.9)	108 (2.1)	1.3 (0.91–1.78)	0.16	1.2(0.86–1.76)	0.26
Tertiary	3151 (98.4)	52 (1.6)	1		1	
Occupation (p = 0.09)						
Civil servant	1394 (98.0)	30 (2.0)	1.4(0.88–2.14)	0.17	1.3(0.80–2.13)	0.28
Business	1374 (98.0)	29 (2.0)	1.3 (0.86–2.10)	0.20	1.1(0.65–1.79)	0.77
Farmer	355 (98.1)	7 (1.9)	1.3 (0.57–2.77)	0.58	1.0(0.42–2.31)	0.97
Driver	5056 (97.6)	125 (2.4)	1.6 (1.15–2.15)	0.005	1.3(0.88–1.93)	0.18
Student	3687 (98.5)	58 (1.5)	1		1	
Religion (p = 0.000)						
Christian	11611 (98.0)	243 (2.0)	0.1 (0.03–0.28)	0.000	0.1(0.03–0.26)	0.000
Muslim	237 (99.2)	2 (0.8)	0.0 (0.01–0.22)	0.000	0.0(0.00–0.19)	0.00
Pagan	18 (81.8)	4 (18.2)	1		1	
Residence (p = 0.49)						
Bamenda	9964 (98.0)	205 (2.0)	0.9(0.64–1.24)	0.485	0.9(0.66–1.30)	0.63
Out of Bamenda	1902 (97.7)	44 (2.3)	1		1	
Year of donation (p = 0.21)						
2012	1479(97.3)	41(2.7)	1.6(1.04–2.36)	0.03	1.5(1.01–2.32)	0.04
2013	2372(98.1)	45(1.9)	1.1.(0.72–1.59)	0.73	1.0(0.65–1.47)	0.92
2014	1874(97.7)	45(2.3)	1.3(0.91–2.02)	0.13	1.3(0.87–1.93)	0.21

Characteristics	Non Reactive (%)	Reactive (%)	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
2015	1085(97.6)	27(2.4)	1.4(0.88–2.24)	0.15	1.4(0.86–2.19	0.19
2016	1950(98.2)	36(1.8)	1.0(0.68–1.59)	0.85	1.1(0.71–1.67)	0.70
2017	3106(98.3)	55(1.7)	1		1	

OR: odd ratio; aOR: adjusted odds ratio (odds ratios adjusted for socio-demographic characteristics); CI: confidence interval

Table 2:

Bivariate and multivariate analyses of factors associated with HBV positivity rates among the 12,115 donations between 2012–2017 at the Bamenda Regional Hospital Blood Bank

Characteristics	Non Reactive (%)	Reactive (%)	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Gender (p = 0.01)						
Male	9814 (95.1)	509 (4.9)	1.4 (1.10–1.86)	0.009	1.3 (0.97–1.69)	0.07
Female	1729 (96.5)	63 (3.5)	1		1	
Age range (in years; (p = 0.03)						
<20	1108 (96.0)	46 (4.0)	0.7 (0.42–1.27)	0.27	0.9(0.48–1.60)	0.66
20 – 29	6070 (94.8)	333 (5.2)	0.9 (0.60–1.56)	0.89	1.1 (0.64–1.78)	0.83
30 – 39	2946 (96.1)	137 (4.9)	0.8 (0.50–1.34)	0.43	0.8 (0.50–1.36)	0.46
40 – 49	1084 (96.7)	37 (3.3)	0.6 (0.34–1.06)	0.08	0.6 (0.34–1.06)	0.07
≥50	335 (94.6)	19 (5.4)	1		1	
Marital status (p = 0.80)						
Married	4138(95.2)	207(4.8)	1.6(0.39–6.59)	0.51	1.3(0.32–5.48)	0.70
Single	7341(95.3)	363(4.7)	1.6(0.39–6.49	0.52	1.2(0.29–5.06)	0.78
Divorced/Widow	64(97.0)	2(3.0)	1		1	
Level of education (p = 0.04)						
Primary	3458 (94.6)	197 (5.4)	1.3 (1.06–1.66)	0.14	1.2 (1.00–1.65)	
Secondary	5014 (95.4)	243 (4.6)	1.1 (0.91–1.40)	0.28	1.1 (0.85–1.37)	0.09
Tertiary	3071 (95.9)	132 (4.1)	1		**1**	0.52
Occupation (p = 0.68)						
Civil servant	1361 (95.6)	63 (4.4)	1.0 (0.75–1.36)	0.94	1.1(0.78–1.50)	0.63
Business	1335 (95.2)	68 (4.8)	1.1 (0.83–1.49)	0.47	1.0(0.73–1.40)	0.94
Farmer	345 (95.3)	17 (4.7)	1.1 (0.65–1.79)	0.78	1.1(0.61–1.83)	0.85
Driver	4921 (95.0)	260 (5.0)	1.2 (0.94–1.41)	0.16	1.0(0.79–1.30)	0.93
Student	3581 (95.6)	164 (4.4)	1		1	
Religion (p = 0.27)						
Christian	11289 (95.2)	565 (4.8)	1.1 (0.14–7.83)	0.96	1.3(0.18–10.1)	0.77
Muslim	233 (97.5)	6 (2.5)	0.5 (0.62–4.71)	0.54	0.7(0.07–5.87)	0.72
Pagan	21 (95.5)	1 (4.5)	1		1	
Residence (p = 0.83)						
Bamenda	9687 (95.3)	482 (4.7)	1.0 (0.82–1.29)	0.83	1.0(0.80–1.29)	0.88
Out of Bamenda	1856 (95.4)	90 (4.6)	1		1	
Year of donation (p = 0.000)						
2012	1439(94.7)	81(5.3)	1.4(1.02–1.81)	0.04	1.3(1.00–1.77)	
2013	2271(94.0)	146(6.0)	1.5(1.21–2.00)	0.00	1.5(1.17–1.92)	0.05

Characteristics	Non Reactive (%)	Reactive (%)	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
2014	1819(94.8)	100(5.2)	1.3(1.01–1.73)	0.04	1.3(0.98–1.68)	0.00
2015	1060(95.3)	52(4.7)	1.2(0.85–1.65)	0.32	1.2(0.83–1.61)	0.07
2016	1919(96.6)	67(3.4)	0.8(0.62–1.14)	0.26	0.9(0.63–1.16)	0.40
2017	3035(96.0)	126(4.0)	1		1	0.32

OR: odd ratio; aOR: adjusted odds ratio (odds ratios adjusted for socio-demographic characteristics); CI: confidence interval

Table 3:

Bivariate and multivariate analyses of factors associated with HCV positivity rates among the 12,115 donations between 2012–2017 at the Bamenda Regional Hospital Blood Bank

Characteristics	Non-Reactive (%)	Reactive (%)	Unadjusted odds ratio (95% CI)	P-Value	Adjusted odds ratio (95% CI)	P-Value
Gender (p = 0.41)						
Male	10155 (98.4)	168 (1.6)	0.9 (0.59–1.24)	0.41	0.9(0.57–1.24)	0.37
Female	1758 (98.1)	34 (1.9)	1		1	
Age range (in years; (p = 0.31)						
<20	1133 (98.2)	21 (1.8)	2.2 (0.64–7.31)	0.21	2.1(0.59–7.67)	0.25
20 – 29	6307 (98.5)	96 (1.55)	1.8 (0.56–5.65)	0.33	1.8(0.56–6.01)	0.32
30 – 39	3022 (98)	61 (2)	2.4 (0.74–7.57)	0.15	2.5(0.78–8.11)	0.12
40 – 49	1100 (98.1)	21 (1.9)	2.2 (0.66–7.53)	0.20	2.2(0.66–7.58)	0.19
≥50	351 (99.2)	3 (0.8)	1		1	
Marital status (p = 0.80)						
Married	4249(97.8)	96(2.2)	0.9(0.68–1.21)	0.50	1.0(0.68–1.40)	0.88
Single	7553(98)	151(2)	0.9(0.12–6.22)	0.88	0.9(0.12–6.50)	0.90
Divorced/Widow	64(97)	2(3)	1		1	
Level of education (p=0.80)						
Primary	3590 (98.2)	65 (1.8)	1.1 (0.79–1.66)	0.49	1.0(0.65–1.59)	0.93
Secondary	5170 (98.3)	87 (1.7)	1.1 (0.75–1.51)	0.74	1.0(0.69–1.43)	0.99
Tertiary	3153 (98.4)	50 (1.6)	1		1	
Occupation (p = 0.13)						
Civil servant	1405 (98.7)	19 (1.3)	0.8 (0.46–1.30)	0.34	0.6(0.34–1.19)	0.17
Business	1386 (98.8)	17 (1.2)	0.7 (0.41–1.21)	0.20	0.6(0.33–1.11)	0.11
Farmer	351 (97)	11 (3)	1.8 (0.94–3.45)	0.08	1.3(0.63–2.75)	0.47
Driver	5090 (98.2)	91 (1.8)	1.0 (0.75–1.42)	0.87	0.9(0.61–1.40)	0.71
Student	3681 (98.3)	64 (1.7)	1		1	
Religion (p = 0.50)						
Christian	11658 (98.4)	196 (1.6)	0.4 (0.05–2.64)	0.31	0.4(0.05–2.85)	0.34
Muslim	234 (97.9)	5 (2.1)	0.5 (0.05–4.02)	0.48	0.5(0.05–4.53)	0.53
Pagan	21 (95.5)	1 (4.5)	1		1	
Residence (p = 0.001)						
Bamenda	10017 (98.5)	152 (1.5)	0.6 (0.42–0.80)	0.001	0.6(0.43–0.84)	0.003
Out of Bamenda	1896 (97.4)	50 (2.6)	1		1	
Year of donation (p = 0.25)						
2012	1490(98.0)	30(2.0)	1.4(0.86–2.17)	0.19	1.4(0.85–2.16)	0.21
2013	2371(98.1)	46(1.9)	1.3(0.87–1.98)	0.19	1.3(0.88–2.03)	0.17

Characteristics	Non-Reactive (%)	Reactive (%)	Unadjusted odds ratio (95% CI)	P-Value	Adjusted odds ratio (95% CI)	P-Value
2014	1890(98.5)	29(1.5)	1.0(0.65–1.66)	0.87	1.1(0.67–1.71)	0.79
2015	1087(97.8)	25(2.2)	1.6(0.95–2.55)	0.08	1.6(0.98–2.62)	0.06
2016	1960(98.7)	26(1.3)	0.9(0.55–1.46)	0.66	0.9(0.54–1.44)	0.63
2017	3115(98.5)	46(1.5)	1		1	

OR: odd ratio; aOR: adjusted odds ratio (odds ratios adjusted for socio-demographic characteristics); CI: confidence interval

Table 4:

Bivariate and multivariate analyses of factors associated with Syphilis positivity rates among the 12,115 donations between 2012–2017 at the Bamenda Regional Hospital Blood Bank

Characteristics	Non Reactive (%)	Reactive (%)	Unadjusted odd ratio (95% CI)	P-Value	Adjusted odds ratio (95% CI)	P-Value
Gender (p = 0.45)						
Male	10092 (97.8)	231 (2.2)	1.1 (0.80–1.65)	0.45	0.9(0.61–1.29)	0.53
Female	1757 (98)	35 (2)	1		1	
Age range (in years; (p = 0.000)						
<20	1146 (99.3)	8 (0.7)	0.1 (0.04)–0.17	0.000	0.1 (0.04–0.24)	0.000
20 – 29	6298 (98.4)	105 (1.6)	0.2 (0.12–0.29)	0.000	0.2 (1.13–0.36)	0.000
30 – 39	3012 (97.7)	71 (2.3)	0.3 (0.17–0.41)	0.000	0.3 (0.17–0.43)	0.000
40 – 49	1068 (95.3)	53 (4.7)	0.6 (0.35–0.89)	0.014	0.6 (0.35–0.89)	0.015
≥50	325 (91.8)	29 (8.2)	1		1	
Marital status (p = 0.000)						
Married	4138(95.2)	207(4.8)	1.6 (0.39–6.59)	0.92	1.1(0.25–4.48)	0.93
Single	7341(95.3)	363(4.7)	1.6 (0.39–6.49)	0.37	0.9(0.22–4.01)	0.93
Divorced/Widow	64(97.0)	2(3.0)	1		1	
Level of education (p = 0.000)						
Primary	3539 (96.9)	116 (3.1)	1.9 (1.36–2.60)	0.000	1.6 (1.11–2.42)	0.01
Secondary	5162 (98.2)	95 (1.8)	1.1 (0.75–1.47)	0.76	1.2 (0.80–1.66)	0.44
Tertiary	3148 (98.3)	55 (1.7)	1		1	
Occupation (p = 0.000)						
Civil servant	1387 (97.5)	37 (2.5)	2.1 (1.38–3.32)	0.001	1.2 (0.75–1.97)	0.44
Business	1368 (97.5)	35 (2.5)	2.1 (1.32–3.21)	0.001	1.0 (0.62–1.71)	0.90
Farmer	350 (96.7)	12 (3.3)	2.8 (1.45–5.23)	0.002	1.0 (0.50–2.13)	0.94
Driver	5045 (97.4)	136 (2.6)	2.1 (1.55–3.04)	0.000	1.1 (0.74–1.69)	0.59
Student	3699 (98.8)	46 (1.2)	1		1	
Religion (p = 0.73)						
Christian	11594 (97.8)	260 (2.2)	N/A		N/A	
Muslim	233 (97.5)	6 (2.5)				
Pagan	22 (100)	0 (0)				
Residence (p = 0.16)						
Bamenda	9954 (97.9)	215 (2.1)	0.8 (0.59–1.09)	0.16	1.0(0.70–1.33)	0.84
Out of Bamenda	1895 (97.4)	51 (2.6)	1		1	
Year of donation (p = 0.000)						
2012	1488(97.9)	32(2.1)	1.5(0.92–2.30)	0.11	1.6(1.00–2.53)	0.05

Characteristics	Non Reactive (%)	Reactive (%)	Unadjusted odd ratio (95% CI)	P-Value	Adjusted odds ratio (95% CI)	P-Value
2013	2362(97.7)	55(2.3)	1.6(1.06–2.34)	0.02	1.7(1.14–2.54)	0.00
2014	1868(97.3)	51(2.7)	1.8(1.24–2.77)	0.00	1.8(1.20–2.70)	0.01
2015	1070(96.2)	42(3.8)	2.7(1.74–4.06)	0.00	2.6(1.71–4.02)	0.00
2016	1946(98.0)	40(2.0)	1.4(0.91–2.13)	0.13	1.7(1.08–2.57)	0.02
2017	3115(98.5)	46(1.5)	1		1	

OR: odd ratio; aOR: adjusted odds ratio (odds ratios adjusted for socio-demographic characteristics); CI: confidence interval