

# A Comparative Study on the Seroprevalence of Hepatitis B Virus among Patients and Blood Donors at the Regional Government Referral Hospital in Kenema, Eastern Sierra Leone

Lawrence SB\*, Edmond JS and Daniel BK

*Department of Nursing, School of Community Health Sciences, Njala University, Sierra Leone*

\***Corresponding author:** Lawrence SB, Department of Nursing, School of Community Health Sciences, Njala University, Sierra Leone, Tel: +23276642849, E-mail: lbabawo@njala.edu.sl

**Citation:** Lawrence SB, Edmond JS, Daniel BK (2020) A Comparative Study on the Seroprevalence of Hepatitis B Virus among Patients and Blood Donors at the Regional Government Referral Hospital in Kenema, Eastern Sierra Leone. *J Infect Dis Pathog* 2: 101

**Article history:** Received: 28 October 2019, Accepted: 27 December 2019, Published: 30 December 2019

## Abstract

**Background:** Sierra Leone as one of the most endemic countries for being hepatitis B seropositive is still making prodigious effort to fight other infectious disease but little or nothing has been done to contend the wide spread of hepatitis B infection within the population. Infection by HBV causes serious morbidity and mortality, and thus a major national health problem.

**Study Objective:** This research study was aimed to comparatively investigate the Seroprevalence of Hepatitis B virus among Patients and Blood Donors at the Kenema Government Hospital.

**Methodology:** A hospital-based cross-sectional and descriptive study was conducted from January to July 2019. 3548 subjects enrolled during the study period. The Determine HBsAg 2 (Abbott's Laboratories and technologies) were used which provides rapid and accurate results of HBV status with an analytical sensitivity of 0.1 IU/ml to test venous blood samples collected. Descriptive statistical analysis using appropriate tests like test of proportions, odds ratios (ORs), 95% confidence intervals (CIs), Fisher's exact and Chi squared tests were used to calculate categorical data to obtain and compare prevalence rates of HBV infection.

**Results and Discussion:** For this study, a total of 3548 clinical patients referred for laboratory test and blood donors screened for bleeding took part in the study within the seven month study period. 3,161(89.1%) of subjects were tested HBsAg negative whilst 387(10.9%) were HBsAg positive. The prevalence of the disease was 10.9% (N = 3548) (95% CI = 7.7 - 14.1). HBsAg prevalence was 20.5% and 7.4% among Male Patients and Blood donors respectively whilst the prevalence was 20.6% and 9.1% among Female Patients and Blood Donors respectively.

**Conclusion:** Our study concluded that the Seroprevalence of HBV was high in the sierra Leonean population. Gender, age and educational status were shown to be significantly related to HBV infection. The study also revealed a low level of awareness of Hepatitis B virus among patients and donor population.

**Keywords:** Hepatitis; Seroprevalence; Donor; Virus

## Introduction

Hepatitis B virus (HBV) is a life-threatening public health problem across sub-Saharan Africa and is considered a global disease of the human race with estimated prevalence of 30% around the world but about 350 million of the world population were found to be serological carries of hepatitis B [1]. It is an infectious disease and the tenth leading cause of mortality all over the world; also it could occur with no seasonal spreading [2,3]. Overall, Around 500, 000, 000 people are chronically infected with hepatitis B virus (HBV). Approximately 1, 000, 000 people die each year (~2.7% of all deaths) from causes related to viral hepatitis, most commonly liver disease, including liver cancer [4]. An estimated 57% of cases of liver cirrhosis and 78% of cases of primary liver cancer result from HBV infection [5]. The SDGsreport for 2016 to 2030 includes a target to fight viral hepatitis as part of extensive efforts by the United Nations and its partner agencies and organizations to promote human and environmental health [6]. Progress toward achieving this SDG target will be monitored with an indicator of hepatitis B incidence, the number of new hepatitis B infections per 100,000 people per year [6].

Hepatitis B virus (HBV) is a small double-stranded DNA virus which predominantly affects the liver [7]. Three major viral antigens are involved in infection and disease propagation: the surface antigen (HBsAg), a glycoprotein forming the virus envelope; the core antigen (HBcAg) which forms the viral capsid; and the envelope antigen (HBeAg) which is mainly secreted into the extracellular space during infection [8]. HBV could be transmitted through pestiferous blood or blood products, secretions and unsafe sex. The disease is divided into two phases; acute or chronic infection. The acute phase could result in fulminant hepatitis with urgent need

for liver transplantation [9]. On the other hand, chronic type is significantly associated with death due to cirrhosis and failure of liver that results in hepatocellular carcinoma (HCC) [10,11]. However, chronic HBV infection usually does not produce symptoms and people feel healthy even in the early stages of liver cancer [12-14]. So that the disease can progress without patients' knowledge thus, HBV infection is called a silent killer [4]. The HBV is endemic in many low-income countries as there is no routine HBV vaccination among child bearing aged women making them at risk of transmitting infections to the fetus during pregnancy. Most of individuals in endemic areas have been infected vertically or during childhood [15].

Blood transfusions save lives and improve health but in low income countries, particularly in Africa, many patients requiring blood are faced with two crucial blood transfusion-related issues--blood shortages and unsafe blood [22]. These infectious agents pose serious threats to the safety of blood for the recipients. In the World Health Organization (WHO) African blood safety and availability status survey reports, not much improvement was seen in many countries. Many studies have shown a high prevalence of hepatitis B virus (HBV), and other blood borne infections among blood donors in West African countries [16-21]. In 2001, the WHO African region adopted a strategy (document AFR/RC51/9) that aimed at improving blood transfusion safety and bridging the gap between blood needs and blood availability in health services. Its objectives were to recruit more low-risk donors to improve the safety of blood and blood products and to promote their appropriate use by clinicians.

There are no national hepatitis B strategy plan or high quality estimates of prevalence in Sierra Leone and Healthcare workers are perceived as an at-risk group for hepatitis B. Although the prevalence of HBV is high among native sierra Leoneans, many are unaware of their infection status, most likely due to a lack of knowledge and misconception about HBV transmission and due to not having been screened for HBV. Moreover, despite the fact that young adults within the population are at high risk for HBV and have a need for HBV education, there are limited studies and resources available to inform the communities through the district health management teams (DHMT) across the country, development of school and university-tailored education programs on the prevention of HBV infection and vaccination. Sociodemographics characteristics and acculturation such as language, income and illiteracy and are known factors to be related to knowledge of HBV infection and vaccination [19-25].

Previous studies have reported HBsAg prevalence among specific patient population and blood donors in Sierra Leone but data on the seroprevalence of the HBV is still inadequate and contradictory. Therefore this current study sought to comparatively investigate the overall Seroprevalence of viral Hepatitis among patient and blood donors in selected research setting in Sierra Leone from January to July 2019 assessing the awareness and knowledge about hepatitis B disease, practice and behavioural risk factors that serve as barriers against treatment.

## Methodology

### Study Design and Area

A hospital-based cross-sectional and descriptive study was conducted from January to July 2019. The study was done at the Regional Government Hospital located in Kenema. Kenema is largest city in the eastern province of sierra Leone. It is also a district headquarter town that serves as a centre for major economic activities. The hospital is both a teaching and referral hospital serving thousands of people in the eastern region and beyond.

### Study Population and Subjects

The subjects in this research study were all clinical patients referred for serological laboratory testing and blood donors screened at Kenema Regional Government Referral Hospital were included with a total sample of 3548 subjects enrolled during the study period.

### Data Collection and Laboratory Method

A Structured and pretested self-administered questionnaire was used to collect information regarding Socio-demographic variables and possible risk factors for hepatitis B infection acquisition. Questionnaires were only given to positive HBV study subjects after their test results and were invited to complete a structured self-completed questionnaire consisting of 22 questions with the help of trained medical personnel. The questionnaire consisted of three parts: (1) Socio-demographic characteristics; (2) HBV awareness (3) Behavioural practices. The language of instruction was given in English and subjects were interviewed, questions were explained and translated for all the subjects included in the study as necessary; and anonymity was assured.

Before the collection of serological blood sample from study participants, the objectives of the study were explained, and they were informed that their participation was voluntary. Two to three millilitres of venous blood samples were drawn and collected using aseptic technique and universal precautions during blood collection. The WHO recommended test to diagnose infection with HBV is the Hepatitis B surface antigen (HBsAg). The Determined HBsAg 2 (Abbott's Laboratories and technologies) were used which provides rapid and accurate results of one's HBV status with an analytical sensitivity of 0.1 IU/mL. The test is an in-vitro, visually read, qualitative immunoassay for the detection of HBsAg in serum, plasma or whole blood. The test is easy to use, deployable at the point of care and detects HBV in just 15 minutes, while the patient is still present. Test results were interpreted and reported as positive or negative based on the manufacturer's instructions. HBV infection was defined as subjects who were positive for HBsAg.

### Statistical Analysis

Using Microsoft Excel 2013 spread sheet, data were cautiously entered and double checked to minimize data entry errors and was later analysed through Statistical Package for Social Science (SPSS) program Version 24, 2016 (SPSS, Chicago IL) and presented into Tables and figures. Descriptive statistical analysis using appropriate tests like test of proportions, Fisher's exact and Chi squared

tests were used to calculate categorical data to obtain and compare prevalence rates. Calculation of odds ratios (ORs) and 95% confidence intervals (CIs) was done to determine the associated risk factors and HBV infection; P values < 0.05 were considered statistically significant. Logistic regression was done to ascertain predictors of infection. General characteristics of the subjects were described by mean, standard deviations and percentages.

### Ethical Consideration

Ethical clearance to conduct this study was sought from the Njala University ethical review board. Permission was also granted by the laboratory superintendent of Kenema Government referral Hospital and laboratory respectively. A written informed consent was requested from the study subjects after explaining the study aims before enrolment in the study. For those who cannot read or write, the consent information sheet was read loudly in full in a language they can understand and the participants were requested to thumbprint to indicate their willingness to participate. Participants were asked to participate voluntarily, and those who were not willing to participate were also given a standard care as per the stand operating procedures of the hospital.

## Results

### General Prevalence of Clinical Patients and Blood Donors

For this study, a total of 3548 clinical patients referred for laboratory test and blood donors screened for bleeding took part in the study within the seven months study period. 3,161(89.1%) of subjects tested HBsAg negative whilst 387(10.9%) were HBsAg positive. The prevalence of the disease was 10.9% (N = 3548) (95% CI = 7.7 – 14.1) describing the level of hepatitis B in the Sierra Leone is high. 45% (175) were positive HBsAg patients tested at the clinical laboratory following Doctor's referral and 55% (212) were positive HBsAg Blood Donors screened for bleeding.

### Sex prevalence of Clinical Patients and Blood Donors

The specific prevalence of HBsAg in males was 9.5 % (CI = 7.4–11.4) (225/2367) compared to 13.7% (CI = 12.1–15.2) 162/1181 in females. The difference was found to be statistically significant (P = 0.0007). 387 (10.9%) of the total data collected were positive male and female Subject of patients and Blood Donors. During the Study period, HBsAg prevalence was 20.5% and 7.4% among Male Patients and Blood donors respectively whilst the prevalence was 20.6% and 9.1% among Female Patients and Blood Donors respectively (Table 1).

### Prevalence among Age group of clinical patients and blood donors

The overall median age of the 3548 subject was 30 years (SD = 19.5, range = 2–90 years). Furthermore, the age of participating subjects (patients and Blood Donors) were arranged into categories; 17/271 (6.3 %) (CI = 4.8 – 7.8) were under-fives, 14/203 (6.9 %) (CI = 5.5 – 8.3) were children, 83/757 (11.0%) (CI = 9.4 – 12.6) were adolescent, 200/1554 (12.9%) (CI = 10.9 – 14.9) were young adults, whilst 49/387 (12.6 %) (CI = 10.9 - 14.3) and 24/376 (6.4%) (CI = 5.1 – 7.7) were older adults and seniors respectively (Table 1). HBsAg Seroprevalence was observed to increase with age, 6.3% % among subjects that were between 0 - 5 years to 12.9% among subjects that were between 21-35 years. The difference was also found to be statistically significant (P = 0.0011) (Table 1). The study showed maximum prevalence of HBsAg at 3.10% 200/1554 (12.9%) in 21 - 35 age group and a minimum prevalence at 17/271 (6.3 %) in 0 - 5 age group.

| Characteristics           | n/N             | HBsAg positive % (95% CI) | P          |
|---------------------------|-----------------|---------------------------|------------|
| <b>Total</b>              | <b>387/3548</b> | <b>100%</b>               |            |
| <b>Sex</b>                |                 |                           |            |
| Male                      | 225/2367        | 9.5 % (7.4 – 11.4)        | P = 0.0007 |
| Female                    | 162/1181        | 13.7% (12.1 – 15.2)       |            |
| <b>Age Group</b>          |                 |                           |            |
| Under-fives (0-5 yrs.)    | 17/271          | 6.3 % (4.8 – 7.8)         | P = 0.0011 |
| Children (6 - 12 yrs.)    | 14/203          | 6.9 % (5.5 – 8.3)         |            |
| Adolescent (13-20 yrs.)   | 83/757          | 11.0% (9.4 – 12.6)        |            |
| Young Adult (21-35 yrs.)  | 200/1554        | 12.9% (10.9 – 14.9)       |            |
| Older Adult (36-50 yrs.)  | 49/387          | 12.6 % (10.9 - 14.3)      |            |
| Seniors (≥51 yrs.)        | 24/376          | 6.4% (5.1 – 7.7)          |            |
| <b>Marital Status</b>     |                 |                           |            |
| Single                    | 186/1673        | 11.12 % (9.9 – 12.5)      | P = 0.7339 |
| Married                   | 201/1875        | 10.72% (8.62 - 12.82)     |            |
| <b>Educational Status</b> |                 |                           |            |
| Illiterate                | 124/969         | 12.8 % (10.6 - 15.0)      | P = 0.0314 |
| Primary                   | 116/953         | 12.2% (9.8 – 14.6)        |            |
| Secondary                 | 89/996          | 8.9 % (7.3 – 10.5)        |            |
| Tertiary                  | 58/630          | 9.2 % (7.2 – 11.2)        |            |
| <b>Occupation</b>         |                 |                           |            |
| Business/Trader           | 69/611          | 11.3 % (8.9 - 13.7)       | P = 0.0768 |
| Housewife                 | 74/574          | 12.9 % (9.9 – 15.9)       |            |
| Farmer                    | 43/350          | 12.3 % (9.8 – 14.8)       |            |
| Students/pupils           | 77/634          | 12.1% (9.8 – 14.4)        |            |
| Health worker             | 25/247          | 10.1 % (8.3 – 11.9)       |            |
| Civil savants             | 25/329          | 7.6 % (6.0 – 9.2)         |            |
| Others                    | 66/803          | 8.2% (6.7 - 9.7)          |            |

**Table 1:** General Characteristics of Subjects

Furthermore, the age group patients and blood donors that HBsAg positive was arranged as 17(4.4%) were under-fives, 14(3.6%) were children, 83(21.5%) were adolescent, 200(51.7%) were young adults, whilst 49(12.7%) and 24(6.2%) were older adults and seniors respectively (Table 2).

| Categories  | Age Range   | Blood Donors(+HBsAg)<br>(N= 2698) | Percent<br>(%) | Patients<br>(+HBsAg)<br>(N = 850) | Percent<br>(%) |
|-------------|-------------|-----------------------------------|----------------|-----------------------------------|----------------|
| Under fives | 0-5 yrs.    | -                                 | 0.00           | 17                                | 9.71           |
| Children    | 6 - 12 yrs. | -                                 | 0.00           | 14                                | 8.00           |
| Adolescent  | 13-20 yrs.  | 55                                | 25.94          | 28                                | 16.00          |
| Young Adult | 21-35 yrs.  | 140                               | 66.04          | 60                                | 34.29          |
| Older Adult | 36-50 yrs.  | 17                                | 8.02           | 32                                | 18.29          |
| S seniors   | ≥51 yrs.    | 0                                 | 0.00           | 24                                | 13.71          |
|             |             | 212                               | 100            | 175                               | 100            |

Table 2: Age Category showing Specific Prevalence among Clinical Patients Blood Donors

### Educational Specific Prevalence

Also data on the specific prevalence educational level was collated, 124/969 (12.8 %) (CI = 10.6 - 15.0) were illiterate, 116/953 (12.2%) (CI = 9.8 - 14.6) had primary education, 89/996 (8.9 %) (CI = 7.3 - 10.5) had attained secondary school level and the remaining 58/630 (9.2 %) (CI = 7.2 - 11.2) had college of tertiary education. The difference was found to be statistically significant (P = 0.0314).

### Monthly Prevalence of Clinical Patients and Blood Donors

From the study, the highest prevalence among Male donors was 8.3% in January and the lowest was 6.6% in June whilst the highest prevalence among female donors was 19.2% in February and the lowest was in June with 3.9%. Comparatively, the highest prevalence among Male patients was 20.6% in January, March, May and June whilst the lowest was 20.3% in April. On the other hand, the highest prevalence among female patients was 20.8% in February and the lowest was in May with 20.5%.

|                              | Jan | Feb | Mar | April | May | June | July | Total | %     |
|------------------------------|-----|-----|-----|-------|-----|------|------|-------|-------|
| Male Patients screened       | 63  | 44  | 68  | 54    | 34  | 68   | 49   | 380   | 20.5% |
| Male HBsAg patients          | 13  | 9   | 14  | 11    | 7   | 14   | 10   | 78    |       |
| Male Blood Donors screened   | 290 | 206 | 209 | 319   | 292 | 289  | 382  | 1987  | 7.4%  |
| Male HBsAg Blood Donor       | 24  | 15  | 16  | 22    | 23  | 19   | 28   | 147   |       |
| Female Patients. Screened    | 34  | 77  | 87  | 63    | 44  | 97   | 68   | 470   | 20.6% |
| Female HBsAg Patients.       | 7   | 16  | 18  | 13    | 9   | 20   | 14   | 97    |       |
| Female Blood Donors Screened | 65  | 52  | 91  | 98    | 139 | 130  | 136  | 711   | 9.1%  |
| Female HBsAg Blood Donors    | 6   | 10  | 9   | 10    | 14  | 5    | 11   | 65    |       |

Table3: Showing Monthly Prevalence

### Discussion

Sierra Leone suffers an especially high prevalence of Hepatitis B. The study revealed 10.9% over an estimated 8 percent of the population is actively infected, and 6-11 percent of mothers risk passing the disease onto their children through birth. HBV is most often transmitted via childbirth. It can also be transmitted through exposure to infected blood. The reported prevalence of carrier in different population varies widely from 0.1% in the advanced countries to 20% in the developing nations [7]. A complex interplay of behavioural, environmental and host factors can cause a variation of hepatitis B Prevalence from one area to another. In general, it is lowest in countries or area with high standards of living (e.g.: Australia, North America, North Europe) and highest in countries or areas where socio economic level is lower (e.g.: China, South East Asia, South America) [7].

### General Prevalence of Clinical Patient and Blood Donors

The study showed 7.8% Seroprevalence of HBsAg among blood donors and 20.5% among patients The current study revealed that was higher compared to studies in Ivory Coast, Ghana and Cameroon (3.6-9.6%); but lower than those in Eastern Ethiopia, Nigeria, Equatorial Guinea and Sierra Leone (Masanga hospital) (10.0-15.0%), Madras 5.5%(30), Vellore 7.17%(29) but was lower to a study in Tamil Nadu 24.5. For prevalence among blood donor, the present shows a lower percentage as compared to reports from similar studies for blood donors of other countries like Cameroon 11.72%(35), Ethiopia 14.4%(27), Mauritania 20.3%(20), Djibouti 10.4%(8) and Magnolia 8.2%(33).

### Sex prevalence of Clinical Patient and Blood Donors

Relating to gender, the Study also revealed that HBsAg prevalence in males was 9.5 % compared to 13.7% in females. The difference was found to be statistically significant (P = 0.0007). This finding study is in contrary previous studies, which demonstrated a higher prevalence of HBsAg among the male population (2, 3, 11, 15, 26). However, there was a high percent of male blood donors. HBsAg prevalence was 20.5% and 7.4% among Male Patients and Blood donors respectively whilst the prevalence was 20.6% and 9.1% among Female Patients and Blood Donors respectively.

## Prevalence among Age group of clinical patients and blood donors

In highly endemic areas, the disease this occurs most often before age five. Adults can become infected through exposure to any infected body fluids, including through sexual activity. The present study revealed significant trend of HBV infection with relation to age. The positivity for HBsAg increased with age in comparison with a the study conducted by JAYARAM and Behal R [23]. Higher prevalence was observed in the older age groups as compared to children under five years. This was associated to possible unknown factors including sexual activities and use of contaminated tools. The trend of immunization against hepatitis-B has been introduced in the recent few years. Therefore the older age group population having a higher prevalence of HBsAg detected in the present study is presumptively due to lack of immunization against the disease in their times. In the present study, declining seropositive rates in individuals aged 45 years or over was observed for both genders. Self-selection due to persistent HBV infection may partly account for such tendencies [2].

## Monthly Prevalence of Clinical Patients and Blood Donors

Hepatitis-B is found throughout the world, it has no seasonal distribution. The carrier rate is higher in the tropical than in the temperate regions.

## Blood group specific prevalence

According to the research, ABO blood group within the population and HBsAg Seroprevalence were investigated since not all the subjects were blood donors. However, a previous study in India indicated reported that prevalence can be higher in specific Blood group base on the frequency of that blood group within the study population.

## Conclusion

The research study reveals that the Seroprevalence of HBV is 10.9% which is consider being high in the sierra Leonean population. In conclusion, the results from the study pointed out the essence and need of presenting integrated information and educational programs that targets certain age groups to prevent and control the spread of HBV and its associated risk factors. Moreover, If other studies of similar nature is done at different regional hospitals and major cities would be helpful to estimate real statistics of hepatitis-B infection in Sierraleone, thus future surveillance studies warranting investigations for this viral infection in a broader population would enable us to determine strategies for combating the threats caused by hepatitis-B virus.

## Recommendations

The researchers urge the ministry of health and sanitation in the response to viral hepatitis to take note of the findings from this research of patients and blood donors. The following recommendations were made based on the analysis of research findings and other evidence:

1. Introduce or improve national viral hepatitis surveillance systems.
2. Develop comprehensive multisectoral national viral hepatitis strategies, drawing on WHO and others for technical support and allocate sufficient funding to implement the strategies.
3. Integrate the implementation of national viral hepatitis strategies with national public health agendas, while at the same time monitoring specific hepatitis-related outcomes.
4. Issue evidence-based guidance on hepatitis prevention and share this guidance with all Health facilities.
5. Recognize and seek to overcome barriers that deter members of most-at-risk populations from accessing hepatitis prevention and treatment services and commodities.
6. Ensure access to hepatitis prevention and treatment for everyone in need without discrimination.

## Acknowledgement

The authors are grateful to the staff of Kenema Government Hospital Clinical Laboratory and Blood Bank who contributed to conduct interviews with study subjects, administering of research questionnaires, and the production of validated patient's data. Thanks for the thoughtful written and verbal testimony provided by subjects affected by hepatitis B at Kenema Government Hospital.

## References

1. WHO (2017) Global hepatitis report.
2. Lok AS, McMahon BJ (2007) Chronic hepatitis B. *Hepatology* (Baltimore, Md.) 45: 507-39.
3. Kennedy PTF, Litwin S, Dolman GE, Bertoletti A, Mason WS, et al. (2017) Immune Tolerant Chronic Hepatitis B: The Unrecognized Risks. *Viruses* 9: 96.
4. WHO Executive Board (2009) Viral hepatitis. Report by the Secretariat. EB126/15, 12 November 2009.
5. Perz JF, Armstrong GL, Farrington LA, Hutin YJ, Bell BP, et al. (2006) The contributions of hepatitis B virus and hepatitis C virus infections to cirrhosis and primary liver cancer worldwide. *J Hepatol* 45: 529-38.
6. Ansumana R, Dariano DF, Jacobsen KH, Leski TA, Lamin JM, et al. (2018) Seroprevalence of hepatitis B surface antigen (HBsAg) in Bo, Sierra Leone, 2012–2013. *BMC Res Notes* 11:113.

7. Gebremariam AA, Tsegaye AT, Shiferaw YF, Reta MM, Getaneh A, et al. (2019) Seroprevalence of Hepatitis B Virus and Associated Factors among Health Professionals in University of Gondar Hospital, Northwest Ethiopia. *Adv Prev Med*.
8. López-Gatell H, García-García L, Echániz-Avilés G, Cruz-Hervert P, Olamendi-Portugal M, et al. (2019) Hepatitis B Seroprevalence in 10-25-year-olds in Mexico – the 2012 national health and nutrition survey (ENSANUT) results. *Hum Vaccin Immunother* 15: 433-9.
9. Schreiner S, Nassal M (2017) A Role for the Host DNA Damage Response in Hepatitis B Virus cccDNA Formation-and Beyond? *Viruses* 9: 125.
10. Simao A (2016) Hepatocellular Carcinoma: Portuguese Data in Chronic Hepatitis B Patients on Antiviral Therapy and Treatment Results With Sorafenib. *GE Port J Gastroenterol* 23: 231-2.
11. Ortega-Prieto AM, Dorner M (2017) Immune Evasion Strategies during Chronic Hepatitis B and C Virus Infection. *Vaccines* 5: 24.
12. (2009) HBV vaccines: WHO position paper. *Wkly Epidemiol Rec* 84: 349-60.
13. Perz JF, Armstrong GL, Farrington LA, Hutin YJ, Bell BP, et al. (2006) The contribution of hepatitis virus and hepatitis C virus B infections to cirrhosis and primary liver cancer worldwide. *J Hepatol* 45:529-38.
14. WHO (2005) Resolution WHA58.13. Blood safety: proposal to establish World Blood Donor Day. In: Fifty-eighth World Health Assembly, Geneva, 16–25 May 2005. Resolutions and decisions, annexes. Geneva.
15. Wright TL (2006) Introduction to chronic hepatitis B infection. *Am J Gastroenterol* 101: S1-6.
16. Walana W, Ahiaba S, Hokey P, Kofi Vicar E, Ekuban S, et al. (2014) Sero-prevalence of HIV, HBV and HCV among Blood Donors in the Kintampo Municipal Hospital, Ghana. *Br Microbiol Res J Orig Res Artic Br Microbiol Res J* 4: 1491-9.
17. Buseri FI, Muhibi MA, Jeremiah ZA (2009) Sero-epidemiology of transfusion-transmissible infectious diseases among blood donors in Osogbo, south-west Nigeria. *Blood Transfus* 7: 293-9.
18. N'dri N, Tho'o AS, Okon AJ-B, Assi C, Allah-kouadio E, et al. (2013) Prevalence of HBs Ag among blood donors in Transfusion Center, Abidjan ( Ivory Coast). *Open J Gastroenterol* 3: 165-9.
19. Mohammed Y, Bekele A (2016) Seroprevalence of transfusion transmitted infection among blood donors at Jijiga blood bank, Eastern Ethiopia: retrospective 4 years study. *BMC Res Notes* 9: 129.
20. EboumbouMoukoko CE, Ngo Sack F, Essangui Same EG, Mbangue M, Lehman LG, et al. (2014) HIV, HBV, HCV and T. Pallidum infections among blood donors and Transfusion-related complications among recipients at the Laquintinie hospital in Douala, Cameroon. *BMC Hematol* 14: 5.
21. Xie DD, Li J, Chen JT, Eyi UM, Matesa RA, et al. (2015) Seroprevalence of Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus and *Treponemapallidum* Infections among Blood Donors on Bioko Island Equatorial Guinea. *PLoS One* 10: e0139947.
22. WHO (2006) Making Safe Blood Available in Africa.
23. García-Tardón N, Gresnigt TM, Fofanah AB, Grobusch MP (2017) Hepatitis B and C in Tonkolili Province, Sierra Leone. *Lancet* 390: 1485.
24. Wurie IM, Wurie AT, Gevao SM (2005) Sero-prevalence of hepatitis B virus among middle to high socio-economic antenatal population in Sierra Leone. *West Afr J Med* 24: 18-20.
25. Zoker EM, Sundufu AJ, Jacobsen KH (2017) Seroprevalence of hepatitis B surface antigen in urban Bo, Sierra Leone. *Trop J Med Res* 20: 41-4.