SEROPREVALENCE TRENDS OF HEPATITIS B AND C AMONG DONORS IN THE BLOOD BANK SERVICE OF A NIGERIAN TERTIARY HOSPITAL: A FIVE-YEAR RETROSPECTIVE STUDY

[1]Ibegbulam OG, [2]Ugwoke CK, [3]Umar GK, [4]Moghalu EA and [5]Umek N

[1]Department of Haematology and Immunology, College of Medicine, University of Nigeria/ University of Nigeria Teaching Hospital, Enugu, Nigeria.
[2]Gastroenterology Unit, Department of Medicine, University of Nigeria Teaching Hospital, Enugu, Nigeria
[3]Department of Pathology, Federal Medical Centre, Birin Kebbi, Kebbi State, Nigeria
[4]Department of Haematology and Immunology, University of Nigeria Teaching Hospital, Enugu, Nigeria
[5]General Hospital, Novo Mesto, Slovenia.

Correspondence Address: Dr Chiedozie Kenneth Ugwoke, Gastroenterology Unit, Department of Medicine, University of Nigeria Teaching Hospital, Enugu, Nigeria *E-mail:* ugwoke.chiedozie@gmail.com *Phone number:* +2347033028524

ABSTRACT

Background and Objectives: Hepatitis B Virus (HBV) and Hepatitis C virus (HCV) infections remain very serious public health risks of blood transfusion globally, and especially in developing regions. In the present study, we sought to retrospectively describe the trends of the seroprevalence of HBV and HCV among blood bank donors in the University of Nigeria Teaching Hospital and explore the implications thereof.

Methodology: The blood donors' screening records over a period of five years, from January 2012 to December 2016, were carefully extracted from the University of Nigeria Teaching Hospital Blood Bank record repository, and subjected to descriptive analysis.

Results: Of the 19,667 blood donations recorded within the study period, 775 were hepatitis B positive (3.94%), 251 were hepatitis C positive (1.28%) and 6 were hepatitis B and C co-infected (0.031%). Hepatitis C seropositivity rate was relatively stable across the study period, and varied between 0.45% (2014) and 1.74 % (2012). However, the Hepatitis B prevalence rate appeared to have declined, from 5.51% in 2012 to 2.99% in 2015 and 3.30% in 2016.

Conclusions: The overall HCV seroprevalence in the present study concurs with the relatively low prevalence generally reported in our environment, while the HBV seroprevalence in the index study is significantly lower than the previously documented ranges in the general population. However, the declining trend of HBV seroprevalence noted over the study period appears to mirror the reported trend in the general population.

Keywords: Hepatitis B virus; Hepatitis C virus; Blood donors; Seroprevalence trend; Nigeria

INTRODUCTION

Despite the general progress achieved so far in ensuring the safety of transfusion services, transfusion-associated infections remain a grave concern of blood transfusion world-wide. Of special public health significance in this spectrum are hepatitis B virus (HBV) and hepatitis C virus (HCV) infections.

About a third of the global population is infected with the HBV (with the vast majority of infections occurring in south-east Asia and Sub-Saharan Africa), while an estimated 150 million individuals are infected with HCV[1-4] . HBV and HCV infections are the leading causes of chronic liver disease and liver cancer globally, accounting for about a million annual deaths[5] In Africa, an estimated 50 million people are carriers of the HBV- with a carrier rate of 9-20 % in Sub-Saharan Africa[1]. Similarly, although detailed epidemiologic data is lacking, it is believed that the region bears a substantial weight of the global burden of HCV. A recent meta-analysis suggested an overall HCV seroprevalence of 2.98% in sub-Saharan Africa[6]. According to a mathematical model based projection by Jarayaman *et al,* if the annual transfusion requirements projected by the World Health Organisation(WHO) in sub-Saharan Africa were met, blood transfusion alone would annually account for about 28595 HBV infections and 16625 HCV infections[7].

Routine national childhood immunization at birth for HBV commenced in Nigeria in 2004. However, coverage has been suboptimal: according to the WHO-UNICEF estimates of immunization coverage, birth dose coverage for HBV in Nigeria in 2015 was only 35%[8]. Consequently, HBV infection remains hyper-endemic in the country. Unfortunately, there is no reliable national data on HBV and HCV seroprevalence in the general population, with different studies reporting widely inconsistent figures on account of significant differences in sample sizes, specific population targets, screening techniques and other methodological qualities. Nevertheless, the reported prevalence of HBV and HCV in the country, mainly from small-scale population and subgroup studies, ranges from 7-15 % and 0-3 % respectively[9-11]. A systematic review and meta-analysis of studies from 2000-2013 estimated the pooled prevalence of HBV in Nigeria as 13.6 % while the subgroup pooled prevalence among blood donors was 14.0 % [12]. In the present study, we sought to describe the seroprevalence trends of HBV and HCV in the blood bank services of the University of Nigeria Teaching Hospital (UNTH) using a retrospective design, and explore the implications thereof.

METHODS

The study was carried out at the blood bank of the UNTH which is federal tertiary healthcare institution in south-eastern Nigeria serving as a major national and regional referral centre. Ethical approval for the study was obtained from the Health Research Ethics Committee of the UNTH (approval number: *NHREC/05/01/2008B-FWA00002458-1RB00002323*) and the execution was in accordance with the Declaration of Helsinki.

The blood donors' screening records over a period of five years, from January 2012 to December 2016, were carefully extracted from the UNTH Blood Bank de-identified record files, and subjected to descriptive analysis.

The hospital blood bank service operates the voluntary (non-remunerated) and replacement blood donation systems, and accordingly, all the donors are from these categories. Donor recruitment was based on the outcome of careful medical history, clinical examinations and assessment of basic haematological indices (haemoglobin level, blood group, Rhesus status), in accordance with the Hospital blood donation protocol which is based on the WHO criteria for blood donor suitability and selection[13].

All donors were screened for HBV surface antigen (HBsAg), anti-HCV, HIV antibodies 1 & 2 and Syphilis antibodies (VDRL) and results documented in the blood bank screening record files. The HBV and HCV serological screening were done post-donation with the *Monalisa* HBsAg Ultra ELISA kit (Bio-Rad, California, USA) and HCV ELISA kit (Biotech Laboratories, UK)respectively in years 2012-2014; and KAPG4SGE3 HBsAg screening Kit (DIAsource ImmunoAssays, Belgium) and EIAgen HCV Ab (v.4) Kit (Adaltis, Italy) in years 2015-2016. Equivocal results were subjected to re-testing with same technique, and if found consistently inconclusive, the respective sample and blood was discarded and such results were not reflected in the present analysis. The data extraction was by means of a designed study proforma, while the analysis was carried out using Microsoft Office Excel 2007 (Microsoft, Washington,

USA) and rates for each variable were calculated and compared.

RESULTS

From January 2012 till December 2016, there were 19667 donations of blood at the UNTH: 3629 in 2012, 4134 in 2013, 3331 in 2014, 3143 in 2015 and 5430 in 2016. The donations were given every month except for December 2014 and January 2015 due to a full scale industrial action that grounded hospital services. There was considerable heterogeneity in the number of donations per month with minimum of 10 donations in August 2014 and maximum of 542 donations in June 2014. In general, across all the reference years, the number of donations per month in the first half of the year appears relatively stable (consistently above 200 donors per month) while in the second half of the year the number becomes more variable and less predictable.

Out of the 19667 donations 775 were hepatitis B positive (3.94%), 251 were hepatitis C positive (1.28%) and 6 were hepatitis B and C co-infected (0.031%). A total of 73 (0.37 %) results were inconclusive from HBV and HCV screening combined. Hepatitis B and hepatitis C seroprevalence rates were also calculated for each year and are depicted in ***Figure 1.*** Hepatitis C positive rate was relatively stable (with insignificant downward fluctuation in 2014) and varied between 0.45% and 1.74%. However, the Hepatitis B prevalence rate appeared to have declined from 5.51% in 2012 to 2.99% in 2015 and 3.30% in 2016. There were only few hepatitis B and C co-positive donations each year: 1 in 2012, 3 in 2013, 1 in 2014 and 1 in 2015. The Hospital donor screening registers did not contain any demographic data on the donors, hence further analysis and interpretation of the extracted data could not be performed.

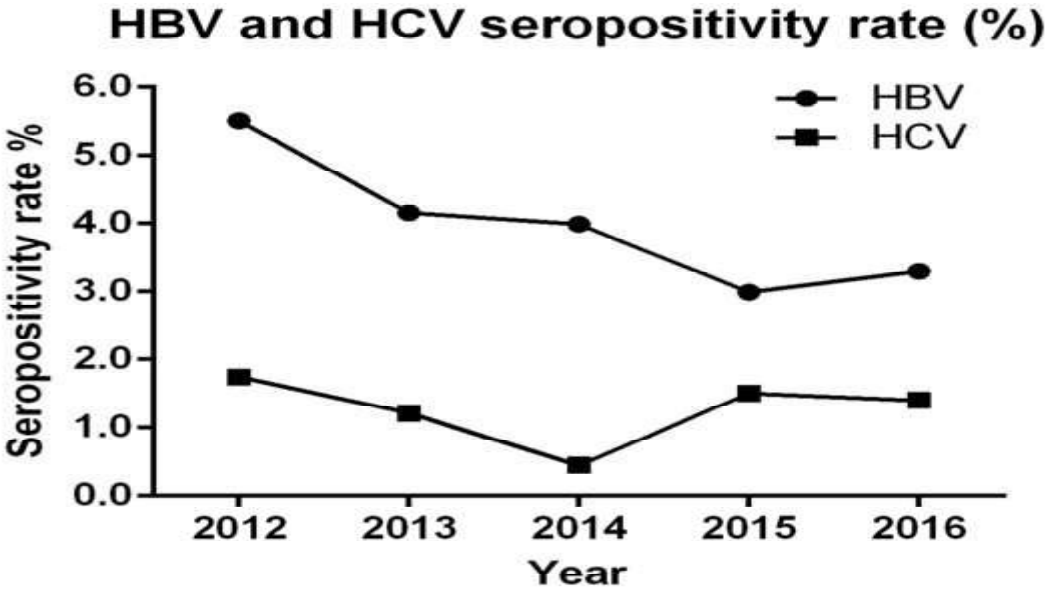

Fig. 1: HBV and HCV seropositivity rate for years 2012-2016

DISCUSSION

Although the WHO advocates that blood donations should be based on the principle of regular, voluntary, non-remunerative donation[13], the hospital still operates the family replacement blood donation system in addition to voluntary donations. However, there have been recent efforts in the hospital to maximise the pool of voluntary blood donors. For example, the observed increase in the number of donors in 2016 probably reflects the intensification of the voluntary blood donation drive by the Voluntary Blood Donors Club of the Hospital in response to the resurrection and expansion of the Open Heart Surgery programme in the hospital. It is not clear why the number of donors

appear more stable in the earlier half of the year even when we should logically expect the reverse, given that major trauma cases (with consequent increase in blood demand) are commoner in the later part of the year when mass travels for festivities occur most. Meanwhile, the observed pattern of donor variation did not significantly correlate with the incidence of HBV and HCV among donors.

The overall prevalence rates of HBV and HCV in our study were 3.94 % and 1.28 % respectively, which are comparable with the results of similar studies in Ethiopia, Turkey and India[14-18]. However, the HBV seroprevalence was significantly lower than figures reported by other investigators among donors in Nigeria. Cross-sectional studies by Adekeye *et al*[19], Gambo *et al,*[20] and Opaleye *et al,*[21] within the period of focus documented high HBV prevalence rates of 20.8 %, 26.2 %, and 19.9 % respectively among blood donors in other cities in Nigeria. The sample sizes in these studies ranged from 182 to 2000. Similarly, the HBV prevalence in our study is also significantly lower than the wider population estimates in the country[12,22] as well the prevalence ranges in other West African nations like Ghana, Benin and Chad[23,12].

The WHO classifies HBV prevalence as low (< 2 %), intermediate (2 – 8 %), and high (> 8 %) [24]. Although the infection is still considered endemic in Nigeria, a similar downward prevalence trend observed in our study has been noted in the general population prevalence. A systematic review and meta-analysis of studies from 2000-2013 noted that HBV prevalence declined annually by 0.8 % in Nigeria[12]. The decreasing trend in the general population may reflect a gradual increase in HBV immunization coverage from zero per cent before 2004 to 35 % in 2015[8]. However, since eligible donors (i.e. > 18 years) in the study period were all born prior to the universal national childhood HBV immunization that commenced in 2004, it is not likely that routine immunization would have played a major direct role in the observed trend in our study.

The HCV rate is relatively low in the general population, as in our study. Our results appear conformable with the 0-3 % range of HCV prevalence reported in previous studies in Nigeria [11,22]. In a 7-year retrospective study (2009-2015) in a hospital-based blood bank in Ibadan, western Nigeria, Fashola *et al,* recorded a comparable HCV seropositivity rate of 1.4 % among blood donors. They however noted an increasing seroprevalence trend from 2012 to 2014 with a decline in 2015[25]**.** Our report showed a relatively stable HCV rate over the study period. Interestingly, however, a cross-sectional study of consecutive blood donors in 2004/2005 at the UNTH blood bank documented a HCV seroprevalence of 3.7 %[26], which compared to our results suggests a significant decline across the reference periods. Accordingly, we also entertain the opinion that the reported declining trend in HBV rate, as well as the possible HCV decline hinted above may suggest an increasing effectiveness of the Hospital pre-donation clinical screening measures.

Generally, we surmise that the observed comparative differences in our study results in relation to other local reports can be attributed to a number of factors. First, being a relatively small subgroup analysis comprising only of blood donors, the result may not be sufficiently representative of the general population. Moreover, voluntary donors formed a significant proportion of the donor pool. Since this category of donors is more likely to be healthy[27] the result might have portrayed a disproportionate reflection of a potentially healthier population. Besides, the screening methodology may have underestimated the seroprevalence rates. For example, no superior or complementary screening modality (e.g. PCR, etc.) were available to confirm equivocal results; such results were simply retested with same original method, hence, a number of donors were unaccounted for because of their persistent indeterminate status. Furthermore, via screening for HBV DNA, significant occult HBV infection rates have been reported among individuals declared HBV negative by HBsAg serology[28-30]. On the other hand, the prevalence of HCV might be actually lower than previously reported in the general population if HCV RNA assays had been done to rule out past infections. A recent report noted that only 68% of subjects in our environment who are labelled positive by HCV antibody serology were found to be viraemic[31].

Since serological screening was done post-donation, a significant economic loss is incurred on donated blood found subsequently to be infected. A rapid pre-donation testing followed by a repeat post-donation ELISA serology would seem a logical option for this challenge. However, at least one study did not find this cost-effective, especially in the context of resource-constrained settings [32].

We acknowledge a significant methodological limitation of our study. Only numerical data were

available in the blood bank screening records and consequently, we could not characterize the donors in finer details: age, sex and other demographic dispositions, distribution of voluntary and replacement donors, identification of repeat donors, etc. Thus, we could only perform simple descriptive and narrative analysis of the data, as further statistical analysis proved invalid. Therefore, we hasten to recommend that the screening data management system of the blood bank be upgraded to an electronic format and expanded to reflect comprehensive information on the donors for follow-up and research.

CONCLUSION

The HCV seroprevalence in our study concurs with the relatively low prevalence generally reported in our environment. The HBV seroprevalence in the present study is significantly lower than the previously reported ranges in the general population and among blood donors. Nevertheless, the declining rate over the study period mirrors currently reported downward trend in the general population prevalence.

For further research, we recommend a coordinated multicentre institutional-based study to determine if a national continuous surveillance programme for HBV and HCV may be organized using systematically pooled blood bank screening records from different tertiary hospitals across the country. Such study may be co-ordinated via the National Blood Transfusion Service, and the data generated may be useful in reliably monitoring the epidemiology and planning public health interventions for HBV and HCV, as well as updating policy regulations on blood donation and transfusion. Also, as recommended earlier, the operational feasibility and integrity of such a study would greatly benefit from electronic facilitation of the donor data management system. Meanwhile, in addition, we recommend that a more evincing screening algorithm be developed to overcome the current limitations of HBV and HCV screening in our environment.

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CONFLICT OF INTEREST

The authors declare no competing interests with regard to this study.

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