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Low Level of Hepatitis B Surface Antigen Screening in a Tertiary Health Facility in Nigeria 2000-2014: Imperative for Provider Initiated Testing and Counselling for Hepatitis B Virus?

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Abstract

Introduction: Viral hepatitis is a major public health challenge that requires an urgent response. Reducing mortality requires major scale-up in prevention, testing and treatment access; coverage in HBV vaccination, testing and treatment is low and must accelerate massively to achieve the 2030 targets. Less than 1% of HBV-infected individuals are diagnosed in Sub-Sahara Africa, despite the availability of rapid tests with good diagnostic accuracy. **Materials and Methods:** This was retrospective cross sectional study conducted in Federal Teaching Hospital Gombe, in North East Nigeria. All children and adults who presented to the out-patient departments, and those that were admitted irrespective of their HIV and or Hepatitis C virus status and had Hepatitis B and/or Hepatitis B envelope antigen test were conducted between 2000 to 2015. All children and adults were tested using the Hospital standard for Hepatitis B surface antigen test strip. **Results:** Between 2000 and 2014, 739,456 children and adults were admitted and reviewed in the outpatient units of the Federal Teaching Hospital Gombe; there were 685,552 adults and 53,904 children. Children constituted 7.3% (53,904/739,456) of admissions and outpatient consultations. 2.8% (210/7570), 3.3% (773/23,783), 3.6% (1145/32,142), 5.2% (1694/33,043), 3.3% (986/29,216), 1.9% (661/3321), 0.1% (53/41,626),

0.2% (113/46,634), 2.6% (1418/54,423), 5.4% (3717/69,696), 3.7% (2332/62,086), 3.5% (3241/90,623), 3.2% (2881/89,398), 3.8% (2428/62,687), 2.8% (1835/63,208) of children and adults were tested for HBsAg in 2000, 2001, 20002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013 and 2014 respectively. 23,487 children and adults were tested for HBsAg with a cumulative testing rate of 3%. Overall 4465/23,487 children and adults were seropositive for HBsAg giving a cumulative prevalence of 19%. **Conclusion:** HBV screening in our health facility is very low. Massive scale up in awareness and HBV vaccination are required. Provider initiated testing and counseling for HBV in health facilities needs support for implementation in Health Facilities in Sub Saharan Africa.

Keywords

Hepatitis B, Testing, Provider Initiated Counseling and Testing, Sub-Saharan Africa

1. Introduction

Viral hepatitis is a major public health challenge that requires an urgent response [1]. While mortality from HIV, tuberculosis, and malaria is now declining, mortality caused by viral hepatitis is on the rise [1]. HBV infection is widespread in sub-Saharan Africa, affecting >8% of the population in West and Central Africa, reaching 15% in some areas [2]. HBV infection has heterogeneous outcomes: acute viral hepatitis, spontaneous clearance or chronicity, with its common fatal sequalae of hepatic cirrhosis and hepatocellular carcinoma [1].

The 194 Member States of WHO committed to eliminating viral hepatitis as a public health threat by 2030 defined as a 65% reduction in mortality and a 90% reduction in incidence compared with the 2015 baseline [3]. Despite decline in the global incidence for hepatitis B, because of immunization and prevention, reducing mortality requires major scale-up in testing and treatment access; coverage in testing and treatment of HBV is low and must accelerate massively to achieve the 2030 targets [4].

Less than 1% of HBV-infected individuals are diagnosed in Sub-Sahara Africa, despite the availability of rapid tests with good diagnostic accuracy. Up to 15% of individuals enter care with liver cirrhosis, a clear indication for antiviral therapy [5].

Nigeria ranks first among the top ten countries with the greatest burden of viral hepatitis in sub-Saharan Africa and the country accounts for 8.3% of the global burden of chronic HBV [6]. The most recent estimate of Hepatitis B vaccination coverage at birth with valid evidence is 35% and about 60% for 3rd dose of Hepatitis B vaccine in Nigeria [7]. HBV testing is gateway to prevention and treatment cascade [1] [8] [9]. In 2015, access to HBV testing was limited as only

9% were diagnosed globally and less than 5% and in Africa [1]. Knowledge of viral hepatitis remains low among Nigerians despite being a leading infectious cause of death each year [10]. As a consequence, most of the estimated 20 million Nigerians living with viral hepatitis B are undiagnosed, increasing the likelihood of future transmission to others and placing them at greater risk for severe, even fatal health complications such as liver cirrhosis and hepatocellular carcinoma [10]. Timely diagnostic testing for HBV is crucial for disease prevention through early detection and treatment, particularly for its long asymptomatic phase. For viral hepatitis, insufficient testing and linkage to care, rather than access to drugs, is an increasing barrier to elimination efforts [11].

It is crucial that an appropriate public health response is in place to ensure that those infected are diagnosed and treated [12] [13].

The aim of this study was to determine the level of HBV testing in children and adults who were admitted or reviewed in all outpatient departments of Federal teaching Hospital Gombe from 2000-2014.

2. Methodology

2.1. Study Design

This was retrospective cross-sectional study.

2.2. Study Area

Gombe is the administrative capital of Gombe state and is one of the six states that comprise North East Geopolitical zone in the country. The North East geopolitical is one of the zones with the highest levels of poverty and the worse maternal and child health indices in Nigeria [14].

2.3. Study Setting

This study was conducted in Federal Teaching Hospital Gombe, a 500 bed hospital serving Gombe state and neighboring states. The Federal Teaching Hospital, Gombe (FTHG) started providing services in the year 2000. It has emerged as a Centre for treatment, teaching and research in the sub-region with large patient referrals from the neighbouring states of Borno, Yobe, Adamawa and Bauchi and Taraba States.

2.4. Study Population

All children and adults who presented to the out-patient departments, and those that were admitted irrespective of their HIV and or Hepatitis C virus status and had Hepatitis B and/or Hepatitis B envelope antigen test conducted from 2000 to 2015.

2.5. Laboratory Methods

All children and adults were tested using the Hospital standard for Hepatitis B surface antigen test strip. The ACON HBsAg (ACON Laboratories, Incorporated

San Diego, California, USA) is a rapid one step test for the qualitative detection of Hepatitis B surface Antigen and Hepatitis B envelope antigen in serum or plasma. The HBsAg test strip has a relative sensitivity, greater than 99.8% and specificity of 99.7%.

The HBeAg EIA Test Kit is a one-step enzyme immunoassay for the qualitative detection of Hepatitis B Envelope Antigen (HBeAg) in human serum or plasma.

Principle

The ACON HBsAg One Step Test is a qualitative, solid phase, two site sandwich immunoassay for the detection of Hepatitis B surface Antigen (HBsAg) and envelope antigen in serum or plasma. The membrane is pre-coated with anti-HBsAg antibodies on the test line region and anti-mouse antibodies on the control region. During testing the serum or plasma samples reacts with dye conjugate (mouse anti-HBsAg antibody-colloidal gold conjugate) which has pre-coated in the test strip. The mixture migrated upwards on the membrane chromatographically by capillary action to react with anti-HBsAg antibodies on the membrane and generates a red line. Presence of this red line indicates a positive result, while its absence indicates a negative result. Regardless of the presence of HBsAg as the mixtures continue to migrate across the membrane to the immobilized goat anti-mouse region, a red line at the control region will always appear. The presence of this red line serves as verification for sufficient sample volume and proper flow as a control for the reagents [15].

2.6. Laboratory Registers/Data Collection

Records of all admissions and outpatient consultations from the inception of the hospital in 2000 were retrieved from the Health records department. Records of Hepatitis B surface and envelope antigen results of children and adults in Federal Teaching Hospital, Gombe between 2000 and 2014 were also retrieved. Variables analysed included age, sex, year, month, and hepatitis B surface and envelope antigen.

2.7. Data Analysis

All records were imputed into EPInfor Version 3.2 and analysed. Children and adults tested for HBsAg and seropositive for HBsAg were presented as percentages. Chi-square was used to determine any association between the number of children and adults admitted/outpatient and tested for HBsAg. A confidence interval of 95% was used in this study and a p-value of <0.05 was considered significant.

2.8. Ethical Clearance

Clearance for this study was received from the Research and Ethical committee of the Federal Teaching Hospital Gombe.

3. Results

Table 1 showed that between 2000 and 2014, 739,456 children and adults were admitted and reviewed in the outpatient units of the Federal Teaching Hospital Gombe. Children constituted 7.3% (53,904). Of those children and adults admitted and reviewed in the outpatient units between the study period, 23,487 were tested for HBsAg with a cumulative testing rate of 3%; Children and adults seropositive for HBsAg cumulative was 19.0% (4465/23,487).

3.1. Yearly Admissions/Outpatient Consultations 2000-2014

Table 2 shows the yearly comparative testing for HBV between adults and children during the review period. Between 2009 and 2014, more children were consistently tested for HBV compared to adults and this was statistically significant. Yearly patient admissions and outpatient consultations increased steadily from inception of the hospital with adult patients at least six times as likely as children to be admitted or consulted in the outpatient unit of the health facility. The distribution was statistically significant.

3.2. Yearly Adult Admissions/Outpatient Consultations 2000-2014

Table 3 shows the yearly distribution of admissions and clinic attendance, HBsAg

Table 1. Children and adults tested and seropositive for HBsAg 2000-2014.

Year	Number of adults Admitted/ Outpatient	Number of Children admitted/ Outpatient	Yearly total of children/ Adults admitted/ outpatient	Yearly total of children/ Adults HBsAg Tested.	Percentage of children and adults tested for HBsAg (%)	Number of children and adults seropositive for HBsAg	Percentage of children and adults seropositive for HBsAg (%)
2000	6526	1044	7570	210	2.8	44	21.0
2001	21,088	2695	23,783	773	3.3	77	10.0
2002	29,267	2875	32,142	1145	3.6	159	13.9
2003	29,597	3446	33,043	1694	5.2	200	11.8
2004	25,891	3325	29,216	986	3.3	141	14.3
2005	30,309	3012	33,321	661	1.9	152	23.0
2006	37,595	4031	41,626	53	0.1	7	13.2
2007	41,501	5133	46,634	113	0.2	15	13.3
2008	48,053	6370	54,423	1418	2.6	330	23.3
2009	64,506	5190	69,696	3717	5.4	812	21.8
2010	56,559	5527	62,086	2332	3.7	423	18.1
2011	87,588	3035	90,623	3241	3.5	666	20.5
2012	85,938	3460	89,398	2881	3.2	826	28.7
2013	60,355	2332	62,687	2428	3.8	580	23.9
2014	60,779	2429	63,208	1835	2.8	33	1.8
Total	**685,552**	**53,904**	**739,456**	**23,487**	**3.0**	**4465**	**19.0**

Table 2. Yearly comparative testing for HBsAg in children and adults 2000-2014.

Year	Number of adults Admitted/ Outpatient	Number of adults HBsAg tested	Number of Children admitted/ Outpatient	Number children HBsAg tested	x^2	P = value
2000	6526	195	1044	15	7.681	0.006
2001	21,088	723	2695	50	17.834	<0.01
2002	29,267	1062	2875	83	3.927	0.048
2003	29,597	1522	3446	172	0.131	0.717
2004	25,891	847	3325	139	6.932	0.008
2005	30,309	538	3012	123	70.866	<0.01
2006	37,595	47	4031	6	0.162	0.687
2007	41,501	94	5133	19	3.877	0.049
2008	48,053	1270	6370	148	2.153	0.142
2009	64,506	3168	5190	549	262.624	<0.01
2010	56,559	2004	5527	328	72.508	<0.01
2011	87,588	2927	3035	314	365.483	<0.01
2012	85,938	2619	3460	262	196.76	<0.01
2013	60,355	2210	2332	218	171.776	<0.01
2014	60,779	1673	2429	162	115.88	<0.01
Total	**685,552**	**20,899**	**53,904**	**2588**	**461.731**	**p < 0.01**

Table 3. Adults tested for Hepatitis B and Hepatitis B surface antigen seropositivity 2000-2014.

Year	Number of adults Admitted/ Outpatient	Number of adults HBsAg tested	Adults Percentage HBsAg Tested (%)	Number of Adults HBsAg Seropositive	Adults Percentage HBsAg Positive (%)
2000	6526	195	2.90	40	20.5
2001	21,088	723	3.40	75	10.4
2002	29,267	1062	3.60	156	14.6
2003	29,597	1522	5.10	178	11.6
2004	25,891	847	3.20	126	14.8
2005	30,309	538	1.40	139	25.8
2006	37,595	47	0.10	5	10.6
2007	41,501	94	0.20	8	8.5
2008	48,053	1270	2.60	303	23.8
2009	64,506	3168	4.90	719	22.6
2010	56,559	2004	3.50	357	17.8
2011	87,588	2927	3.30	605	20.6
2012	85,938	2619	3.00	759	28.9
2013	60,355	2210	3.60	535	24.2
2014	60,779	1673	**2.70**	26	1.5
Total	**685,552**	**20,899**	**3.0**	**4031**	**19.2**

testing rate and seropositivity in Adults during the study period. Peak adult admissions and outpatient consultations were in 2011 and declined thereafter while testing for HBsAg was highest in 2009 (Table 3). Lowest level of HBV screening occurred in 2006, 2007 and 2014. Yearly testing for HBV in adults was highest in 2003 at 5.1% with cumulative average of 3.0%. The percentage of adults HBsAg seropositive varied widely year by year with 19.2% as the mean seropositivity.

3.3. Yearly Children Admissions and Outpatient Consultations 2000-2014

Table 4 shows the yearly distribution of admissions and clinic attendance, HBsAg testing rate and seropositivity in children during the study period. Children admissions and outpatient consultations peaked in 2008 and declined thereafter while testing for HBsAg was highest in 2009 (Table 4). Lowest level of HBV screening was 2006, 2007 and 2014; Yearly testing for HBV in children was highest in 2009 at 10.5% with cumulative average of 4.8%. The percentage of children HBsAg seropositive varied widely year by year with 16.7% as the mean seropositivity.

The line graph in Figure 1 and Figure 2 show the disparity between admissions and testing for HBV in adults and children respectively during the study

Table 4. Children aged 0 - 18 years tested for Hepatitis B and Hepatitis B surface antigen seropositivity 2000-2014.

Year	Number of Children admitted/ Outpatient	Number children HBsAg tested	Children Percentage HBsAg Tested (%)	Number of Children HBsAg Seropositive	Children Percentage HBsAg Positive (%)
2000	1044	15	1.4	4	26.6
2001	2695	50	1.8	2	4.0
2002	2875	83	2.8	3	3.6
2003	3446	172	4.9	22	30.5
2004	3325	139	1.2	15	10.7
2005	3012	123	4.0	13	10.5
2006	4031	6	0.1	2	33.3
2007	5133	19	0.3	7	36.8
2008	6370	148	2.3	27	18.2
2009	5190	549	10.5	93	16.9
2010	5527	328	5.9	66	20.1
2011	3035	314	10.3	61	19.4
2012	3460	262	7.5	67	25.5
2013	2332	218	9.3	45	20.6
2014	2429	162	6.6	7	4.3
Total	**53,904**	**2588**	**4.8**	**434**	**16.7**

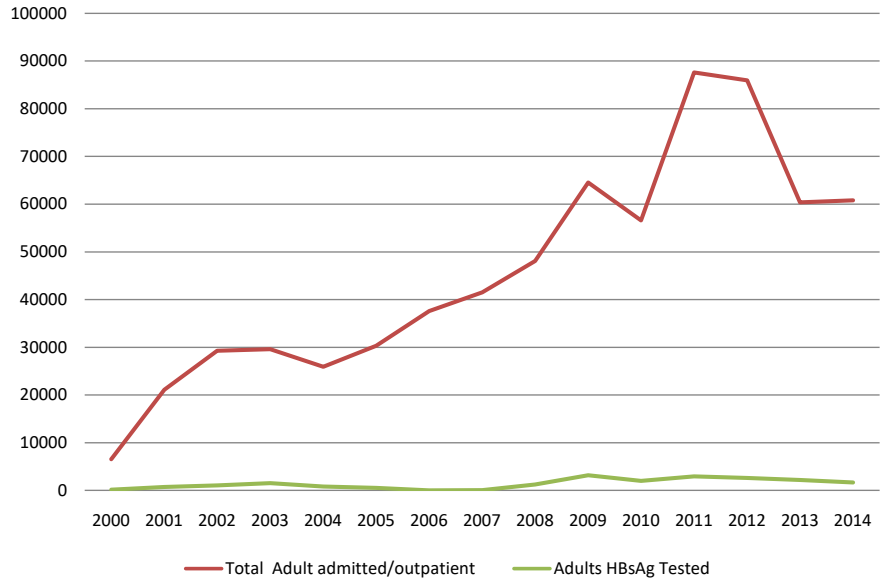

Figure 1. Adults > 18 years admitted/in outpatient and tested for Hepatitis B Surface antigen 2000-2014.

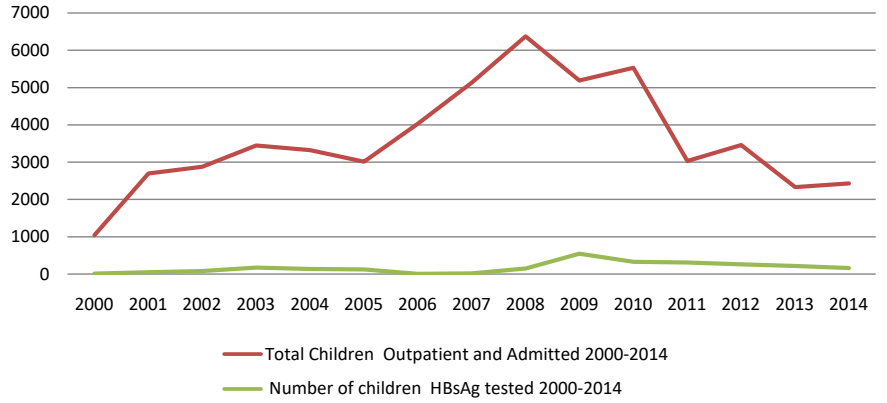

Figure 2. Children 0 - 18 years admitted/in outpatient and tested for Hepatitis B Surface antigen 2000-2014.

period. Adult admissions and outpatient consultations increased steadily overtime and started declining from 2012. Children admission and outpatient consultations started declining from 2009. **Figure 3** shows that more children than adults were tested for HBV from the year 2009 with a peak testing rate of 10% for children; twice as likely as adults. Children demonstrated higher prevalence trend of HBsAg than adults from 2000 to 2008 (**Figure 4**) with however varying prevalences in both children and adults.

4. Discussion

To the best of our knowledge, this is the first study that reports the proportion of all patients and clients in a tertiary health facility screened for HBV over a fifteen-year period in our sub-region. This study also reports HBV test uptake and positivity in all children and adults who were admitted and seen in the various

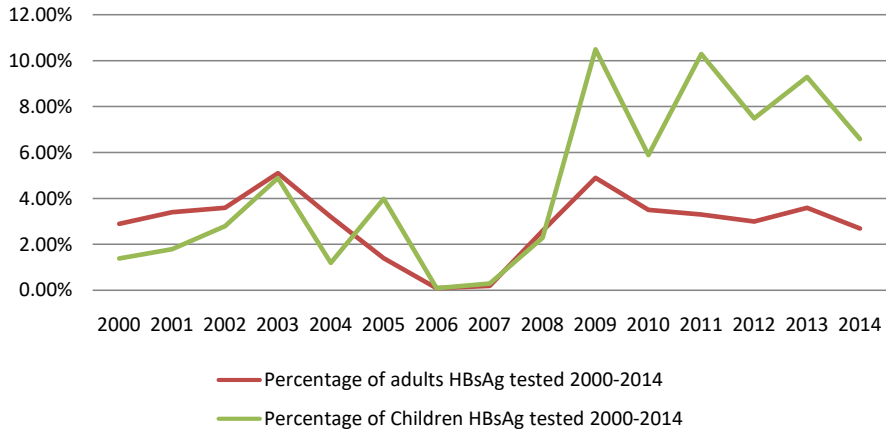

Figure 3. Yearly percentage of children and adults tested for Hepatitis B Surface antigen 2000-2014.

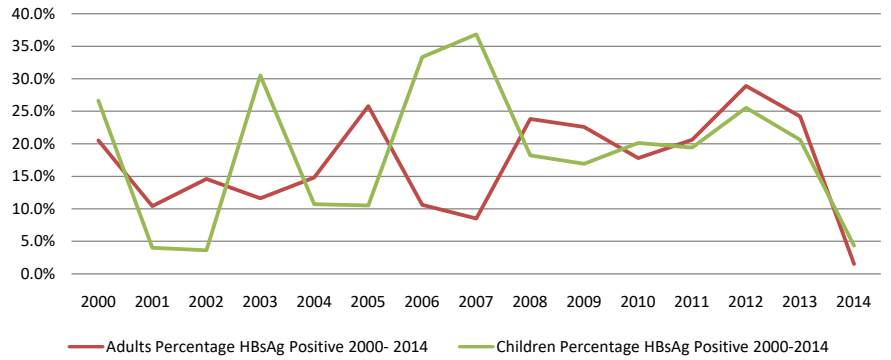

Figure 4. Yearly HBsAg positivity in children 0 - 18 years and adults in federal teaching Hospital Gombe 2000-2014.

outpatient units and clinics in our hospital. They presented with both HBV and non-HBV related illness and included pregnant women, children and adolescents, blood donors, at risk groups such as PWID and MSM, volunteers, medical checkup clients, surgical cases, people living with HIV and Hepatitis C, Tuberculous and cancer patients, sexually transmitted infection clients and patients undergoing dialysis.

All admissions and outpatients consultations in the facility increased steadily from the inception of the hospital in 2000 until 2009 and 2011 when they started declining in both children and adults respectively; this was attributed to the one hundred percent increase in hospital charges in this period and incessant and prolonged boycott of services by health care workers in our facility. Hospital user fees and industrial action by health workers have had negative impact on health service [16] [17].

Overall there was very low testing for HBV (3%) in children and adults in our hospital during the review period. However more children than adults were increasingly tested for HBV and the distribution was statistically significant. HBV screening in our health facility was conducted in a central laboratory with no point of care testing. Point of care testing for HBV across several clinic points

and units has been shown to be feasible and increases uptake and linkage to care for HBV [18] [19] [20]. While there was variation in HBsAg prevalence, the average prevalence of HBsAg carriage of 16.7% in children, 19.2% in adults and 19% in both adults and children is twice as high as the population prevalence of 8% in Nigeria in 2019 [21]. Nigeria is hyperendemic for HBV infection and constitutes a major public health challenge that requires an urgent national response [1] [10] [21].

While a 3-dose HBV vaccine has been in use since 1980s and its efficacy and effectiveness clearly proven [2] [22], Nigeria and indeed the rest of sub-Saharan Africa have reported low levels of vaccine uptake and coverage. Specifically, the HBV birth dose, known to reduce the risk of mother to child transmission of HBV, especially in mothers with the HBV envelope antigen has low coverage in sub-Saharan Africa including Nigeria [7] [23]. Demand, supply and systemic side barriers have impacted negatively on vaccination in Nigeria. Low level of community participation, inadequate cold chain infrastructure and poor funding for routine immunization amongst other factors remain barriers to improving immunization coverage in Nigeria [14] [24].

With Nigerians disproportionately affected and majority infected with HBV unaware of their infection and diagnosis of HBV in the country becomes crucial and therefore a public health imperative in order to prevent and ameliorate the complications and subsequent death associated with this infection [10] [25].

However, despite the high prevalence of disease, and the availability of effective long-term suppressive antiviral treatment for HBV, most people infected with HBV globally have never been tested and so remain unaware of their infection [1] [2].

In Sub-Saharan Africa less than 1% of HBV-infected individuals are diagnosed, despite the availability of rapid tests with good diagnostic accuracy [5] [26]. HBV testing is the gateway to prevention, treatment and care services and therefore early diagnosis of individuals with chronic HBV infection enables them to receive the necessary care and treatment to prevent or delay progression of liver disease. Testing also provides an opportunity to link to interventions to reduce transmission, through counselling on risk behaviours [11] [13] [27].

In general viral hepatitis testing can occur through a number of methods and in various settings, depending on the population group targeted and the local epidemiology and healthcare infrastructure [12] [27]. Community based testing for HBV and HCV have targeted high risk groups and the general population through outreach activities delivering novel and integrated testing initiatives [12] [13] [27] [28].

While our study did not explore factors in the low HBV testing, barriers to HBV testing occur at individual, institutional and community levels [12] [13] [29] [30]. According to the global survey, five main barriers to the diagnosis of viral hepatitis B and C, are: lack of public knowledge of the diseases, lack of knowledge of viral hepatitis among healthcare professionals, lack of easily accessible testing, stigma and discrimination and out-of-pocket costs for the pop-

ulation [29]. Other barriers include limited facilities or services for hepatitis testing, lack of national testing policies or guidelines, costly and complex diagnostic assays and algorithms, and poor laboratory capacity and quality assurance systems [13]. Indeed limited laboratory capacity and access to reliable, low-cost, HBV diagnostics, and lack of testing guidance specifically for LMICs were considered key barriers to limited testing in resource constrained settings [30] [31].

Provider initiated testing and counseling for HBV rooted in a public health and human rights based approach should be the guiding principles in the delivery of HBV testing. The WHO 5Cs are principles that apply to HIV but can apply to HBV/HCV testing; consent, confidentiality, counseling, correct test results and connection (linkages to prevention, treatment and care services [32]. Expanding access to viral hepatitis testing through integration with Gene Expert, Dried blood spot sampling and RDT for Oral test for viral hepatitis are feasible and practical considerations [31] [33]. Integrated delivery of HBV, HCV, HIV as a triple, SYPHILLIS as a quadruple and TB in a quintuple platform may be feasible, cost effective and attractive propositions especially in high burden settings [34] [35]. Provision of high quality HBV services in health facilities is dependent on competent health care professionals brought about by training and retraining using appropriate national training tools including guidelines, job aids and standard operating procedures [1] [10] [13] [27].

Without a massive scale-up in awareness coupled with diagnostic services for HBV, to ensure that everyone infected gets tested, treatment rates will not increase and infection rates may rise thereby impacting negatively on United Nations elimination target of 2030 [12].

In our tertiary health facility, situated in the sub-region with one of the lowest HBV vaccine coverage in Nigeria, HBV testing was abysmally low for all patients and clients who attended the facility between 2000 and 2014.

Limitations

We were unable to report disaggregated data of HBV testing by clinics and wards thereby giving us insights into screening efforts by the respective units

As retrospective cross sectional study, we were unable to report Anti-Hbs or Anti-Hbc status which could have defined non-exposure and therefore requiring HBV vaccine preventive intervention. As this was a one point screening test we could not determine if all the cases detected were those with chronic infection (HBsAg for >6 months). We could not report liver function and liver status including Biopsy and Hepatitis B viral load tests results, our facility started liver biopsy and HBV DNA determination in 2018.

Recommendations

Massive scales up of awareness on Viral Hepatitis especially HBV and HCV should be become priority item on the agenda of public health in Nigeria.

Provider initiated testing and counseling for HBV and HCV for all children

and adults especially pregnant women should be offered and linked to treatment, care and support.

Routine immunization including HBV vaccination should be made mandatory through legislation in Nigeria and indeed in Sub-Saharan Africa

Institutional capacity for HBV multi-centre research, treatment and care in the country is urgently required.

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Author Contributions

Isaac Warnow Elon: Conceived of the study and study design, developed the first manuscript draft, and critically reviewed all drafts of the manuscript.

Ajani Ayomikun: Oversaw the study design, conducted quantitative data analysis, developed the first manuscript draft, and critically reviewed all drafts of the manuscript.

Jalo Iliya, Alkali Yaya: Oversaw the study design and critically reviewed and commented on the final manuscript.

Abubakar Joshua Difa, Oyeniyi Christianah: Conducted quantitative analysis and commented on all drafts of the manuscript.

Aremu John, Danlami Halilu: Critically reviewed and commented on the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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