Prevalence of Hepatitis B Virus Infection among Pregnant Women in Jos, Nigeria

Francis Ajang Magaji1,2, Mark Ojogba Okolo1,3, Z. Hassan1,4, Iornum H. Shambe1,2, Victor Chung Pam1,2, Amaka Ngozi Ocheke1,2, Esther S. Yiltok4,5, Williams Goliff6, Stephen Ajen Anzaku7, Martins Daloek8, Jerry Ogwuche9, Godwin E. Imade10, Christain Isichei11, Joshua T. Muthir12, Stephen Oguche1,2, Oche Agbaji13, Jonah Musa12, Solomon Alene Sagay12, A. I. Zoakah14, Susan E. Cohn15

1. Jos University Teaching Hospital, Departments of 2. Obstetrics and Gynecology, 3. Medical Microbiology, 4. Community Medicine, 5. Pediatrics and 6. Internal Medicine, University of Jos, 7. Department of Obstetrics and Gynecology, Plateau State Specialist Hospital, 8. Department of Obstetrics and Gynecology, Bingham University Teaching Hospital, 9. Department of Obstetrics and Gynecology, Our Lady of Apostles Hospital, 10. Maternal and Child Health Unit, Faith Alive Foundation Hospital, Jos, 11. Division of Infectious Diseases, Northwestern University Feinberg School of Medicine, Chicago, IL USA

Abstract

Objectives: The study sought to determine the prevalence and risk factors associated with Hepatitis B surface antigenemia (HBsAg) positivity among pregnant women in Jos, Nigeria. Methodology: This was a cross-sectional study carried out among the pregnant population in five healthcare facilities in Jos, between November 1, 2017 and April 30, 2018. Informed consent was obtained, and data on sociodemographic and risk factors for hepatitis B virus (HBV) infection were collected. Hepatitis B viral infection was assessed using the in vitro HBsAg diagnostic rapid kit (Acon Laboratories, USA). Descriptive statistics, Chi-square test, and logistic regression were performed to identify predictors of HBV infection in the study population. All statistical analyses were carried out on STATA version 15. Results: Of the 3,238 women enrolled, 7.4% (241/3238) (95% confidence interval [CI] = 6.6% to 8.4%) were HBsAg positive. The absence of HBV vaccination (adjusted odds ratio [AOR] = 2.49; 95% CI = 1.49–4.09; P < 0.001), co-infection with HIV (AOR = 1.90; 95% CI = 1.18–3.08; P = 0.009), and higher parity (AOR = 1.37; 95% CI = 1.04–1.79; P = 0.024) were independently associated with HBV infection in pregnancy. Conclusions: The prevalence of HBV infection among pregnant women was high, especially among those without prior vaccination for HBV, those with HIV co-infection and higher parity.

Keywords: Hepatitis-B virus infection, Nigeria, pregnancy, prevalence

Résumé

Objectifs: L’étude visait à déterminer la prévalence et les facteurs de risque associés à la positivité à l’antigénémie de surface de l’hépatite B (AgHBs) chez les femmes enceintes à Jos, Nigéria. Méthodologie: Il s’agit d’une étude transversale réalisée auprès de la population enceinte dans cinq dans les établissements de santé de Jos, entre le 1er novembre 2017 et le 30 avril 2018. Un consentement éclairé a été obtenu et des données sociodémographiques et les facteurs de risque de la infection par le virus de l’hépatite B (VHB) ont été collectées. L’infection virale de l’hépatite B a été évaluée à l’aide du diagnostic in vitro de l’HBsAg kit rapide (Acon Laboratories, USA). Des statistiques descriptives, test du chi carré et une régression logistique ont été effectués pour identifier les prédicteurs de l’infection par le VHB dans la population étudiée. Toutes les analyses statistiques ont été effectuées sur STATA version 15. Résultats: Sur les 3 238 femmes inscrites, 7,4% (241/3238) (intervalle de confiance à 95% [CI] = 6,6% à 8,4%) étaient AgHBs positives. L’absence de vaccination contre le VHB (cotes ajustées rapport [AOR] = 2,49; IC à 95% = 1,49–4,09; P < 0,001), la co-infection avec le VIH (AOR = 1,90; IC à 95% = 1,18–3,08; P = 0,009), et plus la parité (AOR = 1,37; IC à 95% = 1,04–1,79; P = 0,024) étaient indépendamment associées à l’infection par le VHB pendant la grossesse. Conclusions: La prévalence de l’infection par le VHB était élevée chez les femmes enceintes, en particulier chez celles qui n’avaient pas été vaccinées contre le VHB, celles avec le VIH co-infection et parité plus élevée.

Mots-clés: infection par le virus de l’hépatite B, Nigéria, grossesse, prévalence

Access this article online

Quick Response Code:

Website: www.annalsafmed.org

DOI: 10.4103/aam.aam_20_19

How to cite this article: Magaji FA, Okolo MO, Hassan Z, Shambe IH, Pam VC, Ocheke AN, et al. Prevalence of hepatitis B virus infection among pregnant women in Jos, Nigeria. Ann Afr Med 2020;19:176-81.

Submitted: 26-Apr-2019 Revised: 02-May-2020
Accepted: 08-May-2020 Published: 19-Aug-2020

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com
INTRODUCTION

Globally, estimates suggest that over 250 million people are living with chronic Hepatitis B Virus (HBV) infection, with 4.5 million new HBV infections, and 880,000 HBV-related deaths occurring yearly.[1] The highest prevalence of HBV disease of over 8% is reported in Central Asia, Southeast Asia, sub-Saharan Africa, and the Amazon basin; followed by an intermediate prevalence of 2%–8% reported in the Middle-East, South Asia, some Eastern European countries, and the Mediterranean basin; and the lowest prevalence of < 1% is reported in the United States, Western Europe, Australia, and parts of South America. In HBV endemic regions, the lifetime risk of HBV exposure is universal and 5%–10% of the adults have chronic HBV infection.[2,3]

The differences in the HBV burden across regions are reflected in the modes of transmission and the burden of pediatric HBV infection. In high prevalence regions, HBV is predominantly transmitted in the perinatal period or early childhood, accounting for over 50% of chronic HBV infection in the adult population.[4,6] The risk for the development of chronic hepatitis B infection varies inversely with the age at which acute hepatitis B infection occurs.[7,8] The risk for chronic HBV infection is about 90% if infected at birth or infancy, 30%–50% in children aged 1–6 years, and 5%–10% in children above the age of 6 years to adulthood.[9] Chronic HBV infection acquired in childhood carries a 25% risk of death resulting from complications of chronic liver disease, cirrhosis, or hepatocellular carcinoma.[10]

Although a higher prevalence of HBV infection is reported among surgeons (25.7%), voluntary blood donors (23.4%), and infants (25.7%), Hepatitis B surface antigenemia (HBsAg) studies of pregnant women in Nigeria have revealed HBV prevalence of between 2% and 15.2%.[11,12] In Zaria and Ilorin both in Northern-central Nigeria, studies showed HBV prevalence in pregnancy to be 8.2% and 5.7%, respectively.[13,14] Previous studies on risk factors for HBV infection in pregnancy have shown that high parity, history of blood transfusion, HBV infection in family members, tattooing, and previous surgeries are known risk factors for HBV infection in pregnancy.[15] However, other studies showed no association with a history of multiple sexual partners, previous surgeries, blood transfusion, and circumcision.[16]

There is a paucity of studies on the prevalence and risk factors of HBV in pregnancy, a window of opportunity in the global strategies to reduce HBV prevalence.[17] HBV infection in pregnancy is not only a determinant for vertical transmission, but also has the potential for horizontal transmission to close contacts and remains a significant source of HBV infection. A better understanding of the HBV epidemiology in pregnancy is crucial to developing or adopting strategies to reduce pediatric HBV infection and ultimately reduce its socioeconomic burden. In this study, we sought to determine the prevalence of HBV infection and associated risk factors among pregnant women in Jos, Nigeria.

METHODOLOGY

This cross-sectional study was conducted in five health facilities in Jos, North-Central Nigeria: Jos University Teaching Hospital (JUTH), Plateau State Specialist Hospital (PSSH), Bingham University Teaching Hospital (BHUTH), Faith Alive Foundation Hospital (FAF), and Our Lady of Apostles Hospital (OLA), together with caring for about 40% of pregnant women in this area.[18] Ethical approvals were obtained from the five Institutional Health Committees on ethics and research.

This study sampled antenatal clinic attendees between November 1, 2017 and April 30, 2018, at their first or second visit after obtaining informed written consent.

Data on socio-demographics, obstetric, and sexual risk factors for HBV infection were collected. HBV was tested using the in vitro diagnostic assay for HBsAg manufactured by Wondfo Biotech Co. Ltd, USA. The test kit (dipsticks) was a rapid immune-chromatographic assay designed for the qualitative determination of the HBsAg in plasma. Twenty-five microliters of blood were placed into the specimen pot of the cassette and a drop of the buffer solution was added. A single red or pink band in the control region indicated a negative result, while two bands each at the control and the test region indicated a positive result. The test was deemed invalid if a single band appeared at the test region and thus was repeated. The study participants who were found to be positive for HBsAg were referred to the Gastro-Intestinal unit for further clinical evaluation and care. In addition, blood samples were tested for HIV-1 and HIV-2 antibodies according to the National HIV testing algorithm.

All statistical analyses were performed on STATA 15 (Corp LP, USA). We performed descriptive statistics and relevant tests of hypotheses to identify risk factors for HBV infection in the study population. We further built a multivariable logistic regression model for risk factors that were associated with HBV (P < 0.05) to identify independent predictors of HBV infection among pregnant women. The results were presented as adjusted odds ratio (aOR), with a 95% confidence interval (CI). A value of P < 0.05 was considered statistically significant.

RESULTS

All 3238 pregnant women who enrolled for prenatal care between November 1, 2017 and April 30, 2018 agreed to participate, signed informed consent and entered during their first prenatal visits except for 26 who joined during their second visit. Their ages ranged from 15 years to 48 years, with a mean of 29.03 ± 5.6 years. A total of 1469 (45.4%) of the pregnant women had tertiary education and only 69 (2.1%) had no formal education. Most 3192 (98.6%) were in a marital relationship and more than half 1837 (56.7%) were multiparous.

Of the 3238 women studied, 241 (7.4%) (95% CI = 6.6% to 8.4%) were found to be positive for HBsAg with 90 (37.3%)
enrolling from JUTH, 79 (32.8%) from PSSH, 27 (11.2%) from FAF, 25 (10.4%) from OLA, and 20 (8.3%) from BHUTH. About 493 (15.2%) had a self-reported history of HBV vaccination and 183 (5.7%) had a history of blood transfusion.

On univariate analysis, risk factors associated for HBV infection in pregnancy included women with no prior history of HBV vaccination ($P = 0.001$), women who enrolled for prenatal care in the second half of their pregnancy ($P = 0.003$), those living with HIV ($P = 0.009$) and higher parity ($P = 0.019$) [Table 1].

Pregnant women who had no history of HBV vaccination had three times higher odds of HBsAg positivity compared to women who had HBV vaccination (AOR = 2.49; 95% CI = 1.49–4.09; $P < 0.001$). Women with HIV had two times higher odds of being HBsAg positive compared to women without HIV infection (AOR = 1.90; 95% CI = 1.18–3.08; $P = 0.009$). Pregnant women who enrolled for prenatal care in the second half of pregnancy had higher odds of being HBsAg positivity compared to those that enrolled earlier (AOR = 1.38; 95% CI = 1.05–1.79; $P = 0.019$) and women of higher parity were more likely of being HBsAg positive compared to primigravidae (AOR = 1.37; 95% CI = 1.04–1.79; $P = 0.024$) [Table 2].

**Discussion**

This study reported a high prevalence of HBV infection as defined by the presence of HBsAg among pregnant women in Jos and reflects an intermediate WHO classification for HBV infection burden using the WHO classification.[2] In earlier studies of women in Jos, Nigeria, the prevalence of HBV measured by the presence of Hepatitis B core antibody was 63.3% and 13.0% when HBsAg were measured as HBV viral markers.[19] The HBsAg prevalence in this study was similar to most other studies of nonpregnant populations in Nigeria;[14,20-22] however, other studies have reported an even higher HBsAg prevalence among pregnant women.[13,23]

---

**Table 1: Factors associated with hepatitis B surface antigenemia status among pregnant women that enrolled for prenatal care in Jos, Nigeria (n=3238)**

| Factors                        | HBsAg positive | HBsAg negative | Total   | $\chi^2$ | $P$       |
|--------------------------------|----------------|----------------|---------|----------|-----------|
| Age (years)                    |                |                |         |          |           |
| 15-30                          | 152            | 1842           | 1994    | 0.24     | 0.62      |
| 31-45                          | 89             | 1555           | 1244    | 0.06     | 0.81      |
| Educational status             |                |                |         |          |           |
| No formal education            | 4              | 65             | 69      | 0.27     | 0.60      |
| Formal education**             | 237            | 2932           | 219     |          |           |
| Marital status                 |                |                |         |          |           |
| Single                         | 3              | 43             | 46      | 0.06     | 0.81      |
| Married                        | 238            | 2954           | 3192    |          |           |
| Parity                         |                |                |         |          |           |
| Multi/grand multi              | 145            | 2003           | 2148    | 4.44     | 0.035*    |
| Primigravida                   | 96             | 994            | 1090    |          |           |
| Gestational age (weeks)        |                |                |         |          |           |
| ≤20                            | 111            | 1610           | 1721    | 5.26     | 0.022*    |
| 21-40                          | 130            | 1387           | 1517    |          |           |
| Previous surgery               |                |                |         |          |           |
| Yes                            | 54             | 648            | 702     | 0.081    | 0.776     |
| No                             | 187            | 2349           | 2536    |          |           |
| Circumcision                   |                |                |         |          |           |
| Yes                            | 33             | 315            | 348     | 2.355    | 0.125     |
| No                             | 208            | 2682           | 2890    |          |           |
| Blood transfusion              |                |                |         |          |           |
| Yes                            | 16             | 167            | 183     | 0.476    | 0.490     |
| No                             | 225            | 2830           | 3055    |          |           |
| Previous tattoos               |                |                |         |          |           |
| Yes                            | 32             | 399            | 431     | 0.000    | 0.988     |
| No                             | 209            | 2598           | 2807    |          |           |
| HBV vaccination                |                |                |         |          |           |
| Yes                            | 17             | 476            | 493     | 13.47    | <0.001*   |
| No                             | 224            | 2521           | 2745    |          |           |
| HIV status                     |                |                |         |          |           |
| Positive                       | 21             | 146            | 167     | 6.73     | 0.009*    |
| Negative                       | 220            | 2851           | 3071    |          |           |

*Statistically significant, **At least primary education. HBsAg=Hepatitis B surface antigenemia
East African sub-region, HBsAg positive prevalence among pregnant women was reported as 3.1% in Rwanda, and 5.3% in Ethiopia, while some reported a higher prevalence of HBsAg positivity among pregnant women in Mali (8%), Kenya (9.3%) and Ghana (12.6%).

The varying HBsAg positivity among pregnant women in Nigeria and other African regions may be due to differences in sociodemographics, access to preventive health-care services, including vaccination among the study population and the technology used in assaying HBV status of the sampled population. The current HBsAg prevalence gives a better estimate of HBV infection among pregnant women in Jos, especially since the outcome is reflective of a more robust study enrolled at five clinical care sites. Furthermore, this study confirms that Nigeria remains one of the most affected countries with HBV in Africa and indeed the world.

The prevalence of HBsAg positivity in Jos was associated with a lack of prior HBV vaccination, presenting for prenatal care later in pregnancy, women living with HIV, and higher parity. Similar studies in Ekiti, South-western Nigeria, and Enugu in the South-eastern geopolitical zone of the country showed that higher parity was a predictor of HBV infection. This may be due to increased vulnerability to HBV infection from previous obstetric complications, prior blood transfusions, or sexual exposure to partners with HBV infection. Similar to our findings, an increased risk of HBV infection was observed in those women entering prenatal care later in pregnancy has been reported in Minna, North-central Nigeria, and Zaria in the North-west of the country. In most resource-poor settings, pregnant women who enrolled for prenatal care later in pregnancy, with the late determination of HBV status, leaves little or no time to institute adequately institute HBV preventive measures at delivery and in the post-delivery period.

Similarly, pregnant women who were vaccinated for HBV were 60% less likely to be HBeAg positive compared to those not vaccinated. This observation was also made by investigators studying pregnant women in Osogbo, South-western Nigeria, Vientiane, Laos, and Thailand, where a reduction in HBV prevalence was directly attributable to HBV vaccination. Despite evidence that HBV vaccination remains the best tool for the prevention and elimination of HBV epidemics, vaccination coverage is consistently poor in HBV endemic regions. This study also showed that pregnant women living with HIV were twice as likely to be HBsAg positive compared to those who were pregnant and not living with HIV. However, in earlier studies in Oyo and Osogbo, both in South-western Nigeria, living with HIV was not significantly associated with an increased prevalence of HBV infection. In the East African country of Uganda, pregnant women living with HIV were significantly at risk for HBV infection. This significant association may be attributed to the high burden of HIV in the study area, similarities in risk behaviors, modes of transmission, and management of both HBV and HIV infections.

The public health implication of high HBV burden among pregnant women in Jos is huge, with associated increased risk of exposure to HBV infection of babies at delivery as mother-to-child transmission of HBV, thereby adding to the population of adults who will be living with HBV. Despite evidence suggesting that in intermediate-to-high HBV endemic nations, about 30% to 50% of adults with chronic HBV pass HBV from mother to child in infancy or in the early childhood periods, Nigeria does not yet have a formal strategy for preventing mother to child transmission of HBV infection. This study showed that improving HBV vaccination coverage would likely reduce by over half the HBV burden in endemic settings. Entering prenatal care early in pregnancy, preferably in the first trimester, and screening all women for HBV and HIV infections would enable those infected to (1) access treatment with effective anti-retroviral drugs, (2) prevent exposure of HBV and HIV to their infants, and (3) receive post-exposure prophylaxis with HBV immunoglobulin and HBV vaccination. In 2014, the United States Preventive Services Task Force recommended screening of high-risk adolescents and adults, and pregnant women at their first prenatal visit for HBV infection to prevent transmission of HBV to vulnerable newborns and children. To reverse

### Table 2: Risk factors for hepatitis B viral infection among pregnant women that enrolled for prenatal care in Jos, Nigeria

| Predictors | HBV+ | HBV− | COR | AOR | 95% CI | P |
|------------|------|------|-----|-----|--------|---|
| Parity     |      |      |     |     |        |   |
| Primigravida | 96   | 994  | 1.33| 1.37| 1.04-1.79| 0.024|
| Multi/grand multiparous | 145  | 2003 |     |     |        |   |
| Gestational age (weeks) |      |      |     |     |        |   |
| ≤20        | 130  | 1387 | 1.36| 1.38| 1.05-1.79| 0.019|
| >20        | 111  | 1610 |     |     |        |   |
| HB vaccination |      |      |     |     |        |   |
| Yes        | 224  | 2521 | 2.49| 2.49| 1.49-4.09| <0.001|
| No         | 17   | 476  |     |     |        |   |
| HIV status |      |      |     |     |        |   |
| Positive   | 21   | 146  | 1.90| 1.90| 1.18-3.08| 0.009|
| Negative   | 220  | 2851 |     |     |        |   |

COR=Crude odds ratio, AOR=Adjusted odds ratio, HBV=Hepatitis B viral, CI=Confidence interval
the trend, an HBV prevention protocol similar to that for the prevention of mother-to-child transmission of HIV is required. This protocol would increase HBV case detection rate and lead increased HBV contact tracing of household members, increased adequate HBV vaccination of infants at birth, and enable the evaluation of HBV vaccination uptake among infants.

This study provided a robust baseline data and covered a significant knowledge gap on HBV epidemic among the pregnant population in Jos, Nigeria. However, there are several limitations to our data. It is an institutional-based study conducted in an urban setting and may not be representative of women getting care in rural areas. Data on prior vaccination were collected through self-report, and clinic charts and/or hospital records were not able to be reviewed to verify this data. In addition, the immune chromatography screening method used in the study may be less sensitive compared to Enzyme-Linked Immunosorbent Assay and other HBV-DNA testing strategies, thereby possibly underestimating the true HBV burden in this population.


cOncClusions

Pregnant women in Jos, Nigeria, have a high prevalence of HBV infection, especially among those without prior history of HBV vaccination, living with HIV and of higher parity. There is an urgent need to implement effective prevention strategies to lessen the high HBV burden among pregnant women and prevent infants and children from becoming infected with HBV with its attendant complications in resource-poor settings.

Acknow ledge ment

We thank the participants, midwives, counselors, and laboratory staff in the five study sites for their commitments to the study. We equally thank the data assistant, who ensured that all the data was captured for the analysis.

Financial support and sponsorship

The research reported in this publication was supported by the Fogarty International Centre of the National Institutes of Health and also the Office of the Director, National Institutes of Health (OD), National Institute of Nursing Research, and the National Institutes of Neurological Disorders and Stroke under award number D43TW010130. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Global Hepatitis Report 2017. World Health Organization. Guidelines; 2019. Available from: https://www-who-int/news-room/fact-sheets/detail/hepatitis-b. [Last accessed on 2020 Apr 28].
2. Evans AA, Cohen C, Block TM. Hepatitis viruses: Hepatitis B and hepatitis D. In: Kaslow RA, Stanberry LR, Duc JW. In viral Infections of Humans: Epidemiology and Control. New York: Springer US; 2014. p. 747-64.
3. Rapti I, Hadjiyanni S. Risk for hepatocellular carcinoma in the course of chronic hepatitis B virus infection and the protective effect of therapy with nucleos (i) t ide analogues. World J Hepatol 2015;7:1064-73.
4. Lozano R, Naghri M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for over 20 age groups in 1990 and 2010: A systematic analysis for the Global Burden of Disease study 2010. Lancet 2012;380:2095-128.
5. Jonas MM. Hepatitis B and Pregnancy: An underestimated issue. Liver Int off J Int Assoc Study Liver 2009;29:133-9.
6. Enene GO, Enemdi JJ, Ikefunke AN, Illechukwu GC, Igwe WC, Ejiofor OS, et al. Hepatitis B virus infection in Nigeria. A review. Niger Med J 2009;50:18-22.
7. Eke AC, Eke UA, Okoro CI, Ezebaliu IU, Ogbugha C. Prevalence, correlates and patterns of hepatitis B surface antigen in a low resource setting. Virology J 2011;8:12.
8. Coppola N, Loquerio G, Tonziello G. HBV transmission from an occult carrier with five mutations in the major hydrophilic region of HBsAg to an immunosuppressed plasma recipient. J Clin Virol 2013;58:315-7.
9. Coppola N, Tonziello G, Colombatto P. Lamuvudine – Resistant HBV strain m204I/V in acute HBV. J Infect 2013;67:322-8.
10. Borger J, Carleo MA, Gaeta GB, Gentile I. Hepatitis B in pregnancy. World J Gastroenterol 2012;18:4677-83.
11. Eke CB, Onyire NB, Amadi OF. Prevention of mother to child transmission of hepatitis B virus infection in Nigeria: A call to action. Niger J Paediatri 2016;43:201-8.
12. Alegbele JO, Nyongidiki TK, Ikimalo JO. Maternal and neonatal seroprevalence of hepatitis B surface antigen in a hospital based population in South-South, Nigeria. Int J Med Med Sci 2013;5:2416.
13. Musa B, Bussel S, Borodo MM, Samaila AA, Feni OL. Prevalence of hepatitis B virus infection in Nigeria, 2000 – 2013: A systematic review and meta-analysis. Niger J Clin Pract 2015;18:163-72.
14. Luka SA, Ibrahim MB, Ilyia SN. Seroprevalence of hepatitis B surface antigen among pregnant women attending Ahmadu Bello University Teaching Hospital, Zaria, Nigeria. Niger J Parasitol 2008;29:38-41.
15. Agbede OO, Iseniyi JO, Kolarwole MO, Ojuawo A. Risk factors and seroprevalence of hepatitis surface antigenemia in mothers and their pre-school age children in Ilorin, Nigeria. Therapy 2007;4:67-72.
16. Nyambesi MM, M’Imunya JM, Muvuni CM, Harbua M. Factors associated with hepatitis B surface antigen seropositivity among pregnant women in Kigali, Rwanda: A cross sectional study. J Comm Health Nursing 2017;3:192.
17. Yli P, Chen R, Huang Y, Zhou RR, Fan XG. Management of mother-to-child transmission of hepatitis B virus: Propositions and challenges. J Clin Virol 2016;77:32-9.
18. National Bureau of Statistics Federal Republic of Nigeria: 2006 Population Census Official Gazette FGP 71/25007/2,500(OL24); Legal Notice on Publication of the Details of the breakdown of the National and State Provisional Totals 2006 Census. Available from: http://www.nigerianstat.gov.ng/connection n/pop2006. [Last accessed on 2015 Aug 23].
19. Imade GE, Sagay AS, Ugwu BT, Thacher RW. Seroprevalence of Hepatitis B and Human Immunodeficiency virus infections in pregnant women in Nigeria. J Med Tropics 2004;6:15-1.
20. Opaleye OO, Salami S, Funmilayo F, Olowe OA. Seroprevalence of hepatitis B surface antigen and antibody among pregnant women attending a Tertiary Health Institution in Southwestern Nigeria. J Dent Med Sci 2014;13:67-71.
21. Yakasa I, Ayuba R, Abubakar IS, Ibrahim SA. Seroprevalence of Hepatitis B virus infection and its risk factors among pregnant women attending antenatal clinic at Aminu Kano Teaching Hospital, Kano, Nigeria. J Basic Clin Reprod Sci 2012;1:49-55.
22. Rabiu KA, Akinola OA, Adewunmi AA, Omololu OM, Ojo TO. Risk factors for hepatitis B virus infection among pregnant women in Lagos, Nigeria. Acta Obstet Gynecol Scand 2010;89:1024-8.
23. Zenebe Y, Mulu W, Yimer M, Abera B. Seroprevalence and risk factors of hepatitis B virus and human immunodeficiency virus infection among pregnant women in Bahir Dar city, Northwest Ethiopia: A cross-sectional study. BMC Infect Dis 2014;14:8.
24. Chineneva GA, Adeola F, Chukwuma EO, Rasheed AB. Prevalence,
socio-demographic features and risk factors of Hepatitis B virus infection among pregnant women in Southwestern Nigeria. Pan Afri Med J 2015;20:6.

25. Noubiap JJ, Nansseu JR, Ndoula ST, Bigna JJ, Jingi AM. Prevalence, infectivity, and correlates of hepatitis B virus infection among pregnant women in a rural district of the Far-North Region of Cameroon. BMC Public Health 2015;15:4.

26. Ott JJ, Stevens GA, Groeger J, Wiersma ST. Global epidemiology of hepatitis B virus infection: New estimates of age-specific HBsAg seroprevalence and endemicity. Vaccine 2012;30:2212-9.

27. Awoleke JO. Hepatitis B surface antigenaemia among pregnant women in a tertiary health institution in Ekiti state, Nigeria. Trop J Obstet Gynaecol 2012;29:34-9.

28. Ndams IS, Joshua IA, Lika SA, Sadiq HO. Epidemiology of Hepatitis B infection among pregnant women in Minna, Nigeria. Sci World J 2008;3:5-8.

29. Choisy M, Kzomalaphet S, Xaydalasouk K, Quet F, Lattaphasavang V, Buisson Y. Prevalence of Hepatitis B virus infection among pregnant women attending antenatal clinics in Vientiane, Laos, 2008-2014. Hepatitis Res Treat 2017;1:1-5.

30. USPSTF (US Preventive Services Task Force). USPSTF A and B Recommendations; 2018. Available from: http://www.uspreventiveservicestaskforce.org/uspreventiveservicestaskforce.org/uspreventiveservicestaskforce.org/uspstf/recommendation/hepatitis-b-virus-infection-in-pregnant-women-screening. [Last accessed on 2019 Mar 14].