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***HEPATITIS B VIRUS SCREENING AND LIVER ENZYME OF SEROPOSITIVE HBV AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC IN ENUGU STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY TEACHING HOSPITAL PARKLANE.***

**Abstract**

Chronic Hepatitis B Virus (HBV) infection is a significant global health issue, particularly affecting pregnant women in low- and middle-income countries. This study aims to investigate the prevalence, knowledge, attitudes, practices, and risk factors associated with HBV infection among pregnant women attending antenatal clinics at Enugu State University of Technology Teaching Hospital Parklane, Nigeria.This study employed a mixed cross-sectional design, involving 111 pregnant women recruited from the antenatal clinic at Enugu State University of Science and Technology Teaching Hospital Parklane. Ethical Clearance and patients’ consent were obtained. Data were collected through structured questionnaires assessing sociodemographic factors, knowledge, attitudes, and practices regarding HBV. It was conducted within a period of 6 months; June 1st—November 21st 2024. Blood samples were screened for HBV seropositivity, and liver function tests were performed on seropositive participants. 4 of the participants were shown to have the virus making the prevalence to be 2.7%. 61 participants ( 55.5%) were between 26-35 years old While Only 15 participants (13.5%) were between 36-45 the remaining 35 participants (31.5%) were15-25 years old. 43 participants (38.7%) and 44 particpants (39.6%) were in their Second and third trimester respectively while the rest were in their first trimester. Knowledge about HBV was rated as very good (mean score = 3.39), while attitudes were neutral (mean score = 3.06), and practices towards prevention were excellent (mean score = 3.60). Despite high knowledge levels, only 2.7% reported having been tested for HBV, indicating a significant gap between awareness and practice. Socioeconomic factors. The low prevalence of HBV among pregnant women in this study with only 4 of the 111 participants (2.7%) is encouraging, given the high rates reported in other studies across Nigeria and other Saharan Africa.

**INTRODUCTION**

**BACKGROUND OF THE STUDY**

Chronic hepatitis B viral infection is a global public health threat that is responsible for a significant rise in death and debilitation in liver-related illnesses [1]. It can be contracted at birth and subsequently, through infected blood and body fluids during interpersonal contact [2]. The hepatitis B virus is the source of hepatitis B, a liver infection. Both acute (short-lived and severe) and chronic (long-lived) infections are common.

They are different clinical phases, some lasting decades, typical of the course of a chronic HBV infection. The most frequent end stage is the development of liver cirrhosis and in worst-case scenarios, liver cancer [3]. However, these disease outcomes are also influenced by other clinical and viral characteristics and by host immune responses to viral replication in the body [4]

An elevated level of hepatitis B viral DNA in the serum is the primary risk factor and diagnostic for the progression of the disease in people with chronic infection [2]. When combined with other virological indicators, liver biochemistry, and abdominal ultrasonography, the disease's progression can be effectively monitored, and the prognosis and course of treatment can be determined [2].

Presently, 3.5% of people worldwide have a persistent hepatitis B viral infection which is a leading cause of liver cirrhosis and hepatocellular carcinoma (HCC) [5]. The high mortality rate is accounted for by over 1.3 million fatalities annually [5]. The WHO Western Pacific Region and the WHO African Region have the greatest rates of chronic infection, with 97 million and 65 million individuals, respectively, suffering from this condition [6].

Hepatitis B is most frequently transmitted from mother to child at birth (perinatal transmission) or horizontally (exposure to contaminated blood and body fluids), particularly between an infected and an uninfected child within the first five years of life, in highly endemic areas. When infants acquire an infection from their mothers or before turning five years old, a chronic infection has the potential to develop. Once perinatally infected with the hepatitis B virus, as much as forty per cent of men and 15% of women will die from hepatocellular carcinoma or liver cirrhosis [7].

Furthermore, less than 5% of adult occurrences of hepatitis B infection result in chronic hepatitis, whereas around 95% of cases of hepatitis B infection occur during infancy and early childhood [8]. This forms the cornerstone for bolstering and prioritizing child vaccinations. Since a reliable and safe vaccine became available in 1981, the prevalence of the disease has significantly decreased, albeit at a fluctuating rate, as a result of baby vaccination campaigns and to a lesser extent, by the use of antiviral therapy to reduce the viral load of chronically infected individuals [9]. Long-term antiviral treatment can also reverse cirrhosis and reduce hepatocellular carcinoma.

Over one-third of persistent HBV infections globally are caused by mother-to-child transmission (MTCT) [10, 4]. Furthermore, 25% of people with chronic infection die from HBV-related consequences, which include cirrhosis and hepatic cancer, in an estimated 15% to 40% of cases [4]. Either during pregnancy or after delivery, MTCT can happen. The worldwide burden of new chronic HBV infections can be decreased by lowering MTCT transmission rates and treating mothers with antiviral drugs, as well as by screening pregnant women for HBV infection and offering infant postexposure prophylaxis [11].

**JUSTIFICATION OF STUDY**

The most prevalent type of chronic hepatitis in the world is caused by HBV infection, which is also a potentially avoidable global health issue. According to the World Health Organization (WHO) estimates, about 240 million people globally have a chronic HBV infection. Most of them, especially in highly endemic locations, develop their illnesses in infancy or during the perinatal period [12]. Perinatal or newborn transmission may be the cause of almost one-third of chronic infections, even in low-endemic regions. Previous study data indicates that after contracting HBV, neonates have a 90 per cent likelihood of becoming chronic carriers, with children under the age of three having a 50% chance, and adults having only a 5% chance of developing chronic hepatitis [13]. Because of this, vertical transmission—also known as mother-to-child transmission (MTCT) during the perinatal or postpartum stages has been identified as the critical stage in the prevention of chronic HBV infections [13].

On the other hand, when HBV infections happen early in childhood or in individuals with compromised immune systems, such as those with Down syndrome or dialysis patients, they are more prone to progress into chronic infections [14]. According to a review, newborns who contract HBV from their infected mothers while still in utero or during the perinatal period have the highest incidence of chronicity. Virtually all of these infants grow up to be chronic carriers [15]. Also, the review showed that carrier rates drop for infections acquired later in childhood and are <5% among healthy adults.

Moreover, the highest rate of chronic carrier (>85%) and subsequently elevated incidence of chronic liver disease and hepatocellular cancer are caused by mother-to-child perinatal transmission [16]. Consequently, among the top ten causes of mortality in Asian and African nations with high rates of perinatal and early childhood infection are cirrhosis or HCC, of which more than half are caused by HBV infection [15].

It is important to comprehend the workings of mother-to-child perinatal transmission to stop the spread of HBV and minimize the mortality rates of chronic HBV infections.

Three potential modes of perinatal transmission are known:

* Intrauterine
* Intrapartum (during birth), and
* Postpartum (via close contact or breast milk) transmission ([17])

Identifying HBV-positive mothers for whom intervention may lower MTCT risk allows for the stopping of mother-to-child transmission (MTCT) through universal screening of expectant women during the second trimester. The single most significant predictor of MTCT is the level of HBV DNA in HBV-positive mothers. It is important to add that HBeAg, HBe Ab, anti-HB core IgG, and HIV status are additional risk factors [18].

In high-risk neonates, the HBV immunisation by itself was found to be somewhat protective. However in a Taiwanese trial, just 23 per cent of newborns who received the vaccine one week after birth went on to become chronic carriers [19]. There was evidence of success even when treatment started one month after birth, at a lesser rate: 40% of newborns developed into carriers [20]. This showed that the administration of vaccines alone was insufficient for the control of transmission hence the approach to combine the use of HBIG and vaccines was visited and marked improvements have been noted ([13]).

Therefore, the combined administration of HBIG with the Hepatitis B vaccine is more effective in reducing the prevalence of MTCT than either the vaccine or HBIG alone. Numerous studies, including Cochrane systematic reviews, suggest that immunization alone is not adequate to prevent MTCT of HBV in these HBsAg-positive mothers [15].

According to [21] standards, newborns whose mothers are HBsAg-positive may benefit further from HBIG in addition to vaccination, especially if they are also HBeAg-positive. Because neonates are universally receiving passive and active immunoprophylaxis, the rate of HBV transmission has dropped by 85–95%. Therefore, the WHO and the majority of guidelines recommended that infants delivered to women who tested positive for HBsAg receive the HBIG and Hepatitis B vaccines within 12 hours of delivery [21]. As part of the full immunoprophylaxis procedure, the infants also need to receive at least two further doses of the HBV vaccine at one month and six months after birth [13].

By 2030, the World Health Organization wants to completely eradicate HBV. To achieve this, efforts have to be made in endemic regions such as Sub-Saharan Africa to screen pregnant women for HBV infection, treat mothers with antiviral medication and offer infant post-exposure prophylaxis within 24 hours of birth. This could also be aided by creating awareness and educational campaigns in prenatal care for pregnant women in every healthcare setting.`

**1.3 AIM**

This study aims to Screen, Determine the Prevalence of Hepatitis B virus(HBV)infection evaluate the knowledge attitudes, practices, and risk factors of the virus (HBV) among pregnant women visiting prenatal clinics at Enugu State University of Technology (ESUT), Enugu.

**1.4 SPECIFIC OBJECTIVES**

1. Determine the frequency of HBV infection among expectant mothers at ESUT prenatal clinics and management of seropositive cases.
2. Determine the liver function of seropositive women through the analysis of biochemical parameters vis-a-vis ALT, AST, ALP and Bilirubin.
3. Determine the risk factors for HBV infection among ESUT pregnant women, such as shared personal hygiene products, unprotected sexual contact, history of blood transfusions or injections, and perinatal transmission.
4. Evaluate the knowledge, attitudes, and practices of pregnant women on testing, vaccination, prevention, and current HBV preventive measures.

**METHODOLOGY**

**RESEARCH DESIGN:** The chosen research design is a mixed cross-sectional design.

This is recommended as we will be combining both quantitative and qualitative methods to gather data at a single point in time.

**STUDY POPULATION:** All expectant mothers who attended the ESUT Parklane Hospital's antenatal care (ANC) clinic in Enugu, Nigeria, throughout the study period.

•Inclusion criteria: Pregnant women who are willing to engage and give informed consent.

•Exclusion criteria: Refusal to participate or insufficient data.

**STUDY AREA:** The study area is Enugu State University Teaching Hospital Parklane Enugu, Nigeria. Which is situated near Shoprite (Shopping Plaza) in the center of Enugu (Coal City) GRA. The hospital is run by the Enugu state government and has several accolades from various health agencies.

**SAMPLE SIZE**: Using an appropriate sample size calculator from calaculator.net and considering prevalence estimates from previous studies on HBV infection among pregnant women in Nigeria (around 14.1%) and a desired margin of error of not less than 5%, a sample size of 110 was determined and shall be recruited for this study.

Using the Cochrane Sample Size formula

**n=√(N×Z² ×p×q) ÷ (E² × (N-1)+ Z²×p×q)**

where N= estimated population size of ESUT =2000

Z= Confidence Interval= 1.96 or 95%

p = estimated proportion of the population (maternity ward)= 10% or 0.1

q = estimated proportion of population not being studied= 90% or 0.9

E= margin of error = 0.056

**SS = 110 participants**

**DATA COLLECTION:**

**Duration:** Data was collected over (3) months that is, September – November 2024.

**Data collection tools:**

A standard questionnaire designed to gather data on sociodemographic factors such as age, marital status, and education levels along with an assessment of their knowledge, attitudes and practices regarding hepatitis B infection shall be drafted and distributed amongst the recruited participants.

To determine the serological status, participants will be screened for HbsAg seropositivity and if reactive, liver function tests shall be conducted for them to evaluate disease progression indicated by increased serum glutamic pyruvic transaminase (SGPT) levels.

**Data collectors:** Trained research assistants familiar with informed consent procedures and data collection techniques shall be recruited for sample collection and questionnaire distribution.

**SAMPLE COLLECTION**: About 4mls of venous blood was collected with precision and care into plain sample containers. After about 10 minutes at room temperature, the samples are spun and the serum obtained is separated into new sets of plain tubes for analysis.

**SAMPLE ANALYSIS:** HbsAg test strips with the brand name: Palmatec, were used to run tests alongside positive and negative controls, following standard operating procedures for POCT testing according to ISO:15189; 2022.

Sero-positive samples were analyzed for liver function analytes with an automated chemistry analyzer- Selectra with special emphasis on ALT and AST levels.

**DATA ANALYSIS:**

Before analysis, the gathered data was prepared by cross-checking for missing information. Data collected was also anonymized to protect the confidentiality of participants. The data was then analyzed using the Statistical Package for Social Sciences SPSS. Descriptive statistics were used to summarize sociodemographic characteristics and HBV prevalence. Chi-square tests to assess associations between sociodemographic factors and HBV infection status was also done.

**ETHICAL CONSIDERATION:**

The Health Research Ethics Committee at Enugu State University Teaching Hospital granted an ethical clearance certificate, reference number:

Participants in the research gave their consent after being duly informed. The anonymous recording and coding of blood samples and results guaranteed the confidentiality of the

participants

**RESULTS**

**4.1 HEPATITIS B VIRUS AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINIC IN ESUT TEACHING HOSPITAL PARKLANE.**

One hundred and eleven (111) pregnant women were recruited for this study. 55% of the study population were between 26-35 years old while only 13.5% were between 36-45 years of age. The rest were between 15-25 years. 42.4% of the pregnant women had a university degree (B.Sc/B.A), while 41.4% had O’ level. Only 16.2% acquired primary school leaving certificate. 29.7%, 24.3% and 30.6% of the pregnant women were civil servants, artisans and traders respectively while only14.5% and 0.9% were students and unemployed respectively. Majority of the women were married (96.4%)

As only 0.9% were divorced and 2.7% was widowed. 38.7% and 39.6% were in their second and third trimester of pregnancy respectively while the rest were in their first trimester. Majority (68.5%) of the pregnant women had 2-3 children already.

|  |  |
| --- | --- |
| **Demographic data** | N (%) |
| **Age**  15-25  26-35  36-45  **Educational level**  FSLC  O’ level  B.Sc/B.A  **Occupation**  Civil servant  Artisan  Traders  Students  Unemployed  **Marital status**  Married  Divorced  Widowed  **Trimester of pregnancy**  First trimester  Second trimester  Third trimester  **Number of previous pregnancies**  0-1  2-3  4-5  >6 | 35(31.5)  61(55)  15(13.5)  18(16.2)  46(41.4)  47(42.4)  33(29.7)  27(24.3)  34(30.6)  16(14.5)  1(0.9)  107(96.4)  1(0.9)  3(2.7)  24(21.6)  43(38.7)  44(39.6)  23(20.7)  76(68.5)  11(9.9)  1(0.9) |

**Knowledge, Attitude and Practices**

|  |  |
| --- | --- |
| **Knowledge about hepatitis** | N (%) |
| **What is Hepatitis B?**  A liver infection caused by a virus  A common cold  I don’t know  **How can Hepatitis B be transmitted?**  From mother to baby during pregnancy or childbirth  Unprotected sexual contact  Sharing personal items like toothbrush, razor, syringe etc  **What are some symptoms of Hepatitis B?**  No symptoms in all cases  Fatigue, nausea and vomiting  All of the above  Dark urine and yellowing of the skin (jaundice)  **Is there a vaccine available to treat Hepatitis B?**  Yes  No  I don’t know  **How can a woman protect her baby from Hepatitis B?**  Getting vaccinated during pregnancy  There is no way to prevent transmission  Giving birth through cesarean section | 54(48.6)  15(13.5)  42(37.8)  18(16.2)  43(38.7)  50(45.0)  35(31.5)  16(14.4)  15(13.5)  45(40.5)  79(71.2)  0  32(28.2)  67(60.4)  20(18.0)  24(21.6) |

Table 3

**Mean Score and Standard Deviation ATTITUDE - Likert scale**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| S/N | Items | N |  | SD | Decision |
| 1 | if I am diagnosed with Hepatitis B, I will be too embarrassed to seek treatment | 111 | 3.29 | 1.16 | Disagree |
| 2 | A pregnant woman with Hepatitis B cannot have a healthy baby | 111 | 3.65 | .85 | Disagree |
| 3 | Vaccination is an effective way to prevent Hepatitis B infection | 111 | 3.82 | .48 | Agree |
| 4 | It is important for all pregnant women to be tested for Hepatitis B | 111 | 3.62 | .86 | Agree |
|  | **Overall mean** |  | **3.60** | **0.84** | **Neutral** |

Table 4

|  |  |
| --- | --- |
| **Practices towards hepatitis prevention and management** | N(%) |
| **Have you ever been tested of Hepatitis B?**  Yes  No  **Do you plan to get vaccinated against Hepatitis B during pregnancy?**  Yes  No  **Do you share needles or syringe with anyone?**  Yes  No  **Do you have multiple sex partners?**  Yes  No | 3(2.7)  108(97.3)  94(84.7)  17(15.3)  5(4.5)  106(95.5)  0(0.0)  111(100) |

**Table 5. Mean and Standard Deviation of Knowledge, Attitude and Practice**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | N |  | SD | Decision |
| Knowledge | 111 | 3.39 | 0.94 | Very good |
| Attitude | 111 | 3.06 | 1.04 | Neutral |
| Practice | 111 | 3.60 | 0.84 | Excellent |

The result in Table 5 revealed that weighted overall mean scores and standard deviations of level of knowledge, attitude towards, and level of practice of Hepatitis B virus profile among pregnant women in ESUT teaching hospital Parklane were as follows ( = 3.39, SD = 0.94; = 3.06, SD = 1.04; and = 3.60, SD = 0.84 respectively). The result confirmed that whereas the participants had very good knowledge of hepatitis B, their practices towards its prevention were excellent, while their attitude towards its management was slightly positive (neutral).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ALT | ALP | AST | Direct Bilirubin | Total Bilirubin |
| **Test**  **Control**  **p-value** | 77.0±10.41  67.34±7.69  0.423 | 104.67±3.93  90.0±1.92  0.321 | 43.17±7.80  37.20±4.23  0.221 | 8.49±0.06  7.01±0.01  0.103 | 7.24±0.85  5.20±0.41  0.093 |

Only 2.7% of the pregnant women tested positive for hepatitis B virus. The remaining were negative. From the result, the ALT, ALP, AST, direct bilirubin and total bilirubin level (77.0±10.41, 104.67±3.93, 43.17±7.80, 8.49±0.06 and 7.24±0.85 respectively) of the positive participants were higher compared to the negative participants (67.34±7.69, 90.0±1.92, 37.20±4.23, 7.01±0.01 and 5.20±0.41 respectively. They were statistically not significant. The result was presented as Mean±std error of mean (SEM).

## DISCUSSION AND CONCLUSION

**Prevalence**

The findings of this study provide valuable insights into the hepatitis B virus (HBV) profile among pregnant women attending the Enugu State University of Technology Teaching Hospital Parklane. The low prevalence of HBV infection, with only 2.7% of participants testing positive, is noteworthy given the high rates reported in other studies across Nigeria and sub-Saharan Africa. For instance, a meta-analysis indicated a pooled prevalence of HBV infection among pregnant women in Nigeria to be around 6.49% [22], suggesting that the population in this study may benefit from effective screening and vaccination programs.

### Epidemiological Context

The global burden of HBV is substantial, with approximately 240 million individuals living with chronic infection [21]. In regions like sub-Saharan Africa, including Nigeria, the prevalence can reach as high as 12.2% [23], underscoring the importance of targeted public health interventions. The lower prevalence observed in this study could be attributed to several factors, including increased awareness and access to vaccination, which has been shown to significantly reduce the incidence of HBV [15]. The introduction of the hepatitis B vaccine into Nigeria's National Program on Immunization in 2004 may have contributed to this decline in prevalence among pregnant women.

### Knowledge, Attitudes, and Practices

The study revealed that the participants had very good knowledge of hepatitis B, as indicated by a mean knowledge score of 3.39. This finding aligns with previous studies that reported high levels of awareness among pregnant women regarding HBV transmission and prevention methods [24]. However, despite this knowledge, there remains a gap in practices related to testing and vaccination. Only 2.7% of women reported having been tested for HBV, which highlights a critical area for improvement.

This discrepancy between knowledge and practice is not uncommon in public health. Research has shown that while individuals may understand the risks associated with HBV, barriers such as stigma, fear of discrimination, and lack of access to healthcare can hinder their willingness to seek testing and vaccination [25]. The stigma associated with HBV infection, particularly among pregnant women, can lead to anxiety and reluctance to disclose their status, ultimately impacting their health outcomes [26].

### Risk Factors and Socioeconomic Influences

The study also aimed to identify risk factors associated with HBV infection among pregnant women. While the overall prevalence was low, understanding the socio-economic determinants that contribute to HBV transmission is essential. Factors such as limited access to healthcare services, inadequate health education, and socio-economic challenges were highlighted as barriers to effective screening and vaccination [27]. Pregnant women in Enugu State may face various obstacles, including financial constraints and cultural beliefs that discourage seeking medical care.

Additionally, the study found that most participants were married and had a relatively high level of education, with 42.4% holding a university degree. This demographic profile suggests that educational interventions may be effective in promoting awareness and encouraging preventive behaviours. However, it is crucial to address the knowledge gaps that still exist, particularly regarding the importance of testing and vaccination during pregnancy, with 28.2% having no knowledge of the availability of vaccination and 18% believing that there is no way of preventing MTCT of hepatitis B virus..

### 5.5 Implications for Public Health

The findings of this study underscore the need for enhanced public health initiatives aimed at increasing the screening rates for HBV among pregnant women in Enugu State. The World Health Organization recommends universal screening for HBV during pregnancy to identify infected women and implement appropriate management strategies [12]. Given the low testing rates or health-seeking behaviour observed in this study, there is an urgent need for healthcare providers to prioritize HBV screening in antenatal care settings.

Moreover, educational campaigns should focus on dispelling myths and reducing the stigma associated with HBV. Tailored health education programs that address the specific concerns of pregnant women can improve knowledge and encourage proactive health-seeking behaviours [28]. Such initiatives should also involve community engagement to foster a supportive environment for women to seek testing and treatment without fear of discrimination.

### 5.6 Conclusion

In conclusion, this study provides critical insights into the HBV profile among pregnant women in Enugu State University of Technology Teaching Hospital Parklane. The low prevalence of HBV infection is encouraging but highlights the need for continued vigilance in screening and vaccination efforts. Despite good knowledge levels, the low rates of testing and vaccination practices indicate significant gaps that must be addressed through targeted public health interventions.

To combat the ongoing challenge of HBV, it is essential to implement comprehensive strategies that include routine screening, education, and stigma reduction. By improving access to healthcare services and enhancing awareness about HBV, we can significantly reduce the incidence of mother-to-child transmission and improve maternal and child health outcomes in Enugu State and beyond.

### 5.7 Recommendations

* **Enhanced Screening Programs**: Implement routine HBV screening in all antenatal care clinics to ensure early identification and management of infected women.
* **Educational Campaigns**: Develop targeted educational programs to raise awareness about HBV transmission, prevention, and the importance of vaccination among pregnant women and healthcare providers.
* **Community Engagement**: Involve community leaders and organizations in promoting understanding and reducing stigma associated with HBV infection.
* **Access to Vaccination**: Ensure that all pregnant women have access to the hepatitis B vaccine and post-exposure prophylaxis for their infants.
* **Monitoring and Evaluation**: Establish a monitoring system to evaluate the effectiveness of public health interventions aimed at reducing HBV transmission rates among pregnant women.

**Reference**

1. Maitha GM. *Effects of Hepatitis B Virus Co-Infection on Immune Bio-Markers among Hiv Infected Patients Attending Comprehensive Care Clinics in Makueni County* (Doctoral dissertation).
2. Seto WK, Lo YR, Pawlotsky JM, Yuen MF. Chronic hepatitis B virus infection. The Lancet. 2018 Nov 24;392(10161):2313-24.
3. Tu T, Block JM, Wang S, Cohen C, Douglas MW. The lived experience of chronic hepatitis B: a broader view of its impacts and why we need a cure. Viruses. 2020 May 7;12(5):515.
4. Tang XD, Ji TT, Dong JR, Feng H, Chen FQ, Chen X, Zhao HY, Chen DK, Ma WT. Pathogenesis and treatment of cytokine storm induced by infectious diseases. International journal of molecular sciences. 2021 Nov 30;22(23):13009.
5. Yuen MF, Chen DS, Dusheiko GM, Janssen HL, Lau DT, Locarnini SA, Peters MG, Lai CL. Hepatitis B virus infection. Nature reviews Disease primers. 2018 Jun 7;4(1):1-20.
6. Papastergiou V, Lombardi R, MacDonald D, Tsochatzis EA. Global epidemiology of hepatitis B virus (HBV) infection. Current hepatology reports. 2015 Sep;14:171-8.
7. Trépo C, Chan HL, Lok A. Hepatitis B virus infection. The Lancet. 2014 Dec 6;384(9959):2053-63.
8. Lavanchy D, Kane M. Global epidemiology of hepatitis B virus infection. Hepatitis B virus in human diseases. 2016:187-203.
9. Lampertico P, Agarwal K, Berg T, Buti M, Janssen HL, Papatheodoridis G, Zoulim F, Tacke F. EASL 2017 Clinical Practice Guidelines on the management of hepatitis B virus infection. Journal of Hepatology. 2017 Aug 1;67(2):370-98.
10. Ma L, Alla NR, Li X, Mynbaev OA, Shi Z. Mother‐to‐child transmission of HBV: review of current clinical management and prevention strategies. Reviews in medical virology. 2014 Nov;24(6):396-406.
11. Nelson NP, Jamieson DJ, Murphy TV. Prevention of perinatal hepatitis B virus transmission. Journal of the Pediatric Infectious Diseases Society. 2014 Sep 1;3(suppl\_1):S7-12.
12. World Health Organization. Guidelines for the prevention care and treatment of persons with chronic hepatitis B infection: Mar-15. World Health Organization; 2015 Aug 5.
13. Yi P, Chen R, Huang Y, Zhou RR, Fan XG. Management of mother-to-child transmission of hepatitis B virus: Propositions and challenges. Journal of Clinical Virology. 2016 Apr 1;77:32-9.
14. Verstegen RH, Chang KJ, Kusters MA. Clinical implications of immune‐mediated diseases in children with Down syndrome. Pediatric allergy and immunology. 2020 Feb;31(2):117-23.
15. Stevens CE, Toy P, Kamili S, Taylor PE, Tong MJ, Xia GL, Vyas GN. Eradicating hepatitis B virus: the critical role of preventing perinatal transmission. Biologicals. 2017 Nov 1;50:3-19.
16. Ma L, Alla NR, Li X, Mynbaev OA, Shi Z. Mother‐to‐child transmission of HBV: review of current clinical management and prevention strategies. Reviews in medical virology. 2014 Nov;24(6):396-406.
17. Shih YF, Liu CJ. Mother-to-infant transmission of hepatitis B virus: challenges and perspectives. Hepatology International. 2017 Nov;11(6):481-4.
18. Bleich LM, Swenson ES. Prevention of neonatal hepatitis B virus transmission. Journal of Clinical Gastroenterology. 2014 Oct 1;48(9):765-72.
19. Hu YC, Yeh CC, Chen RY, Su CT, Wang WC, Bai CH, Chan CF, Su FH. Seroprevalence of hepatitis B virus in Taiwan 30 years after the commencement of the national vaccination program. PeerJ. 2018 Feb 16;6:e4297.
20. Lin CL, Kao JH. the prevention of hepatitis B‐related hepatocellular carcinoma. Alimentary Pharmacology & Therapeutics. 2018 Jul;48(1):5-14.
21. World Health Organization. Atlas of African health statistics 2022: health situation analysis of the WHO African Region—summary report.
22. Olakunde BO, Adeyinka DA, Olakunde OA, Uthman OA, Bada FO, Nartey YA, Obiri-Yeboah D, Paintsil E, Ezeanolue EE. A systematic review and meta-analysis of the prevalence of hepatitis B virus infection among pregnant women in Nigeria. PloS one. 2021 Oct 29;16(10):e0259218.
23. Olayinka AT, Oyemakinde A, Balogun MS, Ajudua A, Nguku P, Aderinola M, Egwuenu-Oladejo A, Ajisegiri SW, Sha'aibu S, Musa BO, Gidado S. Seroprevalence of hepatitis B infection in Nigeria: A national survey. The American journal of tropical medicine and hygiene. 2016 Oct 10;95(4):902.
24. Gboeze AJ, Ezeonu PO, Onoh RC, Ukaegbe CI, Nwali MI. Knowledge and awareness of hepatitis B virus infection among pregnant women in Abakaliki Nigeria. Journal of Hepatitis Research. 2015;2(3):1029.
25. Mokaya J, McNaughton AL, Burbridge L, Maponga T, O'Hara G, Andersson M, Seeley J, Matthews PC. A blind spot? Confronting the stigma of hepatitis B virus (HBV) infection-A systematic review. Wellcome open research. 2018;3.
26. Valizadeh L, Zamanzadeh V, Negarandeh R, Zamani F, Hamidia A, Zabihi A. Psychological reactions among patients with chronic hepatitis B: a qualitative study. Journal of caring sciences. 2016 Mar;5(1):57.
27. Nankya-Mutyoba J, Aizire J, Makumbi F, Atuyambe L, Ocama P, Kirk GD. Correlates of hepatitis B awareness and disease-specific knowledge among pregnant women in Northern and Central Uganda: a cross-sectional study. Hepatology, medicine and policy. 2018 Dec;3:1-0.
28. Afolabi IB, Aremu AB, Maidoki LA, Atulomah NO. Dynamics of Hepatitis B infection prevention practices among pregnant women attending antenatal care at Lubaga Hospital Kampala, Uganda using the constructs of information-motivation-behavioural skills model. BMC Public Health. 2022 Dec 1;22(1):2243.