



## Review article

## Prevalence of hepatitis B infection in the Gambian population: A narrative review of recent developments

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## ABSTRACT

Hepatitis B is a “silent epidemic”, fifty to a hundred (50–100) times more infectious than HIV, a potentially life-threatening liver infection caused by the hepatitis B virus (HBV). HBV can cause acute and chronic infection and subsequently results in a high risk of death from cirrhosis and liver cancer. Despite the availability of a safe and effective vaccine, HBV continues to be a global burden including in The Gambia. This study reviewed the recent trends in the epidemiological characteristics of HBV in the Gambia. The researchers conducted an online literature search for primary studies on HBV prevalence published in the past two decades from Jan 1992 to Feb 2022 inclusive on Google Scholar, PubMed, and Scopus. All retrieved studies were assessed for eligibility according to specific inclusion/exclusion criteria, data completeness, and methodological coherence. We found that HBV infection prevalence is above 8% in The Gambia. Moreover, HBV is the most common cause of hepatocellular carcinoma (HCC) in Gambia. Liver cirrhosis and HCC have the highest mortality contribution among hepatitis patients, with occult HBV carriers as major culprits. Also, vaccination coverage has declined from 91% to 88% according to reports from current literature. To achieve the WHO goal of eliminating HBV by 2030, policies targeting infection transmission control among risk groups, community awareness programs, research, price reduction of drugs, mass vaccinations, and diagnostics should be urgently instituted.

## 1. Background

HBV is a member of the Hepadnaviridae family. It is a small DNA virus with atypical features similar to retroviruses. HBV replication is through reverse transcription of an RNA intermediate (Liang, 2009; Herrscher et al., 2020). HBV is classified into ten genotypes (A–J) in which most of the genotypes have specific geographical distributions and subgroups (Liang, 2009; Lin and Kao, 2017; Lavanchy, 2004). Genotype A is highly prevalent in America, Africa, and Europe. Genotypes B and C are common in the Pacific region and Asia while genotypes E–J seem to be restricted to specific regions (Lin and Kao, 2017, Salim et al.,

2014). Genotype E is prominent in Saudi Arabia, Central Africa, and West Africa, which includes the Gambia (Lin and Kao, 2017, Malagnino et al., 2018).

HBV solely infects hepatocytes of humans and to some extent, non-human primates (Liang, 2009). It can cause both acute and chronic diseases. Most people are asymptomatic during the initial infection whilst some people experience acute illness with symptoms including extreme fatigue, vomiting, abdominal pain, jaundice, and nausea (WHO, 2021). Hepatitis B infection is grouped into the following clinical forms: Acute, chronic, fulminant, asymptomatic, and occult hepatitis B virus infection (OBI). Acute hepatitis B infection is an illness followed by

*Abbreviations:* N/A, Not available; MRC, Medical Research Council, The Gambia; OBI, Occult hepatitis B infection; ASIR, Age-standardized incidence rate; HCC, Hepatocellular carcinoma; IVDU, intravenous drug users; CRF, Chronic renal failure; HBV, Hepatitis B Virus; WHO, World Health Organization; HBs Ag, Hepatitis B Antigen; HIV, Human Immunodeficiency Virus; PCR, Polymerase Chain Reaction; MTCT, mother-to-child transmission; HBIG, hepatitis B immunoglobulin; NGOs, Non-Governmental Organizations; ELISA, Enzyme-linked immunosorbent assay; DNA, Deoxyribonucleic Acid; RNA, Ribonucleic Acid; PAP, peripartum antiviral prophylaxis (PAP); HepB-BD, hepatitis B birth dose vaccination; HepB3, hepatitis B infant vaccination.

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exposure to the hepatitis B virus within the first six months post-exposure whilst chronic hepatitis B virus infection is the continued presence of HBsAg in the blood for more than six months (Krajden et al., 2005, CDC website, Arababadi et al., 2011b).

Acute hepatitis can lead to acute liver failure and, subsequently death. Nearly one million people die every year due to chronic liver diseases. HCC is the second most common cause of death from cancers among women in The Gambia (Haghshenas et al., 2014, WHO, 2021, Bittaye et al., 2019a). According to the World Health Organization (WHO), about 296 million people were living with chronic hepatitis B infection in the year 2019, 60 million of whom are living in sub-Saharan Africa. Furthermore, data from the WHO estimates about 1.5 million new HBV infections annually (WHO, 2021, Bittaye et al., 2019a) and it is the 10th leading cause of death in the world (Alavian et al., 2007).

In high endemic areas, HBV is commonly transmitted from mother to child or through exposure to infected blood, including in the Gambia (Bittaye et al., 2019a, WHO, 2021, Shimakawa et al., 2016b). Hepatitis B virus infection is also transmitted through kissing, sexual intercourse, bedsheets, needles, and sharp objects. The elimination of hepatitis B and C is possible; however, the problem continues because of the different approaches and strategies by different countries based on access to resources, and 45% of the world population lives in high-prevalence areas (Kabir et al., 2017, Alavian et al., 2007, CDC website). The WHO recommends the use of oral antiviral agents (Tenofovir or entecavir) as the drug of choice in suppressing the hepatitis B virus. Tenofovir Disoproxil Fumarate (TDF) is used in the Gambia (Ndow et al., 2017).

This study brings updated knowledge on the prevalence of hepatitis B infection in The Gambian population and recent developments that will be useful for enhancing community awareness and formulating new strategies to fight against Hepatitis B. The findings and recommendations of this study will help generate ideas for a better understanding of the effective management and prevention of Hepatitis B infection and will benefit potential students, communities, health workers, governments, and non-governmental organizations (NGOs).

## 2. Methods and search strategy

### 2.1. Study Design

A narrative review was conducted to enable critical analysis of the literature published mainly in journal articles that are accessible from the chosen databases. This type of review is effective where the aggregation of data is difficult because different studies or fields are being analyzed (Baumeister and Leary, 1997, Slavin, 1995). A narrative synthesis based on research studies on the general epidemiology of HBV in The Gambia has been put together. The synthesis is part of a thesis, hence, obtained the approval of the Ethics and Research Committee of Tehran University of Medical Sciences with the appropriate IRB Code (IR.TUMS.MEDICINE.REC.1400.1145). The narrative synthesis strictly adheres to plagiarism rules and responsible and objective publication of data.

### 2.2. Search and data retrieval strategy

A review of published articles on the prevalence of HBV was done with a developed search strategy aimed at including studies using both qualitative and quantitative approaches. Scientific literature was searched in relevant databases (Google Scholar, Scopus, PubMed, Web of Science) for the years 1992 to 2022 inclusive. The search used the terms “(hepatitis B OR HBV) AND (Prevalence OR Epidemiology) AND (Gambia)”. The search was conducted with publication language restricted to English. Titles of articles were reviewed, followed by the abstracts and the full articles. All articles with the prevalence of only HBV infection and not coinfection in the relevant subpopulations were considered for inclusion.

## 3. Signs and symptoms of HBV

Most of the newly infected cases do not experience any symptoms, however, if symptoms occur, they begin at an average of 3 months post-exposure to the virus but can appear anytime between 8 weeks to 20 weeks after exposure. Symptoms of acute hepatitis B include; jaundice, fever, extreme fatigue, abdominal pain, nausea, vomiting, joint pain, and dark urine whilst chronic hepatitis B does not have any symptoms, and remains asymptomatic for a very long time. However, if symptoms do appear, they are similar to acute hepatitis but can be an alarming sign of advanced liver diseases (CDC website; WHO, 2021). The average incubation period to develop acute hepatitis is 90 days. HBsAg and antibodies to hepatitis B core antigen are the first serologic markers to be detectable in acute HBV infection (Shepard, 2006; Sagnelli et al., 2018, Shimakawa et al., 2016b). The possibility of an infected person developing symptoms of HBV is age-dependent. More than 90 percent of the perinatal infections are asymptomatic and the typical manifestation of acute hepatitis is noted in 5–15 percent of the newly infected children aged 1–5 years (CDC website; WHO, 2021).

### 3.1. Prevalence of HBV infection in the Gambia

In the Gambia, the prevalence of HBV infections is around 8% or more of the general population. The prevalence and burden of HBV infection in the Gambia from sampled articles are shown in Table 1 This is high and according to the WHO classification; it is among the high-prevalence regions of HBV infection.

### 3.2. The main routes of HBV transmission and prevention in the Gambia

There is a change in the pattern of HBV transmission from vertical to horizontal in The Gambia (Table 2). Similar changes have been observed in countries with neonatal vaccination programs. In sub-Saharan Africa, the major route of transmission in children is horizontal (Edmunds et al., 1996). The target of HBV treatment is to reduce the incidence of liver cancer, slow the progression of cirrhosis, and enhance long-term survival, however, patients may need to take these medications forever since they do not cure hepatitis B (CDC, 2021; WHO, 2021). To prevent mother-to-child transmission (MTCT) of hepatitis B, post-exposure prophylaxis with hepatitis B immunoglobulin (HBIG) and or an antiviral agent is recommended. Also, in pregnant women who have a high infectivity marker (i.e., HBV DNA  $\geq$  200 000 international units per mL or HBeAg-positive), the addition of peripartum antiviral prophylaxis (PAP) to hepatitis B birth dose vaccination (HepB-BD) and hepatitis B infant vaccination (HepB3) is recommended (Nayagam et al., 2023). Administration of blood safety strategies and safer sex practices also help in reducing hepatitis B transmission. The current vaccination coverage stands at 88% which indicates a sliding decline over three decades (Medicine, 2019). The Gambia was the first African country to implement the hepatitis B vaccine and achieved nationwide coverage of the Hepatitis vaccine by February 1990. Four doses of plasma-derived H-B-Vax were given intramuscularly in the deltoid region. The first dose at

**Table 1**

A summary of included studies conducted on only HBV prevalence in the general Gambian population.

Reference	Year	Sample size	HBV prevalence estimates % (95% CI)	Country/ City
Peto et al (Peto et al., 2014)	2014	4613	0.8** and 12.4	The Gambia
Lemoine et al. (Lemoine et al., 2016b)	2016	5980 and 5559	8.8(7.9–9.7) and 13.0 (12.1–13.9)	The Gambia
Bittaye et al (Bittaye et al., 2019a)	2019	426	9.2	The Gambia

\*\* Positive history of childhood vaccination.

**Table 2**  
Summary information of included studies that reported the main routes of HBV transmission in The Gambia.

Reference	Year	Route of transmission	Country/ City
Whittle et al (Whittle et al., 1990)	1990	Sibling-to-sibling	The Gambia
Ryder et al (Ryder et al., 1992a)	1992	Early postnatal transmission	The Gambia
U. Dumpis et al (Dumpis et al., 2001)	2001	Inter-familial and Intra-familial transmission (close contact during play, siblings-to-siblings, sharing the same bed during sleep and through other compound members.	The Gambia
Shimakawa et al (Shimakawa et al., 2014)	2014	Mother to infant	The Gambia
Shimakawa et al (Shimakawa et al., 2015)	2015	Perinatal transmission	The Gambia
Bittaye et al (Bittaye et al., 2019a)	2019	Vertical transmission, close contact between children, from carrier mother to her newborn, and perinatal transmission through contact with maternal blood and other body fluids during or soon after delivery	The Gambia

birth (first 24 h after birth) and the remaining three doses at two, four, and nine months (Inskip et al., 1991). According to a study conducted by Fortuin et al. 1993, the amalgamation of the HBV vaccine in the Gambian expanded program on immunization (EPI) has been effective in controlling the HBV chronic carrier state and gives hope for the prevention of liver cancer in adulthood. Vaccine efficacy against chronic HBV carriage and infection among 4-year-olds was 94% effective against chronic carriage and 84 % effective against infection. It suggests that vaccination in infancy gives a 94% efficacy in preventing chronic HBV carriage from progressing into liver cancer (Fortuin et al., 1993, Mele et al., 2002, Sowe et al., 2023). The main route of transmission appears to have shifted from vertical to horizontal in the Gambia. This implies that risk factors are changing and the necessary public health interventions are needed urgently. The Gambia Hepatitis Intervention Study previously conducted a study and established a 93% efficacy of childhood vaccination in preventing chronic HBV carriage at up to 9 years of age among Gambians (Viviani et al., 1999). However, according to Mendy et al, the vaccine efficacy against chronic and acute HBV infection was 95.1% and 85.4% respectively. The vaccine efficacy against HBV infection tends to decrease with age. The addition of the hepatitis B vaccine to the BCG vaccine immediately after birth is recommended to prevent early hepatitis B infection (Mendy et al., 2013). The Gambia hepatitis intervention study (GHIS) was also launched in 1986 to evaluate the efficacy of Hepatitis B vaccination in childhood. These are some of the strategies implemented to control HBV infection,

**Table 3**  
Various studies included that reported the main associated risk factors of HBV in the general Gambian population.

Country (city)	Author	Year	Sample size	HBsAg Positive, %	HBc Ab Positive, %	Associated Risk Factors
The Gambia	Kramvis et al (Kramvis and Kew, 2007)	2007	N/A	N/A	N/A	Intra and inter-familial transmission
The Gambia	Lemoine et al (Lemoine et al., 2016b)	2011–2014	5980	10.5	N/A	Male sex and middle-age
The Gambia	Umoh et al (Umoh et al., 2011)	2011	N/A	N/A	N/A	Male sex and younger age
The Gambia	Shimakawa et al (Shimakawa et al., 2014)	2014	N/A	N/A	N/A	A positive mother
The Gambia	Zampino R et al (Zampino, 2015)	2015	N/A	N/A	N/A	Male sex, younger age, scarification, unsafe sharing of daily practices of toiletries and sharpening, cutting, and scraping objects.

N/A: Not Available.

prevent chronic liver disease, and reduce the burden of liver diseases (Viviani et al., 2008a, Viviani et al., 2008b, Viviani et al., 2004). In the later years, the GHIS and the national vaccination program joined the Gambia National Cancer Registry to determine the impact of HBV vaccination in preventing HCC. Since the data collection is still ongoing, a reduction in HCC is expected to be similar to those studies done in Asia (Gomes et al., 2019).

### 3.3. Main risk factors of HBV in the Gambia

The significant risk factors of HBV infection in The Gambia are illustrated in Table 3. Some of the risk factors frequently mentioned in the studies include old age, male gender, marital status, history of contact with hepatitis, sexual activity, intravenous drug use, significant surgeries, visiting unqualified dentists, and certain occupations.

According to the reviewed literature, the most common risk factor for contracting HBV infection was age (22%) and male gender (21%), followed by interfamilial transmission (18%), and positive substance abuse. Although important, addiction status, marriages, level of education, and low socioeconomic status contributed to relatively low HBV risk factors.

### 3.4. Different genotypes of HBV in the Gambia

Sampled studies from the Gambia have been reviewed and summarized in Table 4. Very few studies have been conducted in this aspect. Though other genotypes, like genotype A, exist, evidence from the included studies highlighted genotype E as the dominant genotype in the Gambia.

### 3.5. HBV screening protocols in the Gambia

#### 3.5.1. Screening protocols in the Gambia

Since 2011, a point-of-care test has been used for HBV screening at the Edward Francis Small Teaching Hospital (EFSTH) blood bank, the only tertiary care hospital in Banjul, The Gambia. Blood donations at the EFSTH require individuals above 16 years of age and must be HBsAg negative. Blood donors with positive HBsAg are referred to a study nurse to provide post-test counseling and advise them to visit the Medical Research Center (MRC) clinic for a follow-up (Fig. 1) (Lemoine et al.,

**Table 4**  
A summary of the included studies that reported the different HBV genotypes in The Gambia.

Genotype	Reference	Year	Country (City)
A and E	U. Dumpis et al (Dumpis et al., 2001)	2001	The Gambia
E	Kramvis et al (Kramvis and Kew, 2007)	2007	The Gambia
E (95%)	Shimakawa et al (Shimakawa et al., 2016a)	2013	The Gambia
E	Zampino R et al (Zampino, 2015)	2015	The Gambia



Fig. 1. The HBV screening protocol used for individuals above 16 years before blood donation in EFSTH, The Gambia.

2016b, Nayagam et al., 2016, Ndow et al., 2017). West Africa initiates community-based testing and treatment for HBV in the fight against HBV infection.

### 3.5.2. HBV screen-and-treat interventions (WATCH-B)

The West African Treatment Cohort for Hepatitis B (WATCH-B) is one of the studies conducted in the Gambia and Senegal, using the rapid point-of-care test. This strategy was used to screen individuals in the communities and later invite HBV-infected participants for further assessment including HBV DNA measurement and those eligible for treatment were given Tenofovir. This strategy is feasible in identifying asymptomatic people with chronic HBV infection (Lemoine et al., 2016b; Montesano, 2011).

### 3.6. Global HBV control strategies in the Gambia

Most cases of HBV infection are asymptomatic hence screening individuals, especially in high and intermediate endemic regions is critical in controlling HBV infection. According to the WHO 2017 guidelines on hepatitis B and C testing, there are four approaches for testing HBV infection; mass screening which involves the general population, the focused testing of specific high-risk groups (prisoners, IVDU, individuals older than 40 years, and HIV patients), screening of pregnant women (part of the integrated antenatal services towards triple elimination of mother to child transmission of HIV, syphilis and viral hepatitis) and blood donor screening (Gomes et al., 2019). The WHO also recommends the vaccination of travelers to and from endemic areas (WHO, 2017). These guidelines have been adopted by different countries including the Gambia. However, HBV screening is still low in sub-Saharan Africa. Due to a lack of resources, many countries focus more on target groups and high-risk groups for screening (Lemoine et al., 2016a).

### 3.7. HBV-related HCC, cirrhosis, and other HBV-related outcomes

#### 3.7.1. The trend of Hepatocellular cancer in the Gambia

Hepatocellular carcinoma (HCC) is one of the most common cancers worldwide (Viviani et al., 1997, Umoh et al., 2011, Blum, 2011) with a high burden in The Gambia and West Africa at large. HCC among this population normally presents at very advanced stages (Umoh et al., 2011). The Gambia National Cancer Registry recorded 2975 cases of liver cancer from 1988 to 2006. Other data from (1988–2006) suggest an overall increase in liver cancer diagnosis in The Gambia. Hepatocellular carcinoma (HCC) was found to be the most frequent cancer indicating 62% and 28% of men and women, respectively of all cancer cases recorded in The Gambia National Cancer Registry (Sighoko et al., 2011, Kirk et al., 2004). Recent studies suggest a stable trend of liver cancer among men and an increase among females. A recent study comprised 323 cases from the Gambia and showed above 90% of the cases present with very advanced liver cancer (Bittaye et al., 2019b). The most common cancer in the Gambia is Hepatocellular carcinoma (HCC). Chronic Hepatitis B virus, Hepatitis C virus infection, alcohol consumption, and other toxins such as aflatoxins are risk factors for hepatocellular carcinoma. Fifteen to twenty (15%–20%) of the Gambian population are chronic carriers of HBV and HBV is the most common cause of HCC in the Gambia (Kirk et al., 2004, Viviani et al., 1997, Spearman et al., 2022). HCC in The Gambia presents uniformly with advanced disease and with the common presentation of a triad of weight loss, abdominal pain, and hepatomegaly. In The Gambia, most cases of HCC are attributable to HBV (57%) (Kirk et al., 2004). Also, perinatal

transmission may increase HCC risk more than horizontal transmission (Ryder et al., 1992b). The incidence rate of HCC among chronic HBV carriers is 55.5 per 100,000 persons per year and the survival rate is less than a year after HCC diagnosis in the Gambia. There is an increasing HBsAg prevalence with increasing birth order in full siblings (Shimawaka et al., 2015).

#### 3.7.2. Occult hepatitis B infection

Occult Hepatitis B virus infection is a form of hepatitis B infection in which HBsAg is undetected despite the presence of HBV-DNA in the serum. These individuals may have antibodies to HBV core antigen (HBc Ab) and HBs Ag, about 20% of OBI cases have anti-HBc negative. The Serum HBV level is usually less than  $10^4$  copies/mL. A sensitive HBV-DNA PCR assay is needed to diagnose occult OBI (Aghakhani et al., 2010, Arababadi et al., 2011a, Asli et al., 2016, Makvandi, 2016; Assar et al., 2012). It is a vital risk factor when it comes to post-transfusion hepatitis (PTH), reactivation of HBV, cirrhosis, and hepatocellular carcinoma (HCC) (Arababadi et al., 2012, Assar et al., 2012).

#### 3.7.3. Prevalence of occult hepatitis B (OBI) in the Gambia

Occult hepatitis B infection is a common outcome of HBV infection in the Gambia, West Africa. OBI is endemic with a prevalence of 18.3% among patients with advanced liver disease and 9.4% among the general population and it is an independent risk factor for advanced liver disease in The Gambia. OBI prevalence in the HBs Ag-negative adult population is similar to the HBs Ag prevalence in the Gambia. It has a significant association with advanced liver disease according to a study conducted by Ndow et al. (Ndow et al., 2021). The study indicates that 12% of the advanced liver disease cases in HBsAg-negative individuals are related to OBI, thus increasing the risk for HBV-related advanced liver diseases in The Gambian population. This indicates that occult HBV infection should be incorporated into the global strategy for eliminating viral hepatitis (Im et al., 2022).

### 3.8. Limitations

There was a problem with determining and integrating complex interactions when a large set of studies was involved, information from resources like EMBASE and Cochrane were not readily available for us, and data from populations like inmates were not readily available and difficult to retrieve. There was a limited number of articles or studies conducted in The Gambia.

### 3.9. Future suggestions

We recommend more epidemiologic studies on HBV vaccine research, HBV drug discovery, and HBV infection dynamics to inform preventive public health policy formulation and to create programs for HBV elimination and eradication. Future epidemiologic investigations should focus more on the different genotypes, risk factors, antiviral drug resistance, and vaccine escape mutations. Moreover, mandatory vaccination should be instituted for all travelers visiting endemic countries like Gambia. Lastly, antenatal HBs Ag screening (ELISA-based serology or point-of-care tests), vaccination, and awareness of post-exposure prophylaxis among healthcare workers should be obligatory.

## 4. Conclusion

HBV infection is highly endemic in the Gambia, and despite the

incorporation of universal HBV vaccination, the estimated HBS Ag prevalence is above 8%. The main route of transmission has shifted from vertical to horizontal in the Gambia. Despite the good health system and well-established strategies to eliminate HBV infection, HBV infection is still a burden in endemic areas and it is the most common cause of HCC in the Gambia. Catch-up vaccination, point-of-care tests, community awareness, a price reduction of drugs and diagnostics, and screen-and-treat intervention will help contribute to the elimination of HBV infection to achieve the WHO goal to eliminate HBV by 2030.

#### Ethics approval

The synthesis is part of a thesis, hence, obtained the approval of the Ethics and Research Committee of Tehran University of Medical Sciences with the appropriate IRB Code (IR.TUMS.MEDICINE.REC.1400.1145).

#### Consent for publication

Not applicable

#### Availability of data and materials

Not applicable.

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#### Authors' contributions

Conceptualization; MC, MMT, and ZA, Data curation: MMT and MC, Formal analysis: MC and MMT, Writing - original draft: MC and MMT, Project administration: MC, MMT, FG, and SA, Supervision: ZA, Writing - review & editing: MC, MMT, SA, FG, and ZA.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

No data was used for the research described in the article.

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