

## **A Geographic Epidemiological Review of Viral Hepatitis B**

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**Abstract:** *Hepatitis B virus (HBV) infection is a global public health problem that is epidemic in parts of Asia and Africa, and endemic in China and some other parts of Asia. Approximately 45% of the global population lives in the zones of high prevalence of chronic hepatitis B disease. Infectious Hepatitis B disease is an inflammatory liver disease that is caused by HBV, a member virus of the Hepadnavirus family and one of several viral species that affect hominoidea including humans. Medical Geographers' concern in infectious disease transmission is not only on the spatial spreads and transmission among populations, but also how the spread occurs; how many cases occurred, and how many might occur in the future; the possible constraints and barriers of the spread; where the cases occurred, and where they are likely to occur in the future. This article intended to review the geographic epidemiology of viral hepatitis B, and also examine the relevance of Health Field Model in explaining the geo-spatial spreads of HBV infectious disease and the causes of the disease complications among long-term HBV chronic carriers. This is because individual human genetic make-up, life style, physical, socio-cultural and built environments, and the utilization of healthcare services are the absolute determinants of the success or otherwise of human infectious diseases including the long-term impact of the infectious germs in human systems.*

**Key words:** *Hepatitis B, Infection, Disease, Epidemiology, Model*

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### **I. Introduction**

Infectious diseases have shown a dramatic rise in infectivity in the last twenty years despite the advancement in healthcare services through immunization, provision of modern healthcare facilities, new drugs, and more accuracy in diagnosis (Carballo, 2007). Infectious Hepatitis B virus (HBV) is one major global public health problem, and a potentially life-threatening infection attacking the liver to cause a deadly liver disease. More than 30% of the world population has been infected at one point in their lifetime, including the more than 350 million people who are currently infected chronically (WHO, 2000 and 2013). Approximately 15–40% of infected patients will develop scarring of the liver (liver cirrhosis), liver failure and/or liver cancer (hepatocellular carcinoma—HCC) (Lok, 2002).

Infectious Hepatitis B (HB) disease is an inflammatory liver disease that is caused by HBV, a member virus of the Hepadnavirus family and one of several viral species that affect hominoidea, including humans (Barker et al., 1996 and Willis, 2007). HB was in the beginning called "serum hepatitis" (Barker et al., 1996 and Willis, 2007), with epidemicity in parts of Asia and Africa, and endemic in China and some other parts of Asia (Williams, 2006 and Willis, 2007). Approximately 45% of the global population lives in the zones of high prevalence of chronic hepatitis B (CHB) (Mahoney, 1999).

High rates of CHB are found in the southern parts of eastern and central Europe, as well as the Amazon zone of South America. In the Middle East and the Indian subcontinent, an estimated 2–5% of the general population suffered CHB; meanwhile, it is less than 1% of the population in Western Europe and North America (WHO, 2013). However, the prevalence of HBV infection is specifically highest in sub-Saharan Africa and East Asia. Most people in these regions get infected during childhood and between 5–10% of the adult population are chronically infected (WHO, 2013).

### **II. Hepatitis B Viral Infectivity**

Hepatitis B virus (HBV) is highly infectious to the extent that it was successfully cultured in Egyptian mummies, and can survive on non living surface for not less than seven days (\_\_\_\_\_, 2010). HBV is said to be 10 times more deadly than Human Immuno-Deficiency Virus (HIV) (PM News Nigeria, 2013), in other words, it is 50-100 times more infectious than HIV (HBF, 2005 and WHO, 2013). The virus may be found in the blood, semen, vaginal secretions, menstrual blood, saliva, and to an infinitesimal degree in perspiration, the breast milk, tears and urine of the infected persons. It is highly resilient and resistant to breakdown, and can survive outside the body and easily transmitted through contact with infected body fluids (Lee, 1997).

HBV causes an acute illness with symptoms mimicking that of typhoid and/or Malaria (Anil Handoo, 2009), and can last for a number of weeks, causing liver inflammation, yellowing of the skin and eyes (jaundice), dark urine, pale stools, general body weakness and extreme fatigue, loss of appetite, nausea and vomiting, body joints' and abdominal pains, and sometimes death. The infection is said to be chronic when the virus last for more than six months in the human system, and this may cause liver cirrhosis, which may then lead to HCC and eventually death (Willis, 2007; Anil Handoo, 2009; and WHO, 2013). Unlike HIV, HBV infection may takes up to 20-40 years before it fully manifests in chronic carriers, and once it does, the liver would have been ravaged (PM News Nigeria, 2013).

In highly endemic zones which are mainly developing countries, the virus is mainly transmitted directly from mother to embryo, fetus or baby during pregnancy or childbirth, or from person to person in early childhood. Perinatal or early childhood transmission accounts for more than one-third of chronic infections in the zones of low endemicity. Sexual transmission and the use of contaminated needles, especially among injecting drug users, are also routes of infection, HBV can also be transmitted in a healthcare setting, blood transfusions, dialysis, acupuncture, tattooing, sharing razors or toothbrushes (PM News Nigeria, 2013 and WHO, 2013).

### **III. Epidemiology of Viral Hepatitis B**

Hepatitis B virus (HBV) infection is a global problem, and has been reported that its related illnesses cause an estimated 1–2 million deaths in the world annually with 5,000–6,000 deaths in low endemic America alone (Blumberg, 2002 and HBF, 2005). The infection is the 10th leading cause of death worldwide, with its associated liver cancer incidence increasing worldwide making it the 5th most frequent cancer in the world (Parkin, 2001). Moreover, 60–80% of the world's primary liver cancers are caused by HBV, which is one of the three major causes of death in Asia, Africa and the Pacific Rim (Lemon et al., 2000 and McGlynn et al., 2001). The prevalence of chronic hepatitis B (CHB) in areas of high endemicity is at least 8%. As of 2010, China has 120 million infected people, followed by India and Indonesia with 40 million and 12 million respectively, with an estimated 600,000 related deaths annually (WHO, 2013).

HBV infection is most prevalent in Asia and Africa including Nigeria (PM News Nigeria, 2013). About 20 million people were infected in Nigeria, and five millions are believed to have died due to its consequences (\_\_\_\_\_, 2010). The risk of contracting HBV in Nigeria is wide-ranging due to low vaccination rates and high exposure. Recent statistics about HBV chronic infections in Nigeria are very disturbing, that the pooled prevalence estimate for Nigeria was 13.6% with more than 20,000 million sero-positive cases, high HBV prevalence (25.7%) is recorded among surgeons (Musa *et al.*, 2015). The prevalence is higher in rural areas, where people have no or poor access to healthcare services. On the other hand, ignorance is very high in the urban areas. In 2004, Hepatitis B viral screening was carried out among migrant population of New York, US, 2,600 participants were screened, only five were positive and out of the five people positive, four of them were Nigerians and the fifth was Togolese (PM News Nigeria, 2013).

HBV infection is a major health problem in Nigeria due to its associated morbidity and mortality. The infection is in most cases asymptomatic in nature; moreover, the documentation of mortality is also very poor. Furthermore, many people especially in the poor rural settings do not seek formal medical care early unless at a late stage. Most of the rural healthcare centers lack the requisite adequate manpower, equipment and reagents for virologic diagnosis. However, recent surveys have incriminated hepatitis B viral disease as a major aetiological agent of chronic disease in Nigeria (HBF, 2005). In terms of prevention, there has been a vaccine against HBV infection since 1982, but was unfortunately not incorporated into Nigeria's National Immunization Programme until the year 2005 (\_\_\_\_\_, 2010).

In Nigeria, there are currently only four known government own healthcare centers that have the facilities to carryout HBV-DNA test. This is the most effective test for the depth of the viral infection. These centers are: National Institute of Medical Research, Yaba, Lagos; University of Jos Teaching Hospital; University College Hospital, Ibadan; and Aminu Kano Teaching Hospital, Kano. Musa *et al.* (2015) concluded that HBV infection is hyper-endemic in Nigeria; and this is because HBV vaccination in Nigeria is lower than in many Sub-Saharan African countries. In Nigeria, HBV is reported to be the most common cause of liver disease. However, the extent of HBV exposure among Nigerians at average risk is unknown.

### **IV. Spatial Spread and Risk Factors of Viral Hepatitis B**

Medical Geographers' interests in infectious disease transmission are not only on the spatial spreads and transmission among populations, but also how the spread occurs; how many cases occurred, and how many might occur in the future; the possible constraints and barriers of the spread; where the cases occurred, and where they are likely to occur in the future. The transmission of a disease is also a function of the characteristics of the disease agent itself, such as the virulence, incubation period and mode of transmission among others, and

the population in which it transmits (Meade and Erickson, 2000). The population groups that are at the highest risk of contracting HBV according to World Health Organization (WHO) (2013) are summarized in table 1.

Table 1: Population Groups at Highest Risk of Contracting Viral Hepatitis B

a)	The population group that frequently require blood or blood products, dialysis patients, recipients of solid organ transplantations
b)	The population group interned in prisons
c)	The population group injecting and using drugs
d)	The population group in household and sexual contacts with HBV infected people;
e)	The population group with multiple sexual partners, as well as health-care workers and others who may be exposed to blood and blood products through their work
f)	Travelers to endemic areas, and have not completed their hepatitis B vaccination series

Source: WHO (2013)

The likelihood that hepatitis B viral infection will progress to chronic disease depends on the age group at which the infection occurs. The higher the age, the less likely the progression from acute infection to chronic disease to take place (table 2).

Table 2: Progression from Acute Hepatitis B Infection to Chronic Disease and associate Complication

In infants	80–90% infected during the first year of life develop chronic infections
In children	30–50% infected before the age of 6 years develops chronic infections.
In adults	Less than 5% of otherwise healthy adults who are infected will develop chronic infection
	15–25% of adults who become chronically infected during childhood die from hepatitis B related liver cancer or cirrhosis.

Source: WHO (2013)

### V. Application of Health Field Model on Hepatitis B Disease Ecology

The factors that encourage disease transmission are so complex and diverse to the point that they need to be considered in totality (Peter *et al.*, 1997). Health Field Model (figure 1) developed by Lalonde (1974) is one of the disease study models for studying spatial spreads of diseases. And the model can be employed by geographers in their approach to understand the spatial and temporal spread of viral hepatitis B in human population. The model is comprised of four inter-dependent elements determined to influence human health.

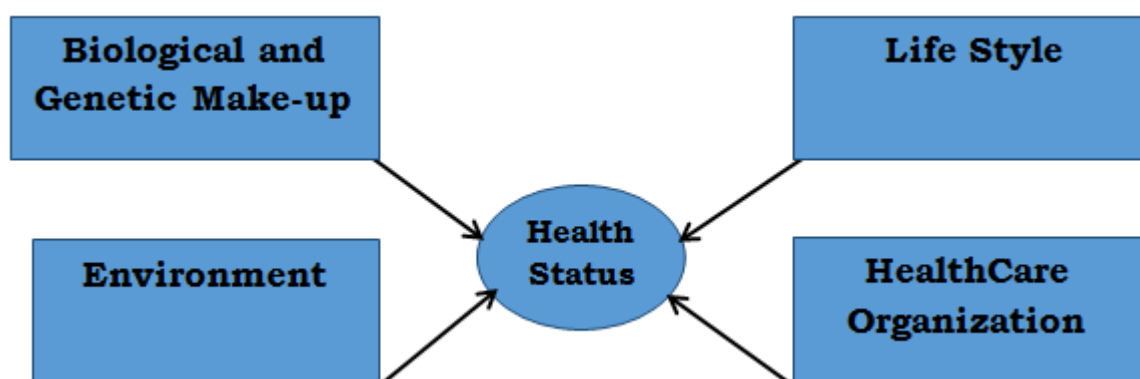


Fig 1: Health Field Model, Lalonde (1974)

1. **Human Biology and Genetic Make-up:** This element encompasses the genetic make-up of individual as inherited across generations, such as the gender, processes of maturation and aging, and the many complex internal systems in the body, such as skeletal, cardio-vascular, nervous, muscular, endocrine, and digestive among others (Lalonde, 1974). This element determines the strength of immunity and body resistance towards the hepatitis B virus. And it also has a direct impact on the ability of human systems to respond to treatment positively or otherwise.
2. **Lifestyle:** Lifestyle is but what you eat and what you do. It is the aggregation of decisions over which individuals have control. Personal decisions and habits that are bad, from a health point of view, create self-imposed risks. When those risks result in illness or death, the victim's lifestyle can be said to have contributed to, or caused, his own illness or death (Lalonde, 1974). In terms of what someone eats, lifestyle

of poor diet would always support not the immune system, and this is very bad for both people with acute and chronic HB. But for what someone does, life style such as having multiple sex partners, illicit drug use by mean of contaminated needles, tattooing, sharing razors or toothbrushes, and carelessness in medical services among others can expose individuals or groups into to a higher degree of chances for contracting HBV. In the case of HBV chronic carriers, more exercise and balance diet can slowdown the progression towards liver damage. While alcohol consumption and drug use among others can speed up the progression to liver failure.

3. **Environment:** The environmental element comprises of all those matters related to health which are external to the human body and over which the individual has little or no control. Population movement can to some extent influence where one found himself according to Carballo (2007). This factor can be sub-divided into four basic components as follows:
  - i) **Physical environment:** This includes certain aspects that affect the environment like attitude, climate, chemical composition of the soil, and quality of drinking water. All these among others play a one or another role in the activities and life cycle of the disease agent as well as susceptibility of the host.
  - ii) **Social-Cultural Environment:** Interactions between social, economic, political and cultural factors formed the concepts of socio-cultural environment which according to Peter et al (1997) effect disease transmission. Lalonde (1974) asserted that the socio-cultural environment represents socio-economic characteristics of the people such as income and literacy levels, relationship with a disease index case, proximity to index cases as well as history of infection. Fada (2014) stressed that whether one gets infected with a disease or not depends on the levels of participation and interaction with others from among humans, and domestic and wild animals within the society.
  - iii) **Built Environment:** This element includes the housing quality and location (Fada, 2014). It includes population density, housing design and construction, and agricultural and industrial process and pollutions.
  - iv) **Biological Environment:** This component of environment that influences human health is specifically concern with the level of interaction with disease agents, such as the hepatitis B virus, and the disease vectors and reservoirs where applicable.
4. **Healthcare Organization:** The quality, quantity, arrangement, nature and relationships of people and resources with respect to the provision, distribution and utilization of healthcare services and facilities, including physicians, nursing, hospitals, paramedical services, medical practice, nursing, nursing homes, medical drugs, public and community health care services, ambulances, and other health services (Lalonde, 1974). A good healthcare organization would always provide both preventive and treatment measures by means of providing to the populatiion HBV vaccination and HBV antiretroviral drugs respectively to the respective groups.

## VI. Hepatitis B Viral Infection Preventive Measures

The hepatitis B (HB) vaccine is the mainstay of HB prevention. The World Health Organization (WHO) recommends that all infants receive the hepatitis B vaccine as soon as possible after birth, preferably within 24 hours after birth. The HB vaccine has been available since 1982. And it is 95% effective in preventing infection and its chronic consequences, and was the first vaccine against a major human cancer (WHO, 2013). Other important measures were summarized in table 3 as adopted from Emechebe *et al.* (2009).

Table 3: Summary of control of HBV infection

a)	Universal immunization of children and adults at risk.
b)	Health education of the public to discard various habits and practices that encourages the transmission of HBV.
c)	Practice safe sex.
d)	Avoid sharing body cutting instruments.
e)	Universal screening of blood and blood products.
f)	Post exposure prophylaxis with HBV immunoglobulin and for babies born to HBsAg positive mothers.
g)	Improve socio-economic status of the citizens

Source: Emechebe *et al.* (2009)

## VII. Intervention of the World Health Organization

The World Health Organization (WHO) organizes World Hepatitis Day on July 28 every year to increase awareness and understanding of Viral Hepatitis. In addition to that, the organization is currently working in the following areas to prevent and control viral hepatitis as shown in table 4.

Table 4: World Health Organization Hepatitis B Intervention Measures

a)	Raising awareness, promoting partnerships and mobilizing resources
b)	Formulating evidence-based policy and data for action
c)	Preventing of transmission
d)	Executing screening, care and treatment

Source: WHO (2013)

### VIII. Conclusion

Hepatitis B virus (HBV) infection could be controlled through public enlightenment campaign, mass immunization of children and adult group at risk, while antiretroviral drugs and immune-stimulatory therapy should be provided for those already infected (Emechebe et al., 2009). Health Field Model of Lalonde (1974) had particularly and perfectly offered a helping hand in explaining from geographic perspectives the infectiousness and causes of complications of viral hepatitis B in human population.

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