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Overview of the Hepatitis B Epidemiology and Vaccination among Healthcare Workers

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Abstract

Introduction: Healthcare workers (HCWs) who are at high risk for HBV infection, have been recommended to receive the HB vaccine for over 20 years. This review aimed to highlight the enablers and obstacle facing the universal coverage of hepatitis B epidemiology and vaccination among healthcare workers.

Methods: A search was conducted using the following terms related to hepatitis B, vaccination, and healthcare workers in Africa: hepatitis B, hepatitis B virus, vaccination, immunization, healthcare workers, health workers, and health personnel. This review included cross-sectional, case-control, and cohort studies. Studies in English or French from any location were selected. A search was conducted for articles published from 1970 to 2022 in PubMed and the Excerpta Medica Database (Embase) using search terms related to hepatitis B and healthcare workers.

Results: This study analyzed 25 cross-sectional studies on healthcare workers (HCWs) in African countries to determine the prevalence of hepatitis B vaccination. The majority of the studies were conducted in hospitals and included HCWs from West and East Africa. After assessing the quality of the studies, 5 (14.3%) were found to be of high quality, 17 (77.1%) were of moderate quality, and 3 (8.6%) were of low quality. The proportion of HCWs who were fully vaccinated against hepatitis B varied widely, ranging from 0.8% in Rwanda to 72.0% in Libya. The overall pooled full vaccination coverage among HCWs in Africa was 24.7%. Subgroup analyses showed significant variation in vaccination coverage among HCWs in different regions of Africa and Asia, with the highest coverage in North Africa and the lowest in Central and East Africa.

Conclusions: Healthcare workers (HCWs) are at higher risk of infection with Hepatitis B virus (HBV) compared to individuals who do not work in hospitals, with frequencies of infection up to 4 times higher. HBV can be transmitted between patients and HCWs, as well as between HCWs and their relatives, contributing to the ongoing chain of transmission.

Keywords: *Hepatitis, Vaccine, Epidemiology, Healthcare workers, Prevalence.*

Introduction

HBV infection is a significant global health problem and a leading cause of infectious disease mortality. Regions with at least 8% of the population being positive for the hepatitis B surface antigen (HBsAg) are considered to have a high prevalence of HBV infection. The presence of hepatitis B e antigen (HBeAg) in the blood is associated with higher levels of HBV and increased infectivity [1]. Outbreaks of hepatitis B have also been linked to tattooing and acupuncture, as well as sexual transmission from individuals with acute or chronic hepatitis B. In developed countries, including those in northern and western Europe, the highest incidence of acute hepatitis B is among young adults, and high-risk sexual behavior and injection drug use are responsible for most new cases of hepatitis B [2].

The hepatitis B (HB) vaccine has been available since the 1980s and has been shown to provide long-term protection against HB infection. Studies have evaluated long-term protection through the anamnestic (booster) response to the vaccine, *in vitro* testing of B- and T-cell activity, and infection rates in vaccinated populations. It is unknown whether individuals who do not respond to a booster dose will still be protected against HB infection, but it is speculated that the incubation period for HB infection may allow sufficient time for the immune system's memory to provide protection against acute symptoms and chronic infection. In addition to humoral immunity, cellular immunity induced by the vaccine is also important in preventing HBV infection [3]. HBV infection used to be a common occupational hazard among healthcare workers, but vaccination and the implementation of universal precautions have made it a rare occurrence in this population. The main goal of HBV prevention programs is to reduce chronic liver disease and chronic HBV infection, with a secondary goal of preventing acute hepatitis B. The World Health Organization recommends that all countries include the HB vaccine in their routine infant immunization programs, but many children around the world still remain at risk for HBV infection. In countries such as Italy and the United States, the incidence of acute type

hepatitis B has significantly declined in recent years, particularly among younger age groups [4]. The infrastructure for delivering the vaccine to children is already in place and the vaccine has been shown to provide long-term protection against chronic HBV infection. Most HBV transmission and morbidity from acute hepatitis B occur among older adolescents and young adults and are often the result of sexual transmission. The first licensed HB vaccines were made from purified HBsAg derived from plasma, but most currently available vaccines are produced using recombinant DNA technology. HB vaccines are usually given in a series of three doses, but two- and four-dose schedules are also available for certain age groups. Adhering to the licensed vaccination schedules results in a protective concentration of anti-HBs (10 mIU/ml) in 90-100% of healthy infants, children, and adults [5].

The safety of the HB vaccine has been demonstrated in clinical trials and post-licensure safety analyses. It is now one of the most widely used vaccines in the world. Epidemiological studies have not found a causal link between the HB vaccine and sudden infant death syndrome or other causes of death in the first year of life. Despite concerns about a potential association between the HB vaccine and the development of diabetes mellitus or demyelinating diseases, large controlled epidemiological studies have not found evidence of a causal link. Vaccine failures due to HBV variants with mutations in the small surface protein (S) gene (S mutants) have occurred in infants who were perinatally exposed to HBV and received the HB vaccine or hepatitis B immune globulin appropriately, but still had concentrations of anti-HBs that are usually protective [6]. Occupational exposure to HBV is a well-known risk for healthcare workers (HCWs), who can be exposed to the virus through cuts or mucous membrane contact with blood, often through needle sticks or other sharp injuries. In the past, occupationally acquired HBV accounted for as much as 4.5% of reported cases of acute hepatitis B in the US. In 1982, a vaccine for HBV infection was licensed in the US and the Advisory Committee on

Immunization Practices recommended vaccination for HCWs who were at risk of occupational exposure to blood. In 1991, the Occupational Safety and Health Administration required employers to offer free HB vaccination to employees who were likely to come into contact with blood or other potentially infectious materials. Studies have shown that vaccination coverage among hospital-based HCWs was 51% in 1992 and 66.5% in 1995 [7,8]. The Centers for Disease Control and Prevention has set a goal of achieving 98% vaccination coverage among HCWs as part of the Healthy People 2010 initiative, which aims to eliminate occupationally acquired HBV infection in the US. A survey of a representative sample of hospitals found that vaccination coverage among HCWs varied and was associated with certain hospital characteristics and vaccination policies. Despite the low incidence of acute hepatitis B, outbreaks of patient-to-patient transmission of HBV and hepatitis C virus have occurred, highlighting the continued risk of exposure to bloodborne pathogens in the healthcare setting. HCWs, who are at high risk for HBV infection, have been recommended to receive the HB vaccine for over 20 years [9,10]. This review aimed to highlight the enablers and obstacle facing the universal coverage of hepatitis B vaccination among healthcare workers.

Methods

A search was conducted using the following terms related to hepatitis B, vaccination, and healthcare workers in Africa: hepatitis B, hepatitis B virus, vaccination, immunization, healthcare workers, health workers, and health personnel. The following data were collected from the resulting articles and entered into a form using Microsoft Excel: author, year of publication, country where the study was conducted, sample size, response rate, and hepatitis B vaccination coverage based on the percentage of healthcare workers who were fully vaccinated (received three or more doses of the hepatitis B vaccine) or partially vaccinated (received one or two doses of the vaccine). This review included cross-sectional, case-control, and cohort studies. Studies in English or French from any location were selected. A search was conducted for articles published from 1970 to 2022 in PubMed and the Excerpta Medica Database (Embase) using search terms related to hepatitis B and healthcare

workers. The reference lists of relevant articles were also reviewed to identify additional data sources. Duplicate studies were removed and the titles and abstracts of the remaining articles were screened by four investigators. The full texts of potentially eligible studies were obtained and further assessed for inclusion. Data from the included studies was extracted using Google Forms. The classification divides healthcare workers into the following categories: health professionals, health associate professionals, personal care workers in health services, health management and support personnel, and other health service providers not classified elsewhere.

Results and discussion

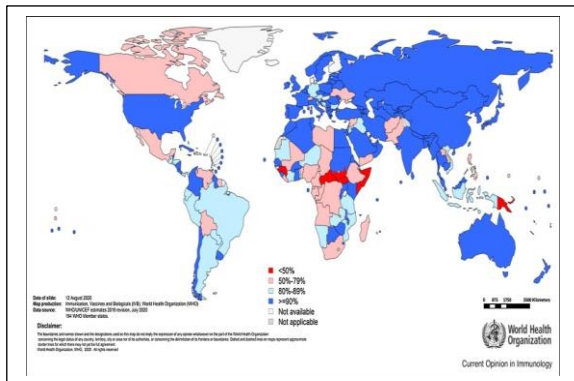
This study analyzed 25 cross-sectional studies on healthcare workers (HCWs) in African countries to determine the prevalence of hepatitis B vaccination. The majority of the studies were conducted in hospitals and included HCWs from West and East Africa. After assessing the quality of the studies, 5 (14.3%) were found to be of high quality, 17 (77.1%) were of moderate quality, and 3 (8.6%) were of low quality [11-14]. The proportion of HCWs who were fully vaccinated against hepatitis B varied widely, ranging from 0.8% in Rwanda to 72.0% in Libya. The overall pooled full vaccination coverage among HCWs in Africa was 24.7%. Subgroup analyses showed significant variation in vaccination coverage among HCWs in different regions of Africa, with the highest coverage in North Africa and the lowest in Central and East Africa [15-18]. Medical doctors had a higher coverage rate than nurses, and HCWs with 10 or more years of work experience were more likely to be vaccinated than those with less experience. The most commonly reported reasons for non-vaccination among HCWs were lack of awareness, lack of access to vaccination, and fear of side effects. There was a need for improved vaccination programs and initiatives to increase awareness and access to vaccination for HCWs in Africa. Studies have shown that the coverage of the Hepatitis B vaccine (HepB) among healthcare workers (HCWs) varies widely, ranging from 15.4% to over 90% in general practitioners (GP) and 40.0% in midwives (MP). Low HepB uptake has resulted in suboptimal protective

levels of anti-HBs antibodies, ranging from 30.6-66.7% in GP, 49% in the Kwa-Zulu Natal Province, 84.3% in the Western Cape Province, and 87.2% in MP [19]. A concerning finding is that 18.8% of GP and MP HCWs were protected through natural infection, rather than vaccination. In addition, some students have opposed the requirement for proof of immunity as a requirement for participating in clinical training, citing unaffordability as a factor. A survey from 2018 found that 35 out of the European Union (EU) countries have policies recommending or mandating HepB for HCWs. Free HepB vaccines are provided to all HCWs in 26 countries, while in three countries, free HepB is provided to specific categories of HCWs as part of a policy of financing only mandatory vaccinations [20]. In nine EU countries, HepB is required for employment for some or all categories of HCWs in specific or all healthcare settings. Successful strategies for increasing coverage of HepB and other HCW vaccines generally involve a combination of approaches, including free and easy access to vaccines, "soft mandates" (e.g. requiring unvaccinated HCWs to sign declination forms and wear masks during patient contact), behavior change interventions (e.g. incentives, reminders, and education), and high-level promotion of vaccination. Some African countries face similar challenges to those in South Africa in terms of low vaccination coverage among HCWs [15].

Globally, over two billion people have evidence of past or current HBV infection, and there are more than 350 million chronic carriers of the virus. In India, the prevalence of HBsAg among the general population ranges from 2% to 8%, placing the country in an intermediate HBV endemicity zone [21]. India also has 50 million cases of chronic HBV infection, making it the second largest global pool of such infections. The seroprevalence of HBV is two to four times higher among healthcare workers compared to the general population. When a person is infected with HBV, the first detectable marker in the serum is HBsAg, which appears before the elevation of serum aminotransferase levels and clinical symptoms. HBV infection is a well-recognized occupational risk for HCWs, particularly those with frequent contact with blood in the workplace and those exposed to HBsAg-positive individuals. Most HBV infections in

healthcare workers are caused by percutaneous exposure, but many infected HCWs do not recall any overt injuries. HBV has also been shown to survive in dried blood on environmental surfaces for extended periods of time, increasing the risk of transmission through contact with such surfaces [22]. In addition, body fluids such as blood, which contain the highest HBV titers of all body fluids, pose a significant risk for transmission in healthcare settings. The risk of HCWs acquiring occupationally-related HBV infection is associated with several factors, including the frequency of blood or needle-stick exposures in the workplace and the HBV endemicity of the region. In developing countries with high HBV prevalence, the risk of occupational exposure is particularly high. In a study conducted in a tertiary care hospital in Delhi, it was found that only 1% of healthcare workers were HBsAg positive [23].

Over 90% of perinatal HBV infections are asymptomatic, while symptoms of acute hepatitis occur in 5-15% of young children (1-5 years old) and 33-50% of older children, adolescents, and adults. Symptoms of acute hepatitis B can include nausea, abdominal pain, vomiting, fever, jaundice, dark urine, changes in stool color, and enlargement of the liver or spleen. Those who recover from HBV infection will eliminate HBsAg from their blood and develop antibodies to hepatitis B surface antigen (anti-HBs) during their recovery. Those who develop HBV-related complications like cirrhosis or hepatocellular carcinoma may be asymptomatic until diagnosis or may have periodic flare-ups of acute hepatitis symptoms [17]. Recently approved treatments for chronic hepatitis B are being used to suppress HBV replication and improve liver health in some patients. Before universal infant hepatitis B vaccination was implemented, an estimated 16,000 children under 10 years old were infected with HBV each year in the US through exposure to HBsAg-positive household members or community contacts. While all of these measures can reduce the risk of HBV transmission, none have been as effective as active immunization with the HB vaccine, which is the most important measure for preventing hepatitis B [24]. It has been found that the annual proportion of healthcare workers exposed to blood-borne pathogens, including HBV, is 5.9%. The positivity rate for HBsAg, a marker of HBV



infection, was 2.4% in a study. In a study conducted in Japan, none of the 141 dental workers were HBsAg positive [25]. Studies in India have found that the prevalence of HBV infection among HCWs is 10% and 2.21%. In the United States, 75% of HCWs at risk for HBV infection had received three or more doses of the vaccine, while in Sweden, 79% of HCWs had received at least one dose, but only 40% were fully vaccinated. During the period from 2000-2004, self-reported HBV vaccination coverage among adults at risk for HBV infection increased from 30% to 45%, which may have contributed to the 35% decline in acute hepatitis B incidence during this time. Non-responders to the vaccine, defined as individuals who test negative for HBsAg and anti-HBc, may have a chance of responding to a second three-dose schedule, with response rates ranging from 30-50% [26,27].

Conclusions

Healthcare workers (HCWs) are at higher risk of infection with Hepatitis B virus (HBV) compared to individuals who do not work in hospitals, with frequencies of infection up to 4 times higher. HBV can be transmitted between patients and HCWs, as well as between HCWs and their relatives, contributing to the ongoing chain of transmission. There is significant heterogeneity across regions in terms of the routes of transmission, risk factors for infection, and interventions for prevention and immunization among HCWs, as well as variations in clinical practice. It is important to understand the global epidemiology of HBV infection in HCWs, including the seroprevalence, immunization rate, and risk factors, in

order to inform decision-making and develop context-specific interventions to reduce the burden of disease caused by HBV infection.

Conflict of interests

The authors declared no conflict of interests.

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