Epidemiology, transmission, and prevention of hepatitis B virus infection

AUTHORS: Eng-Kiong Teo, MD, Anna SF Lok, MD
SECTION EDITORS: Sheldon L Kaplan, MD, Rafael Esteban, MD
DEPUTY EDITOR: Jennifer Mitty, MD, MPH

All topics are updated as new evidence becomes available and our peer review process is complete.

Literature review current through: **Sep 2023.**
This topic last updated: **Sep 21, 2022.**

INTRODUCTION

Hepatitis B virus (HBV) infection is a global public health problem. The World Health Organization estimated that, in 2019, there were 296 million HBV carriers, 1.5 million new infections per year, and an annual mortality of 820,000 individuals (mostly from complications of liver cirrhosis and hepatocellular carcinoma) [1-4]. The implementation of effective vaccination programs in many countries has resulted in a significant decrease in the incidence of new hepatitis B infection. Nevertheless, HBV infection remains an important cause of morbidity and mortality.

The spectrum of clinical manifestations of HBV infection varies in both acute and chronic disease. During the acute phase, manifestations range from subclinical or anicteric hepatitis to icteric hepatitis and, in some cases, fulminant hepatitis. During the chronic phase, manifestations range from an asymptomatic carrier state to chronic hepatitis, cirrhosis, and hepatocellular carcinoma. Extrahepatic manifestations also can occur with both acute and chronic infection.

This topic review will discuss the epidemiology, modes of transmission, and prevention of HBV infection. The clinical manifestations and natural history of HBV infection as well as hepatitis B vaccination are discussed in detail separately. (See "Hepatitis B virus: Clinical manifestations and natural history" and "Hepatitis B virus immunization in adults".)

EPIDEMIOLOGY OF CHRONIC HBV

It is estimated that approximately two billion people worldwide have evidence of past or present infection with HBV, and 296 million individuals are chronic carriers (ie, positive for hepatitis B surface antigen [HBsAg]) [2-5]. The overall prevalence of HBsAg is reported to be 3.5 percent; however, it varies depending upon the geographic area (figure 1). The prevalence is highest in the Western Pacific, accounting for 116 million infections, followed by the African region, accounting for 81 million, and then the Eastern Mediterranean region and Southeast Asia, each accounting for 60 million infections [4]. Europe and the Americas account for 14 and 5 million, respectively.

Among children less than five years of age, the prevalence of chronic HBV is less than 1 percent [4]. The lower prevalence in children less than five years old reflects the effectiveness of the global vaccination program against hepatitis B; however, there is a need for higher vaccination coverage, in particular birth-dose HBV vaccine, to completely eliminate HBV infection among children. (See "Hepatitis B virus immunization in infants, children, and adolescents".)

The wide range in the prevalence of chronic HBV infection in different parts of the world is largely related to differences in the age at infection, which is inversely related to the risk of chronicity. The rate of progression from acute to chronic HBV infection is approximately 90 percent for perinatally acquired infection [6], 20 to 50 percent for infections between the age of one and five years [7,8], and less than 5 percent for adult-acquired infection [7].

In areas of low prevalence, many of the patients who have chronic HBV were born in countries where the prevalence is higher [9-15]. As an example, in an analysis of the National Health and Nutrition Examination Survey (NHANES), which includes data from approximately 20,000 persons, the prevalence of chronic HBV in the United States from 2007 to 2012 was estimated to be 0.3 percent; however, the prevalence among foreign-born non-Hispanic Black individuals during the same period was 2.5 percent [14]. In addition, from 2011 to 2012, the prevalence among non-Hispanic Asian persons (most of whom were foreign born) was estimated to be 3.1 percent, accounting for approximately 50 percent of chronic HBV cases in the United States during that time period. In another study that evaluated 1615 adults with chronic HBV from across the United States and in Toronto, Canada, only 18 percent were born in North America; of those who were born outside North America, most were from Asia (67 percent) and Africa (11 percent) [10].

In 2013, viral hepatitis, primarily due to HBV and hepatitis C virus, was the seventh leading cause of death worldwide [16]. Most mortality was attributable to liver cancer and cirrhosis.

Globally, the total number of deaths due to hepatitis B in 2019 was estimated to be 820,000 [4]. In 2017, the World Health Organization (WHO) estimated a 22 percent increase in hepatitis-related mortality since the year 2000 [17]. By contrast, in the United States, the rate of HBV-related mortality from 2017 to 2019 decreased from 0.46 to 0.42 deaths per 100,000 population [18]. Among the various subpopulations, HBV-related mortality was highest in Asians and Pacific Islanders. In China, where the disease burden is high, the death rate for HBV-related cirrhosis decreased from 8.8 to 3.9 per 100,000 from 1990 to 2017 [19]. However, from 1990 to 2016, the mortality from HBV-related liver cancer increased from 12.88 to 16.42 per 100,000 population [20]. This increase in liver cancer mortality suggests there may be a role for further improvements in the surveillance and treatment for hepatocellular carcinoma among chronic hepatitis B patients in China.

TRANSMISSION OF HBV

HBV is transmitted from patients who are infected to those who are not immune (ie, hepatitis B surface antibody [anti-HBs]-negative). Hepatitis B vaccination has significantly reduced the risk of transmission worldwide. (See "Hepatitis B virus immunization in adults" and "Hepatitis B virus immunization in infants, children, and adolescents".)

The predominant mode of HBV transmission varies in different geographical areas. Mother-to-child transmission is the predominant mode of transmission in high-prevalence areas [21,22]. In comparison, horizontal transmission, particularly in early childhood, accounts for most cases of chronic HBV infection in intermediate-prevalence areas, while unprotected sexual intercourse and injection drug use in adults are the major routes of spread in low-prevalence areas (table 1) [23].

In the United States, the incidence of acute HBV decreased by 81 percent from 1990 to 2006; the greatest decline was among children and adolescents [8]. From 2006 to 2013, the incidence of HBV infection generally remained stable at 1 case per 100,000 persons, with an estimated 19,764 newly infected patients in 2013 [24]. Rates were highest in adults, particularly males aged 25 to 44 years. However, during this period, the incidence of acute HBV infection increased in three states (Kentucky, Tennessee, and West Virginia); the greatest increase occurred in non-urban counties, and most were associated with drug use [25,26]. Several other states have also reported increases in acute HBV infection in the last decade, mainly among young adults who have not received HBV at birth [27]. Prior reports had identified sexual exposure (eg, sexual contact with a person known to have HBV, multiple sex partners, men who have sex with men) as the most common risk factor for HBV transmission in adults in the United States [8], while the more recent increases have been related to the opioid epidemic [27].

This section will review the different modes of transmission. A detailed discussion on prevention is found below. (See 'Prevention' below.)

Mother-to-child transmission — The infection rate of infants born to hepatitis B surface antigen (HBsAg)-positive mothers is as high as 90 percent among infants who do not receive hepatitis B immune globulin and hepatitis B vaccination at birth [6]. Mother-to-child transmission may occur in utero, at the time of birth, or after birth. However, most infections occur at the time of birth. (See "Hepatitis B and pregnancy", section on 'Mother-to-child transmission'.)

Passive and active immunization of the newborn within 12 hours of delivery has reduced the risk of HBV transmission by more than 95 percent. However, despite the proper use of prophylaxis, transmission can still occur. The risk appears to be greatest if the mother is positive for hepatitis B e antigen (HBeAg) and/or has a high HBV viral load. Among women with a high viral load, antiviral therapy for the mother can further reduce the risk of transmission. Detailed discussions on preventing mother-to-child transmission are found elsewhere. (See 'Mother-to-child transmission' below and "Hepatitis B virus immunization in infants, children, and adolescents" and "Hepatitis B and pregnancy", section on 'Prevention of mother-to-child transmission'.)

Breastfeeding — Breastfeeding does not appear to increase the risk of transmission. A discussion of breastfeeding among HBV-infected women is found elsewhere. (See "Hepatitis B and pregnancy", section on 'Breastfeeding and transmission'.)

Paternal transmission — Transmission of HBV from fathers to their infants is possible based upon genotypic and phylogenetic analysis. In a study conducted in Taiwan, the HBV infection rate was 65 percent among neonates born to HBsAg-negative mothers and HBsAg-positive fathers [28]. Most of these transmissions are believed to result from close contact of the unprotected infants with the infected blood and body fluids of the fathers. Although some studies have detected HBV in sperm, there is no clinical evidence to support that infected sperm result in transmission of HBV infection to the fetus [29-32].

Transfusion — The risk of acquiring HBV infection through blood transfusion varies depending on the HBV prevalence. In countries with low HBV prevalence, the risk can range from <1 to 1.4 per million donations [33]. By contrast, in countries with high HBV prevalence, the risk of HBV transmission through blood transfusion has ranged from 16 to more than 100 per million blood donations.

The World Health Organization suggests screening with both HBsAg and hepatitis B core antibody (anti-HBc) [34]. The risk of HBV transmission through blood transfusions was

significantly reduced after the introduction of serologic screening of donors for HBsAg [35]. The risk was further reduced by screening for anti-HBc in addition to HBsAg. Anti-HBc can be detected during the window phase when HBsAg is not present. (See "Hepatitis B virus: Clinical manifestations and natural history", section on 'Acute hepatitis'.)

In the United States, the residual risk of HBV transmission after screening for both HBsAg and anti-HBc ranged from approximately 1 in 280,000 to 1 in 357,000 donations [36]. This risk has been further reduced by the addition of HBV DNA screening, which was added to blood donor screening in the United States in 2009. HBV DNA is tested by mini-pool nucleic acid testing (MP-NAT); if NAT testing is positive in the mini-pool, the individual samples are further evaluated. The practice of testing for HBV nucleic acid as part of MP-NAT screening has lowered the risk of HBV transmission through transfusions to 1 in 1 million [37].

Some countries, including Singapore, Spain, and Germany, are also using NAT for screening of HBV infection. However, the implementation of NAT in countries with high prevalence, where mini-pool testing would identify HBV in as many as 9.5 per million donations [38], is hampered by the cost involved. An additional discussion on blood donor screening is found elsewhere. (See "Blood donor screening: Laboratory testing", section on 'Infectious disease screening and surveillance'.)

Sexual transmission — Sexual transmission remains a common source of HBV transmission [24,25,39]. As an example, in one report that evaluated 2220 cases of acute HBV infection in the United States, sexual risk was believed to account for HBV transmission in approximately 35 percent of the cases [25]. Unvaccinated men who have sex with men and heterosexual persons who have multiple sex partners or contact with sex workers are at particularly high risk [39]. In the United States, sexual transmission had been considered the primary source of transmission [8]; however, from 2006 to 2011, most new cases of acute HBV were associated with drug use [25], and this trend has continued.

Percutaneous inoculation — Percutaneous transmission usually happens among injection drug users (IDU) who share syringes and needles. A systematic review, which evaluated data from 59 countries, estimated that there were 6.4 million injection drug users who were anti-HBc positive, and 1.2 million who were HBsAg positive in 2010 [40]. In the United States, drug use has been reported to be the primary risk factor for HBV transmission in recent years [25,26]. The risk of HBV transmission increases with number of years of drug use, frequency of injection, and sharing of drug preparation equipment [41-43]. In addition to drug use, certain practices such as acupuncture, tattooing, and body piercing have also been associated with transmission of HBV through the use of equipment that is contaminated with HBV-infected blood [39].

Nosocomial infection — HBV can be transmitted in the health care setting [44-46]. One report describes 25 health care-associated hepatitis B outbreaks (two or more cases) reported in the United States between 2008 and 2019. In each case, there were multiple breaches of infection control protocols [46].

Nosocomial transmission generally occurs from patient to patient or from patient to health care providers (HCP) via contaminated instruments or an accidental needle stick. The number of HBV infections among HCP has declined significantly, due in large part to practice of universal precautions, efforts aimed at immunizing all HCP against HBV, and use of postexposure prophylaxis for nonimmune persons (ie, those who are unvaccinated or vaccine nonresponders). (See "Immunizations for health care providers" and "Prevention of hepatitis B virus and hepatitis C virus infection among health care providers".)

Although uncommon, transmission can also occur from an infected HCP to a nonimmune patient. Transmission usually results from unsafe injection practices, which often could have been avoided with standard precautions and appropriate aseptic techniques [47]. However, several reports have demonstrated that transmission can occur even when such policies are followed [48-50]. As an example, in a case series from 1996 to 2002, there were reports of 12 infected HCP infecting a total of 91 patients [50].

The risk of HBV transmission from infected HCP depends upon the HBeAg status and the HBV DNA level of the infected provider. Transmission is greatest among source patients with chronic HBV who are HBeAg positive or have high HBV DNA levels. HBV transmission has been reported when the HBV DNA level of the HCP was approximately 8000 international units/mL [51,52], but not in HCP with HBV DNA levels lower than 1000 international units/mL (the threshold used in the United States Centers for Disease Control and Prevention guidelines for HCP who conduct exposure-prone procedures) [53].

Transplant recipients — HBV infection can be transmitted from HBsAg-positive donors to HBsAg-negative recipients, with severe clinical consequences when the recipient is nonimmune (ie, anti-HBs-negative). (See "Infection in the solid organ transplant recipient", section on 'HIV, HTLV, and hepatitis viruses' and "Overview of infections following hematopoietic cell transplantation".)

Transmission of HBV infection has been reported after hematopoietic stem cell and solid organ transplantation. Among solid organ transplant recipients, the risk of post-transplant HBV infection is seen primarily among seronegative liver recipients [54]; however, cases have also been reported among those who received extrahepatic organs such as kidneys and even avascular tissues such as corneas from HBsAg-positive donors [55,56]. Among organ transplant

patients, transmission has also been reported when the donor had isolated anti-HBc (anti-HBc positive but HBsAg negative and anti-HBs negative) [57]. (See "Hepatitis B virus: Screening and diagnosis in adults", section on 'Isolated anti-HBc'.)

Other modes of transmission — Adults and children may acquire HBV infection via blood exposure to minor breaks in the skin or mucous membranes. In addition, transmission can occur via exposure to household articles that have been contaminated with blood, such as toothbrushes, razors, and toys, since HBV can survive outside the human body for a prolonged period [58]. Although HBV DNA has been detected in various bodily secretions of hepatitis B carriers, there is no firm evidence of HBV transmission via body fluids other than blood or semen. (See "Prevention of hepatitis B virus and hepatitis C virus infection among health care providers", section on 'Epidemiology of bloodborne exposures'.)

PREVENTION

Pre-exposure vaccination — Vaccination against HBV prior to an exposure is the best way to prevent HBV infection. Universal vaccination of newborns is recommended in most countries. In the United States, the Advisory Committee on Immunization Practices (ACIP) also suggests vaccination for adults <60 years of age as well as those of any age who are at high risk of exposure to HBV (table 2) [59]. (See "Hepatitis B virus immunization in adults" and "Immunizations for adults with chronic liver disease" and "Prevention of hepatitis B virus infection in adults with HIV" and "Hepatitis B virus immunization in infants, children, and adolescents".)

Post-exposure prophylaxis — Post-exposure prophylaxis to prevent HBV infection should be considered for individuals who have had an exposure that could potentially transmit HBV. These include percutaneous (eg, bite or needlestick) or mucosal exposures to blood or infectious secretions (eg, semen, body fluids that contain blood) of a patient who is HBsAg positive or whose HBsAg status is unknown.

The need for post-exposure prophylaxis and the type of prophylaxis depend upon the vaccination history and hepatitis B surface antibody (anti-HBs) status of the exposed patient and the HBsAg status of the source patient. A detailed discussion of post-exposure prophylaxis is found elsewhere. (See "Management of nonoccupational exposures to HIV and hepatitis B and C in adults", section on 'Exposure to hepatitis B virus'.)

Management of special populations — Pre-exposure hepatitis B vaccination is the best way to prevent HBV transmission. However, for certain groups of patients, additional strategies are also

used. An overview of these strategies is provided below.

Mother-to-child transmission — To reduce mother-to-child transmission, infants born to mothers who are HBsAg positive should receive active and passive immunization (ie, hepatitis B vaccine and hepatitis B immune globulin [HBIG]) as soon as possible and preferably within 12 hours of birth. In addition, administering antiviral therapy to mothers with high HBV viral loads can further reduce the risk of infection in the newborn. A more detailed discussion on preventing HBV transmission during pregnancy is found elsewhere. (See "Hepatitis B and pregnancy".)

Sexual exposure — HBsAg-positive patients should use condoms to reduce the risk of sexual transmission of HBV if their partner is not immune or if their partner's immune status is unknown. In addition, spouses and steady sex partners of a patient with chronic HBV should be screened to see if they have been previously infected. Those who are not immune and are without evidence of chronic HBV should be vaccinated and immunity verified by testing for anti-HBs one to two months after completing the course of vaccination. (See "Prevention of sexually transmitted infections" and "Hepatitis B virus immunization in adults".)

Percutaneous — To reduce the risk of percutaneous transmission of HBV (via drug use or piercings), patients should be educated about the use of sterile disposable needles and equipment. In addition, individuals who use injection drugs should be screened and vaccinated against HBV if not immune; vaccination without screening may also be considered to facilitate completion of vaccination. For such patients, it is also important to address the underlying substance use disorder. (See "Opioid use disorder: Pharmacologic management" and "Stimulant use disorder: Psychosocial management".)

Health care providers — Health care providers (HCP) should be immunized against HBV. In addition, HCP should be trained in techniques to minimize the risk of exposure to bloodborne pathogens. A detailed discussion of HBV prevention in HCP is found elsewhere. (See "Prevention of hepatitis B virus and hepatitis C virus infection among health care providers" and "Immunizations for health care providers", section on 'Hepatitis B vaccine'.)

To minimize transmission of HBV from an infected HCP to an uninfected patient, guideline panels have put forth recommendations regarding the types of procedures HCP can perform based upon the hepatitis B e antigen (HBeAg) and HBV DNA status of the infected provider [51,60-62]. As an example, in the United States, Centers for Disease Control and Prevention guidelines state that HBV-infected providers can conduct exposure-prone procedures if their HBV viral load is confirmed to be ≤1000 international units/mL or undetectable (spontaneously or while receiving antiviral therapy) on regular testing performed at least every six months [51].

Exposure-prone procedures include major abdominal, cardiothoracic, and orthopedic surgery, repair of major traumatic injuries, abdominal and vaginal hysterectomy, caesarean section, vaginal deliveries, and major oral or maxillofacial surgery. However, if a percutaneous exposure should occur, the uninfected patient should still receive post-exposure prophylaxis. (See 'Post-exposure prophylaxis' above.)

Transplant recipients — To help prevent HBV transmission to solid and hematopoietic transplant recipients, donors are routinely screened for HBsAg. In some countries, donors are also screened for anti-HBc and HBV DNA. It is unclear if testing donors for HBV DNA reduces the risk of HBV transmission to recipients. As an example, in a report from France that included 11,115 consecutive organ, tissue, and cell donors, HBV DNA was only detected in 0.07 percent of individuals without serologic markers for chronic HBV [63]. Thus, serologic testing is still the mainstay of screening [64].

Transmission of HBV infection can occur from HBsAg-negative, anti-HBc-positive donors to non-immune recipients, particularly in the setting of liver transplantation. To reduce this risk, prophylactic antiviral therapy is recommended.

The use of HBsAg-positive or HBV DNA-positive donors should be avoided for HBV-naïve recipients if a suitable donor without HBV is available. However, in situations where this is not possible, treatment of the donor and/or recipients with antiviral therapy and HBIG may help decrease the risk of transmission.

More detailed discussions on preventing HBV in transplant patients are found elsewhere. (See "Prevention of viral infections in hematopoietic cell transplant recipients", section on 'Hepatitis viruses' and "Kidney transplantation in adults: Hepatitis B virus infection in kidney transplant recipients", section on 'Suitable donors' and "Liver transplantation in adults: Preventing hepatitis B virus infection in liver transplant recipients".)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Hepatitis B vaccination" and "Society guideline links: Immunizations in children and adolescents" and "Society guideline links: Immunizations in adults" and "Society guideline links: Prevention of hepatitis B virus and hepatitis C virus infection among health care providers".)

SUMMARY AND RECOMMENDATIONS

- **Epidemiology** – It is estimated that approximately two billion people worldwide have evidence of past or present infection with hepatitis B virus (HBV), and 296 million individuals are chronic carriers (ie, positive for hepatitis B surface antigen [HBsAg]). The overall prevalence of HBsAg is reported to be 3.5 percent; however, it varies depending upon the geographic area (table 1). (See 'Epidemiology of chronic HBV' above.)

- **Transmission** – The predominant mode of HBV transmission varies in different geographical areas. Mother-to-child infection is the predominant mode of transmission in high-prevalence areas. In comparison, horizontal transmission, particularly in early childhood, accounts for most cases of chronic HBV infection in intermediate-prevalence areas. Unprotected sexual intercourse and injection drug use in adults are the major routes of spread in low-prevalence areas. (See 'Transmission of HBV' above.)

- **Prevention** – Vaccination against HBV prior to an exposure is the best way to prevent HBV infection (table 2). Additional strategies (eg, postexposure prophylaxis, antiviral therapy) can be used to reduce the risk of HBV transmission in those who are not immune to HBV and are at high-risk of exposure (eg, infants of HBsAg-positive mothers, sex and drug-using partners of patients who are HBsAg positive, transplant recipients). (See 'Prevention' above.)

REFERENCES

1. Maynard JE. Hepatitis B: global importance and need for control. Vaccine 1990; 8 Suppl:S18.
2. Ott JJ, Stevens GA, Groeger J, Wiersma ST. Global epidemiology of hepatitis B virus infection: new estimates of age-specific HBsAg seroprevalence and endemicity. Vaccine 2012; 30:2212.
3. The World Health Organization. Global Hepatitis Report, 2017. https://apps.who.int/iris/bitstream/handle/10665/255016/9789241565455-eng.pdf;jsessionid=DC3616B5BDF94FA8B6AC2FDBC71E5B51?sequence=1 (Accessed on June 17, 2020).
4. The World Health Organization. Hepatitis B. https://www.who.int/news-room/fact-sheets/detail/hepatitis-b (Accessed on March 13, 2022).
5. Schweitzer A, Horn J, Mikolajczyk RT, et al. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. Lancet 2015; 386:1546.

6. Stevens CE, Beasley RP, Tsui J, Lee WC. Vertical transmission of hepatitis B antigen in Taiwan. N Engl J Med 1975; 292:771.
7. Tassopoulos NC, Papaevangelou GJ, Sjogren MH, et al. Natural history of acute hepatitis B surface antigen-positive hepatitis in Greek adults. Gastroenterology 1987; 92:1844.
8. Wasley A, Grytdal S, Gallagher K, Centers for Disease Control and Prevention (CDC). Surveillance for acute viral hepatitis--United States, 2006. MMWR Surveill Summ 2008; 57:1.
9. Kowdley KV, Wang CC, Welch S, et al. Prevalence of chronic hepatitis B among foreign-born persons living in the United States by country of origin. Hepatology 2012; 56:422.
10. Ghany MG, Perrillo R, Li R, et al. Characteristics of adults in the hepatitis B research network in North America reflect their country of origin and hepatitis B virus genotype. Clin Gastroenterol Hepatol 2015; 13:183.
11. Canadian Immunization Guide, 7th ed, Public Health Agency of Canada, Ottowa, Ontario 20 06.
12. Mossong J, Putz L, Patiny S, Schneider F. Seroepidemiology of hepatitis A and hepatitis B virus in Luxembourg. Epidemiol Infect 2006; 134:808.
13. MacLachlan JH, Allard N, Towell V, Cowie BC. The burden of chronic hepatitis B virus infection in Australia, 2011. Aust N Z J Public Health 2013; 37:416.
14. Roberts H, Kruszon-Moran D, Ly KN, et al. Prevalence of chronic hepatitis B virus (HBV) infection in U.S. households: National Health and Nutrition Examination Survey (NHANES), 1988-2012. Hepatology 2016; 63:388.
15. Jung M, Kuniholm MH, Ho GY, et al. The distribution of hepatitis B virus exposure and infection in a population-based sample of U.S. Hispanic adults. Hepatology 2016; 63:445.
16. Stanaway JD, Flaxman AD, Naghavi M, et al. The global burden of viral hepatitis from 1990 to 2013: findings from the Global Burden of Disease Study 2013. Lancet 2016; 388:1081.
17. World Health Organization. Viral hepatitis: a hidden killer gains visibility. https://www.who.int/publications/10-year-review/hepatitis/en/index5.html (Accessed on June 17, 2020).
18. 2021 National Viral Hepatitis Progress Report. Centers for Disease Control and Prevention. Available at: https://www.cdc.gov/hepatitis/policy/npr/2021/NationalProgressReport2021.htm. (Accessed on March 16, 2022).
19. GBD 2017 Cirrhosis Collaborators. The global, regional, and national burden of cirrhosis by cause in 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Gastroenterol Hepatol 2020; 5:245.
20. Liu J, Liang W, Jing W, Liu M. Countdown to 2030: eliminating hepatitis B disease, China. Bull World Health Organ 2019; 97:230.

21. Alter MJ, Hadler SC, Margolis HS, et al. The changing epidemiology of hepatitis B in the United States. Need for alternative vaccination strategies. JAMA 1990; 263:1218.
22. Beasley RP, Hwang LY, Lin CC, et al. Incidence of hepatitis B virus infections in preschool children in Taiwan. J Infect Dis 1982; 146:198.
23. Kim WR, Ishitani MB, Dickson ER, et al. Rising burden of hepatitis B in the United States: Should the other virus be forgotten? (abstract). Hepatology 2002; 36:222A.
24. Centers for Disease Control. Surveillance for viral hepatitis – United States, 2013 http://www.cdc.gov/hepatitis/statistics/2013surveillance/commentary.htm#hepatitisB (Accessed on October 02, 2015).
25. Iqbal K, Klevens RM, Kainer MA, et al. Epidemiology of Acute Hepatitis B in the United States From Population-Based Surveillance, 2006-2011. Clin Infect Dis 2015; 61:584.
26. Harris AM, Iqbal K, Schillie S, et al. Increases in Acute Hepatitis B Virus Infections - Kentucky, Tennessee, and West Virginia, 2006-2013. MMWR Morb Mortal Wkly Rep 2016; 65:47.
27. Centers for Disease Control and Prevention. Viral Hepatitis Surveillance – United States, 2018. https://www.cdc.gov/hepatitis/statistics/SurveillanceRpts.htm. Published July 2020. (Accessed on August 23, 2020).
28. Lin CL, Kao JH, Chen BF, et al. Application of hepatitis B virus genotyping and phylogenetic analysis in intrafamilial transmission of hepatitis B virus. Clin Infect Dis 2005; 41:1576.
29. Ahmed MM, Huang TH, Xie QD. A sensitive and rapid assay for investigating vertical transmission of hepatitis B virus via male germ line using EGFP Vector as reporter. J Biomed Biotechnol 2008; 2008:495436.
30. Ahmed MM, Huang TH, Xie QD. An improved experimental model for studying vertical transmission of hepatitis B virus via human spermatozoa. J Virol Methods 2008; 151:116.
31. Huang JM, Huang TH, Qiu HY, et al. Effects of hepatitis B virus infection on human sperm chromosomes. World J Gastroenterol 2003; 9:736.
32. Hadchouel M, Scotto J, Huret JL, et al. Presence of HBV DNA in spermatozoa: a possible vertical transmission of HBV via the germ line. J Med Virol 1985; 16:61.
33. Candotti D, Laperche S. Hepatitis B Virus Blood Screening: Need for Reappraisal of Blood Safety Measures? Front Med (Lausanne) 2018; 5:29.
34. World Health Organization. Guidelines on assessing donor suitability for blood donation. http://iacld.ir/DL/elm/whoblooddonorselectionguidelinesonassessingdonorsuitabilityforblooddonation.pdf (Accessed on December 07, 2015).
35. Goh KT. Prevention and control of hepatitis B virus infection in Singapore. Ann Acad Med Singapore 1997; 26:671.

36. Zou S, Stramer SL, Notari EP, et al. Current incidence and residual risk of hepatitis B infection among blood donors in the United States. Transfusion 2009; 49:1609.

37. Stramer SL, Notari EP, Krysztof DE, Dodd RY. Hepatitis B virus testing by minipool nucleic acid testing: does it improve blood safety? Transfusion 2013; 53:2449.

38. Shang G, Seed CR, Wang F, et al. Residual risk of transfusion-transmitted viral infections in Shenzhen, China, 2001 through 2004. Transfusion 2007; 47:529.

39. World Health Organization. Hepatitis B fact sheet. http://www.who.int/mediacentre/factsheets/fs204/en/ (Accessed on December 07, 2015).

40. Nelson PK, Mathers BM, Cowie B, et al. Global epidemiology of hepatitis B and hepatitis C in people who inject drugs: results of systematic reviews. Lancet 2011; 378:571.

41. Hagan H, McGough JP, Thiede H, et al. Syringe exchange and risk of infection with hepatitis B and C viruses. Am J Epidemiol 1999; 149:203.

42. Des Jarlais DC, Diaz T, Perlis T, et al. Variability in the incidence of human immunodeficiency virus, hepatitis B virus, and hepatitis C virus infection among young injecting drug users in New York City. Am J Epidemiol 2003; 157:467.

43. Bialek SR, Bower WA, Mottram K, et al. Risk factors for hepatitis B in an outbreak of hepatitis B and D among injection drug users. J Urban Health 2005; 82:468.

44. Thompson ND, Perz JF, Moorman AC, Holmberg SD. Nonhospital health care-associated hepatitis B and C virus transmission: United States, 1998-2008. Ann Intern Med 2009; 150:33.

45. Gerberding JL. The infected health care provider. N Engl J Med 1996; 334:594.

46. Health care-Associated Hepatitis B and C Outbreaks (≥2 cases) Reported to the Centers for Disease Control and Prevention (CDC) 2008-2019. Centers for Disease Control and Prevention. Available at: https://www.cdc.gov/hepatitis/statistics/healthcareoutbreaktable.htm. (Accessed on March 17, 2022).

47. Williams IT, Perz JF, Bell BP. Viral hepatitis transmission in ambulatory health care settings. Clin Infect Dis 2004; 38:1592.

48. Harpaz R, Von Seidlein L, Averhoff FM, et al. Transmission of hepatitis B virus to multiple patients from a surgeon without evidence of inadequate infection control. N Engl J Med 1996; 334:549.

49. Centers for Disease Control and Prevention (CDC). Nosocomial hepatitis B virus infection associated with reusable fingerstick blood sampling devices--Ohio and New York City, 1996. MMWR Morb Mortal Wkly Rep 1997; 46:217.

50. Perry JL, Pearson RD, Jagger J. Infected health care workers and patient safety: a double standard. Am J Infect Control 2006; 34:313.

51. Centers for Disease Control. Updated CDC recommendations for the management of hepatitis B virus–infected health-care providers and students. http://www.cdc.gov/mmwr/pdf/rr/rr6103.pdf (Accessed on October 05, 2015).

52. Corden S, Ballard AL, Ijaz S, et al. HBV DNA levels and transmission of hepatitis B by health care workers. J Clin Virol 2003; 27:52.

53. Centers for Disease Control and Prevention (CDC). Updated CDC recommendations for the management of hepatitis B virus-infected health-care providers and students. MMWR Recomm Rep 2012; 61:1.

54. De Feo TM, Poli F, Mozzi F, et al. Risk of transmission of hepatitis B virus from anti-HBC positive cadaveric organ donors: a collaborative study. Transplant Proc 2005; 37:1238.

55. Hoft RH, Pflugfelder SC, Forster RK, et al. Clinical evidence for hepatitis B transmission resulting from corneal transplantation. Cornea 1997; 16:132.

56. Fabrizio F, Bunnapradist S, Martin P. Transplanting kidneys from donors with prior hepatitis B infection: one response to the organ shortage. J Nephrol 2002; 15:605.

57. Huprikar S, Danziger-Isakov L, Ahn J, et al. Solid organ transplantation from hepatitis B virus-positive donors: consensus guidelines for recipient management. Am J Transplant 2015; 15:1162.

58. Goh KT, Ding JL, Monteiro EH, Oon CJ. Hepatitis B infection in households of acute cases. J Epidemiol Community Health 1985; 39:123.

59. Weng MK, Doshani M, Khan MA, et al. Universal Hepatitis B Vaccination in Adults Aged 19-59 Years: Updated Recommendations of the Advisory Committee on Immunization Practices - United States, 2022. MMWR Morb Mortal Wkly Rep 2022; 71:477.

60. College of Physicians and Surgeons of British Columbia Resource Manual. Bloodborne Communicable Diseases in Physicians. www.cpsbc.ca. (Accessed on December 06, 2015).

61. American College of Surgeons. Statement on the surgeion and hepatitis. https://www.facs.org/about-acs/statements/22-hepatitis (Accessed on July 01, 2016).

62. United Kingdom Department of Health. Health clearance for tuberculosis, hepatitis B, hepatitis C and HIV: New healthcare workers. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/382152/health_clearance_tuberculosis_hepatitis_hiv.pdf (Accessed on July 01, 2016).

63. Challine D, Chevaliez S, Pawlotsky JM. Efficacy of serologic marker screening in identifying hepatitis B virus infection in organ, tissue, and cell donors. Gastroenterology 2008;

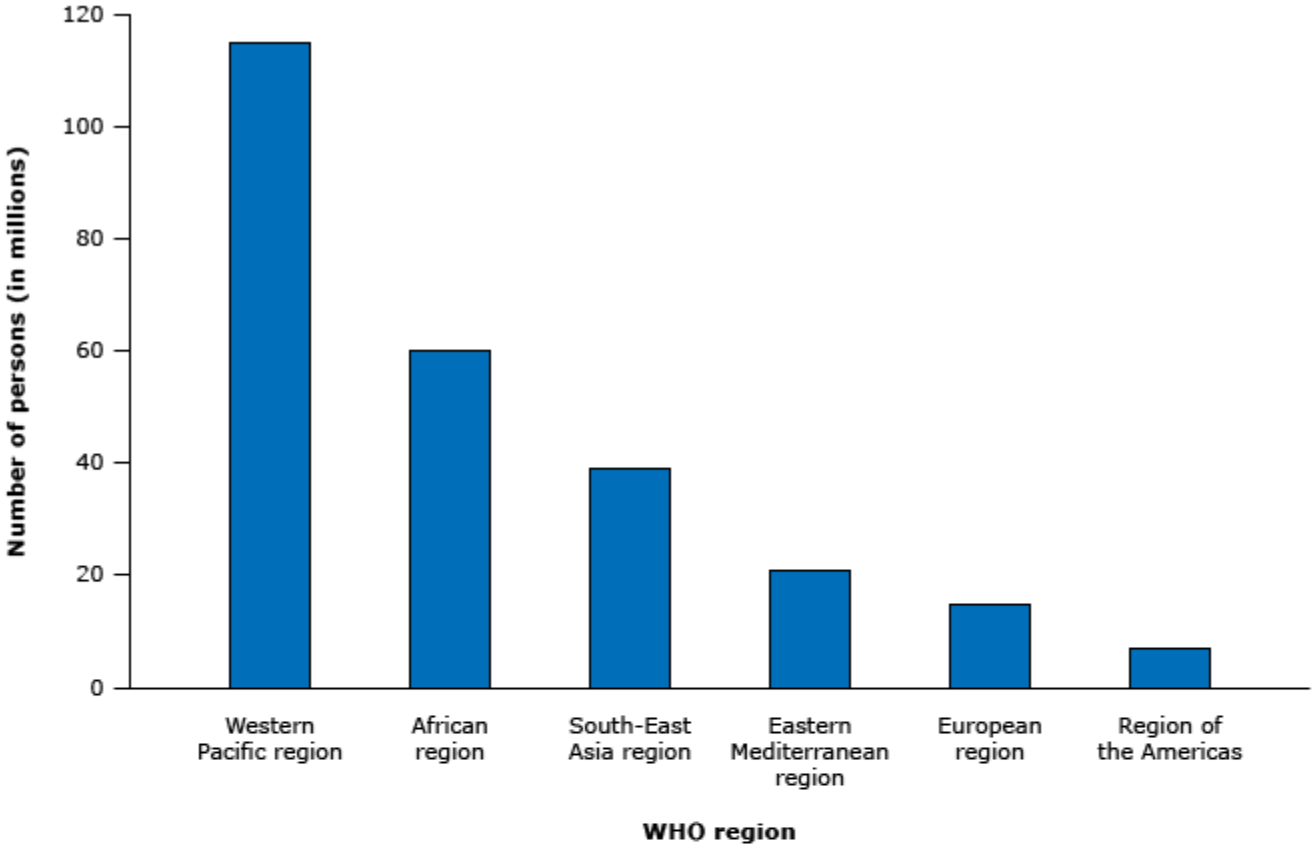
135:1185.

64. Theodoropoulos N, Jaramillo A, Ladner DP, Ison MG. Deceased organ donor screening for HIV, hepatitis B, and hepatitis C viruses: a survey of organ procurement organization practices. Am J Transplant 2013; 13:2186.

Topic 3630 Version 34.0

GRAPHICS

Prevalence of chronic HBV infection in the general population by WHO region, 2015



	Estimates of the prevalence of HBV infection (%)			Estimated number of persons living with HBV (millions)		
		Uncertainty interval (95%)			Uncertainty interval (95%)	
WHO region	**Best**	**Lower**	**Higher**	**Best**	**Lower**	**Higher**
African region	6.1	4.6	8.5	60	45	84
Region of the Americas	0.7	0.4	1.6	7*	4	16
Eastern Mediterranean region	3.3	2.6	4.3	21	17	28
European region	1.6	1.2	2.6	15	11	23
South-East Asia region	2.0	1.5	4.0	39	29	77
Western Pacific region	6.2	5.1	7.6	115	93	140
Total	**3.5**	**2.7**	**5.0**	**257**	**199**	**368**

WHO: the World Health Organization.

* Modelled estimate: 6.6 million, rounded. The WHO Regional Office for the Americas has worked with its Member States to generate estimates through country consultations and modelling. These national estimates were consolidated in 2016 into a regional estimate of 2.8 million people living with chronic HBV infection. The difference between these estimates is consistent with the different methods used. In addition, low-prevalence settings may lead to lower precision and greater uncertainty. WHO headquarters and regional offices will continue to engage in comparative modelling to further understand the source of these differences. Such analyses should allow more precise consensus estimates in the future.

Graphic 129352 Version 1.0

Epidemiology and modes of transmission of hepatitis B virus infection

	High	Intermediate	Low
Carrier rate	≥8%	2 to 7%	<2%
Geographic distribution	Parts of sub-Saharan Africa (eg, Western Africa, South Sudan)	Mediterranean basin; Eastern Europe; Central Asia; Southeast Asia; China; Japan; parts of Latin and South America (eg, Peru, Colombia); Middle East	United States; Canada; Western Europe; Mexico; Australia; New Zealand
Predominant age at infection	Perinatal and early childhood	Early childhood	Adult
Predominant mode of infection	Mother to child; percutaneous	Percutaneous; sexual	Percutaneous; sexual

For updated information on the prevalence of chronic hepatitis B virus infection, refer to the United States Centers for Disease Control and Prevention and the World Health Organization websites.

References:

1. *Ott JJ, Stevens GA, Groeger J, Wiersma ST. Global epidemiology of hepatitis B virus infection: New estimates of age-specific HBsAg seroprevalence and endemicity. Vaccine 2012; 30:2212.*
2. *Schweitzer A, Horn J, Mikolajczyk RT, et al. Estimations of worldwide prevalence of chronic hepatitis B virus infection: A systematic review of data published between 1965 and 2013. Lancet 2015; 386:1546.*
3. *HIV, viral hepatitis and sexually transmissible infections in Australia: Annual Surveillance Report 2013. Sydney: The Kirby Institute, The University of New South Wales; 2013.*
4. *New Zealand Society of Gastroenterology. www.nzsg.org.nz/cms2/research/hepatitis/hepatitis b/ (accessed 12/31/2015).*

Graphic 51820 Version 9.0

Target groups for hepatitis B virus (HBV) vaccination in the United States

Patient groups	Comments
Infants (birth to 1 year)	▪ The vaccination series should be started as soon as possible after birth, preferably within 12 hours.* ▪ For infants born to mothers who are HBsAg positive, HBIG should be administered at the same time as the birth dose HBV vaccine (at a different anatomic site). ▪ For infants born to mothers who are HBsAg positive and mothers whose HBsAg status cannot be determined, obtain HBsAg and anti-HBs after completion of HBV vaccination series (usually at age 9 to 12 months). Revaccination may be necessary.
Unvaccinated persons age 1 to 60 years, regardless of risk for HBV infection	▪ Catch-up immunization is recommended for persons age <60 years who were not vaccinated for HBV or whose HBV vaccination status is unknown.
Unvaccinated persons age ≥60 years who are at increased risk for acquiring HBV or developing severe HBV infection as well as those who wish to be vaccinated This includes individuals with: ▪ Chronic liver disease ▪ HIV infection ▪ HCV infection ▪ Percutaneous or mucosal risk for HBV exposure (eg, injection drug use, occupational risk, household contact of someone with HBsAg) ▪ Sexual risk for HBV (eg, sexual contact with someone who is HBsAg positive, persons who are sexually active and not in mutually monogamous relationships) ▪ Planned travel to countries with high (≥8%) or intermediate (2 to 7%) endemic prevalence of HBV infection ▪ Risk due to being incarcerated	▪ Among individuals who are at increased risk for HBV, post-vaccination serologic testing (anti-HBs) is warranted for certain groups (eg, those with HIV, health care and public safety personnel, persons who are predialysis or are undergoing dialysis, and sexual partners of persons who are HBsAg positive).

▪ Risk due to working or living in facilities for persons who are developmentally disabled ▪ Persons who are predialysis or are undergoing hemodialysis, peritoneal dialysis, or home dialysis	

This table lists target groups for HBV vaccination. More detailed information about groups at increased risk for HBV are presented in UpToDate content that discusses HBV epidemiology, screening, and immunization. For persons who are immunocompromised in all target groups, post-vaccination serology (anti-HBs) is recommended. Revaccination may be necessary. Refer to UpToDate content on HBV vaccination for details.

HBV: hepatitis B virus; HBsAg: hepatitis B surface antigen; HBIG: hepatitis B immune globulin; anti-HBs: antibody to HBsAg; HIV: human immunodeficiency virus; HCV: hepatitis C virus.

* Infants born to mothers who are HBsAg-positive and mothers whose HBsAg status cannot be determined should receive the first dose of HBV and HBIG as soon as possible after birth.

References:

1. *Abara WE, Qaseem A, Schillie S, et al. Hepatitis B vaccination, screening, and linkage to care: Best practice advice from the American College of Physicians and the Centers for Disease Control and Prevention. Ann Intern Med 2017; 167:794.*
2. *Schillie S, Vellozzi C, Reingold A, et al. Prevention of hepatitis B virus infection in the United States: Recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2018; 67:1.*
3. *Terrault NA, Lok AS, McMahon BJ, et al. Update on prevention, diagnosis, and treatment and of chronic hepatitis B: AASLD 2018 hepatitis B guidance. Hepatology 2018; 67:1560.*
4. *United States Preventive Services Task Force, Krist AH, Davidson KW, et al. Screening for hepatitis B virus infection in adolescents and adults: US Preventive Services Task Force Recommendation Statement. JAMA 2020; 324:2415.*
5. *Weng, MK, Doshani M, Khan MA, et al. Universal hepatitis B vaccination in adults aged 19-59 years: Updated recommendations from the Advisory Committee on Immunization Practices – United States, 2022. MMWR Morb Mortal Wkly Rep 2022; 71:477.*
6. *Conners EE, Panagiotakopoulos L, Hofmeister MG, et al. Screening and testing for hepatitis B virus infection: CDC recommendations – United States, 2023. MMWR Recomm Rep 2023; 72:1.*

Graphic 116656 Version 11.0

Contributor Disclosures

Eng-Kiong Teo, MD No relevant financial relationship(s) with ineligible companies to disclose. **Anna SF Lok, MD** Grant/Research/Clinical Trial Support: Target Pharma [NAFL, hepatitis B virus, PBC]. Consultant/Advisory Boards: Arbutus [Hepatitis B virus]; Chroma [Hepatitis B virus]; CLEAR-B [Hepatitis B virus]; GlaxoSmithKline [Hepatitis B virus]; Novo Nordisk [NAFLD]; Target [Hepatitis B virus, PBC, and NAFLD treatment]; Virion [Hepatitis B virus]. All of the relevant financial relationships listed have been mitigated. **Sheldon L Kaplan, MD** Grant/Research/Clinical Trial Support: Pfizer [Streptococcus pneumoniae]. Other Financial Interest: Elsevier [Textbook honoraria – Pediatric infectious diseases]; Pfizer [Honorarium for a talk – PCV13]. All of the relevant financial relationships listed have been mitigated. **Rafael Esteban, MD** Grant/Research/Clinical Trial Support: Gilead [Hepatitis B]. Consultant/Advisory Boards: Abbvie [Hepatitis C]; Gilead [Hepatitis C]. Speaker's Bureau: Gilead [Hepatitis C]. All of the relevant financial relationships listed have been mitigated. **Jennifer Mitty, MD, MPH** No relevant financial relationship(s) with ineligible companies to disclose.

Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a multi-level review process, and through requirements for references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

Conflict of interest policy

→