

Behavioral prevention of HBV transmission in urban communities toward global elimination of hepatitis in 2030: a systematic review

Fiya Diniarti,^{1,2} Mohamed Saifulaman Mohamed Said,² Norhashima Abd Rashid,² Sandeep Poddar²

¹Public Health Programe, Faculty of Health Sciences, Universitas Dehasen Bengkulu, Bengkulu, Indonesia; ²Lincoln University College, Wisma Lincoln, Selangor, Malaysia

Abstract

Hepatitis B is a serious threat to public health on a global scale. The Hepatitis B virus (HBV), which spreads both vertically and horizontally, is easily contracted by anyone. In 2020, the World Health Organization estimates that 257 million people worldwide have hepatitis B, and 900,000 people die from it each year. According to the World Health Organization (2021), there are approximately 39.4 million people in Southeast Asia living with chronic hepatitis B mortality, with 410,000 deaths caused by the disease. HBV can spread through injections, horizontal transmission, blood transfusions, and organ transplants. Cochrane, Science Direct, PubMed, Elsevier, Sage, Willey, DOAJ, and Google Scholar database sources were used to search for supported research on how to prevent hepatitis virus transmission in urban communities. 15 publications address the primary and sec-

ondary prevention of hepatitis B transmission in urban settings. Prevention keeps a person in good health and prevents them from progressing to a later, worse stage. Given that the hepatitis B virus can infect anyone, regardless of age, and that it affects people's health worldwide, as well as their families, communities, and families within them. In order to eradicate the hepatitis B virus, society must be aware of the importance of implementing preventive measures on a continuous and long-term basis through health advocacy activities, hepatitis B virus screening campaigns, health education, counseling, hepatitis B vaccination with community-based activities, and secondary prevention through combination therapy treatment in post-liver transplant patients.

Introduction

Hepatitis B transmission can happen both vertically and horizontally, making it a serious threat to public health on a worldwide scale.¹ A virus called hepatitis affects the liver. Everyone can readily contract the hepatitis B virus (HBV), which spreads both vertically and horizontally.² Hepatitis B virus transmission can happen during childbirth (from an infected mother to her child), prior to sexual contact with a sick partner, while sharing items like razors or toothbrushes, when coming into direct contact with blood or exposed wounds of a contaminated person, or when an infected person spills blood. Needles and sharps from diseased individuals, as well as those used by those getting tattoos or body piercings using non-sterile instruments (from infected people).³ About 328 million people around the world are constantly sick with HBV, and most of them have not been identified or treated.⁴ The World Health Organization (WHO) aims to reach 80% treatment coverage and 90% vaccine coverage by 2030.^{5,6} According to the RISKESDAS⁷ results from 2018, Indonesia shows the prevalence of hepatitis based on a doctor's diagnosis history, with differences between provinces of 0.18% (Bangka Belitung Islands) and 0.66% (Papua). Hepatitis spreads almost evenly across all age groups, genders, educational levels, occupations, and places of residence. The national program for the prevention and control of the virus currently emphasizes keeping mother to child transfer from occurring because infants are in danger of developing hepatitis B virus that persist in their mothers who have the virus (PPIA).⁸ To address this disease globally, public health recommendations and initiatives have been developed concurrently.⁹ One of the tactics used is raising awareness of the hepatitis B virus defense mechanism among people, families, and communities in order to bring about changes in urban communities' behavior.¹⁰

Correspondence: Correspondence: Fiya Diniarti, Universitas Dehasen Bengkulu, Jl. Meranti No.32, Sawah Lebar, Kec. Ratu Agung, Kota Bengkulu, Bengkulu 38228, Indonesia
E-mail: Fiyadiniarti@unived.ac.id

Key words: urban society; preventive behavior; hepatitis B.

Contributions: FD, conceptualization or design of the work, methodology, writing - original draft; MSMS, drafting the work or reviewing it critically, supervision; NAR, drafting the work or reviewing it critically, supervision; SD, project administration, review & editing.

Conflict of interest: the authors declare no potential conflict of interest, and all authors confirm accuracy.

Ethics approval and informed consent: not applicable.

Availability of data and materials: all data generated or analyzed during this study are included in this published article.

Received: 12 November 2023.

Accepted: 13 March 2024.

Early view: 16 April 2024.

This work is licensed under a Creative Commons Attribution 4.0 License (by-nc 4.0).

©Copyright: the Author(s), 2024
Licensee PAGEPress, Italy
Healthcare in Low-resource Settings 2024; 12:12072
doi:10.4081/hls.2024.12072

Publisher's note: all claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article or claim that may be made by its manufacturer is not guaranteed or endorsed by the publisher.

Materials and Methods

With the terms “Prevention” and “Hepatitis B,” this systematic review search uses science direct to get data from sites like PubMed, DOAJ, Cochrane, Sage, Willey, Elsevier, and Google Scholar. The requirements were: research publications with titles and contents that match the study’s goals; research subjects with a possible hepatitis B infection; English; written between 2010 and 2022. The article does not have a comprehensive structure, according to the exclusion criteria. The following actions are taken as part of a systematic review using Prism guidelines: find articles that include manually chosen and recorded keywords; conduct screening in accordance with established inclusion and exclusion criteria; conduct article analysis utilizing the Joanna Briggs Institute. Based on the findings of a literature search conducted using eight online databases, 500 articles were found. These were then filtered from the database selection to 53 articles, and 33 eligible articles were found after examining titles, reading abstracts, background suitability, research objectives, research methods, and results. After reading the full text, 15 articles were eliminated, leaving 10 for examination.

Results

The prevention of suspected hepatitis B in rural and urban areas is examined in this research. The literature under examination is a true investigation, not a critique, and includes the next: author name, research design, and sample size (Figure 1; Supplementary materials, Table 1).

These 15 articles discuss findings about preventative behavior (primary and secondary hepatitis B virus transmission in urban communities) based on the results of article analysis. The twelve articles demonstrate that primary prevention is a collective effort that begins in the stage of optimum health and does not move into a stage that could exacerbate the condition. Actions must be taken prior to the infection of the hepatitis B virus and include aspects of health promotion and protection. According to this article, the primary prevention focuses on promoting health (improving health) through health advocacy, hepatitis B virus screening campaigns, health education, and counseling to increase community knowledge and awareness starting with individuals, families, and community groups as well as focusing on general and specific protection through immunization, insurance, and Hepatitis B immunization. protection both specifically and generally. Three articles show that communities, families, or individuals are responsible for primary prevention. Those who are ill are identified early and receive immediate care through appropriate care. This article focuses on the use of lamivudine (LAM) combination therapy with nucleoside analogue (LAM) to HBIG to treat HBV patients after orthotopic liver transplantation (OLT) to increase patient life expectancy and the use of antiviral and immunoprophylactic drugs for expectant mothers with chronic the hepatitis B virus during pregnancy, especially in reducing the amount of virus and providing protection. The study identified several risk factors for hepatitis B, including age (45 years and older), gender (male), having a mother who was infected, and a history of blood transfusions.

Discussion

Anyone at any age can contract the hepatitis B virus. HBV

attacks the liver. Serological evidence of previous or present viral hepatitis B is present in about one-third of the worlds population (HBV). When HBsAg-positive body fluids from people who have an acute or chronic HBV infection are exposed through parenteral or mucosal routes, the virus is passed on. It reproduces in hepatocytes using a specific reverse transcription method. Percutaneous inoculation, horizontal transmission, blood transfusion, organ transplantation, and post-exposure prophylaxis are all ways that HBV spreads (Figure 2).^{25,27} Based on data from the WHO 2021 (Figure 3),²⁸ the highest number of fresh cases hepatitis B infection cases has the Africa region (990,000 cases). And the greatest quantity of deaths the western pacific (470,000 cases). Primary and secondary prevention strategies that continuously and sustainably raise awareness among individuals, families, and communities aim to lessen the danger of the virus that causes hepatitis B. The fact is that despite the implementation of this strategy in both developed and developing nations, hepatitis B morbidity and mortality remain a problem in the world due to changes in people’s behavior caused by a variety of factors, including age, gender, education, socio-culture, the economy, health services, and stakeholders policy.²⁹

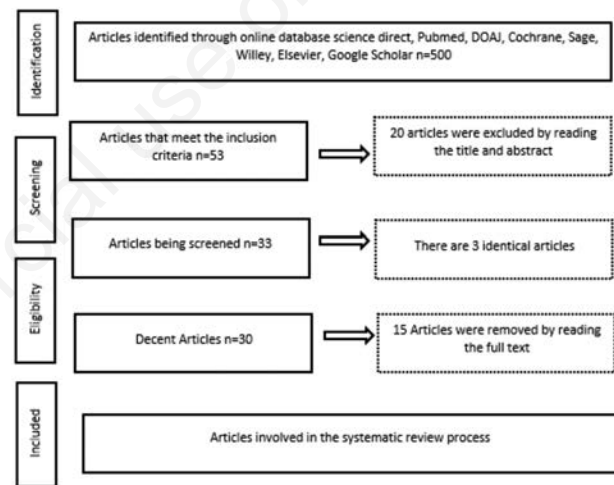


Figure 1. Literature search strategy.

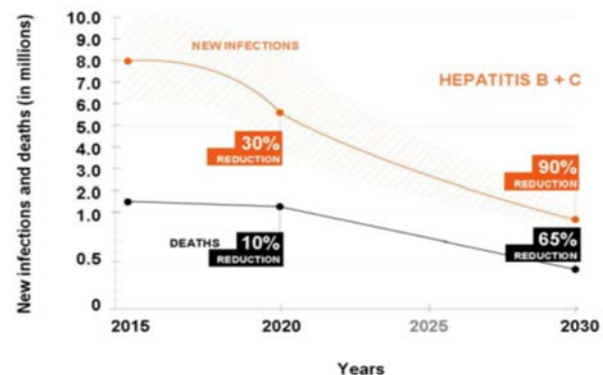


Figure 2. Goals for lowering the number of new cases and deaths caused by chronic hepatitis B and C viruses. Source: World Health Organization. Global Health Sector Strategies on Viral Hepatitis 2016-2021.²⁷

Based on Graphic 3, the average hepatitis B infection is mostly on female with the age 20-45 years.³⁰ Based on Figure 4, it shows that the average risk factors that can cause Acute Hepatitis B are through heterosexual transmission, nosocomial, sex between men and chronic hepatitis transmitted through mother to child transmission.³⁰ Health education is used as the primary method of preventing the spread of Hepatitis B (health promotion). Risk factors for infectious diseases can be described through the theory of the epidemiological triangle. The epidemiological triangle is a model that has been developed to see health problems (infectious diseases), the epidemiological triangle has three angles (agent, host and environment).³¹ Risk factors for hepatitis B are socio-demographic, behavioral, medical, middle age, male, married, rural living, low education, smoking, having positive household contacts of HBsAg, family history of HBV, history of surgery or blood transfusion.³² According to Maamor *et al.* research from 2022,²⁴ she discovered that seven studies (46.7%) and eight (53.3%) reported average and good knowledge, respectively. Study two (40%) in Asia is having strong knowledges, one's (20.0%) had average

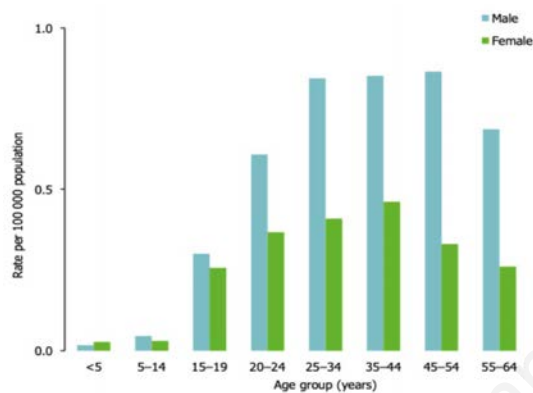


Figure 3. Acute Hepatitis B Cases Reported at High Rate. Source: Hepatitis B Annual Epidemiological Report for 2021.³⁰

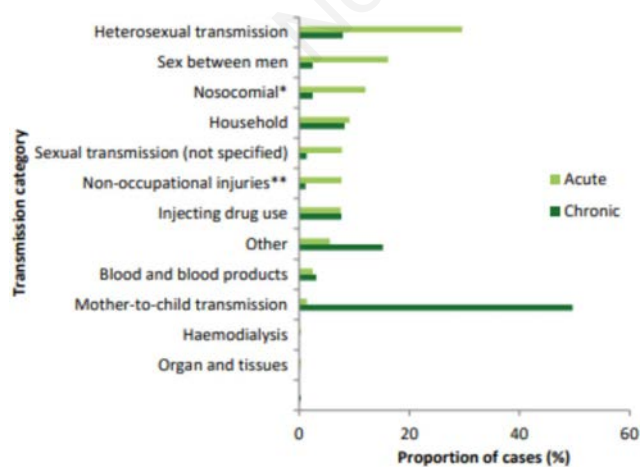


Figure 4. Transmission category of hepatitis B cases by acute and chronic disease status, EU/EEA, 2021. Sources: Hepatitis B Annual Epidemiological Report for 2021.³⁰

knowledge, and two (40%) inadequate knowledge.²² According to research, community-based screening, advocacy, and hepatitis B health education initiatives are effective primary prevention tactics. they can be quite helpful in persuading HBV-infected people to use public health resources.^{33,34} Research findings in Indonesia found that the lack of information about the transmission of hepatitis B infection affects hepatitis B prevention behavior in an effort to support the vaccination program, obstacles to the vaccination program (vaccination campaign) caused by the high cost of vaccination, lack of vaccine availability in certain areas, and limited human resources to carry out the hepatitis B vaccination program.³⁵ This study supports the recommendation that the WHO states that all babies should receive the vaccine for hepatitis B as soon as possible after birth, ideally within 24 hours, and then the next doses should be spaced at least 4 weeks apart. The vaccine's purpose is to provide the general public with lifelong protection, or at least 20 years of it.³⁶ The WHO recommends using antiviral prophylaxis in addition to baby vaccination to stop the spread of hepatitis B from mother to child. Utilizing safer sex techniques, such as limiting the number of partners and using condoms, as well as blood safety strategies lowers transmission.^{37,38} In order to meet the 2030 Sustainable Development Agenda's global hepatitis elimination target, preventive efforts are being made. These efforts include raising awareness, encouraging resource mobilization, developing evidence-based data policies for action, and improving health equity in hepatitis response.^{21,24}

The results of the study in Bangladesh reported that Bangladesh has a medium low prevalence rate of HBV infection (4.0%), a prevalence rate that represents explaining the incidence prevalence and epidemiology of hepatitis B and can be beneficial for public health leaders for policy making. This study aims to improve understanding of the epidemiological identification of HBV in Bangladesh, reduce the risk of hepatitis B in Bangladesh, and increase the coverage of the national immunization program to ensure vaccination of people at all levels.³⁹ Each year the prevalence of liver cancer ranged (4.5%) and cirrhosis hepatis ranged (5.8%) and other liver diseases, including nonalcoholic fatty liver disease/ hepatic steatosis 2016 (4.1%), alcoholic liver disease/alcoholic cirrhosis/alcoholic hepatitis around 2016 in (0.45%).⁴⁰ The prevalence of hepatitis B continued to decline after the introduction of hepatitis B vaccination, but the disease remains a significant public health problem worldwide. This study summarizes the most important recommendation trends for preventing hepatitis B are screening in pregnant women, CHB screening, maternal HBeAg, HBV viral load, ALT level and HbsAg level, and antiviral administration for two main purposes: Vertical treatment and prevention, during pregnancy Tenofovir is administered, a combination of the HBIG and hepatitis B vaccines within the first 12 hours to all babies born to mothers with CHB.⁴¹ The gap in hepatitis B elimination globally is widespread. Many countries have achieved an important target of HBsAg seroprevalence of <0.1% in children under 5 years of age. Lack of knowledge about hepatitis B in women in Thailand can be increased through preventive education by providing counseling about hepatitis B vaccination, the counseling process can run effectively carried out by the Thai government is to train counselors, so that counseling runs interactively, then counselors in providing counseling can be appropriate visual aids in the antenatal period.⁴² Mother-to-child hepatitis B prevention program conducted in Cambodia for pregnant women by providing hepatitis B vaccination and hepatitis B screening during pregnancy.⁴³ Children who have been given doses of HBV vaccine have no risk of HBV infection in the future, HBV vaccine is the only guarantee to protect children and prevent the spread of the

virus in the community. In addition, strengthening awareness, monitoring, and implementation of existing infection control procedures and increasing the coverage of hepatitis B vaccination will further reduce the prevalence of hepatitis B.⁴⁴ Hepatitis B virus infection remains a public health challenge for women with a possible risk of vertical transmission to their babies in the study area. Routine screening recommendations for the hepatitis B virus in pregnancy.⁴⁵ The prevalence of HBV is very low in pregnant women not living with HIV.⁴⁶ There is a significant relationship between the level of RPR (rapid plasma regain examination) and the degree of liver fibrosis based on TE (fibro scan) in chronic hepatitis B patients, then RPR can be used as a non-invasive diagnostic marker to predict severe fibrosis in chronic hepatitis B patients, with a cut-off point of 0.0538 with sensitivity of 76% and a specificity of 63%.⁴⁷ Research findings in Vietnam illustrate that Vietnam is an area of intermediate endemicity of hepatitis B. To combat HBV in Vietnam prevention of hepatitis B from mother to child is carried out through a hepatitis B vaccination policy after the baby is born and immunization coverage must be complete, for incomplete immunization coverage in children will be monitored by health workers.⁴⁸ Early human preterm birth (PTB) is a risk factor for HBV infection alone, and HBV DNA levels do not appear to have an impact on the risk. A comprehensive program focusing on pregnant women with HBV infection will reduce the incidence of adverse outcomes.⁴⁹ Indonesia is an area of high endemicity and is included in the high prevalence of hepatitis B, which is more than 8%. Prevention efforts are carried out through hepatitis B screening in pregnant women, the screening is carried out at Puskesmas.⁵⁰ Risk factors for hepatitis B are parity, low education, history of sexual partners >1, use of non-sterile syringes, family history of hepatitis B. The Singapore study analyzed that the government subsidizes antiviral treatment to reduce perinatal transmission. If hepatitis B cases increase in Singapore, future generations will contract hepatitis B infection and eventually become a burden on the state. Screening and treatment activities are carried out for infected mothers at a cost that is affordable to the community.⁵¹ According to research in Vietnam, the comparison of pregnant women with umbilical cord blood diagnosed with HBsAg positive and negative found that pregnant women who have HBsAg positive umbilical cord blood are at risk of transmitting hepatitis B from mother to child (from mother to child).⁵² The impact of pregnant women who are positive for chronic hepatitis B has the risk of premature birth premature rupture of membranes, heavy bleeding, gestational diabetes and fetal death. Gestational diabetes is diabetes that occurs directly during pregnancy until the delivery process, the condition generally occurs in the second or third trimester.⁵³ Primary prevention efforts (education, campaigns, screening, early detection, and vaccination) are very important in reducing the risk of mother-to-child transmission for all people in the world. The community must work together with the government to support the SDGs program in reducing the prevalence of hepatitis B.⁵⁴

Conclusions

The preventive behavior of urban communities in supporting global elimination in 2030 includes primary and secondary prevention. Primary prevention (health promotion) includes health advocacy, hepatitis B virus screening campaigns, health education, community-based counseling and the condom use. The application of safer sex techniques, such as limiting the number of part-

ners, can help lessen transmission. and primary prevention (general) and specific protection) includes vaccination at the time of birth, preferably within 24 hours and health insurance for the community, as well as secondary prevention by providing combination therapy to patients after liver transplantation. It is hoped that further researchers can examine information technology-based preventive strategies.

References

- Deng X, Liu D, Delcourt MP, et al. No hepatitis delta virus seropositivity among blood donors with overt and occult hepatitis B infection in Dalian, Liaoning Province, China. *Viruses* 2023;15:1509.
- Diniarti F, Rohani T, Prasentya W. Faktor-Faktor yang Mempengaruhi Kejadian Hepatitis B pada Ibu Hamil. *Jurnal riset kesehatan poltekkes depkes bandung* 2022;14:197-205.
- Nlinwe NO, Lungle D. Risk factors associated with hepatitis B virus infection among pregnant women attending the antenatal care unit of the Bamenda Regional Hospital. *Public Health Practice* 2021;2:100160.
- Olaru ID, Meier MB, Mirzayev F, et al. Global prevalence of hepatitis B or hepatitis C infection among patients with tuberculosis disease: systematic review and meta-analysis. *Eclinicalmedicine* 2023;58.
- Raslan E, AbdAllah M, Soliman S. The prevalence and determinants of hepatitis B among Egyptian adults: a further analysis of a country-representative survey. *Egyptian Liver J* 2022;12:46.
- Khan A, Hussain G, Zahri M, Zaman G, Wannasingha Humphries U. A stochastic SACR epidemic model for HBV transmission. *J Biological Dynamics* 2020;14:788-801.
- Riskesdas LN. Indonesian Ministry of Health, Health Research and Development Agency. 2018
- Kementerian Kesehatan, Indonesian Health Profile. Kementerian kesehatan Indonesia: Jakarta. 2021
- Muljono DH, Wijayadi T, Sjahril R. Hepatitis B virus infection among health care workers in Indonesia. *Euroas J Hepato-Gastroenterol* 2018;8:88.
- Luo Y, Dong Z, Qi S. Application of health education model based on theory of behavior change in nursing care of patients with chronic hepatitis B. *J Nanomat* 2022;2022.
- Hidayah AN, Afridah W. Literature Review: Faktor Penyebab Hepatitis B Pada Ibu Hamil. *Jurnal Multidisiplin Indonesia* 2023;2:443-50.
- Khalid FK, Rasheed NA, Hussein NR, Naqid IA. A study of HBV infection and its risk factors in pregnant women in Zakho city, Iraq. *PloS One* 2022;17:e0273362.
- Liu D, Liu Y, Ni J, et al. Hepatitis B infection among pregnant women in China: a systematic review and meta-analysis. *Frontiers Public Health* 2022;10:879289.
- Chen Z, Zeng M, Liu D, et al. Antenatal administration of hepatitis B immunoglobulin and hepatitis B vaccine to prevent mother to child transmission in hepatitis B virus surface antigen positive pregnant women: A systematic review and meta-analysis. *Medicine* 2020;99.
- Aladag H, Aladag M. Is the use of Tenofovir Dipivoxil fumarate effective and safe in preventing vertical transmission in pregnant women with chronic HBV with high viral load?. *Eur Rev Med Pharmacol Sci* 2023;27.
- Hoo CZ, WZ WA, Omar H, Tan SS. Prevention of mother-to-

- child transmission of hepatitis B virus: An observation of routine practice in a tertiary liver centre before and after the introduction of the global health sector strategy on viral hepatitis. *Med J Malaysia* 2023;78:234-40.
17. Dwiartama A, Nirbayati WF, Giri-Rachman EA, et al. Knowledge, attitude, and practice towards hepatitis B infection prevention and screening among Indonesians. *Int J Environ Res Public Health* 2022;19:4644.
 18. Hyun CS, Ko O, Lee S, McMenamin J. Long term outcome of a community-based hepatitis B awareness campaign: eight-year follow-up on linkage to care (LTC) in HBV infected individuals. *BMC Infect Dis* 2019;19:1-8.
 19. Wu Z, Bao H, Yao J, et al. Suitable hepatitis B vaccine for adult immunization in China: a systematic review and meta-analysis. *Human Vaccines & Immunotherapeutics* 2019;15:220-7.
 20. Abdullahi LH, Kagina BM, Ndze VN, et al. Improving vaccination uptake among adolescents. *Cochrane Database of Systematic Reviews* 2020;1:CD011895.
 21. Freeland C, Bodor S, Perera U, Cohen C. Barriers to hepatitis B screening and prevention for African immigrant populations in the United States: A qualitative study. *Viruses* 2020;12:305.
 22. Nguyen MH, Wong G, Gane E, et al. Hepatitis B virus: advances in prevention, diagnosis, and therapy. *Clin Microbiol Rev* 2020;33:10-128.
 23. Zhang X, Guan L, Tian H, et al. Risk factors and prevention of viral hepatitis-related hepatocellular carcinoma. *Front Oncol* 2021;11:686962.
 24. Maamor NH, Muhamad NA, Mohd Dali NS, et al. Seroprevalence of hepatitis B among healthcare workers in Asia and Africa and its association with their knowledge and awareness: a systematic review and meta-analysis. *Front Public Health* 2022;10:859350.
 25. Mauss S, Berg T, Rockstroh J, et al. *Hepatology—a clinical textbook*, 20th. 2020.
 26. Sonderup MW, Spearman CW. Global disparities in hepatitis B elimination—a focus on Africa. *Viruses* 2022;14:82.
 27. World Health Organization. *Global Health Sector Strategies on Viral Hepatitis 2016-2021*. Available from: http://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_32-en.pdf?ua=1
 28. World Health Organization. *Global health sector strategy on viral hepatitis 2016-2021. Towards ending viral hepatitis*. World Health Organization; 2016. <https://iris.who.int/bitstream/handle/10665/246177/who?sequence=1>
 29. Eleje GU, Onubogu CU, Fiebai PO, et al. Mother-to-child transmission of human immunodeficiency virus, hepatitis B virus and hepatitis C virus among pregnant women with single, dual or triplex infections of human immunodeficiency virus, hepatitis B virus and hepatitis C virus in Nigeria: a systematic review and meta-analysis. *SAGE Open Med* 2022;10:20503121221095411.
 30. Hepatitis B Annual Epidemiological Report for 2021. Available from: <https://www.ecdc.europa.eu/sites/default/files/documents/hepatitis-b-annual-epidemiological-report-2021.pdf>
 31. Rockett IR, Putnam SL, Jia H, et al. Unmet substance abuse treatment need, health services utilization, and cost: a population-based emergency department study. *Ann Emerg Med* 2005;45:118-27.
 32. Hamilton EM, Rassam W, Yan Y, et al. Correlates of chronic hepatitis B virus infection in the general adult population of China: Systematic review and meta-analysis. *J Viral Hepat* 2023; <https://doi.org/10.1111/jvh.13816>
 33. Yim HJ, Kim JH, Cho YK, et al. Non-inferior efficacy of tenofovir disoproxil to tenofovir disoproxil fumarate in virologically suppressed chronic hepatitis B patients. *Drug Des Devel Therapy* 2022;3263-74.
 34. Patterson J, Abdullahi L, Hussey GD, et al. A systematic review of the epidemiology of hepatitis A in Africa. *BMC Infect Dis* 2019;19:1-5.
 35. Machmud PB, Führer A, Gottschick C, Mikolajczyk R. Barriers to and Facilitators of Hepatitis B Vaccination among the Adult Population in Indonesia: A Mixed Methods Study. *Vaccines* 2023;11:398.
 36. Périères L, Diallo A, Marcellin F, et al. Hepatitis B in Senegal: a successful infant vaccination program but urgent need to scale up screening and treatment (ANRS 12356 AmbASS survey). *Hepatology Comm* 2022;6:1005-15.
 37. Smathers SA, Sammons JS. A strategy for expanding infection prevention resources to support organizational growth. *Am J Infect Control* 2020;48:975-81.
 38. Wang X, Zhang Y, Ben Y, et al. Anti-HBc IgG responses occurring at the early phase of infection correlate negatively with HBV replication in a mouse model. *Viruses* 2022;14:2011.
 39. Banik S, Datta A, Ghosh A, et al. The prevalence of hepatitis B virus infection in Bangladesh: A systematic review and meta-analysis. *Epidemiol Infect* 2022;150:e47.
 40. Yotsuyanagi H, Kurosaki M, Yatsuhashi H, et al. Characteristics and healthcare costs in the aging hepatitis B population of Japan: a nationwide real-world analysis. *Digest Dis* 2022;40:68-77.
 41. Belopolskaya M, Avrutin V, Kalinina O, et al. Chronic hepatitis B in pregnant women: Current trends and approaches. *World J Gastroenterol* 2021;27:3279.
 42. Bierhoff M, Hashmi AH, Pateekhum C, et al. A mixed-methods evaluation of hepatitis B knowledge, attitudes, and practices among migrant women in Thailand. *BMC Pregnancy Childbirth* 2021;21:1-2.
 43. Ko K, Kim R, Nagashima S, et al. Residual risk of mother-to-child transmission of HBV despite timely Hepatitis B vaccination: a major challenge to eliminate hepatitis B infection in Cambodia. *BMC Infect Dis* 2023;23:1-2.
 44. Banafa AM, Edrees WH, Al-Falahi GH, Al-Shehari WA. Prevalence of hepatitis B surface antigen among orphans children living in orphanage in Sana'a city, Yemen. *PSM Microbiol* 2022;7:19-26.
 45. Mugabiirwe N, Kalyetsi R, Ayella R, et al. Hepatitis B virus infection and HBeAg positivity among pregnant women in South West Uganda. *Afr J Laboratory Med* 2022;11:1-6.
 46. Joseph Davey D, Hsiao NY, Wendy Spearman C, et al. Low prevalence of hepatitis B virus infection in HIV-uninfected pregnant women in Cape Town, South Africa: implications for oral pre-exposure prophylaxis roll out. *BMC Infect Dis* 2022;22:719.
 47. Yusuf F, Abubakar A, Maghfirah D, Baswin A. Relationship red distribution width to platelet ratio with fibrosis degrees based on transient elastography in chronic hepatitis B patients. *Bali Med J* 2021;10:793-7.
 48. Komada K, Ichimura Y, Shimada M, et al. Impact of hepatitis B vaccination programs in Vietnam evaluated by estimating HBsAg prevalence. *J Virus Erad* 2022;8:100309.
 49. Zheng S, Zhang H, Chen R, et al. Pregnancy complicated with hepatitis B virus infection and preterm birth: a retrospective cohort study. *BMC Pregn Childbirth* 2021;21:1-8.
 50. Denando RK, Cahyati WH. Faktor Risiko Hepatitis B pada Ibu Hamil di Kota Semarang Tahun 2020-2021 (Studi Kasus di Puskesmas Genuk & Puskesmas Bangetayu). *Jurnal Kesehatan*

- Masyarakat 2022;10:656-65.
51. Ma T, Aw MM, Lee GH. Cost-effectiveness analysis of antiviral treatment for pregnant women with high viral load to prevent hepatitis B virus vertical transmission. *Singapore Med J* 2020;61:24.
 52. Hoang TT, Bui TT, Pham TT, et al. Study the correlation between the mother-to-child transmission risk factors in chronic hepatitis B virus infection pregnant women in vietnam by HCA method. Available from: <https://doi.org/10.20944/preprints202208.0292.v1>
 53. Sirilert S, Tongsong T. Hepatitis B virus infection in pregnancy: immunological response, natural course and pregnancy outcomes. *J Clin Medi* 2021;10:2926.
 54. Rajamoorthy Y, Taib NM, Mudatsir M, et al. Risk behaviours related to hepatitis B virus infection among adults in Malaysia: A cross-sectional household survey. *Clin Epidemiol Global Health* 2020;8:76-82.

Online supplementary material:

Table 1. Lists the result from a systematic review search (n=15).

Non-commercial use only