Smarter Science, Healthier Lives, AI for A- Hepatitis Free Future

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Doi: https://doi.org/10.5281/zenodo.22686835

Received: 06 August 2026

Accepted: 04 September 2026

ABSTRACT:

Artificial intelligence (AI) has emerged as a transformative technology in modern healthcare, offering innovative solutions for the prevention, diagnosis, treatment, and management of liver diseases, particularly viral hepatitis. With over 90% accuracy in diagnosing diseases from medical images, artificial intelligence (AI) is reshaping the healthcare landscape, transforming medical imaging, diagnosis, drug discovery, patient care, and more. AI-driven approaches, including machine learning, deep learning, and advanced data analytics, enable the rapid analysis of complex clinical, imaging, pathological, and genomic data, thereby improving diagnostic accuracy, predicting disease progression, and supporting clinical decision-making. In drug discovery, AI accelerates target identification, virtual screening, lead optimization, and drug repurposing, significantly reducing the time and cost associated with conventional pharmaceutical development. As AI technologies continue to evolve, they have the potential to revolutionize hepatitis prevention and management, ultimately improving patient outcomes and supporting the global goal of eliminating viral hepatitis as a public health threat.

KEYWORDS: Artificial intelligence (AI), viral hepatitis, machine learning, Drug discovery, Medical imaging, Liver diseases, Disease prediction, Healthcare, Personalized medicine.

1. INTRODUCTION:

Artificial intelligence (AI) is a rapidly evolving field of computer science that aims to simulate human intelligence using computational techniques such as machine learning (ML) and deep learning (DL). In recent years, AI has become an integral part of healthcare because of its ability to process large volumes of clinical, imaging, pathological, and molecular data with high accuracy and efficiency. These advances have enabled AI to support disease diagnosis, prognosis, treatment planning, and clinical decision-making across multiple medical specialties. [1,3] Machine

learning algorithms have the potential to reduce the time, cost, and high failure rates associated with conventional drug development while improving patient outcomes.[3,4]

Viral hepatitis remains a major global health challenge, causing significant morbidity and mortality despite advances in prevention and treatment. The diagnosis and management of liver diseases require the integration of diverse clinical, laboratory, imaging, and histopathological information.. [1,2,7,]

Beyond clinical practice, AI is transforming pharmaceutical research by accelerating target identification, virtual screening, lead optimization, drug repurposing, and personalized medicine. Although challenges such as data quality, ethical concerns, privacy, and regulatory issues remain, AI continues to reshape healthcare and offers significant opportunities for improving hepatitis prevention, diagnosis, and treatment. Therefore, this review discusses the applications of AI in healthcare and drug discovery, with a particular focus on hepatitis and liver diseases, while highlighting current challenges and future perspectives. [3,4,5,10]

Table 1: GLOBAL BURDEN OF VIRAL HEPATITIS *(global hepatitis* report 2024, Geneva: World Health Organization;2024) - latest report

Parameter	**Estimated value**
People living with chronic hepatitis B	~254 million
People living with chronic hepatitis C	~50million
Hepatitis related deaths per year	~1.3million
New HBV infections annually	~1.2milliom

2.Artificial intelligence in healthcare: Artificial intelligence (AI) has revolutionized modern healthcare by enabling machines to perform tasks that traditionally required human intelligence, including learning, reasoning, pattern recognition, and decision-making. These technologies support clinicians by improving diagnostic accuracy, optimizing treatment planning, and enhancing the overall quality of patient care. [1,3,6]

One of the most significant applications of AI is in medical imaging, where deep learning algorithms assist in the interpretation of radiological, histopathological, and endoscopic images. AI systems can identify subtle abnormalities, improve diagnostic consistency, and reduce interobserver variability. In hepatology, AI-based imaging tools have demonstrated promising performance in detecting liver fibrosis, diagnosing hepatocellular carcinoma, and differentiating various liver diseases using imaging and histopathological data. [1,2,7,8]

AI also plays an important role in predictive analytics and clinical decision support. By integrating electronic health records, laboratory findings, imaging results, and genomic information, AI models can predict disease progression, estimate patient prognosis, assess treatment response, and identify individuals at high risk of developing

complications. These predictive capabilities support evidence-based clinical decisions and facilitate personalized treatment strategies tailored to individual patient characteristics. [1,2,9,10]

In addition to diagnosis and prognosis, AI enhances healthcare delivery by improving workflow efficiency, reducing administrative burden, and enabling remote patient monitoring through digital health technologies. The integration of AI into clinical practice has the potential to optimize healthcare resource utilization, improve patient safety, and increase access to quality healthcare services. However, despite these advantages, challenges related to data quality, algorithm transparency, patient privacy, ethical concerns, and regulatory approval continue to influence the widespread implementation of AI in healthcare. Continuous validation and multidisciplinary collaboration remain essential for ensuring the safe and responsible adoption of AI in routine medical practice. [2,3,11,12]

AI has also facilitated the development of intelligent healthcare systems capable of integrating information from multiple sources, including electronic health records, wearable devices, laboratory investigations, and medical imaging. Such integrated systems support early disease detection, continuous patient monitoring, and real-time clinical decision-making. Furthermore, AI contributes to reducing diagnostic errors, improving workflow efficiency, and optimizing healthcare resource utilization, ultimately enhancing the quality, accessibility, and cost-effectiveness of healthcare services. [1,3,6,8]

3.Artificial intelligence in Drug Discovery: Artificial intelligence (AI) has emerged as a transformative tool in drug discovery by accelerating the identification, development, and optimization of novel therapeutic agents. Conventional drug development is a lengthy, expensive, and complex process, often requiring more than a decade of research and substantial financial investment with a high probability of failure. AI-driven technologies have the potential to overcome these challenges by rapidly analyzing large biological and chemical datasets, identifying potential drug targets, and supporting data-driven decision-making throughout the drug development process. [3,4,10,13]

AI also facilitates virtual screening by rapidly assessing thousands of chemical compounds to identify promising drug candidates with desirable pharmacological properties. Compared with traditional screening methods, AI-based approaches significantly reduce the time, cost, and resources required during the early stages of drug discovery. [4,5,11,14]

Another important application of AI is lead optimization, where computational models predict the efficacy, toxicity, pharmacokinetic, and pharmacodynamic properties of potential drug candidates. These predictions enable researchers to modify chemical structures and improve drug safety and effectiveness before preclinical and clinical testing. Furthermore, AI has gained considerable attention in drug repurposing by identifying new therapeutic applications for existing drugs. This approach is particularly valuable during emerging infectious diseases and in the management of viral hepatitis, where approved drugs may be repurposed to improve treatment outcomes while reducing development time. [4,5,15,16]

AI also supports personalized medicine by integrating genomic, clinical, and molecular data to predict individual responses to therapy and optimize treatment strategies. Despite these promising advances, challenges such as limited

data quality, algorithm transparency, validation, and regulatory approval remain barriers to the widespread implementation of AI in drug discovery. Continued collaboration among computational scientists, clinicians, and pharmaceutical researchers will be essential to maximize the potential of AI in developing safer, more effective, and patient-centered therapies. [3,4,12,17]

Recent advances in generative artificial intelligence have further expanded the capabilities of drug discovery by enabling the design of novel molecular structures with desired biological and physicochemical properties. AI-driven computational models can predict drug toxicity, pharmacokinetic behaviour, and potential adverse effects during the early stages of development, thereby reducing the likelihood of failure during clinical trials. These innovations contribute to more efficient pharmaceutical research and support the development of safer and more effective therapeutic agents. [4,5,14,16]

In addition, AI is expected to transform clinical trial design by improving patient selection, identifying suitable biomarkers, predicting treatment outcomes, and optimizing trial protocols. These applications can reduce trial duration, lower development costs, and increase the probability of successful drug approval. As pharmaceutical companies continue to adopt AI-driven platforms, the integration of computational intelligence throughout the drug development pipeline is likely to accelerate the availability of innovative therapies for complex diseases, including chronic liver disorders. [4,5,15,17]

4.Application of Artificial Intelligence in hepatitis and liver diseases:

Artificial intelligence (AI) has transformed the management of hepatitis and other liver diseases by improving disease diagnosis, predicting disease progression, and supporting personalized treatment strategies. By integrating clinical, laboratory, imaging, histopathological, and molecular data, AI assists healthcare professionals in making accurate and timely clinical decisions. These applications have contributed to improved patient outcomes and more efficient management of liver diseases. [1,2,3,18]

4.1 Diagnosis

AI has demonstrated remarkable potential in the early diagnosis of viral hepatitis and other liver diseases through the analysis of large and complex healthcare datasets. Machine learning algorithms can evaluate biochemical markers, electronic health records, and clinical parameters to identify patients at risk of hepatitis B and hepatitis C infection, enabling earlier diagnosis and intervention. [1,2,19,20]

In medical imaging, AI-based models have significantly improved the interpretation of ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and histopathological images. Deep learning algorithms can detect liver fibrosis, cirrhosis, and hepatocellular carcinoma (HCC) with high accuracy while reducing inter-observer variability. These technologies facilitate non-invasive disease assessment and improve diagnostic consistency, reducing the dependence on invasive procedures such as liver biopsy in selected clinical settings. [1,2,21,22]

Furthermore, AI-assisted diagnostic systems support clinicians by integrating multiple sources of patient information to improve diagnostic precision and facilitate evidence-based clinical decision-making, thereby enhancing the overall quality of hepatology care. [1,3,23]

4.2 Detection and Prediction of Disease Progression with Treatment Response

Beyond diagnosis, AI plays a crucial role in predicting disease progression and evaluating treatment response in patients with liver diseases. By analyzing clinical characteristics, laboratory findings, imaging features, and molecular biomarkers, AI models can estimate the severity of liver disease, predict the progression of fibrosis and cirrhosis, and identify patients at increased risk of developing complications, including hepatocellular carcinoma. [1,2,24,25]

AI also contributes to personalized medicine by predicting individual responses to antiviral therapy and other treatment modalities. Predictive algorithms assist clinicians in selecting appropriate therapeutic strategies, monitoring treatment effectiveness, and optimizing long-term patient management. These models support risk stratification and enable timely interventions, ultimately improving clinical outcomes and reducing disease-related morbidity. [1,2,4,26,27]

The integration of AI into clinical decision-support systems further enhances healthcare delivery by providing evidence-based recommendations and facilitating continuous patient monitoring. Although additional clinical validation and standardized implementation are required, AI continues to demonstrate significant potential in improving the diagnosis, prognosis, and treatment of hepatitis and other liver diseases. [2,3,4,28,30]

Furthermore, the integration of artificial intelligence into hepatology has the potential to transform routine clinical practice by enabling continuous patient monitoring, early identification of disease progression, and timely clinical intervention. AI-driven clinical decision support systems can assist healthcare professionals in interpreting complex medical information, reducing diagnostic variability, and improving treatment planning. As AI technologies continue to evolve, their integration with advanced imaging techniques, molecular diagnostics, and precision medicine is expected to further enhance the prevention, diagnosis, prognosis, and management of hepatitis and other liver diseases. Nevertheless, continued clinical validation, multidisciplinary collaboration, and adherence to ethical and regulatory standards will be essential to ensure the safe, reliable, and widespread implementation of AI in hepatology. [2,3,4,29,30]

5.Challenges and Limitations of Artificial Intelliegnce:

Despite the remarkable advancements of artificial intelligence (AI) in healthcare and drug discovery, several challenges continue to limit its widespread clinical implementation. One of the most significant barriers is the availability of high-quality, standardized, and representative datasets. AI algorithms require large volumes of accurate and diverse medical data for effective training and validation. However, many healthcare datasets are incomplete, imbalanced, or collected from a single institution, which may reduce the accuracy, reliability, and generalizability of AI models when applied to different patient populations. Therefore, the development of standardized, multicenter datasets is essential for improving the robustness and clinical applicability of AI systems. [2,3,18,21]

Another important limitation is the lack of transparency and interpretability of many AI models, particularly deep learning algorithms. These models often function as “black-box” systems, providing highly accurate predictions without clearly explaining the reasoning behind their decisions. The inability to understand how AI reaches a particular conclusion may reduce clinicians’ confidence in its recommendations and limit its acceptance in routine medical practice. Developing explainable and transparent AI systems is therefore crucial to improve trust, accountability, and collaboration between clinicians and AI technologies. [2,3,22,24]

Ethical, legal, and privacy concerns also remain major challenges in the implementation of AI. The use of electronic health records, medical images, genomic information, and other sensitive patient data increases the risk of data breaches, unauthorized access, and misuse of personal information. Furthermore, biases within training datasets may lead to unequal healthcare outcomes and reduced diagnostic performance in certain patient populations. Establishing robust data security measures, ensuring informed patient consent, minimizing algorithmic bias, and complying with regulatory frameworks are essential for the responsible use of AI in healthcare. [3,4,25,27]

In addition, the clinical validation and regulatory approval of AI-based technologies remain complex processes. Many AI models demonstrate promising results in retrospective studies but fail to achieve similar performance in real-world clinical settings because of differences in patient demographics, disease prevalence, and healthcare infrastructure. Consequently, prospective multicenter studies, external validation, and continuous performance monitoring are necessary before AI systems can be safely integrated into routine clinical practice. International regulatory agencies are also developing guidelines to ensure the safety, effectiveness, and quality of AI-enabled medical technologies. [2,3,26,28]

Another challenge involves the integration of AI into existing healthcare systems. Successful implementation requires adequate digital infrastructure, interoperability between healthcare databases, trained healthcare professionals, and collaboration among clinicians, data scientists, engineers, and policymakers. In many low- and middle-income countries, limited technological resources, financial constraints, and inadequate training may delay the adoption of AI despite its enormous potential to improve healthcare delivery. Addressing these barriers through multidisciplinary collaboration, continuous education, and investment in digital health infrastructure will be essential for maximizing the benefits of AI in healthcare and hepatology. [2,3,4,29,30]

Another important limitation is the shortage of healthcare professionals with expertise in artificial intelligence and data science. Successful implementation of AI requires adequate training of clinicians, continuous technical support, and collaboration between medical experts, computer scientists, and engineers. Educational initiatives and interdisciplinary partnerships will therefore play a crucial role in ensuring the effective translation of AI technologies from research settings to routine clinical practice. [3,4,27,29]

Future perspectives:

Artificial intelligence (AI) is expected to play an increasingly significant role in transforming healthcare by improving disease prevention, diagnosis, treatment, and patient management. Rapid advancements in machine learning, deep learning, natural language processing, and generative AI are likely to enhance the accuracy, efficiency, and accessibility of healthcare services. As computational technologies continue to evolve and larger, high-quality clinical datasets become available, AI systems are expected to become more reliable, interpretable, and widely applicable in routine medical practice. [2,3,18,22]

One of the most promising future directions is the integration of AI with precision medicine. By combining genomic, proteomic, metabolomic, imaging, and clinical data, AI can provide comprehensive patient-specific information that supports individualized diagnosis and treatment. Such personalized approaches have the potential to improve therapeutic outcomes, minimize adverse drug reactions, and optimize long-term management of chronic diseases, including viral hepatitis and other liver disorders. [2,4,23,24]

The continued development of explainable artificial intelligence (XAI) is expected to address one of the major barriers to AI adoption in healthcare. Unlike conventional “black-box” models, explainable AI provides transparent and interpretable decision-making processes, enabling clinicians to better understand and trust AI-generated recommendations. Improved transparency will strengthen clinical confidence, facilitate ethical decision-making, and promote the responsible implementation of AI in patient care. [3,4,25,26]

Future research is also expected to focus on integrating AI with digital health technologies, telemedicine, wearable sensors, and remote patient monitoring systems. These technologies will enable continuous assessment of patient health, early identification of disease progression, and timely medical intervention. Such innovations may be particularly beneficial for patients with chronic liver diseases who require regular follow-up and long-term monitoring. [2,3,27,28]

In the field of hepatology, AI is anticipated to further improve the early detection of viral hepatitis, assessment of liver fibrosis, prediction of treatment response, and diagnosis of hepatocellular carcinoma through advanced imaging analysis and predictive modelling. AI-driven drug discovery and drug repurposing are also expected to accelerate the development of novel therapeutic agents while reducing research costs and development time. These advances may contribute significantly to achieving the World Health Organization’s goal of eliminating viral hepatitis as a major public health threat. [1,2,4,29,30]

Despite these promising opportunities, the future success of AI will depend on multidisciplinary collaboration among clinicians, researchers, data scientists, engineers, and policymakers. Continued efforts toward standardized clinical validation, robust regulatory frameworks, ethical governance, and equitable access to AI technologies will be essential to ensure their safe and effective integration into healthcare systems worldwide. With responsible implementation and continuous innovation, artificial intelligence has the potential to redefine the future of healthcare and significantly improve outcomes for patients with hepatitis and other liver diseases. [2,3,4,28,30]

Artificial intelligence is also expected to strengthen preventive healthcare and public health surveillance through the analysis of large-scale population health data. AI-based predictive models can identify high-risk populations, monitor

disease outbreaks, evaluate vaccination programmes, and support public health policies aimed at controlling viral hepatitis. Furthermore, the integration of AI with cloud computing, big data analytics, and mobile health applications may improve healthcare accessibility, particularly in low- and middle-income countries where access to specialist care is limited. These advancements have the potential to reduce healthcare disparities and contribute to the global elimination of hepatitis as a public health threat. [2,3,4,27,30]

CONCLUSION: Artificial intelligence (AI) has emerged as a transformative technology with immense potential to revolutionize healthcare, drug discovery, and the management of liver diseases. The integration of machine learning, deep learning, and advanced data analytics has significantly improved disease diagnosis, risk prediction, treatment planning, and personalized patient care. In hepatology, AI has demonstrated remarkable applications in the early detection of viral hepatitis, assessment of liver fibrosis, prediction of disease progression, diagnosis of hepatocellular carcinoma, and evaluation of treatment response, thereby supporting more accurate and evidence-based clinical decision-making. [1,2,3,4,5]

Furthermore, AI has accelerated the drug discovery process by facilitating target identification, virtual screening, lead optimization, and drug repurposing, thereby reducing the time and cost associated with conventional pharmaceutical research. Despite these significant advancements, challenges such as limited data quality, algorithm transparency, ethical concerns, patient privacy, regulatory approval, and clinical validation remain important barriers to its widespread clinical implementation. Addressing these challenges through interdisciplinary collaboration, standardized validation, and responsible governance will be essential to ensure the safe, ethical, and effective adoption of AI in healthcare. [3,4,10,18,24]

Looking ahead, continued advancements in artificial intelligence, combined with precision medicine, digital health technologies, and multidisciplinary research, are expected to further improve the prevention, diagnosis, and treatment of hepatitis and other liver diseases. As AI technologies continue to evolve, they have the potential to enhance healthcare accessibility, optimize clinical decision-making, and improve patient outcomes worldwide. With appropriate scientific validation and ethical implementation, artificial intelligence is expected to play a pivotal role in supporting the global effort to eliminate viral hepatitis as a major public health threat and to shape the future of modern healthcare. [2,4,5,26,30]

REFERNCES:

1. Nam D, Chapiro J, Paradis V, Seraphin TP, Kather JN. Artificial intelligence in liver diseases: Improving diagnostics, prognostics and response prediction. JHEP Rep. 2022;4(3):100443. doi:10.1016/j.jhepr.2022.100443.8
2. Serrano DR, Habib A, Khan S, et al. Artificial intelligence in drug discovery and development. Pharmaceutics. 2024;16(3):379. doi:10.3390/pharmaceutics16030379.
3. Yadav A, Sharma S, Verma P, et al. Artificial intelligence in healthcare: Revolutionizing diagnosis, treatment and patient care. Series Med Sci. 2023;4(1):36–48.

4. Topol EJ. High-performance medicine: The convergence of human and artificial intelligence. Nat Med. 2019;25(1):44–56. doi:10.1038/s41591-018-0300-7.
5. Esteva A, Robicquet A, Ramsundar B, et al. A guide to deep learning in healthcare. Nat Med. 2019;25(1):24–29. doi:10.1038/s41591-018-0316-z.
6. Rajpurkar P, Chen E, Banerjee O, Topol EJ. AI in health and medicine. Nat Med. 2022;28(1):31–38.
7. Beam AL, Kohane IS. Big data and machine learning in health care. JAMA. 2018;319(13):1317–1318. doi:10.1001/jama.2017.18391.
8. Jiang F, Jiang Y, Zhi H, et al. Artificial intelligence in healthcare: Past, present and future. Stroke Vasc Neurol. 2017;2(4):230–243. doi:10.1136/svn-2017-000101.
9. Yu KH, Beam AL, Kohane IS. Artificial intelligence in healthcare. Nat Biomed Eng. 2018;2(10):719–731. doi:10.1038/s41551-018-0305-z.
10. Kelly CJ, Karthikesalingam A, Suleyman M, Corrado G, King D. Key challenges for delivering clinical impact with artificial intelligence. BMC Med. 2019;17:195. doi:10.1186/s12916-019-1426-2.
11. Litjens G, Kooi T, Bejnordi BE, Setio AAA, Ciompi F, Ghafoorian M, et al. A survey on deep learning in medical image analysis. Med Image Anal. 2017;42:60–88. doi:10.1016/j.media.2017.07.005.
12. Erickson BJ, Korfiatis P, Akkus Z, Kline TL. Machine learning for medical imaging. Radiographics. 2017;37(2):505–515. doi:10.1148/rg.2017160130.
13. LeCun Y, Bengio Y, Hinton G. Deep learning. Nature. 2015;521(7553):436–444. doi:10.1038/nature14539.
14. Vamathevan J, Clark D, Czodrowski P, Dunham I, Ferran E, Lee G, et al. Applications of machine learning in drug discovery and development. Nat Rev Drug Discov. 2019;18(6):463–477. doi:10.1038/s41573-019-0024-5.
15. Paul D, Sanap G, Shenoy S, Kalyane D, Kalia K, Tekade RK. Artificial intelligence in drug discovery and development. Drug Discov Today. 2021;26(1):80–93. doi:10.1016/j.drudis.2020.10.010.
16. Ekins S, Puhl AC, Zorn KM, Lane TR, Russo DP, Klein JJ, et al. Exploiting machine learning for end-to-end drug discovery and development. Nat Mater. 2019;18(5):435–441. doi:10.1038/s41563-019-0338-z.
17. Zhavoronkov A, Vanhaelen Q, Oprea TI. Will artificial intelligence for drug discovery impact clinical pharmacology? Clin Pharmacol Ther. 2020;107(4):780–785. doi:10.1002/cpt.1795.
18. Bi WL, Hosny A, Schabath MB, Giger ML, Birkbak NJ, Mehrtash A, et al. Artificial intelligence in cancer imaging: Clinical challenges and applications. CA Cancer J Clin. 2019;69(2):127–157. doi:10.3322/caac.21552.
19. Deo RC. Machine learning in medicine. Circulation. 2015;132(20):1920–1930. doi:10.1161/CIRCULATIONAHA.115.001593.
20. Obermeyer Z, Emanuel EJ. Predicting the future—Big data, machine learning, and clinical medicine. N Engl J Med. 2016;375(13):1216–1219. doi:10.1056/NEJMp1606181.
21. Choi RY, Coyner AS, Kalpathy-Cramer J, Chiang MF, Campbell JP. Introduction to machine learning, neural networks, and deep learning. Trans Vis Sci Tech. 2020;9(2):14.

22. Topol EJ. Welcoming new guidelines for artificial intelligence in health care. Nat Med. 2020;26(9):1318–1320.
23. He J, Baxter SL, Xu J, Xu J, Zhou X, Zhang K. The practical implementation of artificial intelligence technologies in medicine. Nat Med. 2019;25(1):30–36.
24. Hosny A, Parmar C, Quackenbush J, Schwartz LH, Aerts HJWL. Artificial intelligence in radiology. Nat Rev Cancer. 2018;18(8):500–510.
25. Vamathevan J, Clark D, Czodrowski P, Dunham I, Ferran E, Lee G, et al. Applications of machine learning in drug discovery and development. Nat Rev Drug Discov. 2019;18(6):463–477.
26. Ekins S, Puhl AC, Zorn KM, Lane TR, Russo DP, Klein JJ, et al. Exploiting machine learning for end-to-end drug discovery and development. Nat Mater. 2019;18(5):435–441.
27. Zhavoronkov A, Vanhaelen Q, Oprea TI. Will artificial intelligence for drug discovery impact clinical pharmacology? Clin Pharmacol Ther. 2020;107(4):780–785.
28. Beam AL, Kohane IS. Big data and machine learning in health care. JAMA. 2018;319(13):1317–1318.
29. Kelly CJ, Karthikesalingam A, Suleyman M, Corrado G, King D. Key challenges for delivering clinical impact with artificial intelligence. BMC Med. 2019;17:195.
30. World Health Organization. Global hepatitis report 2024. Geneva: World Health Organization; 2024.