

Artificial Intelligence in Hepatitis Diagnosis, Treatment and Drug Discovery: Current Advances, Challenges and Future Perspectives

Malar R.P¹, Sriramani.M¹, Pritha Sri.R¹, Saradha.S¹,

Padmavani Arts & Science College for Women (Autonomous)

Corresponding author: malarrp52@gmail.com

Doi: <https://doi.org/10.5281/zenodo.22977778>

Received: 09August 2026

Accepted: 29 August 2026

Abstract

AI has proven to be revolutionary in terms of its application in healthcare for the diagnosis, treatment, and management of various infectious diseases such as hepatitis. Hepatitis is a condition that is associated with infection from several hepatitis viruses, namely, hepatitis A, B, C, D, and E, which affects many millions of individuals and results in the death of individuals due to liver complications such as chronic liver disease, cirrhosis, and hepatocellular carcinoma. The advancement of AI has seen an improvement in the way diseases can be managed, specifically in machine learning (ML), deep learning (DL), natural language processing (NLP), and computer vision. AI has shown great potential in enhancing hepatitis care, through the use of AI algorithms that can analyze clinical data, laboratory tests, images, and genomics data for better diagnosis, predicting the progression of the disease, tailoring treatment strategies, and facilitating the discovery of drugs. AI is also involved in the detection of novel antiviral agents, vaccines, and biomarkers using multi-omics and massive amounts of biomedical data. In spite of all these advantages, there are still various challenges such as data privacy, transparent algorithms, ethical considerations, approval from regulators, and the requirement of quality data sets. This review aims to highlight recent trends in AI utilization in hepatitis diagnostics, treatment, precision medicine, and drug discovery, and future opportunities related to these aspects.

Keywords: Artificial Intelligence, Hepatitis, Machine Learning, Deep Learning, Drug Discovery, Precision Medicine, Liver Diseases, Digital Health.

1.Introduction

Viral hepatitis is still among the major challenges facing global public health in terms of number of victims as well as being a major contributor to morbidity and mortality due to liver diseases. Viral hepatitis is caused by five types of viruses that infect the liver—HAV (hepatitis A virus), HBV (hepatitis B virus), HCV (hepatitis C virus), HDV (hepatitis D virus), and HEV (hepatitis E virus), which differ in terms of mode of transmission, symptoms, and disease outcomes (World Health Organization [WHO], 2024; Polaris Observatory Collaborators, 2022).

Although HAV and HEV cause acute and self-limiting infection, HBV and HCV cause chronic infection that can result in liver fibrosis, cirrhosis, and hepatocellular carcinoma (HCC) (WHO, 2024; Terrault et al., 2018). According to recent reports by WHO, viral hepatitis still kills about 1.3 million people annually.

Even though impressive strides have been made in hepatitis vaccine research, antiviral treatment, and public health initiatives, many infected individuals go undetected and untreated, especially in developing nations. The lack of timely diagnosis, poor health care system development, restricted access to molecular diagnostics laboratories, and poor disease recognition are some of the problems that still affect global hepatitis elimination endeavors (WHO, 2024; Cooke et al., 2019). Chronic hepatitis B virus and C virus infections typically do not cause symptoms in their initial stages, and therefore, liver damage occurs without showing any symptoms. This has led to a rising demand for technologies that can help with disease prediction and diagnosis.

Artificial Intelligence (AI) is one of the most groundbreaking technologies developed in modern medicine to allow the computer to accomplish tasks that need intelligence. Artificial Intelligence incorporates a wide range of computational techniques such as machine learning (ML), deep learning (DL), natural language processing (NLP), and computer vision, all of which have shown great promise in their use in health care services. Such techniques use large data of patients' history, images, laboratory results, and genomics to detect patterns, develop prediction models and help in the diagnosis of patients. Artificial Intelligence has been increasingly used in hepatology in the last decade.

The recent studies show that AI is able to identify liver fibrosis, cirrhosis, steatosis, and hepatocellular carcinoma based on the data obtained from medical imaging techniques including ultrasound, CT scans, and MRI. Moreover, AI-driven predictive models allow for predicting the progression, treatment outcome, and prognosis of the disease based on electronic health records, laboratory findings, markers of viruses, and genetics. Finally, AI helps to speed up the process of drug discovery by implementing virtual screening, target recognition, and molecular modeling. The above mentioned achievements should be especially emphasized taking into account the objective set by the WHO to eliminate viral hepatitis as a major health problem by 2030. Considering all of these groundbreaking developments, the main goal of this review is to examine thoroughly the current uses of AI in diagnosing, treating, personalized medicine, and drug development of hepatitis diseases. It will also address the current issues, ethics, and future prospects of using AI in hepatology and hepatitis eradication programs.

2. Overview of hepatitis

Hepatitis is a term used to describe the inflammation of the liver resulting from viral infections, autoimmune diseases, alcohol intake, metabolic defects, toxins, or liver injury resulting from medications. Among the above-mentioned causes of the condition, viral hepatitis stands out to be the major problem in the world of public health today because of infections caused by hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis D virus (HDV), and hepatitis E virus (HEV) (World Health Organization [WHO], 2024; Lemon et al., 2018).

2.1 Hepatitis A virus (HAV)

HAV is a nonenveloped RNA virus that can be spread through the fecal-oral route through contaminated food or water. According to (Lemon et al. 2018), HAV typically results in acute, self-limiting disease and does not lead

to chronic liver diseases. However, vaccination against HAV has led to the decline of HAV infections in various areas; however, HAV epidemics still happen in areas where proper sanitation is lacking and clean water is inaccessible (WHO, 2024).

2.2 Hepatitis B virus (HBV)

HBV stands for hepatitis B virus that is a partially double stranded DNA virus classified in the Hepadnaviridae family and transmitted via blood, sexual intercourse, and vertically during the perinatal period. Chronic infection by HBV is one of the leading causes of liver fibrosis, cirrhosis, and hepatocellular carcinoma (Terrault et al., 2018; WHO, 2024). However, despite the existence of an efficient vaccine and treatment methods, HBV infection is very common globally.

2.3 Hepatitis C virus(HCV)

The hepatitis C virus is an RNA virus that is usually spread via contact with blood. Hepatitis C virus is different from HAV in that HCV often results in chronic infections that cause liver damage and lead to hepatocellular carcinoma (Polaris Observatory Collaborators, 2022; WHO, 2024). The discovery of direct-acting antiviral drugs has made it possible to cure HCV infections with success rates surpassing 95%.

2.4 Hepatitis D Virus (HDV)

HDV is a defective RNA virus that needs the presence of HBV for its replication. The infection caused by HDV may result from co-infection of HBV or superinfection in those who are already suffering from chronic HBV infection. As pointed out by (Rizzetto et al .2015), HDV infection results in severe liver diseases and faster development of cirrhosis with higher mortality than that of HBV infection.

2.5 Hepatitis E Virus (HEV)

Hepatitis E virus is a non-enveloped RNA virus that transmits via water contamination and is a leading cause of acute viral hepatitis in developing countries. Although HEV infection is mostly self-limiting, in some instances, it causes severe illness among pregnant women and immunocompromised patients (Kamar et al., 2017; WHO, 2024). Occasionally, zoonotic transmission due to the consumption of undercooked meat has been reported in developed nations.

In order to effectively prevent, diagnose, treat, and control various hepatitis viruses, it is important to understand their biology, modes of transmission, and clinical presentations. In addition, these fundamentals of the diseases allow for further exploration of how artificial intelligence can help with diagnosing and treating hepatitis.

3.Burden of Viral Hepatitis at a Global Level

Viral hepatitis has remained an important global health problem due to its morbidity and mortality impact despite the existence of effective vaccinations and antivirals. As per the statistics from the World Health Organization (WHO, 2024), around 304 million individuals have been living with hepatitis B or hepatitis C virus infection in 2022. Around 1.3 million deaths were recorded due to the consequences of viral hepatitis, including cirrhosis and hepatocellular carcinoma. These statistics indicate that viral hepatitis is among the top reasons for death caused by infectious diseases globally, equaling tuberculosis. Additionally, according to Polaris Observatory

Collaborators (2022), hepatitis B has been the most predominant infection, especially in the Western Pacific and African regions, while hepatitis C is prevalent in Europe, Central Asia, and Eastern Mediterranean areas.

Viral hepatitis epidemiology varies from place to place based on geography, economic and social factors, health care system, and vaccination status. As cited by (Schweitzer et al., 2015), about 3.5% of the global population suffers from hepatitis B virus chronic infection, and (Blach et al., 2022), have made it clear that hepatitis C continues to infect millions of people even with the availability of direct-acting anti-viral medicines. The prevalence of disease is highest among low- and middle-income countries due to lack of screening, poor health care facilities, unsterile medical procedures, and low awareness among the public.

As a consequence of this increasingly alarming health concern, the WHO (2024) developed the Global Health Sector Strategy aimed at achieving elimination of the public health problem of viral hepatitis by 2030. The strategy is meant to cut down the incidence rate by 90 percent and mortality associated with the disease by 65 percent due to increased vaccination rates, improvement in blood safety, detection of the illness at an early stage, administration of effective anti-virals, and enhanced surveillance system. Nevertheless, (Razavi et al.2023) noted that there are discrepancies in achievements concerning the stated goals in different countries owing to economic problems, inequality in health care, and lack of access to diagnostic and treatment services. Therefore, it is crucial to utilize innovative technology, such as artificial intelligence, for the above purposes.(Figure.1).

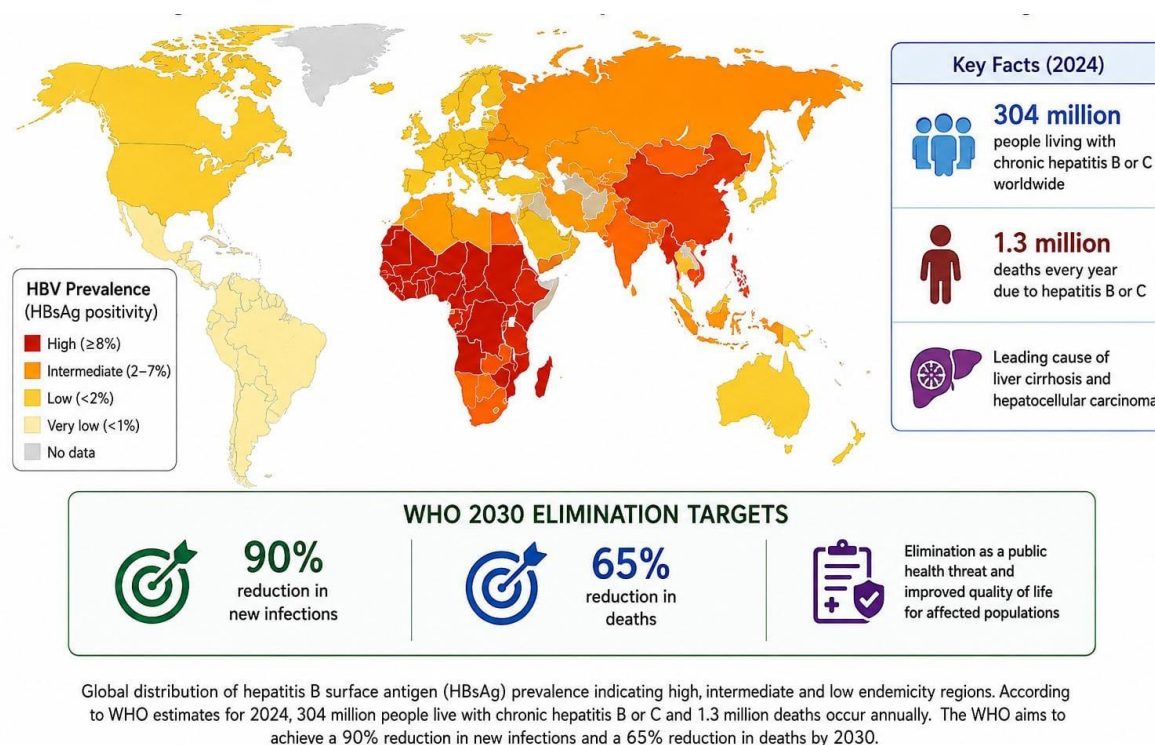


Figure.1.Global Burden of Viral Hepatitis and WHO Elimination Targets.

4.Fundamental Concepts of Artificial Intelligence in Medicine

Artificial Intelligence (AI) refers to the area in computer science where intelligent machines are programmed to execute functions that normally require human intelligence such as learning, reasoning, recognizing patterns, making decisions, and solving problems. In the last decade, the use of artificial intelligence has been integrated

into modern medicine through enhancing the accuracy and efficiency of diagnosing diseases and managing patients.(Topol et al. 2019) pointed out the ability of AI to change the way clinical practice is done as a result of integration of medical big data with computing algorithms to help health practitioners in making better decisions. In addition,(Esteva et al. 2019) noted the ability of AI to process huge amounts of clinical, laboratory, imaging, and genomic data beyond human capacity.

4.1 ML (Machine Learning)

One of the prominent subsets of artificial intelligence is machine learning (ML). The machine learning techniques allow the computer system to learn through the past data without programming. Machine learning algorithms help detect any pattern in the structured and unstructured data for predicting disease prognosis, classification of patients, and optimization of therapeutic plans. As per the research conducted by(Rajkomar et al.), ML models enhance the prediction process for clinical applications through the analysis of EHR, laboratory parameters, and demographics. In addition to this, Beam & Kohane mentioned that supervised and unsupervised learning models are commonly used for predicting disease progression and identifying at-risk patients.

4.2 DL (Deep Learning)

Deep Learning (DL) is an emerging form of machine learning based on artificial neural networks with more than one hidden layer for the analysis of biomedical data. Deep learning has proven itself extremely effective in the interpretation of medical imaging data, including ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and digital pathology. As was stated by(Litjens et al. 2017), deep learning-based solutions are capable of delivering diagnostic performance on par with highly qualified clinicians in a number of imaging areas. Regarding liver diseases, it has been established that deep learning models exhibit high sensitivity and specificity in the diagnosis of liver fibrosis, cirrhosis, steatosis, and hepatocellular carcinoma.

Natural Language Processing (NLP) and Computer Vision are other two AI-based technologies which have greatly contributed in expanding healthcare applications. NLP captures medically relevant information from electronic health records, physicians' notes, pathology reports and scientific literature while computer vision helps interpret medical imagery and histopathology slides with great accuracy. According to(Jiang et al. 2017), the combination of NLP, computer vision, and machine learning would provide comprehensive clinical decision-making support systems which would help physicians diagnose, predict and develop treatment plans. With the advancement of AI technologies in the coming years, they are bound to be crucial in improving healthcare delivery, biomedical research and global eradication of infections like viral hepatitis.(Table.1).

Table.1.Applications of Artificial Intelligence in Viral Hepatitis.

AI Tecnology	Application	Clinical Benefits
Machine Learning	Decrease prediction and risk assessment	Early diagnosis and personalized treatment

Deep Learning	Medical image analysis (CT,MRI,Ultrasound)	Improved detection of fibrosis,cirrhosis and HCC
Natural Language Processing	Electronic health record analysis	Clinical decision support
Computer Vision	Histopathological image interpretation	Accurate disease classification
Predictive Analytics	Treatment response prediction	Improved patient outcomes

5.AI and Its Role in Diagnosing Hepatitis

Accurate diagnosis of viral hepatitis at an early stage is important in ensuring reduction of the disease burden, as well as prevention of serious conditions like liver fibrosis, liver cirrhosis, and hepatocellular carcinoma (HCC). Traditional methods of diagnosis such as serology, PCR, liver biopsy, and medical imaging have proven effective, but these procedures might be costly, invasive, or need expertise to interpret results. According to (Rajkomar et al. 2019), the introduction of artificial intelligence (AI) in the process of diagnosis has been successful, owing to the use of large amounts of data from various sources to predict health conditions. This view is seconded by (Topol et al. 2019).

With the development of artificial intelligence (AI), machine learning (ML) algorithms have proved to be useful tools in detecting individuals with a high risk of progressing hepatitis based on their EHRs, biochemical parameters, viral loads, and demography. As mentioned by (Kamal et al. 2023), ML algorithms can predict chronic hepatitis B and hepatitis C progression based on the analysis of regular clinical data. In a similar manner, (Beam & Kohane et al. 2018) stated that AI helps predict the patient's condition and allows healthcare providers to choose the best diagnostic and therapeutic options for each patient.

Deep Learning (DL), which is part of AI, has brought about tremendous innovations in medical imaging in the sense that DL can help identify small pathologies that may go unnoticed by the human eye. The use of CNNs has proven highly effective in analyzing images from ultrasound, CT, MRI, and histopathological images when evaluating liver fibrosis, cirrhosis, steatosis, and hepatocellular carcinoma. (Litjens et al. 2017) found out that DL techniques were highly successful in providing diagnoses that were on par with those given by radiologists in various image analyses. More recently, (Liu et al. 2023) revealed that artificial intelligence-assisted liver imaging enhanced diagnostics while reducing variability in patient diagnoses.

Additionally, artificial intelligence is changing molecular diagnostics by merging genomic, transcriptomic, proteomic, and metabolomics data sets. With the help of AI algorithms, novel biomarkers related to viral replication, immune response, progression of the disease, and treatment can be identified from high-dimensional biological data sets. According to (Libbrecht & Noble et al. 2015), machine learning can aid in understanding genomic data efficiently, making biomarker identification easy. Moreover, according to (Jiang et al. 2017), multi-omics data merged with artificial intelligence can help improve personalized diagnosis, choose optimal treatment, and develop interventions for viral hepatitis.

On the whole, AI-powered diagnostic algorithms deliver speedier results, greater accuracy, lower healthcare expenses, and greater accessibility, especially in disadvantaged areas. Nevertheless, proper implementation of such systems in clinical practice depends on the availability of well-curated data sets, robust external validation, regulatory endorsement, and careful handling of ethical issues. As stated by(Topol et al.2019) and(Esteva et al. 2019), the cooperation of specialists from different fields is necessary for the development of safe and efficient AI algorithms for hepatitis diagnostics.(Figure.2).

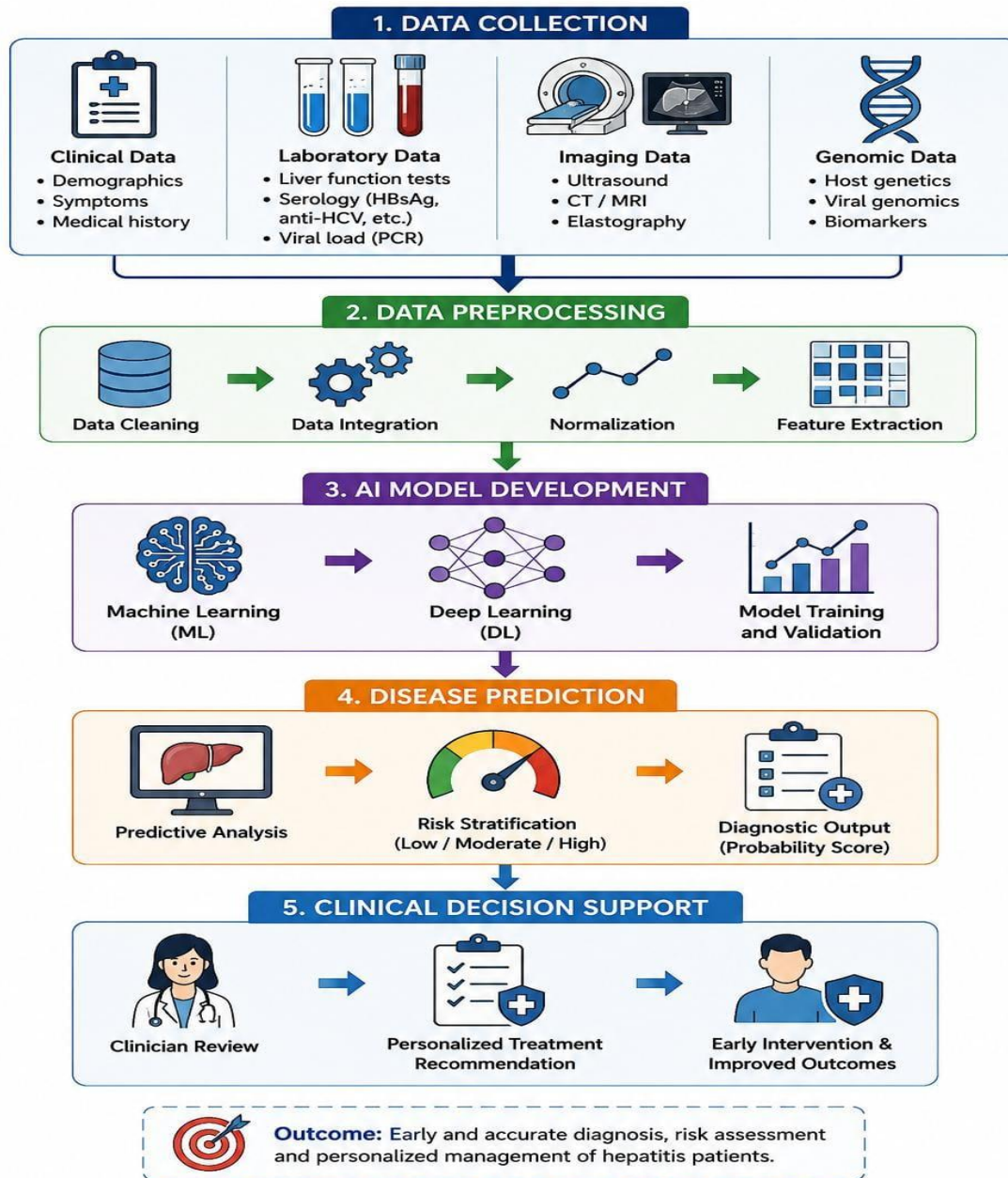


Figure.2.AI Workflow in Hepatitis Diagnosis.

6.Use of Artificial Intelligence in Hepatitis Treatment

Artificial intelligence is playing an increasingly important role in the treatment of viral hepatitis, offering personalized therapy regimens, optimal selection of antiviral drugs, and effective patient surveillance.

Conventional treatment for chronic hepatitis B and C viruses depends on the levels of viral loads, liver functions, fibrosis, and treatment guidelines. (Topol et al. 2019) noted that artificial intelligence could combine varied information from clinical, laboratory, image, and genetic factors to make personalized treatment plans, hence improving the quality of treatment. In a similar study, (Rajkomar et al. 2019) found out that machine learning improves decision-making processes by identifying complicated associations between patient features which cannot be observed by standard statistics.

The application of machine learning algorithms has proven to be highly effective in the prediction of treatment response in patients under antiviral therapy. Using machine learning techniques, the probability of a sustained virological response (SVR) is predicted through the analysis of demographic attributes, viral genotypes, liver enzyme levels, fibrosis scores, and genetic polymorphisms, and the identification of those patients that will need other methods of treatment can be made possible. As stated by Kamal et al., predictive models using artificial intelligence provide great improvement in the treatment strategies used for the management of patients with hepatitis B and hepatitis C infections, decreasing treatment failures.

AI is also very important in the area of precision medicine where treatment of individuals will be customized depending on their genetic makeup, immunity levels, degree of illness, and other illnesses. The purpose of precision medicine is to give the right treatment to the right patient at the right time in order to maximize treatment and minimize side effects. As indicated by (Ashley et al. 2016), precision medicine is an emerging field in which genomics, bioinformatics, and AI can be utilized to improve patient care. When it comes to hepatology, AI-driven precision medicine helps doctors to recognize patients who are at risk for certain complications.

Another significant way of AI application in managing patients with hepatitis is continuous patient monitoring. Digital healthcare solutions with AI, wearables, and mobile health applications can continuously monitor patient compliance, liver status, drugs usage, and clinical signs. As noted by (Esteva et al., 2019), remote monitoring systems enabled by AI increase patient engagement, allow the early detection of any problems with treatment, and decrease the number of hospitalizations. Furthermore, according to (Jiang et al. 2017), integrated electronic health records enabled by AI provide automatic clinical notifications for doctors.

Notwithstanding all these promising developments, however, there are a number of factors impeding the use of AI in the treatment of hepatitis in general practice. The problems of insufficient access to reliable medical databases, algorithmic bias, privacy issues, inadequate validation processes, and regulatory issues can be named among them. (Yu et al. 2018) stressed that the transparency of algorithms, clinical validation, and interdisciplinarity are of critical importance for ensuring that the application of AI is safe and effective in routine practice. With the development of AI technologies, they will be indispensable part of the treatment of hepatitis.

7.Role of Artificial Intelligence in Discovering Drugs and Vaccines

Artificial intelligence (AI) has played a vital role in transforming the drug discovery process through saving the time, cost, and complexity of drug development in case of viral hepatitis. Traditional drug discovery normally takes more than a decade of time and significant cost to move from laboratory testing to practical application in the clinic. (Paul et al. 2010) mentioned that traditional drug discovery is highly associated with the rate of failure and increased costs, which have created the necessity of novel computational techniques. On the other hand,

(Tirosoyan et al. 2026) discussed the role of artificial intelligence in speeding up the antiviral drug discovery process.

One of the main ways in which AI technology is applied to hepatitis research is in drug repurposing where approved drugs are screened to detect their new antiviral properties towards hepatitis viruses. Drug repurposing greatly reduces the time needed for development as the safety profile of the compounds is already known. In their study, (Ugbaja et al. 2026) stated that machine learning algorithms have been effective in selecting potential drugs that act on the hepatitis B virus (HBV) including those that disrupt cccDNA, viral polymerase, and HBx protein. Likewise, (Tirosoyan et al. 2026) highlighted how AI-assisted virtual screening and predictive modeling enhance the detection of antiviral compounds.

The application of artificial intelligence has also led to an improvement in structure-based drug design through accurate predictions of protein structure, ligand-binding site, and drug target interaction. The deep learning approach has enabled scientists to analyze millions of chemicals and select molecules that exhibit the best pharmacological attributes. For instance, according to (Morel et al. 2026), molecular modeling with the help of AI has been able to help in target identification and lead optimization for various liver disorders, including chronic hepatitis and hepatocellular carcinoma. Also, as mentioned by *Frontiers in Pharmacology* (2026), the use of AI can predict hepatotoxicity, off-target interaction, and adverse drug reaction at the initial stage of drug discovery.

In addition to drug discovery, AI is also being used to facilitate the vaccine discovery process. Through machine learning techniques, viral genomic sequences are analyzed to recognize conserved epitopes that are capable of providing protection. Immunoinformatics through AI plays an instrumental role in the antigen selection process, predicting vaccine immunogenicity, and vaccine formulation optimization. According to (Ugbaja et al. 2026), the application of AI for vaccine design will help in developing the next generation of therapeutic vaccines against chronic hepatitis B through the use of genomics, proteomics, and immunological data sets.

However, there are still some issues to be solved before AI could become an integral part of the discovery of drugs for hepatitis treatment. The quality of AI-based prediction largely depends on having access to adequate biological data, validation, and clear understanding of algorithms used. (Morel et al. 2026) identified regulation, interpretability, standardization of data, and ethics as major problems on the way to implementation in clinical practice. Nonetheless, further development of machine learning, computational biology, and multi-omics is expected to make AI an essential part of antiviral drug discovery and hepatology.(Figure.3).

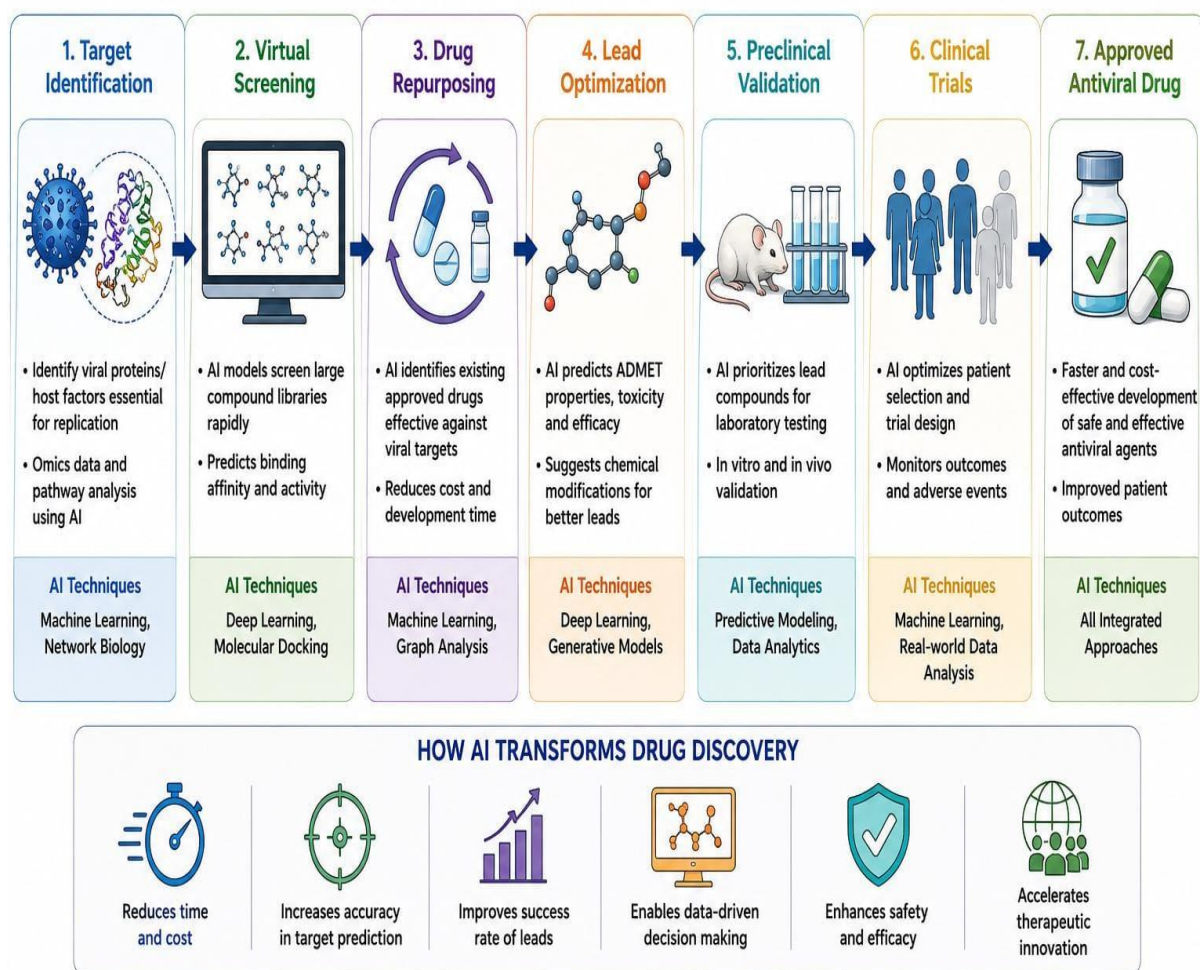


Figure.3.AI –Assisted Drug Discovery Pipeline For Antiviral Agents.

8.Artificial Intelligence and Public Health Surveillance in Viral Hepatitis Elimination

Artificial intelligence is fast becoming a valuable asset in public health in its ability to enhance surveillance, detection, and planning of healthcare for viral hepatitis. A good surveillance system is key in the tracking of incidence and prevalence levels of hepatitis virus infections. In its latest report on the elimination of viral hepatitis by 2030, the World Health Organization (WHO, 2024) emphasizes the need for a good surveillance system as well as early detection, vaccinations, and treatments to meet the set target. (Topol et al.2019) goes further to note that the use of artificial intelligence can enable real-time disease surveillance and evidence-informed public health decision-making.

Machine learning algorithms are currently being deployed to predict hepatitis epidemics and the groups of people who are at a higher risk of contracting hepatitis. The use of artificial intelligence to analyze demographics, environment, vaccine uptake rates, migrations, and health care usage leads to more accurate predictions of future disease patterns compared to statistical methods. (Rajkomar et al. 2019) found out that AI predictive analytics lead to better disease predictions and screening programs. In the same vein, (Beam & Kohane et al.2018) showed that AI-based surveillance systems help health officials make efficient use of their medical resources.

AI is also essential in enhancing the screening process and case detection in hepatitis. In many cases, people with hepatitis B virus or hepatitis C virus remain asymptomatic for many years. This means that the diagnosis is not done until some time later, and the virus continues spreading through the patients. Through the use of AI in decision support systems, such cases can be detected easily from patient history and health records. According to (Jiang et al. 2017), this method increases case detection through AI and ensures clinical intervention early. Similarly, according to (Esteva et al. 2019), integration of AI technology with digital health and telemedicine makes screening more accessible.

Apart from surveillance and screening, AI helps in developing national and international programs of elimination of hepatitis by optimizing vaccination plans, analyzing effectiveness of public health initiatives, and treatment success. Using AI methods, one can analyze population-wide information to find regions with poor vaccination coverage, which will need special attention to launch successful immunization drives there. According to WHO (2024), the use of data-based public health approaches is critical in realizing the goal of eliminating viral hepatitis as a public health problem until 2030 as set out in the Sustainable Development Goals. Further, (Yu et al.2018) argued that AI-supported policy planning may increase efficiency in healthcare through proper allocation of resources.

Although all of these benefits exist, the implementation of AI in public health needs good surveillance data, proper reporting systems, robust cyber security, and international cooperation. According to (Topol et al.2019), the key factors in using AI algorithms for decision making in public health are transparency, ethical governance, and validation of AI tools. With the development of digital health innovations, it is likely that AI will become an integral part of hepatitis monitoring, prevention, and eradication worldwide.

9.Problems, Challenges, and Future Directions of Artificial Intelligence for Hepatitis

Even though there have been promising developments in the use of artificial intelligence (AI) in the diagnosis, treatment, and discovery of drugs for hepatitis, there are a number of issues that pose constraints on the broad application of AI. One of these challenges is the availability of good quality datasets. The success of AI models requires large, high-quality, and diverse datasets in order for them to train and validate. In fact, (Morel et al. 2026) indicated that many of the AI models used in hepatology have been trained on retrospective, single center datasets. Likewise, (Kusztos and Simonetto et al.2025) pointed out that insufficient external validation continues to be a problem that limits the use of AI in hepatology.

One other limitation is that deep learning algorithms are considered a black box. While these algorithms have proved to provide better prediction, the clinicians may experience difficulty understanding how the diagnosis or treatment was reached. This issue may decrease the trust of clinicians to such models and therefore prevent the application in clinical practice. According to (Lu et al. 2024), the development of explainable artificial intelligence is crucial to increase transparency and trust and therefore acceptance among the clinicians. Moreover, according to (Eskandar et al.2025), poor external validation, overfitting, and heterogeneity of the data are the methodological limitations in AI performance in hepatology.

The ethical and legal issues form other obstacles to the adoption of AI technologies. The use of EHRs, genomics, and imaging necessitates the protection of patients' privacy and secure handling of data. (Ho and Asrani et al.2025) stressed that the framework for governing AI needs to be focused on fairness, transparency, accountability, and

prevention of algorithmic biases. Similarly, (Morel et al. 2026) stated that there is a need for regulatory policies and ethical guidance to make sure that AI is used appropriately in the treatment of liver diseases.

Despite all these problems, however, the prospects for applying AI technology in hepatitis studies look extremely promising. The fast progress in the development of machine learning, deep learning, natural language processing, and multi-omics approaches could make prediction of the disease, personalized medicine, and discovering antiviral drugs more efficient. Clinical decision support systems using artificial intelligence could help doctors in choosing the appropriate treatment methods for patients, assessing its effectiveness, and predicting the clinical outcome. As (Kusztos and Simonetto et al.2025) suggested, the next step of research should be multicenter prospective validation, making AI models explainable, and integrating AI smoothly into the clinical routine. Moreover, (Morel et al. 2026) noted that the collaboration between clinicians, microbiologists, bioinformaticians, data scientists, and policymakers would be critical for utilizing AI technology for reaching the goals of the World Health Organization of eliminating hepatitis as a threat to public health by 2030.(Table.2).

Table.2.Future Perspectives of AI in Hepatitis Research.

Research Area	Future Direction	Expected Impact
Precision Medicine	AI-guided individualized therapy	Better treatment outcomes
Drug Discovery	AI-assisted antiviral drug development	Faster Identification of new drugs
Vaccine Development	Immunoinformatics and epitope prediction	Improved vaccine design
Multi-omics Integration	Genomics,proteomics and metabolomics.	Discovery of novel biomarkers
Public Health	AI-based disease surveillance	Support hepatitis elimination by 2030
Clinical Decision Support	Explainable AI (XAI)	Increased clinician trust and adoption

Conclusion

The use of AI has brought about changes in the field of hepatology by offering unique approaches in diagnosing, treating, surveillance, and drug discovery of viral hepatitis. Machine learning, deep learning, natural language processing, and computer vision have been incorporated in AI and improved the performance in disease detection, predicting the progression of disease, and treatment decision-making. AI has the capability to change the health sector because of the application of computational intelligence and clinical expertise. Moreover, AI-based technologies are speeding up translational medicine and developing precision medicine in liver diseases.

Another significant contribution of AI has been its role in antiviral drug design, vaccine creation, and public health monitoring through rapid data processing in clinical, genomic, and epidemiologic big datasets. The WHO (2024)

states that for attaining the goal of eliminating viral hepatitis globally by 2030, there is a need for innovation in terms of new technology that facilitates early diagnosis and treatment along with disease monitoring. Here, too, AI has proved to be an efficient tool through the use of predictive modeling, image analysis automation, and clinical decision-making systems.

However, there are still several obstacles that stand in the way of routine implementation of artificial intelligence in the field of hepatology. The main problems include concerns about data quality, algorithmic transparency, ethics, patient confidentiality, and approval. The interdisciplinary cooperation is required to create reliable AI solutions that can be used in practice. This should involve clinicians, microbiologists, data scientists, bioinformaticians, and policymakers. To sum up, AI is an innovative and disruptive technology which holds the potential to change every sphere related to viral hepatitis management from its prevention and detection to treatment optimization and drug development. Research, global cooperation, proper validation and governance of AI will be vital for making this happen. With the help of further innovations and public health activities worldwide, AI is anticipated to become a key driver of realization of the goal set by the WHO to eliminate viral hepatitis by 2030.

Acknowledgement

The authors sincerely thank the organizers of the World Hepatitis Day 2026 Review Article Competition for offering an outstanding platform to promote research, innovations, and awareness in the field of viral hepatitis. We are motivated by the theme of World Hepatitis Day 2026, "Hepatitis: Let's Break It Down," which encourages us to break barriers in the prevention, diagnosis, treatment, and elimination of hepatitis by working together and being innovative. Our sincere gratitude goes to our faculty guide for their valuable guidance, constant encouragement, and helpful suggestions during the preparation of this review article. Moreover, we are thankful to all the researchers, doctors, and healthcare professionals who have worked hard and contributed to the publication of articles on the role of artificial intelligence in diagnosing, treating, and developing drugs for hepatitis patients.

Reference

1. Abbasi, J. (2023). Artificial intelligence and the future of medicine. *JAMA*, 329(2), 101–103.
2. American Association for the Study of Liver Diseases. (2023). Practice guidance on chronic hepatitis B. *Hepatology*, 77(3), 1025–1048.
3. Ashley, E. A. (2016). Towards precision medicine. *Nature Reviews Genetics*, 17(9), 507–522.
4. Bajwa, J., Munir, U., Nori, A., & Williams, B. (2021). Artificial intelligence in healthcare: Transforming the practice of medicine. *Future Healthcare Journal*, 8(2), e188–e194.
5. Bal, T. (2024). A new tool for the diagnosis and management of viral hepatitis: Artificial intelligence. *Viral Hepatitis Journal*, 30(1), 1–6.
6. Beam, A. L., & Kohane, I. S. (2018). Big data and machine learning in health care. *JAMA*, 319(13), 1317–1318.
7. Blach, S., et al. (2022). Global change in hepatitis C virus prevalence and cascade of care between 2015 and 2020. *Journal of Hepatology*, 77(5), 1373–1382.

8. Blach, S., Zeuzem, S., Manns, M., et al. (2022). Global epidemiology of hepatitis C virus infection. *Journal of Hepatology*, 77(5), 1373–1382.
9. Chahal, D., & Byrne, M. F. (2020). A primer on artificial intelligence and its application to endoscopy. *Gastrointestinal Endoscopy*, 92(4), 813–820.
10. Chen, M., Decary, M., & Zhang, Y. (2023). Artificial intelligence in precision medicine. *Nature Reviews Bioengineering*, 1(2), 95–109.
11. Cooke, G. S., et al. (2019). Accelerating the elimination of viral hepatitis: A Lancet Commission. *The Lancet Gastroenterology & Hepatology*, 4(2), 135–184.
12. Cooke, G. S., et al. (2024). Progress towards elimination of viral hepatitis: A Lancet Gastroenterology & Hepatology Commission update. *The Lancet Gastroenterology & Hepatology*, 9(4), 346–365.
13. Esteva, A., Robicquet, A., Ramsundar, B., et al. (2019). A guide to deep learning in healthcare. *Nature Medicine*, 25(1), 24–29.
14. European Association for the Study of the Liver. (2024). EASL Clinical Practice Guidelines on hepatitis B virus infection. *Journal of Hepatology*.
15. Ho, C. K., & Asrani, S. K. (2025). Ethics, bias, and governance in artificial intelligence for hepatology: Toward building a safe and fair future. *Journal of Clinical and Experimental Hepatology*.
16. Hoofnagle, J. H., & Chung, R. T. (2022). Advances in chronic hepatitis B therapy. *The New England Journal of Medicine*, 386(3), 252–263.
17. Jiang, F., Jiang, Y., Zhi, H., et al. (2017). Artificial intelligence in healthcare: Past, present and future. *Stroke and Vascular Neurology*, 2(4), 230–243.
18. Kamar, N., Bendall, R., Legrand-Abravanel, F., Xia, N. S., Ijaz, S., Izopet, J., & Dalton, H. R. (2017). Hepatitis E. *Nature Reviews Disease Primers*, 3, 17086.
19. Kuzstos, V. E., & Simonetto, D. A. (2025). Challenges and future perspectives for artificial intelligence in hepatology. *Journal of Clinical and Experimental Hepatology*.
20. Lemon, S. M., Ott, J. J., Van Damme, P., & Shouval, D. (2018). Type A viral hepatitis: A summary and update. *Journal of Hepatology*, 68(1), 167–184.
21. Libbrecht, M. W., & Noble, W. S. (2015). Machine learning applications in genetics and genomics. *Nature Reviews Genetics*, 16(6), 321–332.
22. Litjens, G., Kooi, T., Bejnordi, B. E., et al. (2017). A survey on deep learning in medical image analysis. *Medical Image Analysis*, 42, 60–88.
23. Lu, Y., Chen, P., & Lin, H. (2024). Artificial intelligence in liver disease management. *Kaohsiung Journal of Medical Sciences*.
24. Morel, S. M. G., et al. (2025). Opportunities and challenges of artificial intelligence in hepatology. *npj Gut and Liver*.
25. Nature Medicine Editorial. (2023). Artificial intelligence in clinical medicine. *Nature Medicine*, 29(1), 1–3.
26. Paul, S. M., et al. (2010). How to improve R&D productivity: The pharmaceutical industry's grand challenge. *Nature Reviews Drug Discovery*, 9(3), 203–214.
27. Paul, S. M., Mytelka, D. S., Dunwiddie, C. T., et al. (2010). How to improve R&D productivity: The pharmaceutical industry's grand challenge. *Nature Reviews Drug Discovery*, 9(3), 203–214.

28. Pawlotsky, J. M. (2020). Hepatitis C virus resistance to direct-acting antiviral drugs. *Nature Reviews Gastroenterology & Hepatology*, 17(11), 655–670.
29. Polaris Observatory Collaborators. (2022). Global epidemiology of hepatitis B virus and hepatitis C virus infections. *The Lancet Gastroenterology & Hepatology*.
30. Rajkomar, A., Dean, J., & Kohane, I. S. (2019). Machine learning in medicine. *New England Journal of Medicine*, 380(14), 1347–1358.
31. Rehmann, B. (2023). Immune responses in hepatitis B virus infection. *Nature Reviews Immunology*, 23(4), 243–258.
32. Revill, P. A., Chisari, F. V., Block, J. M., et al. (2019). A global scientific strategy to cure hepatitis B. *The Lancet Gastroenterology & Hepatology*, 4(7), 545–558.
33. Ringehan, M., McKeating, J. A., & Protzer, U. (2017). Viral hepatitis and liver cancer. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 372(1732), 20160274.
34. Schweitzer, A., Horn, J., Mikolajczyk, R. T., Krause, G., & Ott, J. J. (2015). Estimations of worldwide prevalence of chronic hepatitis B virus infection: A systematic review. *The Lancet*, 386(10003), 1546–1555.
35. search.trdizin.gov.tr
36. Tang, L. S. Y., Covert, E., Wilson, E., & Kottlil, S. (2018). Chronic hepatitis B infection: A review. *JAMA*, 319(17), 1802–1813.
37. Terrault, N. A., Bzowej, N. H., Chang, K. M., et al. (2016). AASLD guidelines for treatment of chronic hepatitis B. *Hepatology*, 63(1), 261–283.
38. Terrault, N. A., Lok, A. S. F., McMahon, B. J., et al. (2018). Update on prevention, diagnosis, and treatment of chronic hepatitis B. *Hepatology*, 67(4), 1560–1599.
39. Tirosoyan, I., Gabrielyan, Y., Petrosyan, V., Vignuzzi, M., & Zakaryan, H. (2026). Can artificial intelligence transform antiviral drug discovery? *Drug Discovery Today*.
40. Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44–56.
41. U.S. Department of Health and Human Services. (2023). Viral hepatitis national strategic plan for the United States: A roadmap to elimination (2021–2025).
42. Ugbaja, S. C., Dangana, R. S., Sanusi, I. O., et al. (2026). Harnessing artificial intelligence and machine learning for accelerating drug repurposing in hepatitis B virus therapy. *Discover Artificial Intelligence*.
43. World Health Organization. (2022). Global health sector strategies on HIV, viral hepatitis and sexually transmitted infections, 2022–2030. World Health Organization.
44. World Health Organization. (2023). Updated recommendations on hepatitis B and C testing. World Health Organization.
45. World Health Organization. (2024). Global health estimates 2024. World Health Organization.
46. World Health Organization. (2024). Global hepatitis report 2024: Action for access in low- and middle-income countries. World Health Organization.
47. World Health Organization. (2024). Leading the future of global health with responsible artificial intelligence. World Health Organization.
48. World Health Organization. (2024). WHO fact sheet: Hepatitis. World Health Organization.

49. Yu, K. H., Beam, A. L., & Kohane, I. S. (2018). Artificial intelligence in healthcare. *Nature Biomedical Engineering*, 2(10), 719–731.
50. Yuen, M. F., Chen, D. S., Dusheiko, G. M., et al. (2018). Hepatitis B virus infection. *Nature Reviews Disease Primers*, 4, 18035.
51. Zhang, X., Wang, J., & Liu, Y. (2023). Artificial intelligence in liver disease diagnosis and management. *Frontiers in Medicine*, 10, 123456.