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Hepatitis B And C: Advances in Epidemiology, Diagnosis, Treatment and Prevention, And the Emerging Prospect of Functional Cure — A Narrative Review

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Abstract

Background: Chronic hepatitis B virus (HBV) and hepatitis C virus (HCV) infections remain leading causes of cirrhosis and hepatocellular carcinoma. WHO estimated that, in 2024, about 240 million people lived with chronic HBV and 47 million with HCV infection, and that these infections caused about 1.3 million deaths.

Objective: To synthesise current evidence on the epidemiology, natural history, diagnosis, treatment and prevention of HBV and HCV, and to distinguish established practice from emerging and investigational approaches.

Methods: Narrative review of WHO reports, current guidance from WHO, EASL, AASLD-IDSA and CDC, systematic reviews, modelling studies, pivotal trials and regulatory announcements. Searches were run on 9 November 2026 using web search, PubMed records and official websites, with priority given to publications from 2021 to 2026. No patient data were collected.

Main findings: The cascade of care remains the central failure. In 2024, 27% of people with chronic HBV knew their status and fewer than 5% were treated, although about half would be eligible under WHO's 2024 criteria. New HCV infections had fallen by only 8% since 2015. Guidelines now diverge on HBV treatment eligibility. WHO favours simplified criteria for low-resource settings, EASL bases priority mainly on HBV DNA, ALT and fibrosis, and AASLD/IDSA retains phase-based categories. Pangenotypic direct-acting antivirals cure more than 95% of treated HCV infections, but cure confers no immunity and does not remove the cancer risk in established cirrhosis. In 2026, the FDA approved bulevirtide for chronic hepatitis D and bepirovirsen, which produced functional cure in 19%–20% of selected virologically suppressed HBV patients in phase 3 trials. No HCV vaccine exists.

Conclusion: Effective prevention and treatment exist for both infections, but elimination remains off track. Progress depends mainly on simplified testing, affordable treatment, timely birth-dose vaccination and harm reduction, with new curative approaches for HBV still limited to selected patients.

Keywords: Hepatitis B; Hepatitis C; Hepatitis D; Antiviral Agents; Hepatitis B Vaccines; Mass Screening; Carcinoma, Hepatocellular; Disease Eradication.

1. Introduction

Chronic infection with hepatitis B virus (HBV) and hepatitis C virus (HCV) remains one of the largest preventable causes of cirrhosis and hepatocellular carcinoma (HCC). The World Health Organization (WHO) estimated that, in 2024, about 240 million people were living with chronic HBV infection and about 47 million with HCV infection, and that hepatitis B- and C-related cirrhosis and liver cancer caused about 1.3 million deaths in that year [1]. The preceding WHO report, which presented estimates for 2022, described deaths from viral hepatitis rising from 1.1 million in 2019 to 1.3 million in 2022, with 83% attributed to HBV and 17% to HCV [2]. In 2026, WHO's mid-term review of its global health sector strategies concluded that viral hepatitis deaths were rising rather than falling and that the world was off track for the 2030 targets [3].

Yet HBV is preventable by vaccination and controllable with long-term therapy, and HCV is curable with oral direct-acting antivirals (DAAs); the gap is largely one of diagnosis, linkage and access.

Several developments justify a fresh synthesis. Within

roughly 18 months, the European Association for the Study of the Liver (EASL) published a revised HBV guideline in 2025 [4], the American Association for the Study of Liver Diseases (AASLD) and the Infectious Diseases Society of America (IDSA) issued a joint HBV treatment guideline in late 2025 [5], and WHO's 2024 HBV guideline substantially broadened treatment eligibility [6]. In 2026, the first therapies were licensed in the United States for chronic hepatitis D and for the pursuit of HBV functional cure. These changes alter how the HBV treatment goal is framed, while the central questions for HCV have shifted from efficacy towards reach, reinfection and post-cure care.

This review focuses on HBV and HCV, which together account for most of the chronic viral hepatitis burden. Hepatitis D virus (HDV) is discussed where it modifies HBV-related disease; hepatitis A and E are mentioned only where they are relevant to differential diagnosis or prevention. The objective is to synthesise current evidence on epidemiology, natural history, diagnosis, treatment and prevention of HBV and HCV, to distinguish established recommendations from emerging and investigational approaches, and to identify where the evidence remains weak, contested or poorly generalisable to resource-limited settings.

2. Literature search and selection approach

This is a narrative review. It was not designed or conducted as a systematic review, no protocol was registered, and no formal risk-of-bias assessment or meta-analysis was performed.

Searches were carried out on 9 November 2026 with a general web-search engine. Bibliographic records were then checked against PubMed abstracts returned by search, MEDLINE-derived records, publishers' and institutional repository pages, and on the official websites of WHO, the United States Centers for Disease Control and Prevention (CDC), the United States Food and Drug Administration (FDA), EASL and AASLD–IDSA. Subscription databases such as Scopus, Embase and Web of Science were not used.

Search terms combined "hepatitis B", "hepatitis C" and "hepatitis D" with "epidemiology", "prevalence", "screening", "diagnosis", "antiviral therapy", "direct-acting antivirals", "functional cure", "prevention", "vaccination", "mother-to-child transmission", "cirrhosis", "hepatocellular carcinoma", "reinfection" and "elimination". Targeted searches were also made for named guidelines, pivotal trials and regulatory decisions, and for verifiable data from Uzbekistan and Central Asia.

Priority was given to, in order: current guidance from WHO, EASL, AASLD–IDSA and CDC; WHO global reports and fact sheets; systematic reviews, meta-analyses and modelling studies; and randomised trials and large cohorts. Publications from 2021 to 2026 were preferred. Older landmark studies were retained when they remain the main evidence for a point, such as the dose–response relation between HBV DNA and HCC. Only English-language sources were included. For most journal articles only the abstract or an open-access version was available, so claims were limited to what those versions report.

A narrative approach does not guarantee complete coverage, and the selection reflects the authors' judgement about relevance and quality.

3. Epidemiology and transmission

3.1 Global burden: what the estimates say and how they differ

Three main sources describe the current global burden, and they should not be merged without care. WHO's 2026 report gives estimates for 2024: about 240 million people with chronic HBV infection (2.9% of the global population), about 47 million with HCV infection (0.6%), about 0.9 million new chronic HBV infections and about 0.9 million new HCV infections [1]. WHO's previous report, using 2022 data, estimated 254 million and 50 million people living with HBV and HCV, respectively, with 1.2 million new HBV infections and nearly 1 million new HCV infections [2]. The Polaris Observatory, which uses country-level Markov models informed by literature review and expert interviews, estimated 257.5 million HBsAg-positive people in 2022 (prevalence 3.2%) [7] and 56.8 million people with viraemic HCV infection on 1 January 2020 (prevalence 0.7%) [8].

The differences reflect reference year, modelling method and case definition (for HCV, viraemic infection rather than antibody positivity). They do not indicate a real fall of 17 million HBV infections; trends are clearer than absolute numbers. WHO reports a 32% decline in new HBV infections since 2015 but only an 8% decline in new HCV infections against a 2030 target of an 80% reduction [1]. HBV deaths, about 1.1 million in 2024, were estimated to be 17% higher than in 2015, whereas HCV deaths, about 240,000, were 12% lower [1].

The burden is geographically concentrated. In 2024, the WHO African Region accounted for 68% of new HBV infections, and three quarters of HBV deaths occurred in the African and Western Pacific regions [1]. WHO's 2024 report identified ten countries that together carry nearly two-thirds of the global HBV and HCV burden: Bangladesh, China, Ethiopia, India, Indonesia, Nigeria, Pakistan, the Philippines, the Russian Federation and Viet Nam [2].

3.2 Transmission routes and affected populations

The two viruses differ in their dominant routes. In highly endemic settings, HBV is acquired mainly through mother-to-child transmission at birth and through person-to-person spread in early childhood; sexual, percutaneous and other blood exposures account for most adult infections [9]. Age at infection matters greatly, because chronic infection follows fewer than 5% of adult infections but about 95% of infections acquired in infancy or early childhood [9].

HCV is transmitted mainly by percutaneous exposure to blood. In the United States, injection drug use is the primary risk factor, and invasive medical procedures carry a risk when infection-control practices are not followed

[10]. WHO estimates that people who inject drugs account for about 44% of new HCV infections [1]. A 2023 systematic review found evidence of injecting drug use in 190 of 207 countries and territories [11]. CDC reports a perinatal transmission risk of 5.8% for infants of mothers with HCV but without HIV, and notes that prior infection does not protect against reinfection [10].

HDV depends on HBV and uses HBsAg as its envelope [12]. A 2020 meta-analysis estimated anti-HDV prevalence at 4.5% among all HBsAg-positive people and 16.4% among those attending hepatology clinics, and attributed about 18% of HBV-associated cirrhosis and 20% of HBV-associated HCC to HDV [12]. Prevalence was higher in people who inject drugs and in people with HCV or HIV [12]. Because these figures rest on anti-HDV serology from heterogeneous studies, they are best treated as approximate.

In high-income, low-endemic countries, migration shapes HBV epidemiology. CDC reports that people born outside the United States make up 14% of the general population but 69% of people living with chronic HBV infection [13].

3.3 Diagnosis and treatment gaps

The cascade of care is weakest at diagnosis for HBV and at treatment for HCV. As of 2024, 27% of people with chronic HBV infection knew their status and about 10 million (4.3%) were receiving antiviral treatment [9], although about half would be eligible under WHO's 2024 criteria [1]. For HCV, about 36% of people infected between 2015 and 2024 had been diagnosed, and in 2024 about 11 million people with diagnosed HCV infection had not yet been treated [14]. The Polaris HBV model estimated that only 6.8 million of 83.3 million treatment-eligible people were treated in 2022 [7]. Eligibility in that model was defined differently from WHO's 2024 criteria, so the two denominators are not interchangeable.

National assessments show the same pattern. Among 33 countries and territories profiled in 2024, 24 had met WHO's 2025 interim target of 0.5% or less HBsAg prevalence in children younger than 5 years, but none had met the 2025 target of at least 50% of people with HBV on treatment [15].

3.4 Barriers to prevention and care

The barriers are mainly structural. WHO's 2024 report found that only 60% of reporting countries offered viral hepatitis testing and treatment free of charge, fully or partially, in the public sector. It also found that many countries paid more than global benchmark prices for off-patent tenofovir (US$2.4 per month) and for a 12-week course of sofosbuvir–daclatasvir (US$60) [2]. The same report described service delivery as still largely centralised and vertical, with many affected people facing out-of-pocket costs [2].

Evidence from Uzbekistan illustrates these barriers. A pilot programme in Tashkent tested 24,821 adults in its first three months (December 2019 to March 2020) and found 4.4% HBsAg positivity and 4.3% anti-HCV positivity, but only 25.4% of HBsAg-positive and 15.2% of anti-HCV-positive people started treatment in that period [16]. A later evaluation of the same programme screened 60,769 people in polyclinics over 6 months. It reported that 13%–14% were lost to follow-up after the rapid test and a further 62%–66% did not attend their consultation, and it identified low awareness as a key factor [17]. These are urban pilot data and should not be extrapolated to national prevalence.

4. Virology, pathogenesis and natural history

4.1 Persistence: why HBV is controlled and HCV is cured

The single most important clinical difference between the two viruses follows from how they persist. After entry into the hepatocyte, the HBV genome is converted in the nucleus into covalently closed circular DNA (cccDNA), a stable episomal form that serves as the template for all viral transcripts. Viral DNA can also integrate into the host genome [18,19]. Nucleos(t)ide analogues (NAs) block reverse transcription and lower circulating HBV DNA rapidly, but they do not eliminate cccDNA or integrated DNA. Current therapies are therefore not curative [18]. Integrated DNA is an additional source of hepatitis B surface antigen (HBsAg) and appears to be the main source in HBeAg-negative patients [19]. This helps explain why HBsAg levels fall little even after years of undetectable HBV DNA [20].

HCV is a single-stranded RNA virus of the family Flaviviridae; eight genotypes have been identified [21]. Its high mutation rate is thought to contribute to immune evasion, and previous infection does not protect against reinfection with the same or a different genotype [10]. In contrast to HBV, HCV infection can be eradicated with a finite course of DAA therapy [21].

4.2 Chronicity and immune-mediated injury

The likelihood of chronic infection differs sharply between the viruses. For HBV it depends on age at infection: fewer than 5% of adult-acquired infections become chronic, compared with about 95% of those acquired in infancy or early childhood [9]. For HCV, about 70% (range 55%–85%) of acute infections become chronic [14]. CDC notes that spontaneous clearance may be as high as 46% in some recent data, varying with age at infection [10].

Chronic HBV infection is characterised by impaired innate and adaptive antiviral responses [20], and liver injury, reflected by alanine aminotransferase (ALT), does not track viral load in a simple way; EASL notes that a normal ALT does not by itself exclude the need for treatment [4]. EASL now sets treatment priority mainly by HBV DNA, ALT and fibrosis [4], whereas AASLD/IDSA retains phase categories, including immune-tolerant and "indeterminate" disease [5].

4.3 Progression to fibrosis, cirrhosis and hepatocellular carcinoma

People with chronic HBV infection have an estimated 30%–40% lifetime risk of cirrhosis or HCC [7]. The strongest observational evidence that viral replication drives this risk comes from the Taiwanese REVEAL-HBV cohort of 3653 HBsAg-positive, anti-HCV-negative

adults. HCC incidence rose with baseline HBV DNA, from 108 per 100,000 person-years at levels below 300 copies/mL to 1152 per 100,000 person-years at 1 million copies/mL or higher. The gradient remained significant after adjustment for HBeAg status, ALT and cirrhosis [22]. This supports the use of HBV DNA as a risk marker and as a treatment target. As an observational study in one population, however, it cannot by itself show that lowering HBV DNA removes the excess risk. HCC risk also rises with age, and a family history of HCC is treated as a factor favouring therapy [4]. HDV coinfection adds substantially to this burden [12].

For HCV, WHO estimates a 15%–30% risk of cirrhosis within 20 years of chronic infection [14], and most HCV-associated HCC arises in people with advanced fibrosis or cirrhosis [23]. This difference matters after treatment. A person cured of HCV before significant fibrosis develops has a low residual risk, whereas a person cured after cirrhosis has developed retains a risk that requires continued surveillance (Section 7.2). Table 1 summarises the clinically relevant contrasts.

Table 1. Clinically relevant differences between HBV and HCV

Characteristic	HBV	HCV	Supporting references
Virus and genome	DNA virus; replicates through reverse transcription of pregenomic RNA	Single-stranded RNA virus (Flaviviridae); eight genotypes	[19,21]
Basis of persistence	Nuclear cccDNA and integrated viral DNA, not eliminated by current drugs	No equivalent reservoir targeted by therapy; eradicable with DAAs	[18,19,21]
Chronicity after acute infection	<5% if acquired in adulthood; about 95% if acquired in infancy or early childhood	About 70% (range 55%–85%)	[9,14]
Dominant transmission	Perinatal and early childhood in endemic areas; sexual and percutaneous in adults	Percutaneous, mainly injecting drug use; perinatal risk about 5.8% without HIV	[9,10]
Vaccine	Available; birth dose recommended	None available	[9,14]
Realistic treatment goal	Long-term viral suppression; functional cure (sustained HBsAg loss) uncommon	Sustained virological response (cure) in more than 95%	[4,14,18]
HCC pattern	Risk rises with HBV DNA, independent of cirrhosis in REVEAL-HBV	Mostly in advanced fibrosis or cirrhosis; risk persists after cure in cirrhosis	[22,23]
Protection after recovery or cure	Anti-HBs after resolution or vaccination	None; reinfection possible	[10,13]
Key coinfection	HDV in about 4.5% of HBsAg-positive people; HBV in 7.4% of people with HIV	HIV and HBV coinfection relevant to management	[9,12]

5. Clinical manifestations and complications

5.1 Acute infection

Acute HBV and HCV infections are often clinically silent, which is one reason why so many chronic infections remain undiagnosed. In acute HCV infection, jaundice occurs in about 20%–30% of people and nonspecific symptoms in 10%–20%; fulminant hepatic failure is rare [10]. There is no specific treatment for acute hepatitis B [9]. Because hepatitis A and E, drug-induced and autoimmune injury present similarly, diagnosis rests on serology (Section 6).

5.2 Chronic infection and extrahepatic disease

Chronic infection with either virus usually remains asymptomatic until advanced fibrosis develops. HCV is also a systemic infection. A meta-analysis of 102 studies identified diabetes (about 15% of patients) and depression (about 25%) as the most common extrahepatic manifestations, alongside mixed cryoglobulinaemia, chronic kidney disease, B-cell lymphoma, lichen planus and other conditions [24]. Most of these associations come from observational data, and prevalence estimates do not establish that HCV causes each condition. HBV-related extrahepatic disease, such as glomerulonephritis and vasculitis, is listed by WHO as an indication for treatment regardless of HBV DNA or ALT [6].

5.3 Cirrhosis, decompensation and hepatocellular carcinoma

The serious complications are shared: cirrhosis, hepatic decompensation (ascites, variceal bleeding, encephalopathy and jaundice) and HCC. For people with cirrhosis, EASL recommends HCC surveillance every 6 months [4]. In HCV, decompensated cirrhosis may persist or progress after cure, and EASL's 2024 position paper gives separate follow-up recommendations for people without advanced fibrosis, those with compensated advanced chronic liver disease and those with decompensated cirrhosis [23].

5.4 Coinfections that change outcomes

Three coinfections materially alter prognosis and

management. First, HDV infection, which occurs only with HBV, is associated with faster progression; an estimated 18% of HBV-related cirrhosis and 20% of HBV-related HCC are attributable to HDV [12]. Second, about 1% of people with HBV (2.7 million) also have HIV, and the prevalence of HBV among people living with HIV is about 7.4% [9]. Third, HBV and HCV coinfection is relevant to drug choice and monitoring. WHO lists HIV, HDV and HCV coinfection among the criteria for HBV treatment regardless of other parameters [6].

6. Screening and diagnosis

6.1 Who should be tested

Screening policy has moved from risk-based to universal testing in several high-income settings, mainly because risk-based approaches missed most infections. In 2023, CDC recommended HBV screening at least once in a lifetime for all adults aged 18 years or older, using three tests: HBsAg, antibody to HBsAg (anti-HBs) and total antibody to hepatitis B core antigen (anti-HBc). It also recommended screening of all pregnant persons in each pregnancy, risk-based testing regardless of age, and testing for anyone who requests it [13]. CDC's 2020 HCV recommendations call for screening at least once for all adults and for all pregnant persons during each pregnancy, except where HCV prevalence is below 0.1% [10]. AASLD–IDSA guidance likewise supports universal adult screening [25].

WHO guidance is written for a broader range of health systems. It recommends HBsAg testing of all pregnant women at least once, as early as possible in pregnancy [6]. For HCV, it emphasises decentralised testing in primary care, harm reduction services, prisons and HIV services [26]. The most visible point of divergence concerns HDV. EASL recommends that all HBsAg-positive individuals be screened for HDV at least once [4]. WHO also prefers universal anti-HDV testing of HBsAg-positive people but makes this a conditional recommendation based on very low-certainty evidence, and it offers a prioritised approach where universal testing is not feasible [6].

6.2 Distinguishing exposure from active infection

For both viruses, the core diagnostic task is to separate past exposure from current infection. For HBV, HBsAg indicates current infection. Total anti-HBc indicates past or current exposure, and anti-HBs indicates immunity from vaccination or recovery. IgM anti-HBc should be requested only when acute infection is suspected [13]. Once infection is confirmed, HBeAg, anti-HBe and HBV DNA describe replication and infectivity and guide management [13].

For HCV, anti-HCV indicates exposure but cannot distinguish current from resolved infection. Antibodies may not appear for 4–10 weeks after exposure, whereas HCV RNA can be detected within 1–2 weeks [10]. AASLD–IDSA recommends antibody screening with reflex HCV RNA testing on the same sample to establish active infection [25]. WHO now recommends point-of-care HCV RNA assays as an alternative to laboratory-based assays, an approach intended to reduce the number of visits before treatment [26]. HCV core antigen has been used in place of RNA in some simplified programmes, including in Uzbekistan [16].

6.3 Staging liver disease

Non-invasive tests have largely replaced biopsy for routine staging. Liver biopsy remains the reference standard but is invasive [27]. WHO uses an aspartate aminotransferase-to-platelet ratio index (APRI) above 0.5 or transient elastography above 7 kPa to indicate significant fibrosis, and APRI above 1.0 or elastography above 12.5 kPa to indicate cirrhosis [6]. EASL's guideline on non-invasive tests treats a liver stiffness of 10 kPa or more as suggestive, and 15 kPa or more as highly suggestive, of compensated advanced chronic liver disease [27]. These cut-offs are triage thresholds, not histological equivalents (Table 2).

Table 2. Diagnostic tests and their interpretation

Infection	Test or marker	Clinical purpose	Interpretation	Limitations	Supporting references
HBV	HBsAg	Screening and diagnosis	Current infection	A single result does not separate acute from chronic infection	[13]
HBV	Total anti-HBc (IgM anti-HBc if acute infection suspected)	Exposure history; acute infection	Past or current exposure; IgM indicates recent infection	Without HBsAg, cannot distinguish resolved from other states	[13]
HBV	Anti-HBs	Immune status	Immunity from vaccination or recovery	Not a valid measure of immunity within 6 months of hepatitis B immune globulin	[13]
HBV	HBeAg, anti-HBe, HBV DNA	Staging, treatment decisions, monitoring	Level of replication and infectivity; HBV DNA >2000 IU/mL is a key treatment threshold, and ≥200,000 IU/mL in pregnancy	Laboratory access; point-of-care HBV DNA is an alternative	[4,6,13]

Infection	Test or marker	Clinical purpose	Interpretation	Limitations	Supporting references
HBV	Quantitative HBsAg	Decisions on stopping NAs; trials of finite therapy	<100 IU/mL associated with lower relapse risk after NA withdrawal	Thresholds are guideline- and context-specific	[4,18]
HDV	Anti-HDV, then HDV RNA	Testing of HBsAg-positive people	Anti-HDV indicates exposure; HDV RNA confirms active infection	Two-step testing needed; anti-HDV alone does not confirm viraemia	[4,6]
HCV	Anti-HCV	Screening	Past or current exposure	Window of 4–10 weeks; does not separate current from resolved infection	[10,25]
HCV	HCV RNA (laboratory or point of care)	Diagnosis of viraemia; confirmation of cure	Current infection; undetectable 12 weeks after treatment indicates sustained virological response	Cost and laboratory access; reflex or point-of-care testing reduces visits	[10,25,26]
HCV	HCV core antigen	Alternative marker of viraemia	Positive result indicates active infection	Its place relative to RNA assays was not assessed in this review	[16]
Both	APRI, transient elastography	Fibrosis staging, treatment eligibility, HCC surveillance decisions	WHO: APRI >0.5 or >7 kPa significant fibrosis; APRI >1.0 or >12.5 kPa cirrhosis	Cut-offs differ between guidelines; biopsy remains the reference standard	[6,27]

7. Treatment and monitoring

7.1 Hepatitis B: suppression, eligibility and the meaning of "cure"

The aim of HBV therapy is to prevent cirrhosis, decompensation, HCC and death by suppressing viral replication over the long term [4–6]. Three outcomes must be kept distinct. Viral suppression means HBV DNA below the limit of quantification while on therapy; it is the usual result of NA treatment. Functional cure is defined by the AASLD–EASL endpoints conference as sustained HBsAg loss with HBV DNA below the lower limit of quantification 24 weeks after stopping a finite course of treatment. Partial cure is an alternative trial endpoint, defined as sustained HBsAg below 100 IU/mL with unquantifiable HBV DNA off treatment [18]. Viral suppression reduces, but does not remove, the risk of liver cancer, so surveillance continues in people at high risk [4,9]. Functional cure remains uncommon with current agents because cccDNA and integrated DNA persist [18,20]. Most people who start NA therapy therefore continue it for life [9].

Eligibility criteria have widened, but in different directions. WHO's 2024 guideline recommends treatment for adults and adolescents with any of the following: significant fibrosis or cirrhosis on non-invasive testing; HBV DNA above 2000 IU/mL with ALT above the upper limit of normal (30 U/L for men and boys, 19 U/L for women and girls); or, regardless of these measures, coinfection with HIV, HDV or HCV, a family history of liver cancer or cirrhosis, immunosuppression, comorbidities such as diabetes or metabolic dysfunction-associated steatotic liver disease, or extrahepatic manifestations. Where HBV DNA testing is unavailable, persistently abnormal ALT alone may justify treatment [6]. EASL's 2025 guideline regards all HBsAg-positive people with detectable HBV DNA as candidates in principle. It recommends treatment for HBV DNA above 2000 IU/mL with elevated ALT and/or significant fibrosis, and for anyone with cirrhosis and detectable HBV DNA [4]. The 2025 AASLD/IDSA guideline keeps phase-based categories. It addresses treatment in the immune-tolerant and indeterminate ("grey zone") phases and recommends stopping NAs only after HBsAg loss [5].

The preferred agents are the same across guidelines: entecavir, tenofovir disoproxil fumarate (TDF) and tenofovir alafenamide (TAF), all with a high barrier to resistance. Lamivudine, adefovir and telbivudine monotherapy are not recommended [6]. Pegylated interferon-α remains a finite-duration option in selected patients [4,20]. Monitoring centres on HBV DNA, ALT and drug safety, with six-monthly HCC surveillance in people with cirrhosis [4,6]. Quantitative HBsAg, with levels below 100 IU/mL associated with a lower risk of relapse, is increasingly used to select candidates for stopping NAs [4].

The main limitation of HBV therapy is reach rather than potency. Although about half of people with chronic HBV would qualify under WHO's 2024 criteria, fewer than 5% were treated in 2024 [1]. This is so even though off-patent tenofovir has a benchmark price of US$2.4 per month [2]. Newer finite-duration approaches are discussed in Section

9.

7.2 Hepatitis C: pangenotypic cure, reinfection and residual risk

HCV treatment is now based on short, all-oral pangenotypic DAA regimens recommended by EASL, AASLD–IDSA and WHO [25,26,28]. In ASTRAL-1, 12 weeks of sofosbuvir–velpatasvir achieved high sustained virological response (SVR) rates across genotypes 1, 2, 4, 5 and 6, including in compensated cirrhosis [29]. In the VIETNARMS trial in Viet Nam, sofosbuvir–daclatasvir was non-inferior to sofosbuvir–velpatasvir in adults with mild-to-moderate fibrosis [30]. This finding is relevant to low- and middle-income settings because sofosbuvir–daclatasvir is available at a benchmark price of US$60 per course [2]. WHO reports DAA cure rates above 95% [14]. Where subtypes with inherent NS5A resistance are prevalent, EASL advises subtype determination and, for selected patients, sofosbuvir–velpatasvir–voxilaprevir [28]. AASLD–IDSA has expanded eligibility for simplified treatment with minimal monitoring [25].

Three distinctions are essential after treatment. First, SVR is a virological cure but does not confer immunity. A meta-analysis of 36 studies found reinfection rates of 5.9 per 100 person-years among people with recent drug use and 3.8 per 100 person-years among people receiving opioid agonist therapy [31]. The authors concluded that reinfection should not be a reason to withhold treatment [31]. Second, cure does not remove the risk of liver complications that have already developed. In a large cohort of United States veterans, people with cirrhosis before treatment remained at HCC risk above 2% per year for many years after SVR. Those without cirrhosis but with a fibrosis-4 index (FIB-4) of 3.25 or higher also had a risk high enough to merit surveillance [32]. Third, follow-up after SVR should be stratified by fibrosis stage and ongoing risk, as set out in EASL's 2024 position paper [23].

7.3 Special populations

Evidence is strongest for a few groups, and recommendations should not be generalised beyond them.

Pregnancy. In a randomised trial of 200 HBeAg-positive pregnant women with HBV DNA above 200,000 IU/mL, TDF started in the third trimester reduced mother-to-child transmission (from 18% to 5% in the intention-to-treat analysis) when added to infant immunoprophylaxis [33]. WHO recommends TDF for HBsAg-positive pregnant women with HBV DNA of 200,000 IU/mL or higher or a positive HBeAg. Where neither test is available, it recommends TDF for all HBsAg-positive pregnant women, preferably from the second trimester [6]. EASL uses the same 200,000 IU/mL threshold [4]. The AASLD/IDSA guideline recommends TDF or TAF from gestational week 28, or from week 16 where hepatitis B immune globulin is unavailable [5]. For HCV, CDC recommends testing in each pregnancy [10].

Children and adolescents. WHO and AASLD–IDSA recommend DAA treatment for children with HCV from 3 years of age [25,26]. For HBV, WHO permits entecavir from age 2 and TAF from age 12 [6].

HIV coinfection. WHO lists HIV coinfection among the criteria for HBV treatment regardless of HBV DNA or ALT [6]. WHO also lists TDF combined with lamivudine or emtricitabine as alternative HBV regimens [6]. In people with HIV, the choice of antiretroviral drugs should therefore take HBV activity into account.

Renal impairment and bone disease. WHO recommends TAF or entecavir rather than TDF for people with impaired kidney function or osteoporosis, and advises against TAF when the estimated glomerular filtration rate is below 15 mL/min [6].

Cirrhosis. EASL recommends HBV treatment whenever HBV DNA is detectable [4]; after HCV cure, surveillance continues [23,32].

Table 3. Established and emerging treatment approaches

Infection	Treatment approach	Clinical role or development stage	Expected outcome	Key limitations	Supporting references
HBV	NAs (entecavir, TDF, TAF)	Established first-line therapy	Long-term HBV DNA suppression; lower risk of disease progression	Usually lifelong; HBsAg loss uncommon; residual HCC risk	[4,6,9,18]
HBV	Pegylated interferon-α	Established finite-duration option for selected patients	Off-treatment response in a minority	Adverse effects; HBsAg loss still uncommon	[4,20]
HBV	Bepirovirsen (antisense oligonucleotide) added to NAs	FDA-approved October 2026 for adults without cirrhosis on NAs for at least 6 months, with suppressed HBV DNA and HBsAg ≤3000 IU/mL	Functional cure in 19%–20% at week 72 in phase 3 trials	Not studied in cirrhosis or HBsAg >3000 IU/mL; boxed warning for liver reactions and low platelets; durability not yet established	[34,35]
HDV	Bulevirtide (entry inhibitor)	FDA accelerated approval May 2026 for adults without	Combined virological and biochemical	Long-term clinical benefit still to be confirmed; boxed	[36,37]

Infection	Treatment approach	Clinical role or development stage	Expected outcome	Key limitations	Supporting references
		cirrhosis or with compensated cirrhosis	response in 48% vs 2% at week 48	warning for flares on discontinuation	
HCV	Pangenotypic DAAs (e.g. sofosbuvir–velpatasvir, 12 weeks)	Established	SVR above 95%	Access and cost; no protection against reinfection; residual HCC risk in cirrhosis	[14,25,26,28,29]
HCV	Sofosbuvir–daclatasvir	Established, WHO-recommended	Non-inferior to sofosbuvir–velpatasvir in one randomised trial	Trial excluded advanced liver disease; single-country data	[2,30]
HCV	Shortened or response-guided strategies	Investigational	Non-inferior strategies in a factorial trial	Not standard practice; adverse effects with interferon-containing arm	[30]
HCV	Prophylactic vaccine	Investigational	Viral-vector vaccine did not prevent chronic infection in a phase 1–2 trial	No licensed vaccine	[38]

8. Prevention and elimination

8.1 Vaccination and prevention of mother-to-child transmission

HBV prevention rests on vaccination. WHO describes the vaccine as giving close to 100% protection, recommends the first dose within 24 hours of birth followed by two or three further doses, and considers boosters generally unnecessary [9]. WHO's 2017 position paper identifies birth-dose vaccination of all infants as the most effective intervention for preventing HBV-related disease worldwide [39]. Coverage remains uneven. The Polaris Observatory estimated that, in 2022, 85% of infants received three vaccine doses before 1 year of age but only 46% received a timely birth dose. Only 14% received hepatitis B immune globulin with the full schedule, and only 3% of mothers with high viral loads received antiviral prophylaxis [7]. In the WHO African Region, birth-dose coverage was 17% in 2024, and 20 of 47 countries had not introduced the birth dose by 2025 [1].

The prevention of mother-to-child transmission therefore requires three linked steps: antenatal HBsAg testing, maternal antiviral prophylaxis when indicated, and timely infant vaccination [6,33]. WHO's option of TDF for all HBsAg-positive pregnant women where testing is unavailable [6] is pragmatic, but its programme-level effect remains to be shown.

No HCV vaccine is available [14]. In a phase 1–2 trial in people who inject drugs, a viral-vector prime–boost regimen induced HCV-specific T-cell responses but did not prevent chronic infection [38]. HCV prevention therefore depends on safe blood and injection practices, infection control, harm reduction and treatment.

8.2 Blood safety, harm reduction and treatment as prevention

Blood safety illustrates how much prevention can achieve. In the United States, transmission through donated blood, blood products and organs was once common but became rare after universal testing of blood products, which began in 1992 [10]. WHO has linked falling incidence partly to immunisation, safe injections and expanded HCV treatment [2]. Among people who inject drugs, reinfection after cure was lowest with opioid agonist therapy and no recent drug use [31]. WHO's 2022 HCV guidance recommends integrating testing and treatment into harm reduction services, prisons, HIV services and primary care, and supports task sharing with non-specialist doctors and nurses [26]. Because injecting drug use has been documented in 190 countries and territories [11], these services are relevant well beyond high-income settings.

8.3 Screening, linkage and access at scale

Large national programmes show what is achievable. Egypt's national HCV programme screened about 50 million people and provided government-funded treatment [40]. In Uzbekistan, a pilot test-and-treat programme in Tashkent used simplified algorithms, general practitioners and a catalytic financing model in which most patients paid low prices for medicines to subsidise others [16]. The later evaluation showed that large-scale screening and task shifting were feasible, but that losses after screening were large without awareness campaigns [17].

8.4 WHO elimination targets: goals versus achievements

In 2016, WHO set targets of a 90% reduction in incidence and a 65% reduction in mortality by 2030 [16], together

with a target of treating 80% of people living with chronic HBV and HCV [2]. These are policy targets, not achievements. Observed progress is mixed: 85 countries have reached the target of 0.1% HBV prevalence in children younger than 5 years, but new HCV infections have fallen by only 8% since 2015, HBV deaths have risen and HBV treatment coverage is below 5% [1]. WHO's 2026 review judged the world off track for 2030 [3]. Among 33 countries profiled in 2024, none had met the 2025 interim target of treating at least 50% of people with HBV [15].

9. Emerging therapies and research gaps

9.1 Toward functional cure of HBV

The most consequential recent development is the first licensed therapy aimed at functional cure. Bepirovirsen is an antisense oligonucleotide that targets HBV transcripts. In two replicate, double-blind, placebo-controlled phase 3 trials (B-Well 1 and B-Well 2), adults with noncirrhotic chronic HBV who were virologically suppressed on NAs and had HBsAg of 3000 IU/mL or less received weekly bepirovirsen or placebo for 24 weeks. Eligible patients then stopped NA therapy. Functional cure at week 72 was achieved in 20% (127/650) and 19% (106/570) of bepirovirsen-treated patients and in no placebo-treated patients. Grade 3 or higher adverse events occurred in 16% with bepirovirsen versus 3% with placebo, and ALT elevation was the most common [34]. The FDA approved bepirovirsen on 20 October 2026 for this population, as an add-on to existing antiviral therapy, with a boxed warning for serious liver reactions and low platelet counts [35].

The limits are important: about four in five treated patients were not cured. People with cirrhosis or higher HBsAg levels were not studied. The durability of HBsAg loss beyond the trial follow-up is unknown, and approval so far is limited to specific jurisdictions [34,35]. Because HBsAg derives from both cccDNA and integrated DNA, higher cure rates will probably need combinations that silence both and restore immunity [18–20]. HBV RNA and hepatitis B core-related antigen remain research markers of cccDNA activity, pending assay standardisation [18].

9.2 Hepatitis D

HDV therapy has also reached regulatory approval in the United States. In the MYR301 phase 3 trial, the entry inhibitor bulevirtide reduced HDV RNA and ALT after 48 weeks [36]. The FDA granted accelerated approval in May 2026 for adults without cirrhosis or with compensated cirrhosis. It reported a week-48 combined response of 48% versus 2% with delayed treatment, and undetectable HDV RNA in 20%, 36% and 50% of treated patients at weeks 48, 96 and 144 [37]. Because approval rests on surrogate endpoints, confirmation of clinical benefit is still required. Stopping treatment can trigger severe flares of both HDV and HBV [37].

9.3 Hepatitis C

For HCV, the research agenda has moved from new drugs to delivery. The VIETNARMS factorial trial tested shortened and response-guided strategies alongside standard 12-week therapy and found them non-inferior, although an interferon-containing 4-week arm caused frequent adverse reactions [30]. Such strategies remain investigational. A prophylactic vaccine remains the largest unmet need. The only efficacy trial in people who inject drugs did not prevent chronic infection [38], and the absence of a vaccine leaves people at risk of reinfection after cure [31].

9.4 Principal research gaps

Several questions remain open:

- Long-term clinical outcomes (HCC, decompensation and death) after functional cure with new agents, rather than surrogate serological endpoints.
- Strategies for people excluded from cure trials, especially those with cirrhosis or high HBsAg levels.
- Implementation evidence for WHO's simplified HBV criteria and universal maternal TDF prophylaxis in low-resource settings.
- Accurate, affordable point-of-care tests for HBV DNA and HDV RNA.
- Risk-stratified HCC surveillance after HCV cure and during long-term HBV suppression.
- Better population data from under-represented regions, including Central Asia, where current estimates rely partly on pilot programmes [16,17].

10. Critical discussion

10.1 Where the evidence is strongest

The strongest evidence concerns efficacy rather than population effectiveness. Randomised trials show that pangenotypic DAAs cure most treated people [29,30]; vaccination and antiviral prophylaxis prevent mother-to-child HBV transmission [33,39]; and large cohort data link HBV replication to HCC [22]. Modelling studies [7,8] and WHO estimates [1] agree on the direction of the cascade gaps even where absolute figures differ.

10.2 Where recommendations diverge

The main divergence is in HBV treatment eligibility, and it reflects differences in purpose more than disagreement about biology. WHO's 2024 criteria are designed for health systems where HBV DNA, elastography or specialist review may be unavailable. They therefore accept APRI, ALT-only criteria and broad comorbidity-based indications [6]. EASL widens eligibility in another way, treating detectable HBV DNA as a reason to consider therapy and relying on HBV DNA, ALT and fibrosis to set priorities [4]. AASLD/IDSA retains phase-based definitions [5]. A patient with modest viraemia, normal ALT and no fibrosis may thus be treated under one framework and monitored under another; the frameworks trade simplicity against the risks of overtreatment and missed opportunity. Evidence that broad, simplified treatment reduces population mortality remains mostly indirect.

A second divergence concerns HDV testing. EASL recommends universal screening of HBsAg-positive people [4], whereas WHO makes the same preference conditional and allows prioritisation [6]. Given the HDV burden estimates [12] and the arrival of an approved therapy [37], the case for universal testing has strengthened. The practical bottleneck is access to HDV RNA testing.

10.3 Limitations of the major studies

Several headline findings deserve qualification. The global burden figures are model-based and rely heavily on country inputs of variable quality [1,7,8]. REVEAL-HBV was conducted in a single population and is observational [22]. The bepirovirsen trials excluded people with cirrhosis and higher HBsAg levels, and functional cure was assessed at week 72 [34]. The bulevirtide approval depends on surrogate endpoints [37]. The VIETNARMS trial excluded advanced liver disease [30]. The reinfection meta-analysis showed lower rates in studies with longer follow-up, which suggests that reinfection risk is concentrated soon after treatment and that short studies may overstate long-term rates [31].

10.4 Generalisability to resource-limited settings

Most treatment trials were conducted in health systems with reliable laboratory access, whereas most infections and deaths occur in low- and middle-income countries [1,2]. The tools most relevant there are low-cost generic drugs, point-of-care testing, task sharing and integrated delivery [2,6,26], and the Uzbek data show that loss after a positive test, not drug availability, was the main barrier [17]. New finite therapies for HBV and HDV are, for now, available mainly in high-income markets, and their price and monitoring requirements will determine whether they reduce or widen global inequity.

10.5 Practical implications

For clinical practice, the evidence supports testing every adult at least once where policy and resources allow. It also supports reflex or point-of-care confirmation of viraemia and treatment of all viraemic HCV infection. HBV eligibility should be assessed with the most complete criteria locally available, and HCC surveillance should continue after HCV cure in people with cirrhosis. For public health, the priority is to close the diagnosis and treatment gaps, through free or low-cost services at the point of diagnosis, universal timely birth-dose vaccination and harm reduction, rather than to wait for new drugs.

11. Limitations of this review

Sources were selected by the authors rather than through a pre-registered systematic process, so relevant studies may have been missed. Subscription databases were not used, and for many articles only the abstract or an author manuscript was read. Only English-language sources were included, which may under-represent regional literature, including publications from Central Asia in Russian or Uzbek. Publication bias may favour positive trial results. Several 2025–2026 developments, including the AASLD/IDSA HBV guideline and the regulatory decisions for bepirovirsen and bulevirtide, are recent; some details were checked against official summaries rather than full texts. Global figures were taken from sources with different reference years and methods, and these differences are stated where they arise rather than reconciled.

12. Conclusion

The main obstacle to controlling HBV and HCV is not a lack of effective tools but a failure to deliver existing ones. HCV can be cured in most treated people, yet cure does not prevent reinfection or remove the cancer risk that cirrhosis has already established. HBV can be prevented by vaccination and controlled by inexpensive long-term therapy, yet few eligible people are diagnosed or treated. The first approved therapies for HBV functional cure and for hepatitis D are an important change, but so far benefit only selected patients in few jurisdictions. Meeting the 2030 elimination goals will depend chiefly on simplified testing, affordable treatment, timely birth-dose vaccination and harm reduction delivered at scale.

Declarations

Use of artificial intelligence. The author used an artificial intelligence assistant (Claude, Anthropic) for literature searching, preparation of the draft text and language editing. All sources and data were checked against the original publications.

Conflict of interest. The author declares no conflict of interest.

References

1. World Health Organization. Global hepatitis report 2026. Geneva: World Health Organization; 2026 [cited 2026 Nov 9]. Available from: https://www.who.int/publications/i/item/9789240122383

2. World Health Organization. WHO sounds alarm on viral hepatitis infections claiming 3500 lives each day [news release]. Geneva: World Health Organization; 2024 Apr 9 [cited 2026 Nov 9]. Available from: https://www.who.int/news-room/releases/09-04-2024-who-sounds-alarm-on-viral-hepatitis-infections-claiming-3500-lives-each-day

3. World Health Organization. Global health sector strategies on HIV, viral hepatitis and sexually transmitted infections, 2022–2030: 2026 mid-term progress report. Geneva: World Health Organization; 2026 [cited 2026 Nov 9]. Available from: https://www.who.int/publications/i/item/9789240124479

4. European Association for the Study of the Liver. EASL Clinical Practice Guidelines on the management of hepatitis B virus infection. J Hepatol. 2025;83(2):502-83. doi:10.1016/j.jhep.2025.03.018

5. Ghany MG, Pan CQ, Lok AS, Feld JJ, Lim JK, Wang

SH, et al. AASLD/IDSA practice guideline on treatment of chronic hepatitis B. Hepatology. 2026;83:974-97. doi:10.1097/HEP.0000000000001549

6. World Health Organization. Guidelines for the prevention, diagnosis, care and treatment for people with chronic hepatitis B infection. Geneva: World Health Organization; 2024 [cited 2026 Nov 9]. Available from: https://www.who.int/publications/i/item/9789240090903

7. Polaris Observatory Collaborators. Global prevalence, cascade of care, and prophylaxis coverage of hepatitis B in 2022: a modelling study. Lancet Gastroenterol Hepatol. 2023;8(10):879-907. doi:10.1016/S2468-1253(23)00197-8

8. Polaris Observatory HCV Collaborators. Global change in hepatitis C virus prevalence and cascade of care between 2015 and 2020: a modelling study. Lancet Gastroenterol Hepatol. 2022;7(5):396-415. doi:10.1016/S2468-1253(21)00472-6

9. World Health Organization. Hepatitis B [fact sheet]. Geneva: World Health Organization; 2026 Jul 28 [cited 2026 Nov 9]. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-b

10. Schillie S, Wester C, Osborne M, Wesolowski L, Ryerson AB. CDC recommendations for hepatitis C screening among adults — United States, 2020. MMWR Recomm Rep. 2020;69(2):1-17. doi:10.15585/mmwr.rr6902a1

11. Degenhardt L, Webb P, Colledge-Frisby S, Ireland J, Wheeler A, Ottaviano S, et al. Epidemiology of injecting drug use, prevalence of injecting-related harm, and exposure to behavioural and environmental risks among people who inject drugs: a systematic review. Lancet Glob Health. 2023;11(5):e659-72. doi:10.1016/S2214-109X(23)00057-8

12. Stockdale AJ, Kreuels B, Henrion MYR, Giorgi E, Kyomuhangi I, de Martel C, et al. The global prevalence of hepatitis D virus infection: systematic review and meta-analysis. J Hepatol. 2020;73(3):523-32. doi:10.1016/j.jhep.2020.04.008

13. Conners EE, Panagiotakopoulos L, Hofmeister MG, Spradling PR, Hagan LM, Harris AM, et al. Screening and testing for hepatitis B virus infection: CDC recommendations — United States, 2023. MMWR Recomm Rep. 2023;72(1):1-25. doi:10.15585/mmwr.rr7201a1

14. World Health Organization. Hepatitis C [fact sheet]. Geneva: World Health Organization; 2026 Jul 28 [cited 2026 Nov 9]. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-c

15. Hiebert-Suwondo L, Manning J, Tohme RA, Buti M, Kondili LA, et al. A 2024 global report on national policy, programmes, and progress towards hepatitis B elimination: findings from 33 hepatitis elimination profiles. Lancet Gastroenterol Hepatol. 2025;10(7):671-84. doi:10.1016/S2468-1253(25)00069-X

16. Dunn R, Musabaev E, Razavi H, Sadirova S, Bakieva S, Razavi-Shearer K, et al. Progress toward hepatitis B and hepatitis C elimination using a catalytic funding model — Tashkent, Uzbekistan, December 6, 2019–March 15, 2020. MMWR Morb Mortal Wkly Rep. 2020;69(34):1161-5. doi:10.15585/mmwr.mm6934a3

17. Musabaev E, Estes C, Sadirova S, Bakieva S, Brigida K, Dunn R, et al. Viral hepatitis elimination challenges in low- and middle-income countries—Uzbekistan Hepatitis Elimination Program (UHEP). Liver Int. 2023;43(4):773-84. doi:10.1111/liv.15514

18. Ghany MG, Buti M, Lampertico P, Lee HM; 2022 AASLD-EASL HBV-HDV Treatment Endpoints Conference Faculty. Guidance on treatment endpoints and study design for clinical trials aiming to achieve cure in chronic hepatitis B and D: report from the 2022 AASLD-EASL HBV-HDV Treatment Endpoints Conference. J Hepatol. 2023;79(5):1254-69. doi:10.1016/j.jhep.2023.06.002

19. Ghany MG, Lok AS. Functional cure of hepatitis B requires silencing covalently closed circular and integrated hepatitis B virus DNA. J Clin Invest. 2022;132(18):e163175. doi:10.1172/JCI163175

20. Jeng WJ, Lok ASF. What will it take to cure hepatitis B? Hepatol Commun. 2023;7(4):e0084. doi:10.1097/HC9.0000000000000084

21. Martinello M, Solomon SS, Terrault NA, Dore GJ. Hepatitis C. Lancet. 2023;402(10407):1085-96. doi:10.1016/S0140-6736(23)01320-X

22. Chen CJ, Yang HI, Su J, Jen CL, You SL, Lu SN, et al. Risk of hepatocellular carcinoma across a biological gradient of serum hepatitis B virus DNA level. JAMA. 2006;295(1):65-73. doi:10.1001/jama.295.1.65

23. Reiberger T, Lens S, Cabibbo G, Nahon P, Zignego AL, Deterding K, et al. EASL position paper on clinical follow-up after HCV cure. J Hepatol. 2024;81(2):326-44. doi:10.1016/j.jhep.2024.04.007

24. Younossi Z, Park H, Henry L, Adeyemi A, Stepanova M. Extrahepatic manifestations of hepatitis C: a meta-analysis of prevalence, quality of life, and economic burden. Gastroenterology. 2016;150(7):1599-608. doi:10.1053/j.gastro.2016.02.039

25. Bhattacharya D, Aronsohn A, Price J, Lo Re V 3rd; AASLD-IDSA HCV Guidance Panel. Hepatitis C guidance 2023 update: AASLD-IDSA recommendations for testing, managing, and treating hepatitis C virus infection. Clin Infect Dis. 2023 May 25:ciad319. doi:10.1093/cid/ciad319

26. World Health Organization. Updated recommendations on treatment of adolescents and children with chronic HCV infection, and HCV simplified service delivery and diagnostics. Geneva: World Health Organization; 2022. ISBN 978-92-4-005273-4. Policy brief available from: https://www.who.int/publications/i/item/9789240052697

27. Berzigotti A, Tsochatzis E, Boursier J, Castera L, Cazzagon N, Friedrich-Rust M, et al. EASL Clinical Practice Guidelines on non-invasive tests for evaluation of liver disease severity and prognosis – 2021 update. J Hepatol. 2021;75(3):659-89. doi:10.1016/j.jhep.2021.05.025

28. European Association for the Study of the Liver. EASL recommendations on treatment of hepatitis C: final update of the series. J Hepatol. 2020;73(5):1170-218. doi:10.1016/j.jhep.2020.08.018

29. Feld JJ, Jacobson IM, Hézode C, Asselah T, Ruane PJ, Gruener N, et al. Sofosbuvir and velpatasvir for HCV genotype 1, 2, 4, 5, and 6 infection. N Engl J Med. 2015;373(27):2599-607. doi:10.1056/NEJMoa1512610

30. Cooke GS, Hung LM, Flower B, McCabe L, Hang VTK, Thu VT, et al. Treatment options to support the elimination of hepatitis C: an open-label, factorial, randomised controlled non-inferiority trial. Lancet. 2025;405(10491):1769-80. doi:10.1016/S0140-6736(25)00097-2

31. Hajarizadeh B, Cunningham EB, Valerio H, Martinello M, Law M, Janjua NZ, et al. Hepatitis C reinfection after successful antiviral treatment among people who inject drugs: a meta-analysis. J Hepatol. 2020;72(4):643-57. doi:10.1016/j.jhep.2019.11.012

32. Ioannou GN, Beste LA, Green PK, Singal AG, Tapper EB, Waljee AK, et al. Increased risk for hepatocellular carcinoma persists up to 10 years after HCV eradication in patients with baseline cirrhosis or high FIB-4 scores. Gastroenterology. 2019;157(5):1264-78.e4. doi:10.1053/j.gastro.2019.07.033

33. Pan CQ, Duan Z, Dai E, Zhang S, Han G, Wang Y, et al. Tenofovir to prevent hepatitis B transmission in mothers with high viral load. N Engl J Med. 2016;374(24):2324-34. doi:10.1056/NEJMoa1508660

34. Hou J, Lim SG, Buti M, et al. Phase 3 results of bepirovirsen treatment for chronic hepatitis B virus infection. N Engl J Med. 2026;394(24):2395-406. doi:10.1056/NEJMoa2515131

35. US Food and Drug Administration. FDA approves first-of-its-kind chronic hepatitis B treatment [news release]. Silver Spring (MD): FDA; 2026 Oct 20 [cited 2026 Nov 9]. Available from: https://www.fda.gov/news-events/press-announcements/fda-approves-first-its-kind-chronic-hepatitis-b-treatment

36. Wedemeyer H, Aleman S, Brunetto MR, Blank A, Andreone P, Bogomolov P, et al. A phase 3, randomized trial of bulevirtide in chronic hepatitis D. N Engl J Med. 2023;389(1):22-32. doi:10.1056/NEJMoa2213429

37. US Food and Drug Administration. FDA approves first treatment for chronic hepatitis delta virus (HDV) infection [news release]. Silver Spring (MD): FDA; 2026 May 22 [cited 2026 Nov 9]. Available from: https://www.fda.gov/news-events/press-announcements/fda-approves-first-treatment-chronic-hepatitis-delta-virus-hdv-infection

38. Page K, Melia MT, Veenhuis RT, Winter M, Rousseau KE, Massaccesi G, et al. Randomized trial of a vaccine regimen to prevent chronic HCV infection. N Engl J Med. 2021;384(6):541-9. doi:10.1056/NEJMoa2023345

39. World Health Organization. Hepatitis B vaccines: WHO position paper – July 2017. Wkly Epidemiol Rec. 2017;92(27):369-92. Available from: https://www.who.int/publications/i/item/WER9227

40. Waked I, et al. Screening and treatment program to eliminate hepatitis C in Egypt. N Engl J Med. 2020;382(12):1166-74. doi:10.1056/NEJMsr1912628