

Saudi Arabia's Journey Toward Hepatitis C Elimination: Achievements, Implementation Gaps, and Innovations for 2030 Targets

Dr. Shuaibu Abdullahi Hudu, MBBS, PhD*,** Abdulgafar Olayiwola Jimoh, MBBS, PhD***

ABSTRACT

Hepatitis C virus (HCV) is a major cause of liver-related morbidity and mortality across the globe. Saudi Arabia has become a regional leader in viral hepatitis control, with its centralized National Viral Hepatitis Program (NVHP), DAA treatment available to all, and comprehensive testing in primary care. A narrative review was conducted of papers published in PubMed, Scopus, Web of Science, and official reports (2010–2025) to summarize the status of HCV in Saudi Arabia with respect to epidemiology, control strategies, and progress toward the WHO 2030 elimination targets. This narrative review consolidates available epidemiological, clinical, and policy evidence to assess progress towards HCV elimination towards the WHO 2030 targets. National prevalence has fallen from >1.5% pre-DAA era to 95%. Significant determinants of success include population-wide reflex RNA testing, pan-genotypic DAA options, and effective public procurement of free treatment for every citizen. Challenges do not mean the elimination has been achieved completely; there is under-reporting among the migrants and prisoners, a lack of data cordiality between public and private sectors, and poor post-treatment follow-up on cirrhotic patients. Economic evaluations confirm that universal early screening remains highly cost-effective by averting subsequent cirrhosis and hepatocellular carcinoma. Examining lessons from Egypt's mass-testing campaign highlights the importance of decentralization and community mobilization. Similarly, Saudi Arabia's digital health integration stands out as a key strength. Further priorities will be to scale up micro-elimination projects, use artificial intelligence for risk stratification, and establish a national, shared, unified hepatitis registry. The elimination of HCV in Saudi Arabia is feasible and sustainable, with a commitment to innovation, multilevel partnership, and equity-oriented policy.

Keywords: Hepatitis C, Saudi Arabia, Elimination, Direct-Acting Antivirals, Screening, WHO 2030 Targets

INTRODUCTION

The international goal to end viral hepatitis as a major public health threat is one of the significant challenges in contemporary infection control. In particular, the Hepatitis C virus (HCV) remains a significant global health issue, with approximately 58 million people infected chronically and approximately 1.5 million new infections each year globally¹. Persistent HCV is one of the significant causes of liver cirrhosis, hepatocellular carcinoma (HCC), and liver-related mortality, which imposes a tremendous burden on the healthcare system and economy all over the world. To address this enduring predicament, the World Health Organization (WHO) has set ambitious 2030 elimination targets: a 90% reduction in new HCV infections and a 65% decrease in mortality relative to their respective 2015 baselines². The direct-acting antiviral (DAA) era, which brought cure rates for HCV to more than 95% with very few side effects, turned this elimination dream from a theoretical possibility into an actual public health goal. The road to HCV elimination is not a therapeutic highway alone, but a complex one that needs thriving networks of prevention, screening, diagnosis, and linkage for care. While progress has been substantial in high-income countries, the experience of MENA is particularly informative, given its historically moderate local-level HCV endemicity and

heterogeneity in socio-structural circumstances. In this context, the Kingdom of Saudi Arabia emerges as a regional leader, demonstrating a strong commitment to addressing viral hepatitis through strategic public health interventions. The Kingdom's experience reflects that of the world story of HCV, from high endemic to prevalence capable of being eradicated: previous studies in the pre-DAA period estimated its prevalence (1.5%–2%).

In comparison, current national ones have recorded less than 0.5%³. This stunning achievement is no doubt the result of a comprehensive national strategy. The National Viral Hepatitis Program (NVHP), launched in 2018, provided a catalytic framework by integrating routine HCV screening into primary care, premarital testing, and blood donor safety protocols. This was augmented by strategic procurement and free provision of pan-genotypic DAAs, sofosbuvir/velpatasvir, at the point of care in public health services⁴. This simplified treatment, with a short duration, remarkable efficacy, and an excellent tolerability profile, has overcome many of the obstacles that existed during the interferon-based therapy era. In addition, Saudi Arabia has led the way in incorporating state-of-the-art diagnostics, such as reflex RNA testing for antibody-positive persons, reducing the link between

* Professor, Center for Health Research
Northern Border University
Arar 91431, Saudi Arabia.

** Department of Microbiology, Faculty of Medicine
Northern Border University, Arar 91431, Saudi Arabia.
Email: Abdullahi.Hudu@nbu.edu.sa

*** Professor, Department of Pharmacology and Therapeutics
Faculty of Basic Clinical Sciences, College of Health Sciences
Usmanu Danfodiyo University
Sokoto, 840232 Sokoto State, Nigeria.

screening and confirmation of active viremia, and preventing patients from being lost to follow-up. There is a strong economic rationale for such a holistic approach. When applied to the Saudi population, local health economic models have repeatedly demonstrated that universal screening followed by DAA treatment is both cost-effective and cost-saving. By averting the downstream consequences of advanced-stage liver disease, decompensated cirrhosis, HCC, and the need for liver transplant, the economy accrues long-term health cost savings and productivity gains⁵.

This economic evidence has been crucial in securing continued political and financial commitment to the Kingdom's elimination strategy, as an investment in population health. Though these significant accomplishments have been made, the final stretch to the 2030 finish line can be one of the most difficult. With a reduction in HCV prevalence within the general population, more infections are present among difficult-to-treat-at-risk groups; a lack of comprehensive roll-out may undermine progress. These include suboptimal coverage in screening & linkage to care in those with HCV from the large expatriate workforce and prison populations, a disintegrated records system between public and private health sector providers, and a lack of coherent, real-time national viral hepatitis registry^{6,7}. In addition, evolving issues such as reinfection risk among people who inject drugs (PWID) and suboptimal long-term monitoring after achieving a sustained virologic response (SVR) require targeted and nuanced public health responses. On an international scale, valuable lessons can be learned from their regional neighbours, particularly Egypt. The magnitude of Egypt's historic mass screening and treatment campaign, in which over 60 million people were tested in a short period, is proof that elimination at scale in a high-prevalence setting can be achieved⁸. Although Saudi Arabia has taken a more targeted approach, the experience of Egypt may be instructive; the country had a high level of community mobilisation for hepatitis control action and decentralised testing services, as well as a strong public-private partnership, which holds promise in guiding an accelerated response to MI among specific subpopulations in KSA. Developing techniques such as point-of-care RNA testing, dried-blood-spot sampling for remote diagnosis, and digital health platforms to monitor patient adherence holds significant potential. The use of artificial intelligence and machine learning for risk stratification and resource optimization can optimize the effectiveness of screening programs. By targeting clearly defined, high-prevalence groups such as those on hemodialysis, prisoners, and attendees of particular clinics, the term 'micro-elimination' provides a practical and measurable framework for addressing this final reservoir of infection⁹. Therefore, this narrative review aims to compile an evidence-based expert opinion on Saudi Arabia's path to HCV elimination. It will evaluate the country's epidemiological transition, the accomplishments of its national screening and treatment programs, and the well-founded economic rationale that supports its approach. Most importantly, it will help identify ongoing bottlenecks and obstacles by comparing regional and global elimination rates.

METHODOLOGY

Materials and methods: We conducted this narrative review to summarize the Saudi Arabian journey toward hepatitis C virus (HCV) elimination in line with the WHO 2030 targets. A literature review was conducted systematically across PubMed, Scopus, Web of Science, and Google Scholar from January 2010 to August 2025. The search strategy involved Medical Subject Headings (MeSH) terms and text words, including "hepatitis C," "Saudi Arabia," "elimination," "screening," "direct-acting antivirals," "public health policy," and the phrase "WHO 2030 targets." Boolean operators (AND, OR) were used to further refine the results. Sources of grey literature were through the WHO, the

Saudi Ministry of Health, and the SASLT guidelines. Handsearching of the reference lists of included papers was performed to select further pertinent material. Articles were eligible if they included data or analyses about HCV epidemiology, screening, diagnosis, treatment, or elimination interventions in Saudi Arabia; case reports, non-peer-reviewed commentaries, and articles not relevant to the context of KSA or the Gulf region were excluded.

Data were extracted systematically with a focus on the prevalence of HCV, genotypic distribution, screening uptake, treatment effectiveness and costs as well as economic evaluations across key thematic areas including: epidemiology and burden monitoring; screening and diagnosis; therapeutic advancements including offering new DAAs regimens soon to be made available in Egypt to reflect future clinical practice; progress on policy implementation gaps and novel advances. Quantitative results were verified with policy and programmatic evidence to develop a situational analysis of responses and gaps. Since this review used only published, publicly available data, no ethical approval was required. This methodological approach, grounded in evidence, enabled a comprehensive assessment of the success of Saudi Arabia's elimination strategy, the system-level obstacles it faces, and the innovations it has introduced.

Epidemiology and Burden of HCV in Saudi Arabia

Appreciating the evolving epidemiology of HCV in Saudi Arabia is essential for understanding the country's pathway to elimination. The Kingdom's performance is a remarkable public health success story, transforming from a mesoendemic to a near-endemic region, achieved through targeted national strategies. Historically, before the development of blood donor screening and infection control measures, HCV was a serious public health challenge, with prevalence studies from the late 1990s and early 2000s reporting general population prevalence of 1% to 3%¹⁰. Saudi Arabia was therefore one of the countries in this classification that warranted widespread public health action, with transmission primarily due to iatrogenic sources such as unsafe therapeutic injections and unscreened blood transfusions, both of which were common before the Ministry of Health introduced universal blood screening by the early 1990s. This has led to a steep decline in incidence over the following decades, mainly due to strong efforts to improve blood and injection safety. According to recent national data from Saudi Arabia, anti-HCV antibody prevalence is approximately 0.23%, which is below 0.5% and consistent with the country's progress toward elimination. This drop is not evenly distributed across all members of society. The high prevalence among the older group of nationals is a consequence of MSM <30 years constituting the majority, and should be taken into account as this group approaches 50 years. The group is a "pre-screening" cohort, meaning it was more likely than later groups of patients to have been exposed to the virus through medical procedures before modern safety standards were in place. Accordingly, the age-segmented prevalence shows a strong gradient that rises steeply with age, as in a sufficiently interrupted transmission cycle in which new infections have become rare^{11,12}. Furthermore, the genotypic distribution of HCV in the Kingdom provides other clues in understanding the epidemiological profile. Genotypes 1 and 4 are the most common, together representing the mainstay of infection across MENA^{13,14}. The high prevalence of these genotypes has therapeutic implications. Yet, here, the pan-genotypic DAA regimens and both first-line regimens in Saudi Arabia (sofosbuvir/velpatasvir and glecaprevir/pibrentasvir) have similarly high efficacy across genotypes, permitting a streamlined treatment approach that leaves behind all those complex genotype-based algorithms of the past¹⁵⁻¹⁷.

Although the absolute prevalence is low, significant epidemiological work is needed to identify and assess lingering pockets of infection.

Some subpopulations are clearly disproportionately affected. These populations include chronic hemodialysis patients, PWID, and prisoners. The prevalence in these high-risk groups, which has not been extensively studied in the available national data, is likely to be several orders of magnitude higher than that seen in the general population and therefore represents a potential reservoir for continued transmission if left unchecked. In addition, the vast number and wide variety of foreign workers in Saudi Arabia contribute to an unusual epidemiological pattern. Migrants may come from countries with increased HCV prevalence. They could present certain obstacles to the use of healthcare services, such as fear, language barrier, and financial problems, rendering them another essential group for intervention^{18,19}.

The economic and health-related quality-of-life burden of the long-term sequelae of chronic infection cirrhosis, hepatic decompensation, and hepatocellular carcinoma (HCC) continues to be prevalent. Although the burden of disease projected for the future has decreased significantly due to the introduction of DAAs, there is a group of patients with advanced liver disease who were infected many years ago and still need expensive hospital care. DSAs and cured individuals treated with direct-acting antiviral therapies (DAAs) can be considered part of the top of the pyramid, whereas the base, which represents almost untouched resolved infections and a large proportion with past exposure history not yet diagnosed, is depicted in Figure 1. Besides that, we still have significant numbers that deserve attention. An elimination program aims to remove the base that sustains active infection and the development of new cases, ultimately addressing the root cause of severe disease.

National Screening and Diagnostic Initiatives

A sensitive algorithm for detecting and confirming cases is essential for any successful HCV disease elimination effort. This involves combining large-scale serological screening with confirmation by molecular methods techniques^{20,21}. Saudi Arabia's path in this regard is illustrative of an evolution from piecemeal, unstable testing to comprehensive, multi-strategy national screening that has helped stem the epidemic's

prevalence and chart its course. The national viral hepatitis program, established in 2018 at MOH, represented a paradigm shift, moving HCV screening from passive, physician-driven processes to active, systematic public health practices. A key factor in the program's success was the "mainstreaming" of HCV testing at existing, high-volume points of care. This has included the adoption of HCV antibody testing in primary care office visits, premarital screening panels, and the well-established national blood donor screening program. This approach leverages available infrastructure and patient throughput to optimize efficiency while minimizing incremental test costs. In addition, by integrating screening into primary care, the program shifts away from targeting high-risk groups toward a broader case-finding approach, critical for identifying the large proportion of asymptomatic chronic infections within the general population²². Second, incorporating the combined test into premarital screening serves not only public health benefits but also as a strategy to raise awareness among the general population and mitigate its adverse social effects.

However, the diagnostic cascade does not stop there; once you have a positive antibody test, further steps are necessary. One key point at which patients may be lost to follow-up is between confirmation of antibody positivity and RNA testing to confirm active viremia. This bottleneck has been addressed in Saudi Arabia by the step-wise utilization of reflex testing²². In this model, the immunodiagnostic blood draw for initial antibody testing is reflexed to HCV RNA polymerase chain reaction (PCR) if the antibody result is reactive. This procedure saves patients from having to make a second appointment and being re-sticked for phlebotomy, effectively shortening the diagnostic path. Reflex testing has been demonstrated to increase linkage to viremia confirmation by more than 30% in comparison with conventional MOVE-IT services⁵. Although implementation is now routine in the majority of public MOH facilities, adoption in the sprawling private healthcare sector remains variable and constitutes a significant diagnostic continuum gap. The IT infrastructure is the key platform on which these efforts are built. The Saudi Health Electronic Surveillance Network (SHESN) and NVHP's digital backbone are usually a part of SEHA (digital telehealth platform)²¹. This system enables real-time reporting of reportable

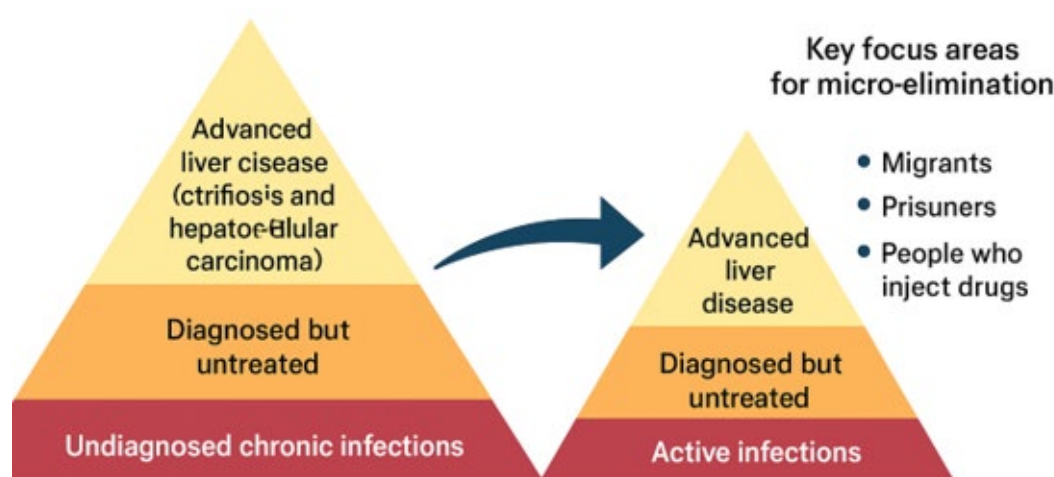


Figure 1. The Evolving Epidemiological Pyramid of Hepatitis C in Saudi Arabia. This chart shows the dynamic pattern of HCV burden in Saudi Arabia following national elimination efforts. The analogy of the two pyramids is that on the left side, it represents pre-elimination, a comprehensive base of undiagnosed chronic disease, many who are diagnosed and not treated yet, that has advanced liver disease (cirrhosis or hepatocellular carcinoma). The solid pyramid on the right illustrates the current elimination phase and reveals a greatly diminished base of active infections from screen-and-treat with direct-acting antivirals (DAAs). The advanced complications cohort is now reduced, demonstrating disease modification. The arrow represents the direction of the national program to stop HCV morbidity and mortality. Residual pockets that can be targeted are identified as priority areas for micro-elimination (migrants, prisoners, and people who inject drugs).

diseases, such as HCV, and facilitates patient follow-up through a care cascade from screening to diagnosis, treatment initiation, and SVR²³. The establishment of the national viral hepatitis registry, currently in development, will capture this data and provide it as a single source to epidemiologists and policymakers, enabling them to monitor progress and identify gaps or target resources, and to illustrate the ideal patient pathway from screening to cure. In Saudi Arabia, as shown in Figure 2, the ideal patient trajectory is simple and digitized. The figure depicts the two hypothetical diagnostic pathways: efficient reflex testing versus the traditional, multi-step sequential path, which is more prone to patient dropout. It also underscores the importance of SHESN/SEHA in monitoring outcomes and addressing the continued fragmentation with the private sector, which challenges a truly national picture of the data.

Despite these advances, challenges persist. In addition to addressing the private sector gap, there is still a need to intensify screening in non-integrated settings, such as prisons, and to strengthen dedicated migrant health services. The excellent sensitivity of the currently available serological assays, however, can be challenging in some immunocompromised populations, such as those undergoing hemodialysis, and there may be rare instances of false-negative results, prompting practitioners to lower the threshold for RT-PCR testing in high-risk clinical scenarios^{24,25}. Saudi national screening and diagnostic programmes constitute an elegant system of public health machinery that, for the most part, works. Strategic embedding in routine care, the implementation of reflex RNA testing, and engagement with digital health tools together represent a powerful engine for case finding. The continuing challenge is to consistently apply these best practices across all care settings and to maintain an unyielding emphasis on eliminating other gaps in linkage to care, especially for the most vulnerable and hard-to-reach populations.

Therapeutic Advances and Access to Direct-Acting Antivirals

Hepatitis C virus (HCV) treatment has been revolutionized over the past decade, an upheaval that has been a cornerstone of making global eradication viable. Introduction of direct-acting antiviral (DAA) regimens, in essence, transformed HCV from a nearly incurable chronic infection into one for which cure is achievable in virtually all patients, replacing interferon-based regimens that were complex and long-term and offered few, if any, benefits for many decades^{26,27}. In Saudi Arabia, the strategic implementation and use of these therapeutics have contributed to their success in decreasing the burden of HCV at a national level, dramatically changing the natural history and future prognosis for thousands. The pharmacological profile of most modern DAAs underlies this achievement. These agents are administered in pill form and act on components of the HCV lifecycle, including non-structural (NS) proteins such as NS5B polymerase, NS5A, and NS3/4A protease, with rapid and potent suppression of viral replication²⁸. The most substantial progress for public health purposes is achieving approvals of pan-genotypic treatment regimens. These all-genotype regimens have eliminated costly and frequently difficult-to-get genotype testing, making the treatment decision process extremely simple²³. This is particularly relevant in Saudi Arabia, where genotypes 1 and 4 are the most prevalent; thus, these regimens offer a straightforward solution that suits all patients, given their high response rates.

The actual clinical outcomes in the Kingdom have been similar to those reported in international clinical trials. SVR rates (undetectable HCV RNA at 12 weeks post-treatment, considered a cure) invariably exceed C95% across patient subsets, including compensated and decompensated cirrhotic. Such high efficacy is accompanied by a favorable safety profile, with most patients experiencing no or few side

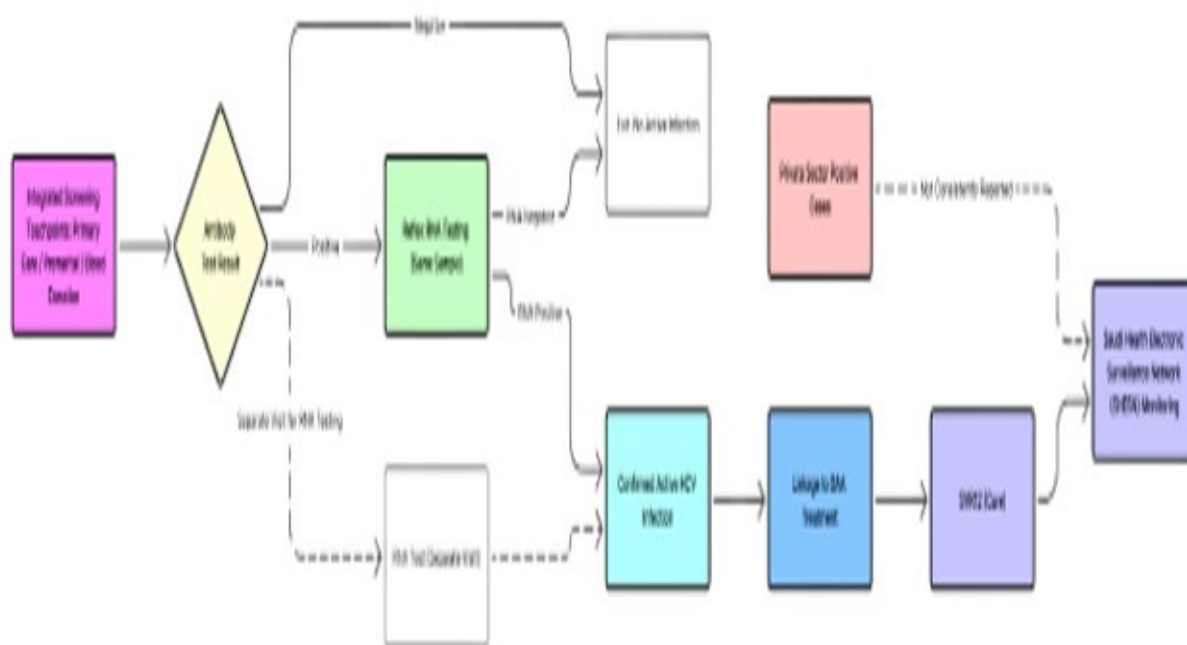


Figure 2. The HCV Diagnostic and Linkage-to-Care Cascade in Saudi Arabia's National Program. This best practice statement summarises the ideal patient pathway for HCV screening, diagnosis, and treatment initiation in the Saudi Arabian national health care setting, presented as a flowchart. It all starts with integrated screening across multiple touchpoints (Primary Care, Premarital, & Blood Donation). For antibody-positive cases, the preferred pathway (solid arrows) is to perform reflex RNA testing on the initial sample to confirm active viremia and then directly link to DAA treatment. The alternate, non-platform pathway (dotted arrows) requires a visit for RNA confirmation, which is disconnected from the patient, and introduces an additional risk of loss to follow-up. Monitoring of outcomes (SVR12) and program performance are key elements of the SHESN. A key disparity is evident: positive private-sector cases may not be reliably reported or tracked in the national system, indicating a need for future integration.

effects and treatment durations of only 8 weeks among those who are treatment-naïve and without cirrhosis. This is in heavy contrast to the 24–48-week therapy days of interferon trap, with sledgehammer side effects and black box indications a mile long. The key to achieving equitable impact has been the Kingdom's stewardship, which includes offering these curative DAA regimens free of charge to all known patients diagnosed through the public health system under the Ministry of Health. This policy of universal access has played a key role in launching the elimination agenda by addressing financial barriers, which can frequently be a barrier to care in other health systems. This has been financially feasible due to the widespread use of generic drugs, DAAs imported through national tender, and the availability of these at roughly 1% of the cost of previous branded originator drugs⁵. Sofosbuvir/velpatasvir and glecaprevir/pibrentasvir were the most widely used treatments in the national program for their pan-genotypic profiles, simplified treatment regimens, and few drug-drug interactions.

The clinical and societal implications of this therapeutic revolution are enormous. The demand for liver transplants as a result of HCV-induced liver failure has sharply decreased, resulting in released resources and in re-orienting hepatology practice from dealing with end-stage complications to aiming at cure^{29,30}. Moreover, SVR has been demonstrated to stop fibrosis evolution and cancer risk development in terms of hepatocellular carcinoma (HCC), although with a remaining HCC risk in the advanced cirrhosis population, prompting the need for surveillance even after achieving the end-point. As highlighted in Table 1, the leading DAA regimens used within the Saudi national programme are high-efficacy, short-duration, and pan-genotypic agents, and they have theoretical potential to be adopted as tools in a public health-driven campaign of elimination. Strategically choosing and delivering these therapies has been critical for translating clinical progress into broader population health gains. The DAA drugs are the game-changer in treatments for HCV³¹. Success in Saudi Arabia is not just about the availability of medicines, but also about a purposeful, systematic approach to ensuring treatment is readily available and integrated within overall disease screening and care. This makes HCV no longer a chronic progressive disease but an acute curable illness.

Implementation Gaps and Challenges

Despite many advances and strategic support, tracking the hepatitis C virus (HCV) in Saudi Arabia is not straightforward. It is typically the most challenging phase of a disease-elimination campaign: moving from broad, population-based measures to the granular disassembly of stubborn system and sociostructural barriers³⁷. The building blocks of screening, diagnosis, and treatment are in place, but significant implementation gaps may hinder future advances, posing a risk that Saudi Arabia will not meet the 2030 goal. Significant challenges include health equity, especially in reaching those on the edge of the health-care system¹⁸. The large and heterogeneous population of foreign workers in Saudi Arabia, comprising many nationally-population equivalent-sized groups, represents a notable absence from extant policy paradigms³⁸. Migrants may experience a cluster of barriers, such as lower health literacy, linguistic differences, fear of deportation or job loss, and financial constraints, particularly for those without employer-based health insurance plans³⁹. Background Prison populations also demonstrate increased HCV prevalence, but less access to repetitive screening and linkage to care services. These populations are bottom-up reservoirs of infection, and if not specifically catered for in a culturally sensitive way, risk being left behind, with the capacity to sustain transmission networks that may threaten population-level impact. The second equally fundamental barrier is the technological siloing of health data. SHESN provides a strong platform in the public sector, but a standalone, all-encompassing, real-time hepatitis registry with bidirectional interoperability remains an unmet need. Data fragmentation is most pronounced between public health services and the sprawling private healthcare system. Furthermore, unreliable data from private hospitals and clinics result in an underestimate of diagnosed cases, hindering the ability to track patients across all levels of care. This absence of a central data ecosystem is inimical to strategic planning, resource allocation, and accurate measurement of progress toward WHO targets.

However, in addition to these specific patient populations, early approaches published previously could not account for the post-Sustained Virological Response (SVR) scenario and now face their own

Table 1. Key Direct-Acting Antiviral (DAA) Regimens Used in the Saudi National Hepatitis C Elimination Program

Regimen	Components (Drugs)	Genotype Coverage	Typical Duration	Sustained Virologic Response (SVR12)	Key Advantages	Reference
Sofosbuvir/ Velpatasvir (SOF/VEL)	Sofosbuvir 400 mg + Velpatasvir 100 mg (once daily)	Pan-genotypic (1–6)	12 weeks	≥ 98%	Pan-genotypic, once-daily single tablet, minimal side effects	32, 33
Glecaprevir/ Pibrentasvir (GLE/PIB)	Glecaprevir 300 mg + Pibrentasvir 120 mg (3 tablets once daily)	Pan-genotypic (1–6)	8 weeks (12 weeks if cirrhosis)	≥ 97%	Short 8-week regimen, ribavirin-free, high barrier to resistance	34
Sofosbuvir/ Ledipasvir (SOF/LDV)	Sofosbuvir 400 mg + Ledipasvir 90 mg (once daily)	Genotypes 1, 4, 5, 6	12 weeks	≥ 96%	Widely available, proven efficacy in genotype 4 (common in KSA)	35
Sofosbuvir + Daclatasvir (SOF + DCV)	Sofosbuvir 400 mg + Daclatasvir 60 mg (separate tablets)	Genotypes 1–6	12 weeks	≥ 95%	Flexible use, cost-effective alternative in public sector programs	36
Sofosbuvir/Velpatasvir/ Voxilaprevir (SOF/VEL/VOX)	Sofosbuvir 400 mg + Velpatasvir 100 mg + Voxilaprevir 100 mg (once daily)	Pan-genotypic, especially DAA-experienced	12 weeks	≥ 96%	Salvage regimen for prior DAA failure	32

DAA, direct-acting antiviral; SVR12, sustained virological response at 12 weeks post-treatment (considered a cure); KSA, Kingdom of Saudi Arabia.

difficulties. In the vast majority of patients, no virological monitoring is indicated. However, a large number of patients who achieve SVR after baseline F3 or cirrhosis are still to be monitored for HCC lifelong, since their risk is not wiped out even if reduced. Maintaining sustained long-term follow-up of this subset against the backdrop of a hectic healthcare system is challenging, and surveillance gaps contribute to nonsurvivable cancers that erase some of the mortality gains resulting from DAA treatment^{40,41}. In addition, with decreasing overall prevalence, the relative relevance of some high-risk groups, including PWID, seems to be growing. HCV incidence and reinfection rates after treatment are high among this group. The public health response to PWID in the Kingdom is still developing, and a lack of integrated harm reduction interventions, including needle and syringe exchanges, opioid substitution treatment, represents a substantial barrier to controlling onward transmission in this population^{42,43}. A comprehensive response to HCV among PWID calls for a combined testing, treatment, and prevention/harm reduction programme, an effort that extends across sectors beyond health care itself. Finally, there is an understated but essential danger of complacency. With the decline in HCV incidence and prevalence, it is increasingly difficult to maintain political attention, funding scope, and screening provider engagement. The “low-hanging fruit” has already been picked; the remaining cases are the most difficult to detect and treat. This entails active advocacy, continued education for PCPs to keep a high index of suspicion, and novel case-finding strategies.

Regional Comparisons and Lessons from Egypt

In the worldwide search to eliminate the Hepatitis C virus (HCV), comparative science plays a key role. This is where a critical study of strategies, achievements, and pitfalls across the region can provide countries with a blueprint that they can adapt according to their own national objectives. The Arab Republic of Egypt is an instructive example for Saudi Arabia and other Gulf Cooperation Council (GCC) countries. Formerly home to the highest global burden of HCV, Egypt represents one of the most extraordinary public health success stories in history: from a sentinel host country for infection transmission rates, it has emerged as an epicenter of elimination. Through the lens of the Egyptian model, it is possible to map points of divergence and convergence with, and learn from, the Saudi strategy as it existed before 2030. The fundamental difference between the two national campaigns is their approach to the screen. Egypt initiated an ambitious mass screening program, the “100 million Seha” campaign, to test its entire adult population of over 60 million people in two years. It was a top-down, politically motivated campaign that took advantage of extensive coverage from both fixed and mobile testing facilities, giving the impression that it was a national battle⁸. Saudi Arabia, meanwhile, is taking a more purposeful, focused, and integrated approach, with screening structures already part of healthcare touchpoints such as primary care, premarital testing, and blood donation. Less spectacular on the scale, but much more efficient and sustainable, with prevalence efficiently reduced by systematic, routine care, was probably the Saudi model.

Perhaps the most essential lessons from Egypt are those about simplification and decentralization. The Egyptian program significantly simplified the diagnostic and treatment process. In many of these places, they used point-of-care antibody and RNA testing, with the time from ‘screening’ to start of treatment curtailed considerably. Additionally, care shifted from specialized hepatology centers to local primary healthcare units, enabling broad access^{44,45}. Simplification Saudi Arabia has already achieved significant success in simplifying treatment through the introduction of pan-genotypic DAAs and reflex RNA testing. However, there remains potential for further simplification, particularly in remote areas nationwide, such as Egypt,

where the geography poses a significant barrier to accessing care. This helped to not only save costs but also to cultivate a national sense of ownership⁸. Saudi Arabia has also achieved considerable cost savings by procuring generic DAA on the market; however, Egypt’s model of using domestic manufacturing as a basis for both health security and economic development may hold the promise of a blueprint for the Kingdom and the larger Arab Gulf states.

There was nothing like it in Egypt for community and knowledge. The campaign was complemented by an extensive media campaign featuring celebrities, religious leaders, and public figures that helped decrease stigma and encourage testing^{46,47}. Furthermore, while public awareness campaigns have been launched in Saudi Arabia, the simple force and scope of the Egyptian campaign underscore how a more aggressive and multi-platform media strategy could be used to reach the very last undiagnosed pockets of population out there, taking into special account those who are hesitant to interact with the health system. The Saudi model has its strengths that Egypt can learn from, however. The more developed digital health infrastructure in Saudi Arabia, with systems such as SEHA and SHESN, better supports a sustainable framework for patient follow-up and data quality than in Egypt, where the response was implemented through a campaign. Moreover, Chetty says that Saudi Arabia’s targeted, initial approach could be more resource-efficient in a low-burden setting, halting the law of diminishing returns in mass screening as most cases are found. The Egyptian and Saudi elimination odysseys are not antithetical but symmetrical. Egypt shows what three weeks of a unified, massively scaled, and severely simplified national mobilization of a central Messiah can do to transformation. Saudi Arabia is leading this effort with a model of a sustainable, comprehensive, and digitally enabled healthcare system. To be better prepared for similar crises and expedite its journey towards 2030, Saudi Arabia may need to deploy Egyptian lessons: specifically, ramping up the decentralization of treatment, renewed public-private cooperation in diagnostics, and a bold national awareness campaign that busts stigma once and for all. The objective, however, is not to carbon-copy the Egyptian approach; rather, it is to judiciously hybridize its best ingredients with those of the Kingdom’s sophisticated public health apparatus and overcome the remaining citadels standing in the way of elimination.

Innovations and Future Directions

More than traditional approaches are required for the most challenging yet necessary final phase of Saudi Arabia’s Hepatitis C virus (HCV) country elimination journey. The journey to 2030 requires a new vision of action, propelled by technological development, fresh approaches to public health challenges, and precision-oriented solutions. As Saudi Arabia’s courageous campaign moves from mass implementation to the new era of “smart elimination” through the use of truly modern technologies and finding all remaining undiagnosed individuals, curing them, and preventing reinfection. Diagnostic technology is a critical frontier for innovation. Although reflex RNA testing has facilitated diagnosis, the last mile will require approaches that eliminate venous phlebotomy and the need for central laboratory infrastructure. This is a paradigm in which point-of-care (POC) RNA testing devices capable of providing confirmatory viremia results in fewer than 60 minutes have been accepted. When used in prisons, harm reduction programmes and mobile clinics for migrant workers, the implementation of these could collapse the diagnosis cascade from weeks to a single visit with considerable savings in pre-treatment loss to follow-up⁵. In addition, dried blood spot (DBS) sampling will enable easy collection, stability, and shipment of samples from disparate or complex-to-reach locations to central laboratories for both serologic testing and RNA assays. This technology has the potential to bring the program to every nook and cranny of the Kingdom, without requiring cold-chain logistics for

liquid blood samples. Micro-elimination has become a cornerstone of future orientation. This would be achieved by progressively focusing on separate, highly prevalent segments of the population, like hemodialysis patients, prisoners, persons who inject drugs (PWID), and particular expatriate groups with more intensified interventions. By setting and meeting elimination targets in these tightly defined pockets, the national program can create a patchwork quilt of success stories that collectively lead to national elimination^{48,49}. This approach also permits tailored outreach, messaging, and service delivery; it is vastly more effective than a monolithic national campaign for these remaining infection hotspots.

Data science and digital health will be used to ensure the most efficient distribution of resources. Integration of ML/AI with the Saudi Viral Hepatitis Registry and EHR can transform case-finding. ML models can be trained to predict at-risk patients with high liver enzymes or specific risk-factor codes, even before they test for HCV, so that physicians would receive proactive automated reminders encouraging testing through the EHR³. In addition, digital adherence interventions, such as smartphone apps with built-in reminders and patient educational content, can facilitate patient engagement through the treatment cascade^{50,51}. Geospatial risk mapping of cases can help public health officials identify and address unexpected transmission clusters. Finally, future tactics must address the issue of sustaining beyond elimination. These features include the development of cost-effective and sustainable sentinel surveillance sites that can rapidly detect any resurgence in transmission. Given the substantial number of patients cured of HCV infection with advanced fibrosis, efficient and budget-friendly long-term surveillance pathways for HCC are crucial to maximize the mortality reduction effects in the DAA era. Novel HCV vaccines are still under development. However, this research should be closely followed, as the prophylactic vaccine is the ideal tool to achieve sustained suppression of the virus and provide lasting protection for future generations. The pathway ahead for HCV elimination in Saudi Arabia looks optimistic, as long as it is treated as a dynamic and inventive initiative. By optimally utilizing point-of-care diagnostics, advocating a micro-elimination framework, exploiting the predictive strength of AI, and planning for the post-elimination era, the Kingdom can move from controlling HCV to becoming part of history. These advances will not only help achieve the 2030 targets but also establish a more agile and adaptive public health infrastructure to address future health challenges.

Policy Recommendations

The path of Saudi Arabia's Hepatitis C elimination program is encouraging, but the WHO 2030 goals are not inevitable. It will take thoughtful, research-based policy actions to close enduring gaps and seize new opportunities. The following actions are recommended to bridge the "implementation gap" and optimize resource utilization, thereby accelerating progress and enabling the Kingdom to achieve and sustain elimination.

Require and Support Targeted Screening for All Underserved Populations.

Current screening needs to be scaled up beyond integrated primary care and across all key populations, implemented through a policy of mandatory opt-out screening. This comprises offenders on entry and at intervals thereafter, migrants during the Iqama medical examination or soon after this has been conducted, and all patients seen at substance use disorder clinics. Policy cannot operate in a vacuum and must be partnered with dedicated funding for mandatory testing, culturally and linguistically appropriate care services, linkage-to-care navigators targeting these populations to ensure equitable access to the program⁵².

Implement a National Reflex RNA Testing Strategy

To address one of the primary causes of patient drop-out, the MoH should issue and enforce a national policy covering both the public and private sectors, mandating reflex-RNA testing for all HCV-Ab-positive results. The policy must be accompanied by technical instructions, capacity development in laboratories, and a mechanism to finance the incremental cost of conducting RNA testing, so that positive screening results undergo confirmatory diagnosis^{53,54}.

Facilitate the construction and integration of the Saudi Viral Hepatitis Registry

Nothing more about investment in the completion of a whole-population, real-time national HCV register. Policy should require all laboratories (public and private) and healthcare sites to report positive antibody results with/without positive RNA results, treatment start information, and SVR outcome into this centralized system. Importantly, the policy should enforce interoperability standards for bidirectional data exchange with the SEHA/SHESEN system and any such future system, primary care records, and hospital-based EMRs, to achieve an integrated patient journey^{55,56}.

Promote Private Sector Integration via the Regulatory and Reimbursement Mechanism

The private sector can no longer be a blind spot. Policy levers should also require HCV screening and case reporting as a condition of accreditation and licensing for hospitals. Concurrently, the Council for Cooperative Health Insurance (CCHI) should include HCV screening with reflex RNA testing and DAA therapy in its essential benefit package, promoting financial incentives for private providers to invest in a national program to eliminate the disease⁵⁷.

Implement a National Awareness and De-stigmatization Campaign (Sustained, Multi-Platform)

Learning from the Egypt example requires a high-impact, culturally relevant public awareness campaign advertisement. This initiative aims to utilize TV, social media influencers, and religious leaders to convey two key messages: that HCV is curable, and that testing is a responsible action for both health and family. A complementary element should be to work on the destigmatization of the infection, especially in high-risk populations, to motivate testing and seeking treatment without fear of retaliation^{58,59}.

Operationalize a "Test-and-Treat" Approach in Priority Settings

Policy Action should officially endorse and fund "test-and-treat" or "same-day treatment initiation" models in high-yield settings, such as criminal justice and harm reduction settings. This includes having POC RNA testing and a first dose of DAA available at the point of service, allowing an individual to be diagnosed and treated in a single visit. This successful strategy bridges the gap between diagnosis and treatment for individuals who are traditionally hard to reach^{60,61}.

Ongoing Strategic Research and Evaluation Advisory Commission

To avoid policy based on uninformed hype, the government must fund an independent research program. This includes regular sero-surveys to track progress independently of case-based reporting, ongoing economic analyses to support resource allocation decisions, and operational research to pilot and evaluate new interventions such as micro-elimination projects or the use of AI in case-finding before national scale-up^{62,63}.

CONCLUSIONS

Saudi Arabia's organized and committed attack on Hepatitis C is a model of strategic public health investment, coordination, and political resolve that can change the lives of millions. From a country in transition from intermediate endemicity to elimination, the Kingdom's success can be attributed to a combined approach: it's National Viral Hepatitis Program, universal access to curative direct-acting antiviral therapies, and integration of HCV screening into primary healthcare. The resultant overall prevalence of below 0.5%, in addition to virological response above 95%, represents a public health success that can be replicated within the Middle East and beyond. Nevertheless, as this Review has shown, the endgame of elimination brings its own unique challenges, especially in getting to micro epidemics among marginalised and itinerant communities, closing interoperability gaps around data widely seen as with only partial exchange into places like the private sector, and promoting consistent uptake of next-generation diagnostics such as reflex testing. Learning from lessons appearing at the regional level, such as in Egypt, Saudi Arabia, should continue to follow a trend that takes it from population-wide action towards precision public health via micro-elimination strategies supported with new tools such as point-of-care RNA testing, dried blood spot sampling, or AI-aided case finding. Reaching and maintaining the WHO 2030 targets will require firm commitment to equity-led approaches, digital culmination of the care cascade, and active engagement of all sectors to leave no infection undiagnosed. With its strong foundation, resources, and long-term commitment, Saudi Arabia can accomplish this mission, leading to the eradication of Hepatitis C as a significant global health victory. This will be achieved through a final push towards sustained success, ensuring no one is left behind.

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