VOLUME 31 NUMBER 1 January 2025

pISSN 2287-2728
eISSN 2387-285X

CLINICAL and MOLECULAR HEPATOLOGY

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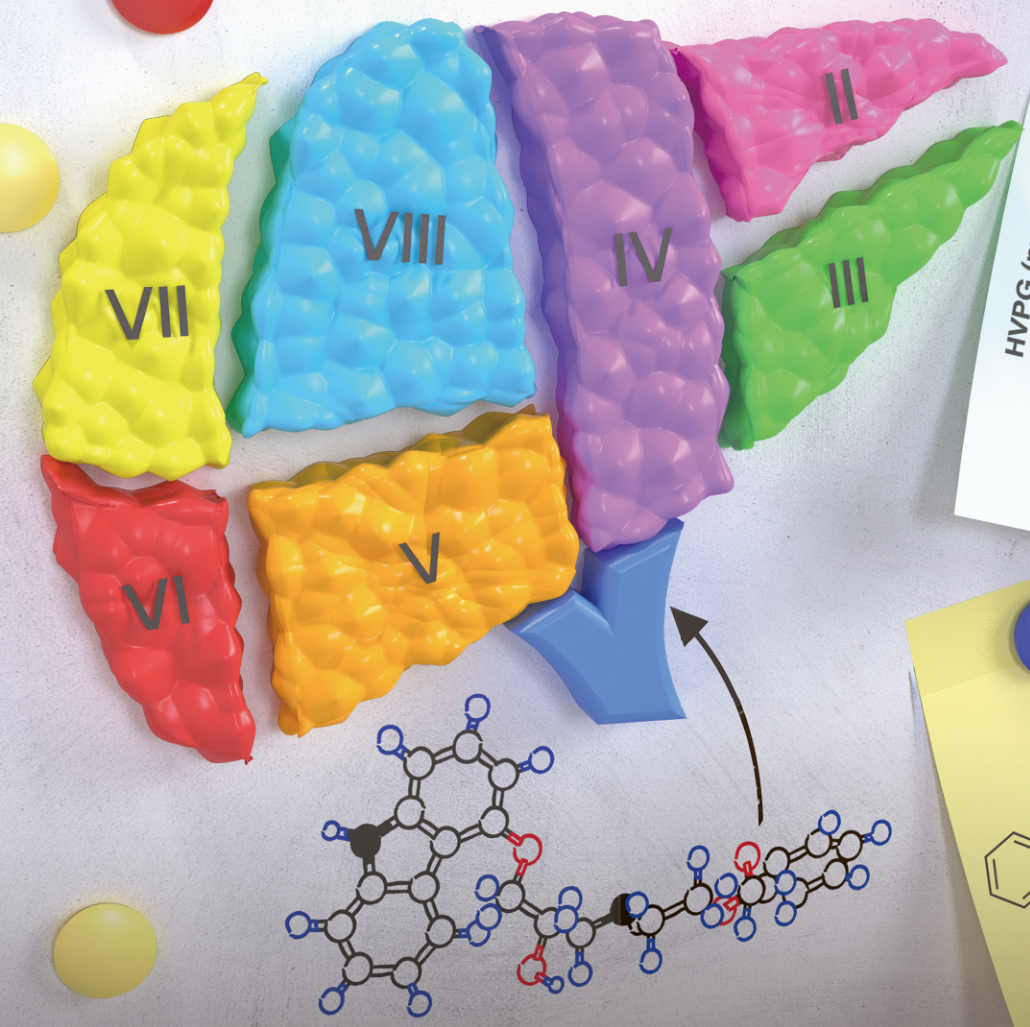

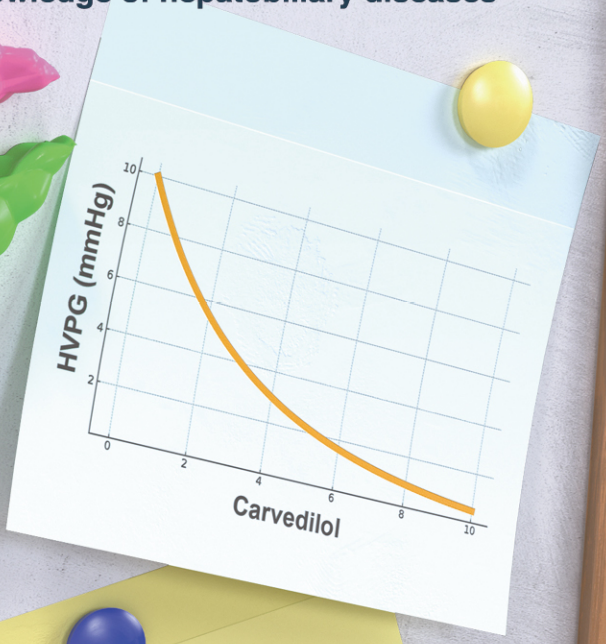

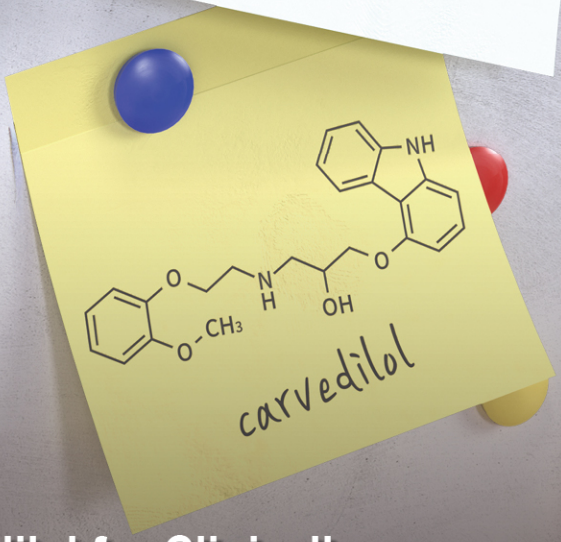

Non-invasive Model guiding Carvedilol for Clinically Significant Portal HTN

Intrapatient variability of tacrolimus on CKD in LT
HCV self-testing and disease burden reduction
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eISSN 2287-285X

CLINICAL and MOLECULAR HEPATOLOGY

https://doi.org/10.3350/cmh.2024.0484
Clinical and Molecular Hepatology 2025;31:166-178

Original Article

Self-testing strategy to eliminate hepatitis C as per World Health Organization's goal: Analysis of disease burden and cost-effectiveness

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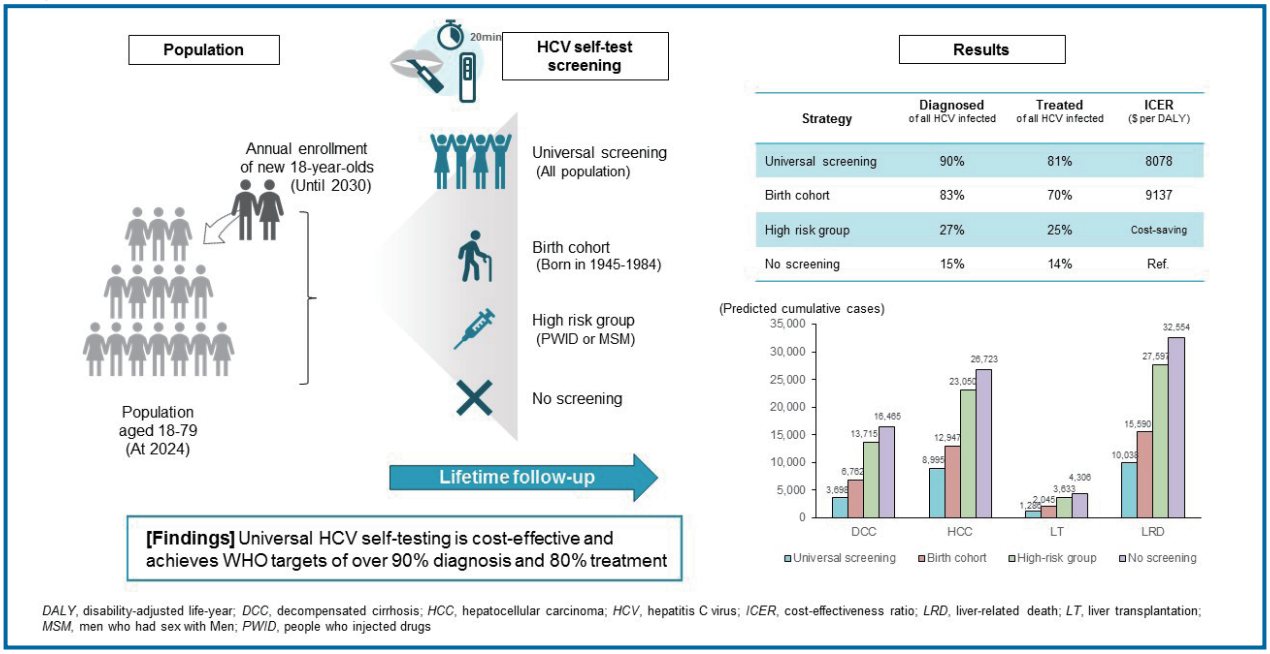
Graphical Abstract



DALY, disability-adjusted life-year; *DCC*, decompensated cirrhosis; *HCC*, hepatocellular carcinoma; *HCV*, hepatitis C virus; *ICER*, cost-effectiveness ratio; *LRD*, liver-related death; *LT*, liver transplantation; *MSM*, men who had sex with Men; *PWID*, people who injected drugs

Study Highlights

- The WHO recommends widespread HCV screening to achieve elimination by 2030.
- Universal HCV self-testing is highly cost-effective, with an ICER of US$8,078 per DALY averted.
- Universal HCV self-testing can reduce severe liver disease and deaths by up to 71% and 69%, respectively, significantly lowering the disease burden.
- Although universal HCV self-testing incurs higher costs, it is more effective than screening only high-risk populations and substantially expands access to testing.

Background/Aims: The World Health Organization (WHO) aims to eliminate hepatitis C virus (HCV) by 2030; therefore, widespread HCV screening is required. The WHO recommends HCV self-testing (HCVST) as a new approach. We aimed to evaluate disease burden reduction using the HCVST screening strategy and identify the most cost-effective approach.

Methods: We developed a dynamic open-cohort Markov model to assess the long-term effects and cost-effectiveness of HCVST in the Republic of Korea from 2024 to 2030. Strategies for comparison included universal, birth cohort, high-risk group screening, and no screening, focusing on the following: (1) incremental cost-effectiveness ratio (ICER) per disability-adjusted life-year (DALY) saved; (2) severe liver disease cases; and (3) liver-related death reduction.

Results: Universal HCVST screening is the most effective strategy for achieving the WHO goal by 2030, substantially lowering the incidence of severe liver disease by 71% and preventing liver-related deaths by 69%, thereby averting 267,942 DALYs. Moreover, with an ICER of US$8,078 per DALY and high cost-effectiveness, the sensitivity results prove that cost-effectiveness is robust. Although high-risk group screening offers the lowest cost compared with other strategies, its effectiveness in preventing severe liver disease is minimal, falling short of the current WHO goal.

Conclusions: Our study confirms that universal HCVST screening is a cost-effective strategy aligned with the WHO goal to eliminate HCV by 2030. Despite its higher costs compared to risk-based screening, the disease burden can be significantly reduced by providing effective HCVST access to individuals who might otherwise not be tested. **(Clin Mol Hepatol 2025;31:166-178)**

Keywords: Hepatitis C; Elimination of hepatitis C; Hepatitis C screening; Disease burden; Cost-effectiveness

INTRODUCTION

Hepatitis C virus (HCV) infection imposes a substantial global health and economic burden, leading to liver cirrhosis, hepatocellular carcinoma (HCC), and liver-related mortality. The advent of highly efficacious direct-acting antivirals has made the treatment of HCV a feasible goal.[1,2] Treatment with direct-acting antivirals for 8–12 weeks has achieved a sustained virologic response (SVR) of over 95%, which is considered a "cure".[3,4] Achieving SVR lowers the risk of HCC by approximately 85%, as well as decreases liver-related and overall mortality by 70–75%, regardless of cirrhosis status.[5-8]

The World Health Organization (WHO) has estimated that, in 2019, there were 58 million people with chronic HCV infections worldwide, but only 21% had been diagnosed and 13% had received treatment.[6] Thus, by 2030, from the baseline year of 2015, the WHO recommended that HCV infection be eradicated as a public health issue with an 80% drop in incidence and a 65% reduction in mortality.[9] To achieve these goals, it is essential that more than 90% of HCV infections be diagnosed and more than 80% of diagnosed patients be treated.[10,11] Recognizing the rising prevalence of HCV and the availability of effective and well-

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Editor: Tai-Chung Tseng, National Taiwan University Hospital, Taiwan

Received : Jun. 26, 2024 / **Revised :** Oct. 1, 2024 / **Accepted :** Oct. 2, 2024

Abbreviations:

DALY, disability-adjusted life year; DCC, decompensated cirrhosis; HCC, hepatocellular carcinoma; HCV, hepatitis C virus; HCVST, hepatitis C virus self-testing; ICER, incremental cost-effectiveness ratio; MSM, men who had sex with Men; PWID, people who injected drugs; SVR, sustained virological response; WHO, World Health Organization; WTP, willingness to pay

tolerated treatments, the Centers for Disease Control and Prevention (CDC) advises that all adults in the United States undergo HCV screening at least once in their lifetime, with more frequent testing for those with certain risk factors.[12,13] Most patients with HCV infection remain asymptomatic, therefore, screening for HCV infection should be conducted to ensure timely diagnosis and proper treatment.[14,15] Hence, the importance of universal HCV infection screening has been consistently reported.[16-18]

Meanwhile, the COVID-19 pandemic has substantially impacted many hepatitis elimination programs, which have been slowed down or completely halted, making it almost impossible to eliminate HCV by 2030.[19] Additionally, while strong national programs have been implemented in some countries to focus on the elimination of HCV, their testing has plateaued over time, facing challenges in reaching key and vulnerable populations.[20,21] Among the new and innovative approaches to accelerate HCV elimination, self-testing was considered. Recently, the WHO issued a new recommendation to use HCV self-testing (HCVST) as an additional screening approach to supplement facility-based testing services.[20] HCVST offers privacy and convenience and can reduce the stigma often associated with medical facilities.[22,23] To increase the acceptance of screening tests, it is necessary to simplify diagnostic approaches and improve awareness.[24,25] However, evaluations on the cost-effectiveness of widespread testing using new methods are still lacking.

To contribute to HCV elimination according to the WHO goal, we assessed disease burden reduction using the HCVST screening strategy and the optimal strategy based on cost-effectiveness analysis.

MATERIALS AND METHODS

Model development and framework

We developed a dynamic open-cohort Markov model to evaluate the cost-effectiveness of the universal HCVST screening strategy in the Republic of Korea. The structure of the model is composed of two elements: a decision tree and Markov transition model. In the decision tree, we evaluated the following four screening strategies: (1) universal screening (all individuals aged 18–79), (2) birth cohort screening (born between 1945–1984), (3) high-risk groups aged 18–79, and (4) no screening. Upon entering the model, individuals either received an HCV diagnosis or remained undiagnosed according to the respective strategy, and then proceeded to the Markov model, entering fibrosis stages (F0–F4) based on the age-related distribution of fibrosis epidemiology (Fig. 1A).

Our Markov model was simplified using a previously published Markov model simulating the natural history of chronic HCV infection in the Republic of Korea, allowing for a streamlined and contextually relevant approach.[26] The Markov model consists of 13 health states, including chronic hepatitis with fibrosis stages (F0–F4), sustained virological response (SVR), decompensated cirrhosis (DCC), (HCC, and liver transplantation (LT). In each health state, patients were at risk of general or liver-related death (DCC, HCC, or LT). The Markov model was conducted with a one-year cycle length and designed for a lifetime horizon. During the study period, the individuals transitioned based on the probability of transitioning between their health states. Thus, at the end of each cycle, they either remained in their current health state or shifted to a different state, culminating in the final cycle in which all individuals ultimately transitioned to the state of death (Fig. 1B). Posttreatment reinfection was assumed to be nonexistent.

This study conformed to the Consolidated Health Economic Evaluation Reporting Standards in its design, analysis, and reporting (Appendix 1 in Supplementary Materials). Additionally, we validated the model using the Validation Status of Health-Economic Decision Models tool, a process reviewed by four independent experts (Appendix 2 in Supplementary Materials). An exemption from the Institutional Review Board (IRB) of Severance Hospital was obtained (approval number: 4-2024-0006) as the model inputs used only published literature and publicly available data.

Study population

The study population comprised a dynamic cohort of new individuals reaching the study age annually and mortality exits. The initial cohort at the start of 2024 comprised all the Republic of Korea adults aged 18–79 years, with new 18-year-olds enrolled each year until 2030 (Supplementary Fig. 1, Supplementary Table 1, and Supplementary Table 2).[27,28]

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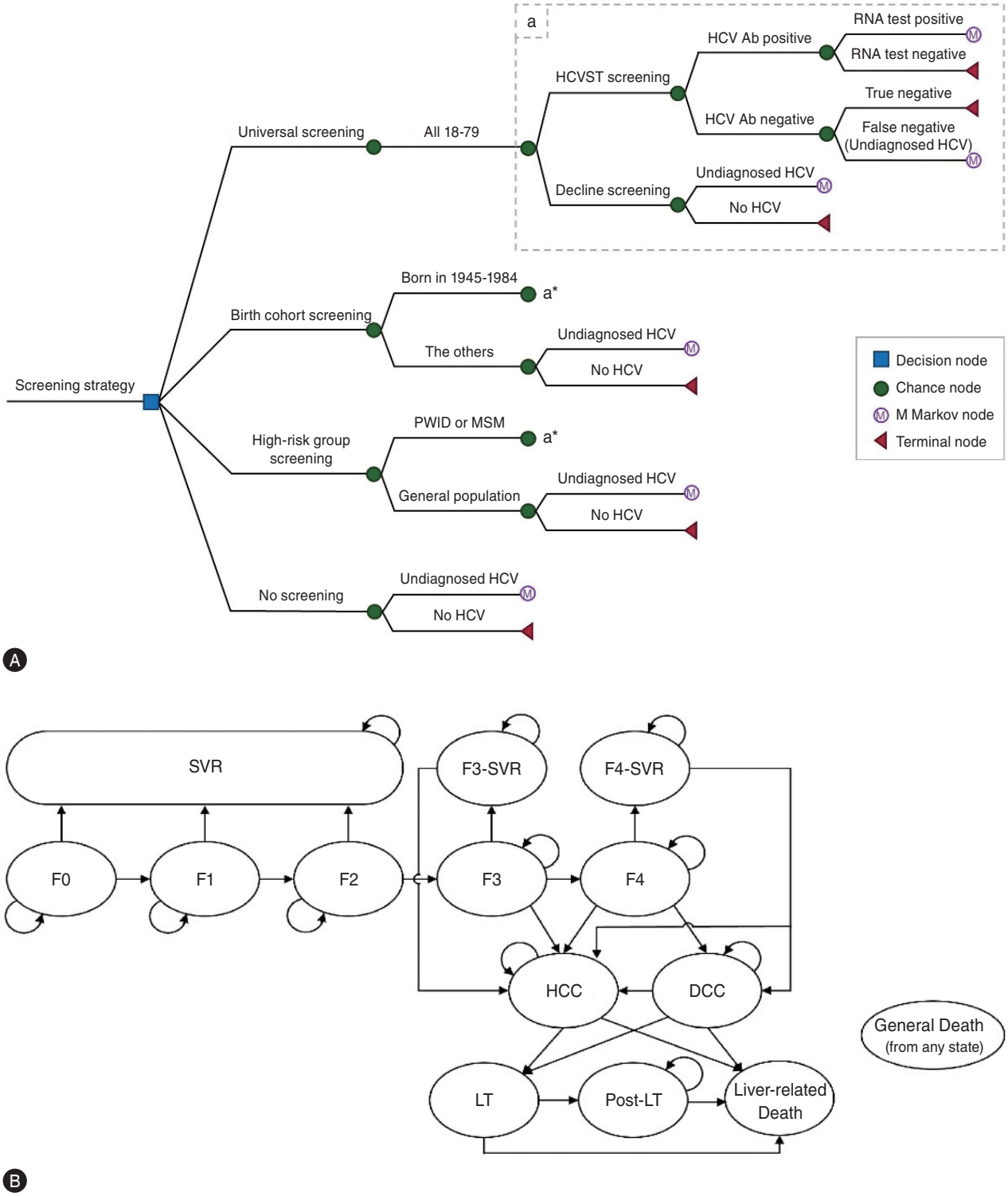

Figure 1. Model structure for screening (A) strategies in decision tree. (B) Markov transition model of hepatitis C stages and progression. *The symbol 'a' indicates that the subsequent pathway follows the same sequence of events as outlined in the decision node 'a' within the dashed box. This includes initial screening for HCV antibodies, followed by RNA testing to confirm active infection. DCC, decompensated cirrhosis; HCC, hepatocellular carcinoma; HCV, hepatitis C virus; HCVST, hepatitis C virus self-testing; LT, liver transplantation; MSM, men who have sex with men; PWID, person who injects drugs; RNA, ribonucleic acid; SVR, sustained virological response; WTP, willingness to pay.

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High-risk groups included people who injected drugs (PWID) and men who had sex with men (MSM). At the beginning of the screening in 2024, we estimated the number of HCV infections in the population and based our seven-year screening project simulation on this estimate.

Screening strategies

Four screening strategies were evaluated: (1) universal screening (all individuals aged 18–79); (2) birth cohort screening (born between 1945–1984); (3) high-risk groups aged 18–79; and (4) no screening. Universal screening targets all individuals aged 18–79, aiming to provide comprehensive coverage by identifying and treating HCV across the entire adult population. Birth cohort screening focused on individuals born between 1945 and 1984, a group known to have a higher prevalence of HCV infection,[29] thereby optimizing resource use by concentrating on demographics with an elevated risk. High-risk group screening included individuals aged 18–79 who engage in behaviors or have conditions associated with a higher risk of HCV infection, such as PWID and MSM, as extensively reported in previous studies.[16,30,31] No screening serves as a control scenario, representing the current status in the Republic of Korea, where systematic nationwide HCV screening has not been implemented. Hence, HCV testing in the Republic of Korea might be largely opportunistic, meaning that individuals might be tested for HCV infection only based on self-interest, job (e.g., health professional), or specific medical conditions (e.g., outbreak, before surgery, or abnormal liver function). In the study population, individuals who were not targeted for screening under each strategy were assumed to be diagnosed and treated for HCV infection at the same rate as those who were not screened.

Anti-HCV antibodies can be screened using the HCVST. All patients who tested positive for anti-HCV antibodies were referred for HCV RNA testing for confirmatory diagnosis, distinguishing false-positive anti-HCV antibody results from prior treatment or self-recovery. Finally, treatment with direct-acting antivirals was initiated, if appropriate. Screening was simulated from 2024 to 2030, during which a one-time screening was provided as part of the seven-year strategy, contributing to the WHO goal of HCV elimination by 2030. An annual screening rate of 28% was assumed, resulting in a cumulative rate of 90% for a one-time screening over a period of seven years. If the annual screening rate exceeded 28%, a cumulative rate of 90% for a one-time screening might be achieved earlier, within less than 7 years. Beyond 2030, no further screening was offered, and lifetime follow-ups will be conducted. All eligible patients were assumed to have an equal chance of receiving HCV treatment irrespective of the severity of fibrosis. Additionally, it was assumed that individuals diagnosed with HCV infection had the same treatment opportunities regardless of whether they were screened.

Estimation of transition probabilities

A thorough literature review and public databases were used to estimate the transition probabilities of our model, focusing on data from the Republic of Korea. Data on the prevalence of the HCV antibody and awareness among those who have the antibody was retrieved from the Korea National Health and Nutrition Examination Survey.[29] For individuals diagnosed with HCV infection, the treatment initiation rate was referenced from the Korean HCV Cohort Study.[32,33] Treatment approaches followed the standard regimens of glecaprevir 0.1 g/pibrentasvir 40 mg and sofosbuvir 0.4 g/velpatasvir 0.1 g, with SVR rates derived from clinical trials.[34,35] The input parameters are detailed in Supplementary Table 3.

Estimation of costs and utilities

Our base analysis focused on the direct medical costs, estimated costs from a healthcare system perspective, coverage of the HCVST kit, confirmatory testing, treatment, and other related medical expenses. The healthcare system perspective encompasses all direct medical costs incurred by the healthcare system, such as medications, diagnostic tests, and hospital services. The medication costs were based on the 2023 health insurance reimbursement rate in the Republic of Korea. Additionally, we broadened our analysis to include a societal perspective encompassing non-medical costs, such as transportation and caregiving, along with productivity losses. These productivity losses were applicable to individuals under the age of 65 and accounted for treatment-related absenteeism, as well as losses due to disease states at or beyond the DCC level. Disability weights were sourced from the 2019 Global Bur-

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den of Disease estimates,[36] and age-specific life expectancy data for the Republic of Korea were obtained from Statistics Korea.[28] All future costs and health outcomes were discounted annually at 4.5% according to the Korean guidelines. All the values used in the model are detailed in Supplementary Table 3. All costs were expressed as 2023 US dollars.

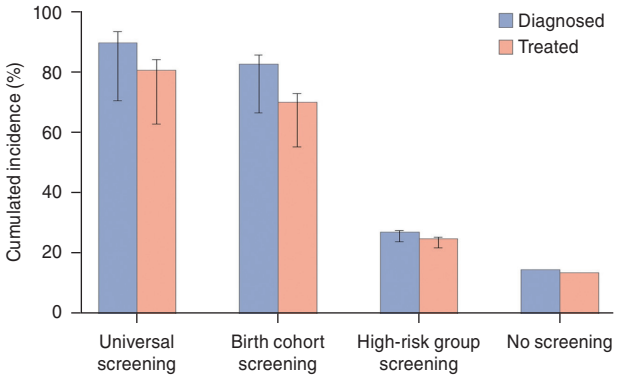

Figure 2. Cumulative incidence of diagnosed and treated hepatitis C cases during universal and targeted screening strategies from 2024 to 2030.

Cost-effectiveness analysis

This model operates within a decision-analytic framework, allowing for comprehensive cost-effectiveness analysis. The results of each strategy were described for frequency of screening and treatment, total costs, and outcomes, including both DALYs and quality-adjusted life-years (QALYs). ICER was calculated by dividing the incremental total cost of each strategy by its incremental total outcomes (i.e., DALY or QALY) relative to no screening. The willingness-to-pay (WTP) threshold was set at the per capita GDP (USD 33,150). The analysis assessed the cost-effectiveness of the intervention through the ICER over different time horizons, focusing on lifetime evaluation and a supplementary 15-year short-term horizon from the start of the intervention. Additionally, projections were made for the

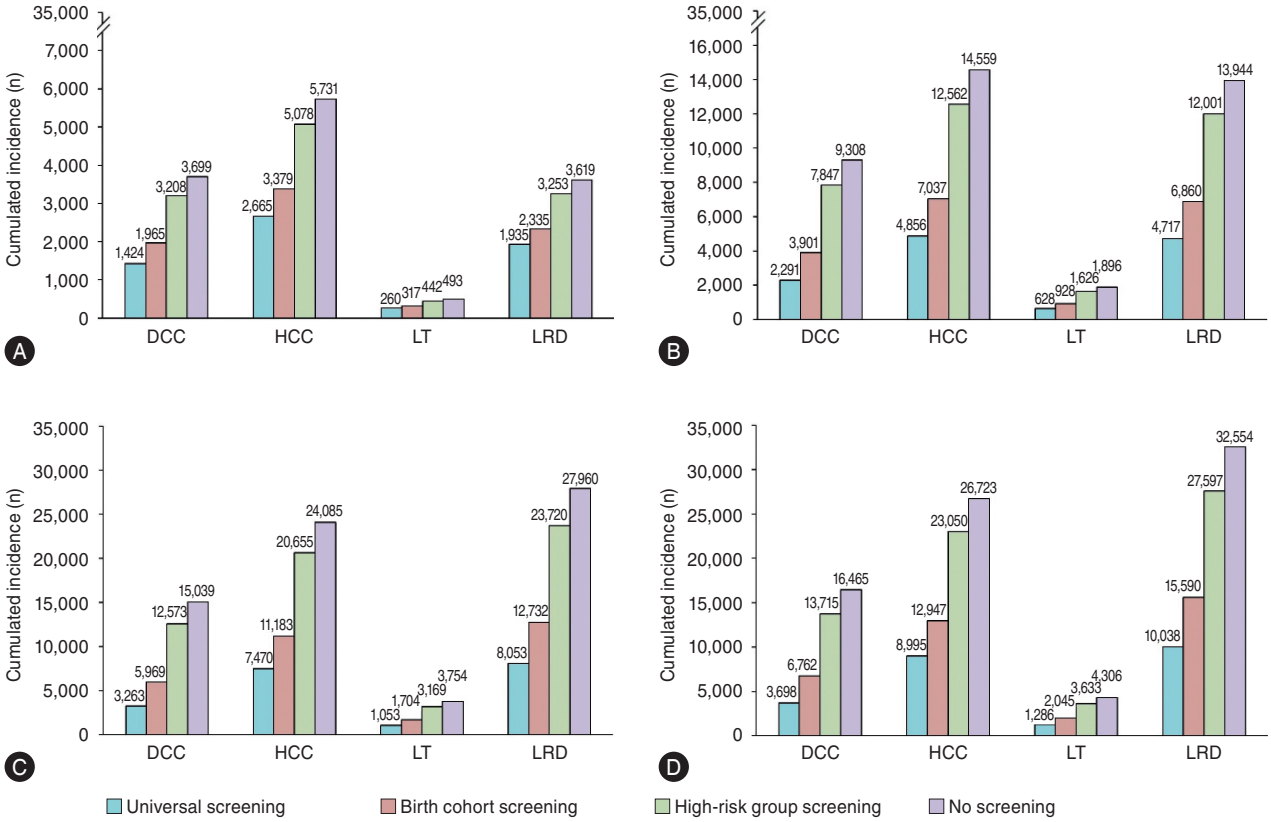

Figure 3. Predicted cumulative case of advanced disease and liver-related death over various follow-up periods (A) At completion of the screening (7 years from the initiation of screening), (B) 15 years post-screening, (C) 30 years post-screening, and (D) throughout lifetime follow-up. DCC, decompensated cirrhosis; HCC, hepatocellular carcinoma; LRD, liver-related death; LT, liver transplantation.

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cumulative number of expected cases of severe liver disease and liver-related mortality.

Sensitivity analyses

Sensitivity analyses, including one-way deterministic and probabilistic sensitivity analyses based on 1000 Monte Carlo simulations, were conducted. In the probabilistic sensitivity analyses, we defined the distributions of each parameter based on their respective sources. Beta distributions were used for probabilities and utilities, whereas cost parameters were modeled using gamma distributions (Supplementary Table 3). These analyses evaluated the effects of parameter uncertainties and model robustness. All analyses were performed using Microsoft Excel.

RESULTS

Clinical outcomes

Upon completion of screening by 2030, the universal screening strategy was projected to result in 90% (95% confidence interval [CI] 71–94%) of all HCV-infected individuals being screened and 81% (95% CI 63–84%) receiving treatment. In the birth cohort screening, 83% (95% CI 67–86%) were expected to be screened and 70% (95% CI 55–73%) were treated, whereas in the high-risk group, 27% (95% CI 24–28%) were likely to be screened and 25% (95% CI 22–26%) were treated (Fig. 2).

Cost-effectiveness assessment

The effectiveness of screening strategies is expected to considerably vary, with a wide range of outcomes, depending on the approach used. Universal screening has been identified as the most effective method for reducing the cases of advanced disease and liver-related deaths. Screening up to 2030 is expected to reduce the number of severe cases by 12–56% compared to that with no screening, with a 15–71% decrease observed over a lifetime. Additionally, liver-related death is anticipated to decrease by 15–69% over the same lifetime. As the follow-up period was extended, the expected cumulative incidence of severe liver disease and liver-related mortality declined compared to that with no screening, with universal screening potentially preventing up to 22,516 liver-related deaths. However, when screening was limited to only the high-risk group, there was a minimal difference in outcomes compared to that with no screening (Fig. 3).

Table 1. Cost-effectiveness results from different hepatitis C virus screening strategies

Strategy	Cost	Incremental cost	DALY	DALY averted	ICER (cost per DALY averted)
Lifetime					
Universal screening	3,850,366,380	2,164,313,631	139,097	267,942	8,078
Birth cohort screening	3,109,966,165	1,423,912,416	251,207	155,833	9,137
High-risk group screening	1,590,552,557	-95,500,192	323,111	83,929	Cost-saving
No screening	1,686,052,749	Ref.	407,039	Ref.	Ref.
30 years					
Universal screening	3,809,081,909	2,216,028,926	133,210	259,713	8,533
Birth cohort screening	3,051,814,783	1,458,761,799	240,729	152,194	9,585
High-risk group screening	1,511,580,072	–81,472,912	312,066	80,857	Cost-saving
No screening	1,593,052,984	Ref.	392,923	Ref.	Ref.
15 years					
Universal screening	3,659,779,256	2,616,082,796	102,252	167,722	15,414
Birth cohort screening	2,809,669,254	1,765,972,793	170,613	101,361	17,423
High-risk group screening	1,047,165,537	3,469,076	219,614	52,360	66
No screening	1,043,696,461	Ref.	271,974	Ref.	Ref.

DALY, disability-adjusted life-year; ICER, incremental cost-effectiveness ratio; Ref., reference.

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In the base-case analysis over a lifetime, universal screening averted 267,942 DALYs with an associated ICER of US$8,078 per DALY averted (Table 1). The observation of a decreasing trend in the ICERs over an extended follow-up period was attributed to the prolonged time from HCV infection to severe liver disease, highlighting the increased benefits of screening over time. The high-risk group screening strategy demonstrated cost-effectiveness, was dominant, or presented the lowest ICER, followed by the ICER for universal screening. Other screening strategies also proved to be cost-effective at the WTP threshold of US$33,150. However, universal screening reduced the highest number of DALYs and maintained high cost-effectiveness throughout the observation period.

Supplementary Table 4 presents the detailed costs, costs per DALY, and costs per QALY along with the results from the perspectives of the healthcare system and society. The trends in the base-case analysis were consistent per QALY, and from a societal perspective, the ICER were US$5,940 per DALY and US$5,473 per QALY.

Screening focused on high-risk groups was cost-saving because of the involvement of fewer populations (Supplementary Table 1), which resulted in lower screening costs (Table 1). However, it had a minimal impact on preventing severe liver disease due to HCV infection, thus being the farthest from achieving the WHO elimination goals. Despite the cost-effectiveness, this strategy does not significantly mitigate the overall burden of severe HCV-related diseases.

Sensitivity analyses

A one-way sensitivity analysis depicted the associations of independent variations in parameters, such as time horizon, prevalence, and cost on the ICER. The most influential parameter was the discount rate, and all parameters within the observed range indicated the robustness of the model in terms of cost-effectiveness (range: from a healthcare provider's perspective, US$2,684–18,967 per DALY; from a societal perspective, US$649–17,074 per DALY) (Supplementary Fig. 2).

The results of the probabilistic sensitivity analysis, conducted 10,000 times, are illustrated in a cost-effectiveness acceptability curve and cost-effectiveness scatter plot (Fig. 4). The cost-effectiveness acceptability curve shows that the probability of a strategy being cost-effective at a WTP threshold of US$33,150 was greater than 100% for all strategies. Additionally, the analysis indicates substantial robustness of results; even when the WTP threshold was lowered to approximately US$13,000, all strategies still achieved a cost-effectiveness probability exceeding 90%.

DISCUSSION

In 2021, the WHO updated its guidelines on HCVST, a substantial step that can markedly increase the uptake of HCV screening, especially in countries with limited health-

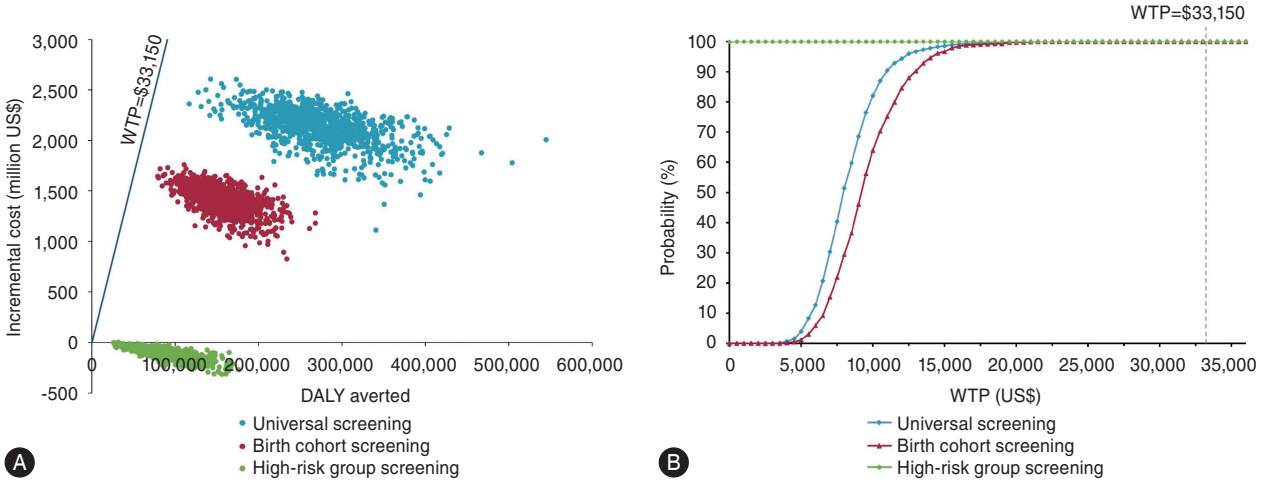

Figure 4. Probabilistic sensitivity analysis results in cost-effectiveness model (A) Scatter plot with 1000 Monte Carlo simulation. (B) Acceptability curve representing the probability of the incremental cost-effectiveness ratio. DALY, disability-adjusted life-years; US$, United States dollar; WTP, willingness to pay.

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care access.[37] Furthermore, HCVST might be beneficial even in countries with adequate healthcare access where the testing uptake has plateaued over time, facing challenges in reaching key and vulnerable populations. In the present study, we evaluated the cost-effectiveness of HCVST-based screening strategies to achieve the WHO goal of HCV elimination by 2030. Furthermore, we assessed the extent to which the disease burden could be reduced using the four different strategies.

Our study has several important findings. Although the cost-effectiveness of blood-based testing has been well documented in previous studies,[5,16,38] to the best of our knowledge, this is the first study to evaluate the cost-effectiveness of HCVST-based screening strategies over a long period, including both targeted and general populations. HCVST, which is slightly expensive, may offer long-term savings by enhancing testing coverage and early detection, particularly in hard-to-reach populations. HCVST fulfilled the required diagnostic performance standards for effective screening (sensitivity 0.98, specificity 1.00).[39] Thus, we revealed that universal screening, rather than screening only high-risk individuals, is a cost-effective option that markedly reduces the disease burden. While previous research has often focused on limited populations, such as high-risk groups, or recommended targeted screening (e.g., PWID and MSM),[30,31,40] our study identified major limitations of risk-based and birth-cohort screening strategies. Furthermore, if self-testing kits became available at lower costs, the cost-effectiveness of universal screening is expected to increase.

Although screening strategies focusing solely on high-risk groups might be cost-effective, WHO goal cannot be achieved. A major drawback of birth cohort screening, which focuses on age groups with higher HCV prevalence, is the exclusion of younger individuals. Considering that over 50% of HCV-infected individuals within high-risk groups are estimated to be under 40 years of age (Supplementary Table 1), this approach may overlook a considerable proportion of the population. Importantly, our findings indicate that universal screening and testing of both high- and low-risk individuals can lead to a greater reduction in the disease burden and bring us closer to achieving HCV elimination.[17,37]

Our study has the ability to effectively capture the long-term benefits of early detection and treatment of individuals with HCV over an extended period. The long time period is crucial, as chronic HCV infection often remains asymptomatic until severe liver disease manifests, and even then, it can remain undiagnosed for a substantial duration.[41,42] This extended perspective allows us to comprehensively evaluate the enduring impacts of HCV intervention strategies, shedding light on their potential to substantially improve public health outcomes over time.

This study used a dynamic open-cohort model, which realistically reflects the implementation of multiyear screening strategies aimed at achieving the 2030 goal. By considering population dynamics and changes in health status over time,[43] our model effectively captured the premature deaths caused by HCV infection. The dynamic nature of our cohort model allowed us to track long-term health trends and gain insight into the effectiveness of screening over time. This approach provides more accurate outcome predictions, reflects real-world conditions, and makes our findings highly relevant for public health planning.[44]

The results of this study demonstrate the clinical and economic benefits of universal HCV screening in Korea. However, there are some limitations to consider. First, we adopt a fixed annual screening rate of 28% as the base case. However, considering that the average participation rate for biennial health examinations in the Republic of Korea between 2015 and 2019 was as high as 77%, this rate can be regarded as a feasible assumption.[45] Second, we applied the current treatment initiation rate of 72.8%, slightly lower than the suggested value of 80%.[9,10] Given that treatment initiation rates may not automatically increase with the provision of screening alone, additional awareness campaigns and education are required to improve these rates. In addition, we confirmed consistent results from the one-way deterministic sensitivity analysis when the treatment initiation rate is 50–80% (Supplementary Fig. 2). Third, although most studies on targeted HCV testing strategies for high-risk groups have focused on PWID, MSM, prisoners, or sex workers, we acknowledge that our definition of high-risk groups, focusing solely on PWID and MSM, might be somewhat narrow in achieving the WHO goal. Further studies are required to assess the potential benefits of expanding the high-risk group to include patients on dialysis or with diabetes.[46,47] Fourth, our estimated target population included individuals who had already been diagnosed with chronic HCV infection and then treat-

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ed. While we aimed to estimate the additional benefits of systematic screening compared with that with the no-screening scenario, the inclusion of a previously diagnosed population might have partially affected the results. Further studies with adjustments for this population may be necessary to refine cost estimates and assess the impact of our HCV screening strategy. Finally, not all model inputs in the present study were based on empirical data. The transition probabilities in our disease model and sensitivity analyses primarily originated from prospective cohort studies and various kinds of pooled analyses based on real-world practice, ensuring generalizability, robustness, and clinical relevance. However, further studies are required to address this issue.

In an international context, our study's implications extend beyond the Republic of Korea by considering global variations in healthcare systems and HCV prevalence rates. Universal screening, irrespective of the risk level, offers a potential model for countries that aim to eliminate HCV. The cost-effectiveness of universal screening was previously reported, even when compared to birth cohorts or risk-based screening.[16,38,48] The pandemic has increased acceptance of self-testing, which has been established as essential for long-term hepatitis elimination efforts.[49] Additionally, low- and middle-income countries with limited healthcare access may find self-testing particularly relevant.[37,50] Our study highlights the challenges and successes of HCVST implementation in these contexts and provides valuable insights.

In conclusion, our study demonstrates that the universal HCVST is a cost-effective and important strategy in the Republic of Korea, capable of diagnosing and treating over 90% and 80% of all HCV-infected patients, respectively. Prioritizing healthcare services and support for the treatment of high-risk groups, such as PWID, is necessary.[51] Although this approach incurs higher costs than risk-based screening, universal screening can lead to a greater reduction in disease burden and has the potential to be a more powerful tool than existing national programs in some countries. Despite the WHO goal, the findings of this report suggest that few countries are likely to reach elimination by 2030 and many may fail to achieve the WHO targets.[21,25] To effectively eliminate HCV, a greater effort from governments, healthcare systems, national and international institutions, and civil society is required than is currently being expended.[52] If the objective is to increase the number of individuals being screened, including those at heightened risk, and ultimately eliminate HCV, universal HCVST screening is a feasible and effective strategy, as suggested by our research findings.

Authors' contributions

BKK and SHA conceptualized this study. The data included in this study were retrieved by GS, BKK, and SB. GS and HL performed the data analysis. GS, BKK, and HL contributed to data visualization. BKK and SHA provided critical feedback on the methods and results. SB and HL provided critical feedback on discussions and revisions. GS, BKK, and HL contributed to the data interpretation. HL and SHA contributed to management of the research enterprise. BKK, GS, and SB had full access to all data in the study and took responsibility for the integrity of the data and accuracy of the data analysis. GS, BKK, and SB wrote the original draft and critically revised the manuscript for important intellectual content. HL and SHA approved the final version of the manuscript. GS and HL directly accessed and verified the data. All the authors are accountable for all aspects of this study.

Acknowledgements

This study was supported by the Research Support Program of the Korean Association for the Study of the Liver and the Korean Liver Foundation. The sponsor had no role in the study design; collection, analysis, and interpretation of data; writing of the report; or decision to submit the paper for publication.

Conflicts of Interest

The authors have no conflicts to disclose.

SUPPLEMENTARY MATERIAL

Supplementary material is available at Clinical and Molecular Hepatology website (http://www.e-cmh.org).

This study did not involve collection or reporting of primary data. In addition, no individual-participant-level data were used. The data included in the analysis were derived from publicly available sources; detailed references are available in Supplementary Table 3.

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https://doi.org/10.3350/cmh.2024.0484