Cost-Effectiveness of Universal Screening for CHB Infection in Adults

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The Asian Liver Center at Stanford University is the first non-profit organization in the United States that addresses the disproportionately high rates of chronic hepatitis B infection and liver cancer in Asians and Asian Americans.

The center addresses the gaps in the fight against hepatitis B through a four-pronged approach of collaboration, advocacy, research, and education & outreach
www.liver.stanford.edu

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Cost-Effectiveness Analysis

- CEA is a method to evaluate the outcomes and costs of interventions designed to improve health

- Help decision maker determine how to allocate resources

- Who is the target audience for the study?

Influence an opinion on a subject or add the weight of information on an intervention

Practice guidelines that may be influenced by a CEA, but eventually physicians and patients who make the decision

Health Effect Measure

Health Effectiveness is expressed in terms of unit of output

- **# Cancer cases detected, infections averted…**

- **Life Years Gained (LYG)**

  Gains in longevity without quality of life adjustment

- **Disability Adjusted Life Years (DALYs)**

  Not generally used in CEA, less developed country context, minimize DALY's

- **Quality Adjusted Life Years (QALY's)**
  Advantage of QALY: Incorporating changes in survival and morbidity in a single measure

QALY is a measure of the length and quality of life gained from an intervention/ treatment– 1 QALY is one year spent in perfect health

Incremental Cost-Effectiveness Ratio

An ICER is calculated:

Incremental Cost

(difference in cost between the new intervention and comparator)

_____

Incremental QALY

(difference in QALY's between new intervention and comparator)

WHO Definition of Cost-Effectiveness

Intervention/treatment is considered Cost-Effective:

Cost is less than 3 x GDP per capita for 1 QALY

■ GDP per capita in US in 2019= US$65,297

In the US, < 195,891/QALY

Cost-saving: if a (new) intervention costs less and gains more QALYs vs. comparator (status quo or current practice)

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Cost-Effectiveness of One-Time Universal Screening for Chronic Hepatitis B Infection in Adults in the United States

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Background

- NHANES 2011-2016 report: 840,000-862,000 CHB adults

- 18-34: 0.30%
  35-49: 0.37%
  50-64: 0.41%
  65+:   0.35%

- NHANES: 33% of the US population are unaware of their CHB infection

- Patient related and healthcare provider (or healthcare system) related barriers account for **low screening** and **diagnosis rates**

- CDC, USPSTF, and the AASLD recommend universal HBsAg screening of pregnant women and risk-based testing of non-pregnant

Aim

- Assess the economic and public health impact of one-time universal screening of the general adult population for CHB in the United States

- Comparing current practice to current practice + one time testing

- Outcomes: Lifetime costs, QALYs, and clinical endpoints

Methods

- Using a Markov model: simulated cohorts' progression through series of health states

- According to NHANES data: HBsAg prevalence among adults >18 years is 0.36%. We multiplied 0.36% by 67% (unaware of their infection) to obtain an estimated prevalence of 0.24% undiagnosed CHB

- Disease progression estimate rates for the model were derived from recent cohort studies and meta-analysis from North America for HBV mono-infected patients

- Two scenarios were considered: current practice vs. current practice plus one-time universal hepatitis B screening

- 33% are currently diagnosed, 36% are linked to care, and 18% of those diagnosed are receiving treatment

Markov Schematic
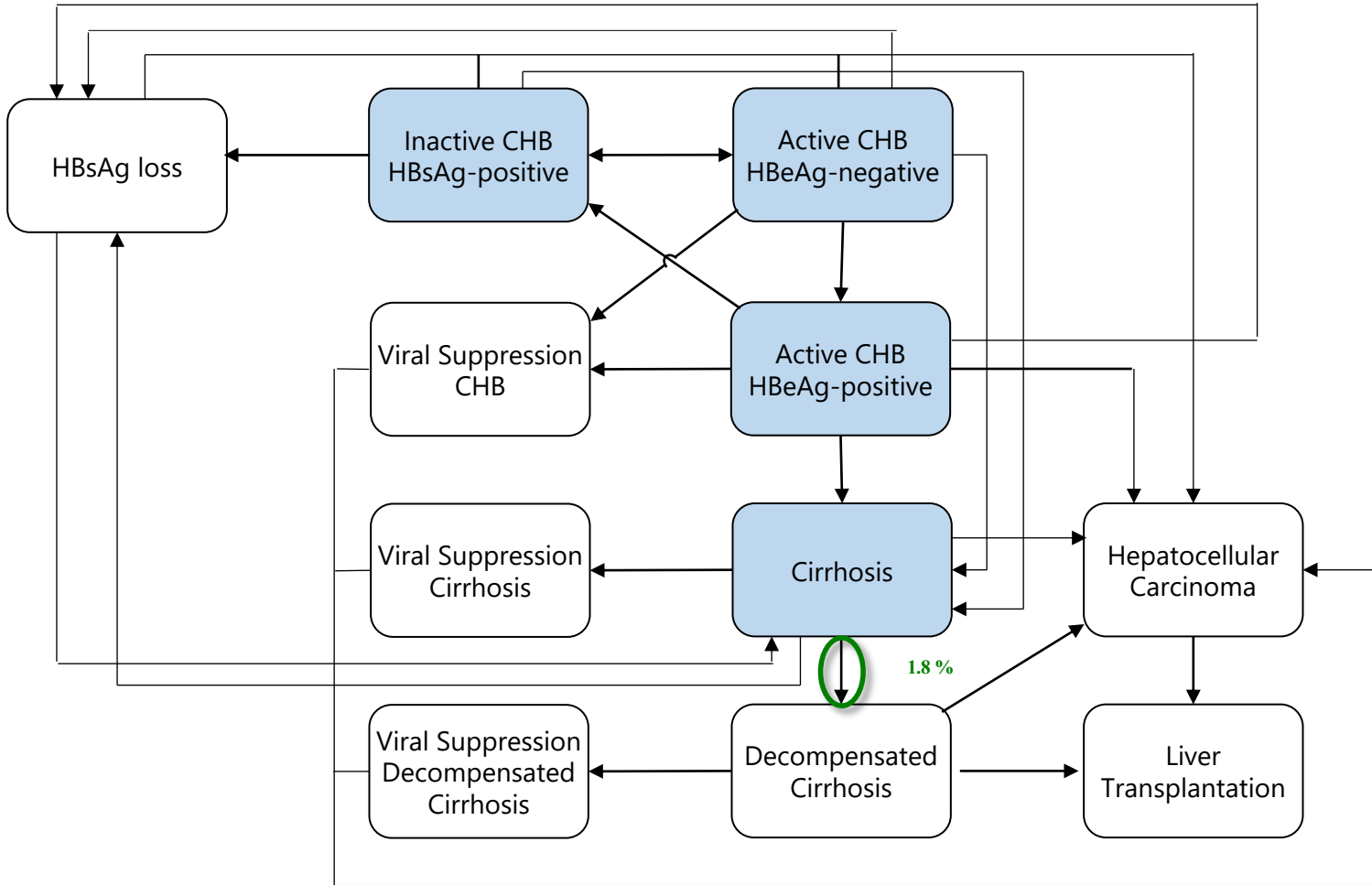
All states can lead to death (not shown). Highlighted are the initial starting states

Key Input Variables

| Variable	Base Case	Range	References
Age/birth cohort	≥18 yrs	18-69 yrs	
HBsAg prevalence in adult US population	0.36%	0.29-0.46%	Patel et al. 2019 (6)
Male to female ratio of positive HBsAg population	58:42		Patel et al. 2019 (6)
Percent not aware of their infection	67%		Patel et al. 2019 (6)
Estimated prevalence of undiagnosed adult US population who are HBsAg positive	0.24%		
Percent adults diagnosed with CHB and linked to care and received antiviral treatment	18%	17-19%	Harris et al. 2020 (7)
Percent adults with cirrhosis diagnosed with CHB who are linked to care and receive antiviral treatment	100%		Assumption
Percent of adults who are eligible for treatment	30%	26-30%	(54-57)
Screening Costs (U.S. dollars) $			
Cost of hepatitis B serologic tests			
Hepatitis B surface antigen (HBsAg)	$10.33		Medicare reimbursement
Hepatitis B core antibody (anti-HBc)	$10.74		Medicare reimbursement
Hepatitis B surface antibody (anti-HBs)	$12.05		Medicare reimbursement
All 3 hepatitis B tests	$28.27		Medicare reimbursement
Linkage to Care and Treatment Costs			
Antiviral drug costs per year*	$502	$326-$16,464†	Redbook (Jan 22, 2021) (35)
Initial Baseline Tests (HBeAg, CBC, LFT, HBV DNA)	$86.74	$43.23-$129.71	Medicare reimbursement
Total annual monitoring costs‡	$369	$185-$554	Medicare reimbursement
Clinic visit x 2	$74 x2	$37-$111	Medicare reimbursement
Ultrasound x 1 (50% none, 50% x 2)	$125 x 1	$62-$187	Medicare reimbursement
AFP x 2 (50% none, 50% x2)	$23 x 2	$12-$35	Medicare reimbursement
ALT x 2	$7 x 2	$4-$11	Medicare reimbursement
HBV DNA x 1	$59 x 1	$29-$88	Medicare reimbursement
Annual Disease Management Costs**			
Chronic Hepatitis B	$1,695	$176-$6808	Liu et al. 2012 (36)
Cirrhosis	$5,045	$176-$6181	Liu et al. 2012 (36)

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Assumptions

- Assuming 60% on generic TDF and 40% on generic ETV

- Adjusted to 2020 USD using the 2020 Medical Consumer Price Index (CPI)

- Annual monitoring: total cost including bi-annual clinic visits and blood tests for ALT and annual HBV DNA level plus assuming 50% would receive additional HCC surveillance consisting of bi-annual liver ultrasound and AFP blood tests as recommended by AASLD guidelines

Results

Clinical outcome and cost-effectiveness of one-time universal HBsAg screening for CHB compared with current practice for a population of 100,000 persons age 18-69 years

	Cirrhosis	Decomp. Cirrhosis	HCC	Transplants	HBV Deaths	Cost*	QALYs	ICER
Current Practice (CP)	24.9	7.6	23.9	8.0	38.0	8,747,703	2,062,384	-
CP + One-time Universal Screening	17.5	4.3	18.4	6.1	27.7	8,484,846	2,062,521	-
Difference	-7.4	-3.3	-5.5	-1.9	-10.3	-262,857	+137	Cost-saving

Sensitivity Analysis on Annual Antiviral Treatment Drug Costs on CE of CHB Screening
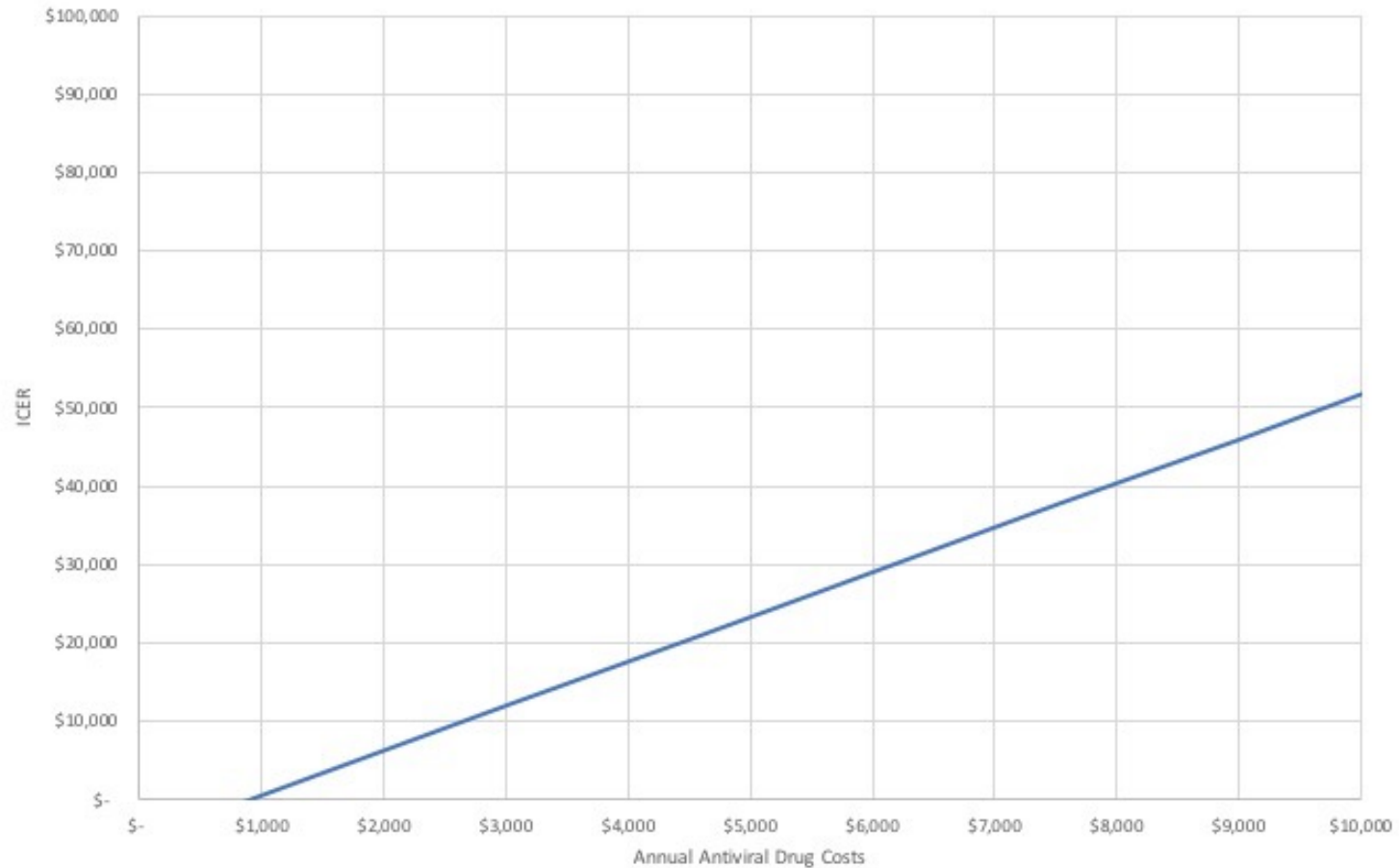
Willingness to pay or ICER threshold of $50,000/QALY is considered cost-effective

Incremental cost-effectiveness ratio for one-time universal hepatitis B screening compared to current practice, by various undiagnosed CHB prevalence points and testing costs

Undiagnosed CHB Prevalence	Base Case ICER (HBsAg test at $10.33)	Cost-Saving (Testing costs threshold)	Cost-Effective at $50,000/QALY (Testing costs threshold)
0.01%	$ 171,971	$ 0.54	$ 3.39
0.02%	$ 81,243	$ 1.08	$ 6.77
0.03%	$ 51,001	$ 1.62	$ 10.16
0.04%	$ 35,879	$ 2.16	$ 13.55
0.05%	$ 26,807	$ 2.70	$ 16.93
0.10%	$ 8,661	$ 5.40	$ 33.86
0.15%	$ 2,613	$ 8.10	$ 50.80
0.20%	Cost-Saving	$ 10.80	$ 67.73
0.25%	Cost-Saving	$ 13.50	$ 84.66
0.30%	Cost-Saving	$ 16.20	$ 101.59
0.40%	Cost-Saving	$ 21.60	$ 135.45
0.50%	Cost-Saving	$ 27.00	$ 169.32

Base cost of the HBsAg screening test is $10.33

Conclusion

- A one-time universal screening of the US population ages 18-69 years for CHB is cost-saving and would result in better health outcomes with reduction in cases of cirrhosis, decompensated cirrhosis, HCC, liver transplantations, and HBV-related deaths.

- A national recommendation for universal CHB screening beyond pregnant women will greatly simplify the screening process and can be readily included in the electronic medical record system to offer all adults a one-time hepatitis B test.

Thank you!

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The price tag of a potential cure for chronic hepatitis B infection: A cost threshold analysis for USA, China and Australia

Mehlika Toy ✉, David Hutton, Karen McCulloch, Nicole Romero, Peter A. Revill **... See all authors** ⌄

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Abstract

Background & Aims

We aim to capture the economic impact of a potential cure for chronic hepatitis B infection (CHB) in three countries (USA, China and Australia) with different health systems and epidemics to estimate the threshold drug prices below which a CHB cure would be cost-saving and/or highly cost-effective.

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