Supporting Information Accompanying Manuscript
Transplanting HCV-positive livers into HCV-negative patients with preemptive antiviral treatment: Outcomes of a modeling study

Jagpreet Chhatwal, PhD,*[1,2,3] Sumeyye Samur, PhD*[1,2] Emily D. Bethea, MD[1,2], Turgay Ayer, PhD,[4] Fasiha Kanwal, MD, MSHS,[7,8] Chin Hur, MD, MPH[1,2,3] Mark S. Roberts, MD, MPP,[5,6] Raymond T. Chung, MD[2,3]

[1]Massachusetts General Hospital Institute for Technology Assessment, Boston, MA

[2]Harvard Medical School, Boston, MA

[3]Liver Center and Gastrointestinal Division, Massachusetts General Hospital, Boston, MA

[4]Department of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA

[5]Department of Health Policy and Management, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA

[6]University of Pittsburgh School of Medicine, Pittsburgh, PA

[7]Department of Medicine, Gastroenterology and Hepatology, Baylor College of Medicine, Houston, TX

[8]Houston Veterans Affairs Health Services Research and Development Center of Excellence, Michael E. DeBakey Veterans Affairs Medical Center, Houston, TX

**The authors contributed equally to the construction of the manuscript*

Corresponding author:

Jagpreet Chhatwal, PhD
MGH Institute for Technology Assessment
101 Merrimac Street, Floor 10th
Boston, MA 02114
Email: JagChhatwal@mgh.harvard.edu
Tel: 1-617-724-4445; Fax: 1-617-726-9414

Table S1. Weekly Liver-related Death Probabilities based on MELD Score

MELD Score	Weekly Probability of Liver-related Death
6–7	0.000014
8–9	0.000697
10–11	0.000691
12–13	0.000022
14–15	0.000681
16–17	0.000235
18–19	0.003659
20–21	0.007021
22–23	0.009891
24–25	0.011323
26–27	0.047260
28–29	0.078599
30–31	0.159678
32–33	0.192294
34–35	0.211013
36–37	0.273120
38–39	0.344884
40	0.481372

Source: Alagoz et al. (1) and UNOS data

Table S2. Weekly Liver Transplantation Probabilities based on MELD Score

MELD Score	Weekly Probability of Liver Transplant
<14	0
14–15	0.008161
16–17	0.012561
18–19	0.026286
20–21	0.036498
22–23	0.052484
24–25	0.066997
26–27	0.078408
28–29	0.082616
30–31	0.084809
32–33	0.087066
34–35	0.084809
36–37	0.068787
38–39	0.066997
40	0.052484

Source: Massie et al.(2)

Table S3. Health-Related Quality-of-Life Utilities of the United States Population

Age Group	Male	Female
20–29	0.928	0.913
30–39	0.918	0.893
40–49	0.887	0.863
50–59	0.861	0.837
60–69	0.84	0.811
70–79	0.802	0.771
80–89	0.782	0.724

Source: Hanmer et al.(3)

Section S1. Transplant Rate and Mortality by UNOS Region

We used UNOS-reported transplantation and death rates for each region to adjust the probability of receiving an LT and probability of death on the waiting list. Specifically, we estimated the ratio of observed transplant rate of each region and overall rate in the United States. Using the ratio, we estimated region-specific rates as follow:

$$\textit{Region-specific-probability} = 1 - (1 - \textit{National probability})^{\text{Ratio}}$$

Table S4. Transplantation and Death Ratios by UNOS Regions

Region	Transplantation (Rate per 100 Person Years)	Ratio (Region / U.S.)	Death (Rate per 100 Person Years)	Ratio (Region / U.S.)
1	30.5	0.709	19	1.061
2	34	0.791	18.4	1.028
3	110.2	2.563	20.1	1.123
4	29.8	0.693	15.9	0.888
5	28.7	0.667	16.9	0.944
6	50.5	1.174	21.3	1.190
7	47.8	1.112	19.2	1.073
8	37.9	0.881	16	0.894
9	26.4	0.614	17.2	0.961
10	68.8	1.600	20	1.117
11	76.9	1.788	18.9	1.056
U.S.	**43.0**		**17.9**	

We further accounted for the HCV-positive organ rates to adjust the transplant rate within the region. Specifically, we used the following formula:

$$\textit{Adjusted transplant probability} = 1 - (1 - \textit{region-specific transplant probability})^{(1+\text{HCV-positive organ rate})}$$

Table S5. HCV-positive Organ Rate by UNOS Regions

UNOS Region	HCV-positive organ rate
Region 1	0.129
Region 2	0.106
Region 3	0.055
Region 4	0.037
Region 5	0.040
Region 6	0.029
Region 7	0.028
Region 8	0.047
Region 9	0.051
Region 10	0.088
Region 11	0.057
National	0.059

Source: UNOS data (4)

Section S2. Model Validation

We validated the predicted 1-year and 5-year post-LT survival rates with those from Organ Procurement Transplant Network (OPTN) data. Our model-predicted survivals matched perfectly well with the reported data **(Figure S1).**

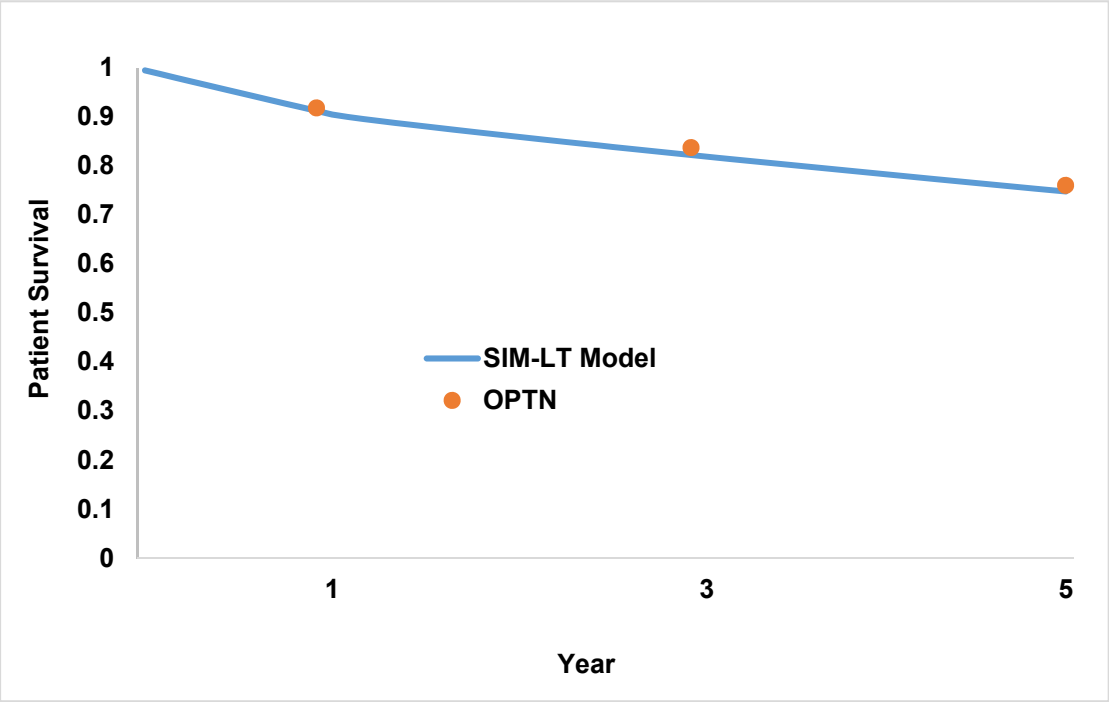

Figure S1. Validation of model-predicted post-liver transplant patient survival with the recent OPTN data

Abbreviations: OPTN, Organ Procurement Transplant Network; SIM-LT; simulation of liver transplant candidates

Section S3. Additional Model Outcomes

Table S6. Expected life years for willing to accept HCV-positive liver versus accepting only HCV-negative livers by MELD score

MELD Score	Expected life years	
	Accept any liver (HCV-positive or HCV-negative)	Accept only HCV-negative liver
12	21.78	21.80
14	19.97	19.99
16	17.57	17.61
18	14.75	14.77
20	13.09	13.05
22	11.98	11.89
24	10.80	10.67
26	8.83	8.67
28	7.12	6.95
30	5.38	5.21
32	4.25	4.10
34	3.48	3.34
36	2.48	2.37
38	1.93	1.85
40	1.20	1.13

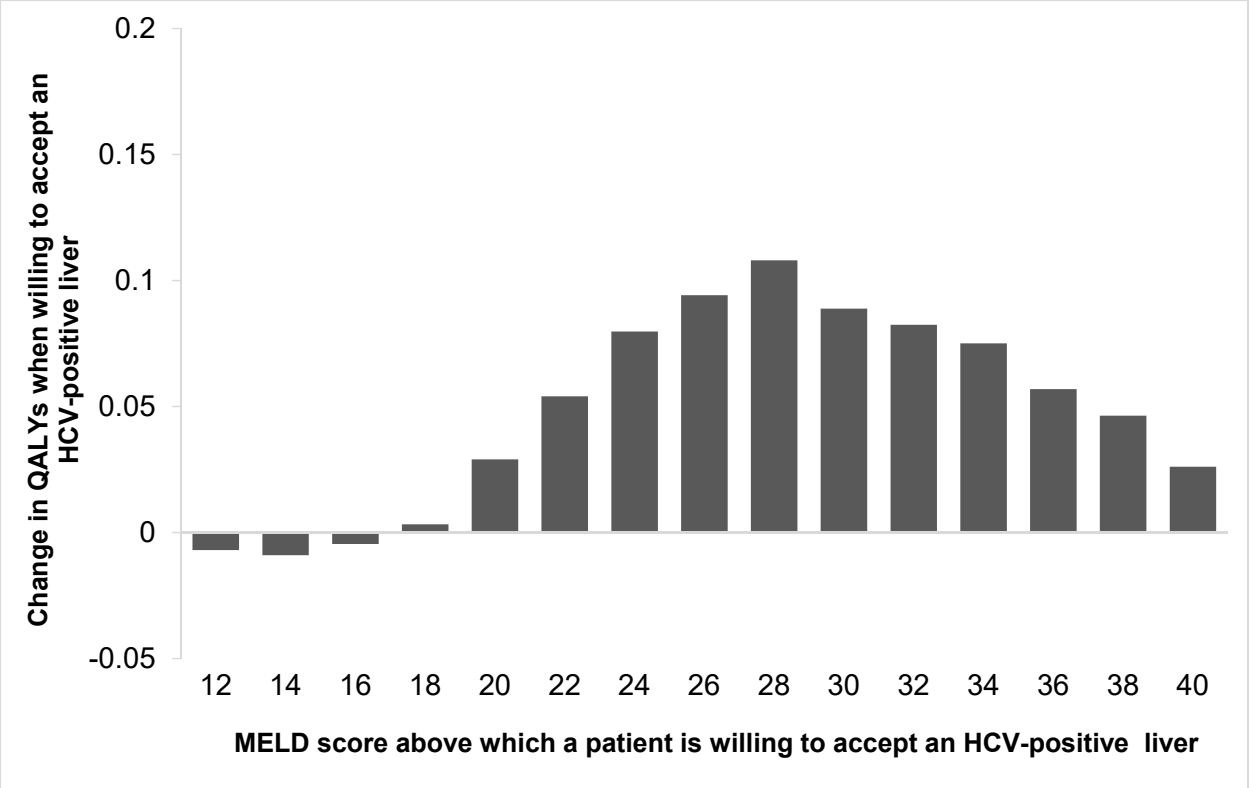

Figure S2. Change in QALYs if patients accept *any* liver versus accept *only* HCV-negative liver on the transplant waiting list. Patients having MELD ≥ 20 will benefit from accepting any liver

Abbreviations: MELD, model for end-stage liver disease; HCV, hepatitis C virus; QALY, Quality adjusted life year

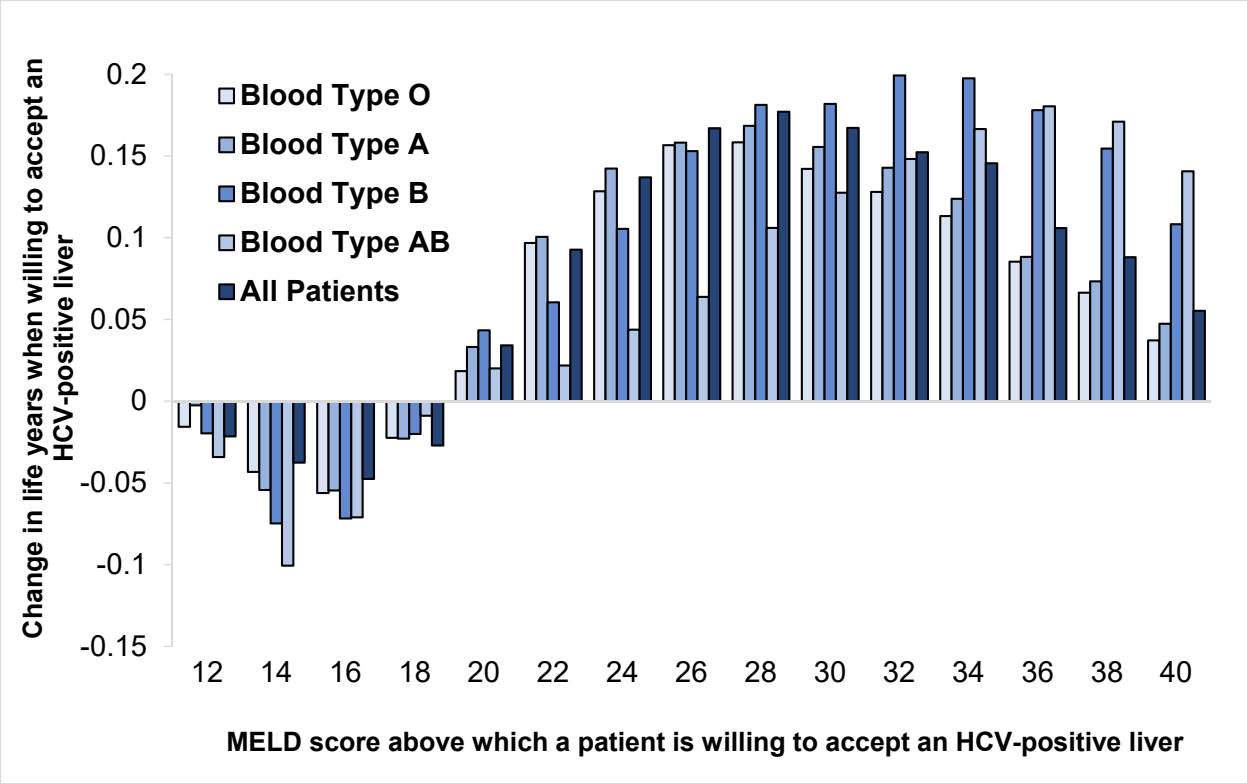

Figure S3. Change in Life Years if patients accept *any* liver versus accept *only* HCV-negative liver by different blood types. Patients having MELD ≥ 20 will benefit from accepting any liver regardless of the blood type

Abbreviations: MELD, model for end-stage liver disease; HCV, hepatitis C virus

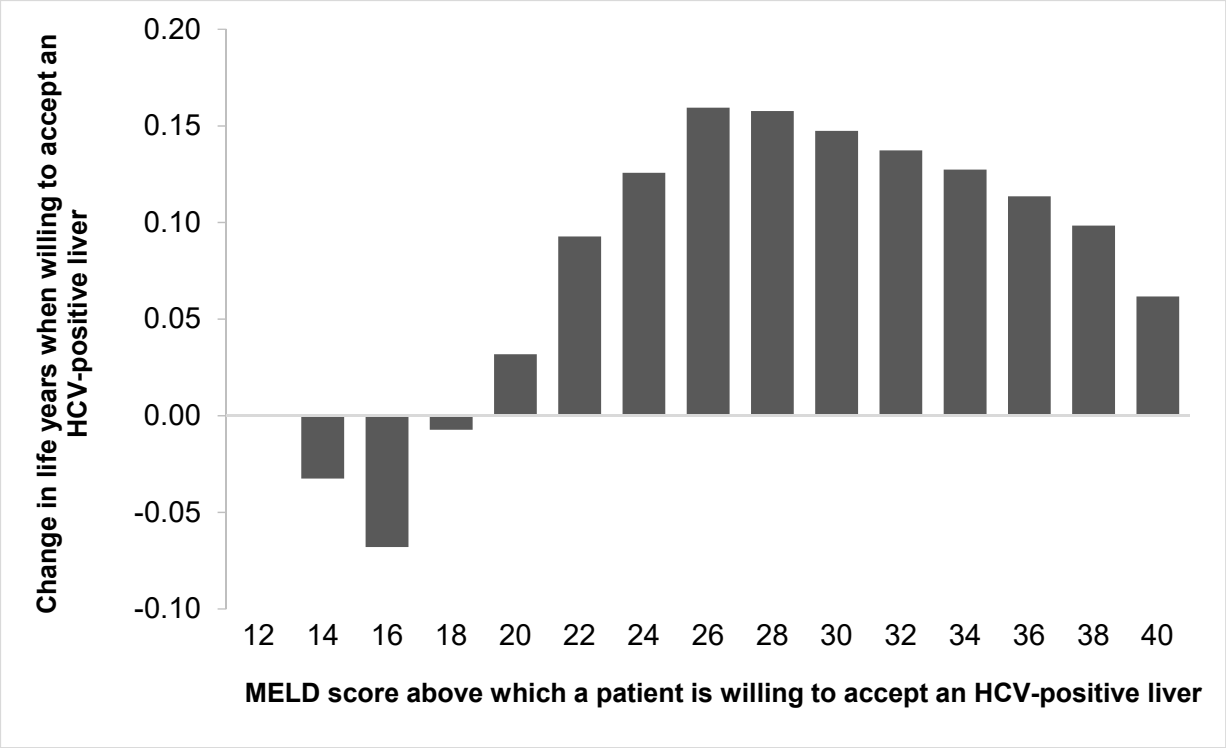

Figure S4. Change in life years if patients accept *any* liver versus accept *only* HCV-negative liver when Regional Share 35 policy is incorporated. Though the clinical benefit increased in patients with higher MELD scores, it decreased for lower ones. Overall, it didn't have any impact on the MELD threshold, i.e. patients having MELD ≥ 20 would still benefit from accepting any liver.

Abbreviations: MELD, model for end-stage liver disease; HCV, hepatitis C virus; QALY, Quality adjusted life year

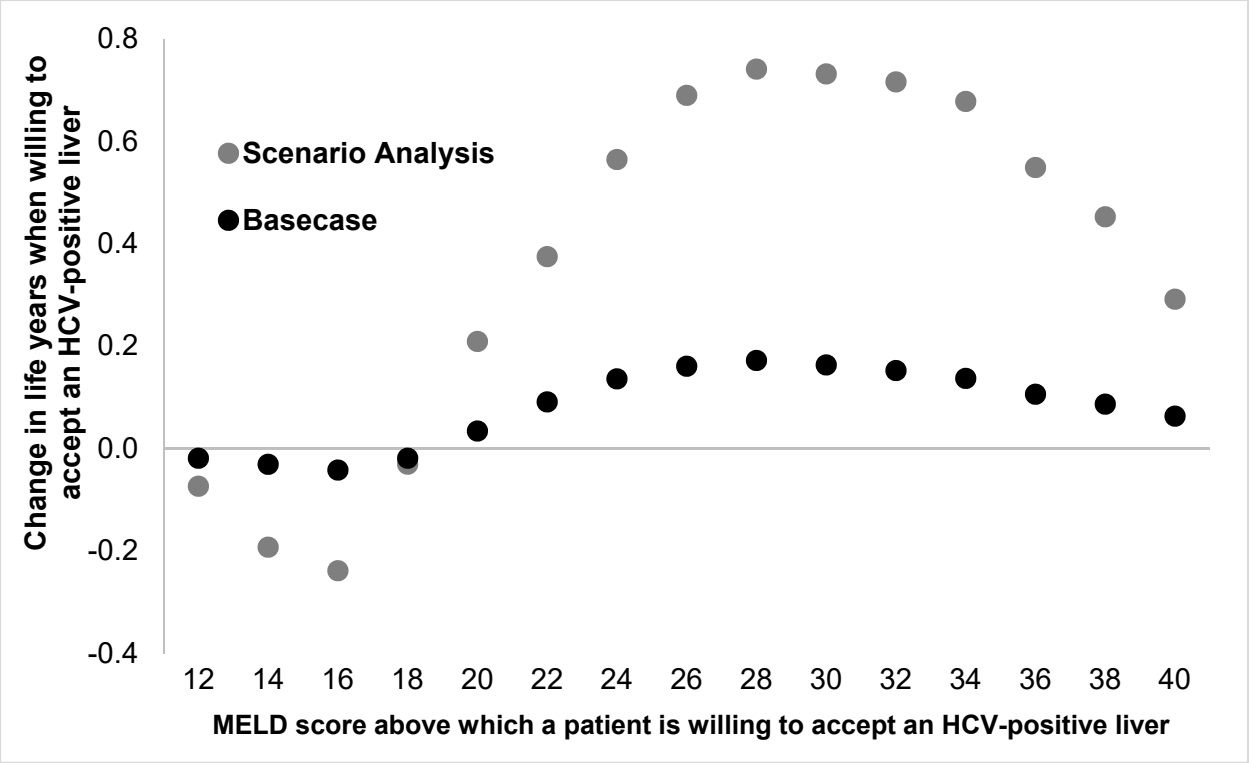

Figure S5. National results for change in life years if patients accept *any* liver versus accept *only* HCV-negative liver when the HCV-positive organ rate is 26.7%. Though the clinical benefit increased with the high HCV-positive organ rate, the MELD threshold above which a patient is willing to accept HCV-positive livers remained the same at 20.

Abbreviations: MELD, model for end-stage liver disease; HCV, hepatitis C virus

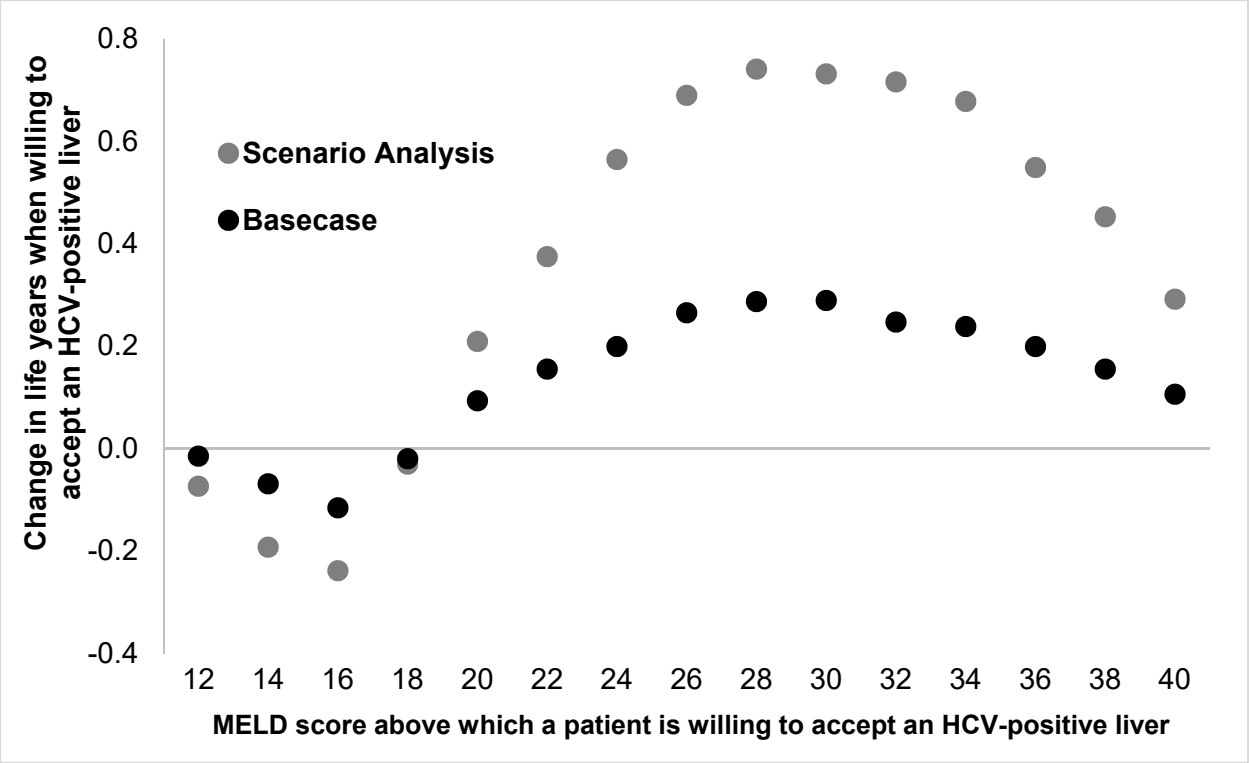

Figure S6. Region 10 results for change in life years if patients accept *any* liver versus accept *only* HCV-negative liver when the HCV-positive organ rate is 26.7%. Though the clinical benefit increased with the high HCV-positive organ rate, the MELD threshold above which a patient is willing to accept HCV-positive livers remained the same at 20.

Abbreviations: MELD, model for end-stage liver disease; HCV, hepatitis C virus

Table S7. One-way sensitivity analysis showing model parameters in a decreasing order based on their impact on the primary model outcome at MELD 20

Parameter	Range (Min-Max)	Change in life years when the parameter has its	
		Min Value	Max Value
Base case	-	**0.034**	
HCV-positive organ rate	0.029-0.267	0.014	0.137
Waiting List Mortality *	±25%	0.024	0.059
Post-LT to LRD (Subs. year) **	0.023-0.038	0.058	0.023
TP: Post-LT Viremic to LRD (Subs. year of 1st LT) ***	0.035-0.058	0.030	0.051
TP: Post-LT Viremic to GF (1st year of 1st LT) ***	0.079-0.131	0.041	0.022
SVR Rate (Preemptive Therapy)	0.900-0.980	0.033	0.051
TP: Post-LT Viremic to LRD (Subs. year of repeat LT) ***	0.040-0.067	0.024	0.040
TP: GF To LT	0.604-1.000	0.035	0.020
TP: Post-LT Viremic to GF (Subs. year of repeat LT) ***	0.044-0.073	0.044	0.029
TP: Post-LT Viremic to GF (1st year of repeat LT) ***	0.161-0.268	0.048	0.032
TP: F0-F2 to F3-F4	0.150-0.250	0.027	0.042
Age	35-65	0.032	0.046
TP: Post-LT Viremic to GF (Subs. year of 1st LT)	0.038-0.063	0.033	0.046
Waiting List Transplant Probability *	±25%	0.021	0.034
Increased Likelihood of Graft Failure after HCV-positive LT	1.080-1.800	0.042	0.032
TP: GF to Death	0.489-0.815	0.034	0.026
TP: Post-LT Viremic to LRD (1st year of 1st LT) ***	0.062-0.103	0.027	0.035
Post-LT to LRD (1st year) **	0.056-0.093	0.040	0.035
TP: F3-F4 to GF (1st year)	0.145-0.242	0.034	0.039
TP: Post-LT Viremic to LRD (1st year of repeat LT) ***	0.143-0.238	0.031	0.034
Post-LT to GF **	0.037-0.062	0.035	0.033
SVR Rate (Salvage Therapy)	0.900-0.980	0.034	0.034

*Parameters having a value by each MELD score. Basically, we used +/- 25% change from baseline values
**Post-LT corresponds to Post-LT (Non-viremic) and Post-LT (SVR) stages in the model.
***Post-LT Viremic correspond to stages including salvage therapy, F0-F2, and F3-F4 in HCV-positive arm in the model

Abbreviations: TP: transition probability; LT, Liver transplant; HCV, hepatitis C virus; QoL, quality of life; GF, graft failure; SVR, sustained virologic response; OPTN, Organ Procurement Transplant Network; LRD, liver related death

Table S8. One-way sensitivity analysis showing model parameters in a decreasing order based on their impact on the primary model outcome at MELD 28

Parameter	Range (Min-Max)	Change in life years when the parameter has its	
		Min Value	Max Value
Base case	-	**0.172**	
HCV-positive organ rate	0.029-0.267	0.080	0.700
Age	35-65	0.195	0.120
Waiting List Transplant Probability *	±25%	0.153	0.182
Post-LT to LRD (Subs. year) **	0.023-0.038	0.180	0.153
Post-LT to GF **	0.037-0.062	0.173	0.161
TP: Post-LT Viremic to GF (1st year of 1st LT) ***	0.079-0.131	0.161	0.173
TP: F3-F4 to GF (1st year)	0.145-0.242	0.162	0.172
TP: Post-LT Viremic to LRD (1st year of 1st LT) ***	0.062-0.103	0.172	0.162
TP: Post-LT Viremic to LRD (1st year of Repeat LT) ***	0.143-0.238	0.164	0.174
TP: Post-LT Viremic to GF (1st year of Repeat LT) ***	0.161-0.268	0.172	0.163
TP: Post-LT Viremic to GF (Subs. year of 1st LT) ***	0.038-0.063	0.173	0.164
TP: Post-LT Viremic to GF (Subs. year of Repeat LT) ***	0.044-0.073	0.171	0.163
Waiting List Mortality *	±25%	0.166	0.172
TP: GF to Death	0.489-0.815	0.172	0.167
TP: Post-LT Viremic to LRD (Subs. year of Repeat LT) ***	0.040-0.067	0.171	0.167
TP: GF To LT	0.603-1.000	0.167	0.171
TP: Post-LT Viremic to LRD (Subs. year of 1st LT) ***	0.035-0.058	0.168	0.171
SVR Rate (Preemptive Therapy)	0.900-0.980	0.169	0.171
Post-LT to LRD (1st year) **	0.056-0.093	0.171	0.171
Increased Likelihood of Graft Failure after HCV-positive LT	1.080-1.800	0.170	0.170
SVR Rate (Salvage Therapy)	0.900-0.980	0.172	0.172
TP: F0-F2 to F3-F4	0.150-0.250	0.171	0.171

*Parameters having a value by each MELD score. Basically, we used +/- 25% change from baseline values
**Post-LT corresponds to Post-LT (Non-viremic) and Post-LT (SVR) stages in the model.
***Post-LT Viremic correspond to stages including salvage therapy, F0-F2, and F3-F4 in HCV-positive arm in the model

Abbreviations: TP: transition probability; LT, Liver transplant; HCV, hepatitis C virus; QoL, quality of life; GF, graft failure; SVR, sustained virologic response; OPTN, Organ Procurement Transplant Network; LRD, liver related death

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