Supplemental Appendix for
“Timing of Testing and Treatment of Hepatitis C and Other Diseases

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Parameter	**Value**	**References**
Cost of screening test (ELISA)	\$ 24.42	Stein et al. (2004)
Cost of combination therapy (peginterferon + ribavirin)	\$ 22,896	DMD America (2006)
Discount factor for costs	3%	Lipscomb et al. (1996)
Discount factor for QALYs	3%	Singer and Younossi (2001)
Health State		
Compensated Cirrhosis	\$ 494 / year	Sullivan et al. (2004)
Decompensated Cirrhosis	\$ 25,691 / year	Sullivan et al. (2004)
Transplantation (1st year)	\$ 312,804 / year	Sullivan et al. (2004)
Transplantation (after 1st year)	\$ 30,121 / year	Sullivan et al. (2004)
Hepatocellular Carcinoma	\$ 16,748 / year	Sullivan et al. (2004)

Table 5: Costs and discount value (where costs are in 2000 dollars)

Factor	**Value**	**Reference**
Percent of population that is Genotype 1 (G1)	60%	Hornberger et al. (2006)
Treatment success rate for G1	29%	Hornberger et al. (2006)
Treatment success rate for non-Genotype 1 (G2)	62%	Hornberger et al. (2006)
Probability of ELISA test false negative	0.014	Singer and Younossi (2001)
Probability of ELISA test false positive	0.009	Singer and Younossi (2001)
QALY change from infecting others	-1.1	calculated by model
Percent of population of heavy drinkers	4.90%	BRFSS

Table 6: Genotype, testing, and infection values

Proof of Theorem 1

Proof: If we test a person, from time t onwards he becomes less risky (there is no change if he does not have the disease). Let π' be the policy that tests the individual at time t, and π be the policy that does not test the individual at time t. Assume that π and π' agree otherwise. If he is not tested at time t and his current health state is s, his utility-to-go function at time t is $u_t^{\pi}(s) = r_t(s, NT) + \lambda \sum_{s'} p(s'|s, NT) u_{t+1}^{\pi}(s')$, and his expected utility from time t onwards is

$$\begin{aligned} E[u_t^\pi] &= \sum_s b_t^\pi(s)[r_t(s,NT) + \lambda \sum_{s'} p_t(s'|s,NT)u_{t+1}^\pi(s')] \\ &= E_\pi[r_t(s,NT)] + \lambda \sum_s b_t^\pi(s) \sum_{s'} p_t(s'|s,NT)u_{t+1}^\pi(s'). \end{aligned}$$

In a similar manner we find that

$$E[u_t^{\pi'}] = E_{\pi'}[r_t(s,T)] + \lambda \sum_s b_t^{\pi'}(s) \sum_{s'} p_t(s'|s,T)u_{t+1}^{\pi'}(s').$$

Then, since he becomes less risky, $q_t((k,i)|s,T) \leq q_t((k,i)|s,NT))$ for any $k \in \{1,\ldots,H\}$, $i \in \{1,2\}$, and Lemma 2 shows that $u_t^{\pi'}((k,i)) \geq u_t^\pi((k,i))$. So, by Lemma 4.7.2 of Puterman (1994), we can conclude that $\sum_{s'} p_t(s'|s,T)u_{t+1}^{\pi'}(s') \geq \sum_{s'} p_t(s'|s,NT)u_{t+1}^\pi(s')$. Since π and π' agree before time t, the probability of being at each state at time t is the same under these two policies, and the second term in $E[u_t^{\pi'}]$ is greater than or equal to the second term in $E[u_t^\pi]$. So, if we are also given that $E_{\pi'}[r_t(s,T)] \geq E_\pi[r_t(s,NT)]$, we have $E[u_t^{\pi'}] \geq E[u_t^\pi]$. Then the result follows from Proposition 1. $\square$

Proof of Theorem 3

Proof: Let us denote the healthy state by 0 and the sick state by 1. We will compare two policies π and π', where π is the policy that does not test (and treat) the person, and π' tests the person at time $N-t$ and treats if he is sick. $\pi_k = \pi'_k = NT$ for $k \neq N-t$. A backwards induction algorithm shows that

$$\begin{aligned} u_{N-t}^\pi(0) &= r_1 \sum_{i=0}^{t-1} (\lambda p)^i + \lambda(1-p) r_2 \sum_{i=0}^{t-1} \lambda^i \sum_{j=0}^{i} p^j \\ &= (r_1 - \lambda p r_2) \frac{1-(\lambda p)^t}{1-\lambda p} + \lambda r_2 \frac{1-\lambda^t}{1-\lambda}, \\ u_{N-t}^\pi(1) &= r_2 \sum_{i=0}^{t} \lambda^i = r_2 \frac{1-\lambda^{t+1}}{1-\lambda}. \end{aligned}$$

Again, by using backwards induction, we find that

$$u_{N-t}^{\pi'}(0) = c_1 + (r_1 - \lambda p r_2) \frac{1-(\lambda p)^t}{1-\lambda p} + \lambda r_2 \frac{1-\lambda^t}{1-\lambda},$$

$$\begin{aligned} u^{\pi'}_{N-t}(1) &= c_1 + c_2 + r_2 + \lambda q \left\{ (r_1 - \lambda p r_2) \frac{1-(\lambda p)^{t-1}}{1-\lambda p} + \lambda r_2 \frac{1-\lambda^{t-1}}{1-\lambda} \right\} + \lambda(1-q) \left\{ r_2 \frac{1-\lambda^t}{1-\lambda} \right\} \\ &= c_1 + c_2 + \lambda q r_1 \frac{1-(\lambda p)^{t-1}}{1-\lambda p} + r_2 \frac{1-\lambda^{t+1}}{1-\lambda} - \lambda q r_2 \frac{1-(\lambda p)^t}{1-\lambda p}. \end{aligned}$$

We then find the expected values of utility-to-go functions as

$$\begin{aligned} E[u^{\pi}_{N-t}] &= p^t u^{\pi}_{N-t}(0) + (1-p^t) u^{\pi}_{N-t}(1) \\ E[u^{\pi'}_{N-t}] &= p^t u^{\pi'}_{N-t}(0) + (1-p^t) u^{\pi'}_{N-t}(1). \end{aligned}$$

Some algebra shows that $E[u^{\pi'}_{N-t}] \geq E[u^{\pi}_{N-t}]$ if the condition corresponding to Equation (1) in the theorem holds. Since π and π' agree before time t, Proposition 1 shows that $E[u^{\pi'}_1] \geq E[u^{\pi}_1]$. $\square$