Cost-effectiveness of hepatitis C treatment: The Indian Scenario

Rakesh Aggarwal, Qiushi Chen, Amit Goel, Nicole Seguy, Razia Pendse, Turgay Ayer, Jagpreet Chhatwal

1Department of Gastroenterology, SGPGI, Lucknow, India
2Massachusetts General Hospital Institute for Technology Assessment, Boston, USA
3WHO India Country Office, New Delhi, India
4WHO SEARO, New Delhi, India
5Georgia Institute of Technology, Atlanta, USA

HCV infection in India

- Disease burden: 6 to 7 million viremic cases (0.5-0.6% of population), mainly genotype 3
- Generic DAAs available at low cost since 2015
  - NS5b inhibitor: Sofosbuvir
  - NS5a inhibitors: Daclatasvir, Ledipasvir, Velpatasvir
- However, number of persons treated still low (except in some areas)
- Cost-effectiveness data for generic HCV DAAs not available
- Could DAA-based treatment for HCV be cost-saving?

Such data may allow a broader use of treatment

Cost-effectiveness evaluation

<table>
<thead>
<tr>
<th>Standard treatment</th>
<th>New intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource use†</td>
<td>Resource use†</td>
</tr>
<tr>
<td>Health outcomes*</td>
<td>Health outcomes*</td>
</tr>
<tr>
<td>Costs of standard treatment</td>
<td>Costs of new intervention</td>
</tr>
<tr>
<td>Benefit associated with standard treatment</td>
<td>Benefit associated with new intervention</td>
</tr>
</tbody>
</table>

Cost-effectiveness analysis

(Cost-efficacy analysis)

(Cost-benefit analysis)

† Healthcare costs: indirect costs: loss of wages

* Benefits as physical quantities (e.g., life span, cases prevented), QALY, DALY, monetary value

Incremental cost-effectiveness plane

Cost (new over old treatment) vs. Effectiveness (new over old treatment)

New treatment more costly

Old treatment dominates

New treatment less effective

New treatment more effective

New treatment less costly

Incremental cost-effectiveness plane

New treatment more costly

New treatment less effective

New treatment less costly

New treatment more effective

Old treatment dominates

New treatment more costly

New treatment less effective

New treatment less costly

New treatment more effective
Cost-effectiveness analysis

- Incremental cost-effectiveness ratio (ICER)
- Defined as
  \[
  \Delta \text{ICER} = \frac{\Delta C}{\Delta E}
  \]
  \(\Delta C = \) Change in cost, \(\Delta E = \) Change in effect
- Represents: extra money spent per unit gain
- Lower values better

Methods

- Used a Markov state-transition model: MATCH
  (Markov-based Analyses of Treatments for Chronic Hepatitis C)
- Modified for India
- Base cases:
  - HCV infected persons in India
  - Age: 35 years
  - M:F (%): 58 : 42
  - Genotype 1:3:4 (%): 32.0 : 63.4 : 4.6
  - Excluded: HBV/HCV coinfection, kidney disease, multi-transfused, or prior failed treatment

HCV: Disease progression model

HCV: Disease progression model

Assumptions: Treatment regimens

<table>
<thead>
<tr>
<th>HCV genotype</th>
<th>F0-F2/ F3</th>
<th>Treatment drugs</th>
<th>Treatment duration (weeks)</th>
<th>Sustained virological response (%)</th>
<th>Treatment discontinuation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>P0-P3</td>
<td>SOF + LDV</td>
<td>12</td>
<td>98.1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>F4</td>
<td>SOF + LDV</td>
<td>12</td>
<td>93.2</td>
<td>1</td>
</tr>
<tr>
<td>G3</td>
<td>P0-P3</td>
<td>SOF + DCV</td>
<td>12</td>
<td>97.0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>F4</td>
<td>SOF + DCV</td>
<td>24</td>
<td>86.0</td>
<td>2</td>
</tr>
</tbody>
</table>

Patient group | No treatment | With DAA-based treatment | Increase in LYs | Quality-adjusted life years (discounted) | Increase in QALY |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-cirrhosis (F0-F3)</td>
<td>30.25</td>
<td>37.92</td>
<td>7.677</td>
<td>18.75</td>
<td>3.71</td>
</tr>
<tr>
<td>Cirrhosis (F4)</td>
<td>30.25</td>
<td>37.92</td>
<td>7.677</td>
<td>18.75</td>
<td>3.71</td>
</tr>
</tbody>
</table>

Quality of life weights

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Value</th>
<th>Baseline</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health payer</td>
<td>0.93</td>
<td>0.84-0.99</td>
<td></td>
</tr>
<tr>
<td>Compensated Cirrhosis</td>
<td>0.90</td>
<td>0.91-0.99</td>
<td></td>
</tr>
<tr>
<td>Decompensated Cirrhosis</td>
<td>0.80</td>
<td>0.57-0.99</td>
<td></td>
</tr>
<tr>
<td>MRC</td>
<td>0.79</td>
<td>0.54-0.99</td>
<td></td>
</tr>
<tr>
<td>Post-SVR</td>
<td>1.00</td>
<td>0.92-1.00</td>
<td></td>
</tr>
</tbody>
</table>

Perspective: Health payer, Discount rate: 3% (for both costs and QALY), Horizon: Life-time, Number of iterations: 10,000, Sensitivity analyses: One-way, probabilistic multi-variate

Results: Change in healthcare expenditure

<table>
<thead>
<tr>
<th>Patient group</th>
<th>No treatment (US$)</th>
<th>With DAA-based treatment (US$)</th>
<th>Difference in cost (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-cirrhosis (F0-F3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genotype 1</td>
<td>1,803</td>
<td>536</td>
<td>−1,267</td>
</tr>
<tr>
<td>Genotype 3</td>
<td>1,803</td>
<td>558</td>
<td>−1,245</td>
</tr>
<tr>
<td>Genotype 4</td>
<td>1,803</td>
<td>590</td>
<td>−1,212</td>
</tr>
<tr>
<td>All F0-F3</td>
<td>1,803</td>
<td>553</td>
<td>−1,250</td>
</tr>
<tr>
<td>Cirrhosis (F4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genotype 1</td>
<td>3,182</td>
<td>1,192</td>
<td>−1,990</td>
</tr>
<tr>
<td>Genotype 3</td>
<td>3,182</td>
<td>1,672</td>
<td>−1,510</td>
</tr>
<tr>
<td>Genotype 4</td>
<td>3,182</td>
<td>1,152</td>
<td>−2,030</td>
</tr>
<tr>
<td>All F4</td>
<td>3,182</td>
<td>1,494</td>
<td>−1,688</td>
</tr>
<tr>
<td>All patients</td>
<td>1,988</td>
<td>679</td>
<td>−1,309</td>
</tr>
</tbody>
</table>
Results: Incremental cost-effectiveness ratios

DAA HCV treatment: ICER over time

DAA treatment: Reduction in liver events

DAA HCV treatment: ICER over time with age

Sensitivity analysis: Age at treatment

Sensitivity analysis: Cost of treatment
Conclusions

• Treatment with ‘generic’ DAAs at prices in India
  – Improves patient outcomes (life-span, QALY, DALY)
  – Is cost-effective within 2 years of treatment
  – Is cost-saving within ~10 years of treatment

• These benefits are seen
  – Irrespective of patient age
  – On different sensitivity analysis
  – Earlier in patients with cirrhosis (5 y) than in those with lesser stages of fibrosis

• HCV treatment should be a priority from both public health and economic perspectives in areas with drug availability at such prices