Hep C Calculator

Global Cost-effectiveness Analysis of Hepatitis C Treatment

Jag Chhatwal, PhD

Massachusetts General Hospital
Harvard Medical School
Boston, United States

World Hepatitis Summit, São Paulo, Nov 1-3 2017
Cost-Effectiveness Models are Black Box
Cost-Effectiveness Models are Black Box

Transparent Model
“Garbage” IN → “Garbage” OUT
A Good Example:
Hurricane Prediction

Hurricane Irma’s Path
September 2017
And A Not So Good Example: U.S. Presidential Election Prediction

Nov 8, 2016; 10:20PM

Hillary Clinton has an 85% chance to win

New York Times

Nov 9, 2016; 2:50AM

Donald Trump Elected U.S. President
Cost-Effectiveness Models are Complex!
Hep C Calculator

Global Cost-effectiveness Analysis of Hepatitis C Treatment

START
What is Hep C Calculator?

- **Online, interactive tool** to evaluate the cost-effectiveness of hepatitis C treatment
  - Phase I: 28 WHO focus countries representing 70% of the global burden
- Standardized variables such as the natural history of hepatitis C across all countries
- Price of antivirals at the local level and over time
- Healthcare costs at the local level

*Hep C Calculator will be updated regularly as new data become available*
User Defined Inputs

Select a Country
Pakistan

Cost Inputs (US Dollars)

- Cost of treatment and testing
  - 4-week DAA regimen: 15
  - Diagnosis of chronic HCV: 125
  - Assessment of HCV treatment response: 25

Annual cost of health state
- F0-F2 fibrosis: 50
- F3 fibrosis: 80
- Compensated cirrhosis: 120
- Decompensated cirrhosis: 500
- Liver cancer: 15000

Population Profile

- Select an age: 35

Fibrosis states distribution (sum=101%)
- F0 %: 34
- F1 %: 31
- F2 %: 14
- F3 %: 13
- Cirrhosis %: 9

Fibrosis Scores

HCV Genotypes

- G1
- G2
- G3
- Others
Cost-effectiveness Results in Real-Time

Figure 1: Discounted QALYs Lived

<table>
<thead>
<tr>
<th></th>
<th>QALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Tx</td>
<td>15.3</td>
</tr>
<tr>
<td>DAA</td>
<td>18.5</td>
</tr>
</tbody>
</table>

Figure 2: Total Discounted Lifetime Healthcare Costs

<table>
<thead>
<tr>
<th></th>
<th>Total cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Tx</td>
<td>$4,693</td>
</tr>
<tr>
<td>DAA</td>
<td>$690</td>
</tr>
</tbody>
</table>

Abbreviations: Tx, treatment; DAA, direct acting anti-viral.
Cost-effectiveness Results in Real-Time

Is treatment with DAAs cost-effective in Pakistan?

**Incremental cost-effectiveness ratio (US$ per QALY)**

- HCV-infected persons without cirrhosis: -1,298/QALY (Cost saving)
- HCV-infected persons with cirrhosis: -964/QALY (Cost saving)
- Overall (with or without cirrhosis): -1,248/QALY (Cost saving)

For each HCV-infected person, DAA treatment (as compared to no treatment) leads to:

- Discounted quality-adjusted life years: Improvement of 3.2 years
- Life-time healthcare expenditure: Reduction of US$ 4,004

**Cost-effectiveness of DAA treatment by time horizon**

- DAA treatment becomes cost-effective within **<1 year**
- DAA treatment becomes cost-saving within **2.8 years**
Cost-effectiveness Results in Real-Time

Cumulative incidence of liver-related deaths

- No treatment
- DAA
Hep C Calculator

Global Cost-effectiveness Analysis of Hepatitis C Treatment

START
Summary and Next Steps

• *Hep C Calculator* is an online, interactive tool developed to evaluate the cost-effectiveness of hepatitis C treatment
  – It allows conducting country-level analysis, sensitivity analysis, etc.

• Collect cost data for additional countries
  – *Available for*: Egypt, Georgia, India, Indonesia, Morocco, Nepal, Pakistan, Thailand
  – WHO has developed a costing tool

• Add more countries in *Hep C Calculator*
Acknowledgements

Qiushi Chen, PhD
Postdoctoral Fellow, Harvard Medical School

Emily Bethea, MD
Fellow, Gastroenterology Unit at Massachusetts General Hospital.

M. A. Ladd, BS
Systems Manager, MGH Institute for Technology Assessment
Thank You!
Case Studies
For each HCV-infected person, DAA treatment (as compared to no treatment) leads to:

- Discounted quality-adjusted life years: improvement of 3.8 years
- Life-time healthcare expenditure: Reduction of US$ 8,436

Cost-effectiveness of DAA treatment by time horizon

- DAA treatment becomes cost-effective within <1 year
- DAA treatment becomes cost-saving within 1.9 years
For each HCV-infected person, DAA treatment (as compared to no treatment) leads to:

- Discounted quality-adjusted life years: Improvement of 3.3 years
- Life-time healthcare expenditure: Reduction of US$ 4,256

**Cost-effectiveness of DAA treatment by time horizon**

- DAA treatment becomes cost-effective within 1.7 years
- DAA treatment becomes cost-saving within 14.2 years
For each HCV-infected person, DAA treatment (as compared to no treatment) leads to:

- Discounted quality-adjusted life years: Improvement of 3.3 years
- Life-time healthcare expenditure: Reduction of US$ 5,938

Cost-effectiveness of DAA treatment by time horizon

- DAA treatment becomes cost-effective within <1 year
- DAA treatment becomes cost-saving within 5.0 years
Select a Country

Morocco

Cost Inputs (US Dollars)

<table>
<thead>
<tr>
<th>Cost of treatment and testing</th>
<th>4-week DAA regimen</th>
<th>Diagnosis of chronic HCV</th>
<th>Assessment of HCV treatment response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>450</td>
<td>336</td>
<td>99</td>
</tr>
</tbody>
</table>

Annual cost of health state

| F0-F2 fibrosis | 88                  |
| F3 fibrosis    | 88                  |
| Compensated cirrhosis | 187               |
| Decompensated cirrhosis | 627               |
| Liver cancer   | 2607                |

[Box: Use WHO disability weights to calculate QALYs]

Figure 1: Discounted QALYs Lived

<table>
<thead>
<tr>
<th>QALYs</th>
<th>No Tx</th>
<th>DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.7</td>
<td>19.3</td>
</tr>
</tbody>
</table>

Figure 2: Total Discounted Lifetime Healthcare Costs

<table>
<thead>
<tr>
<th>Total cost ($)</th>
<th>No Tx</th>
<th>DAA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$3,258</td>
<td>$2,020</td>
</tr>
</tbody>
</table>

Legend:
- No Tx: Disease management cost
- DAA: Treatment cost
- DAA: Testing cost
- DAA: Disease management cost

For each HCV-infected person, DAA treatment (as compared to no treatment) leads to:

- Discounted quality-adjusted life years: Improvement of 3.6 years
- Life-time healthcare expenditure: Reduction of US$ 1,238

Cost-effectiveness of DAA treatment by time horizon

- DAA treatment becomes cost-effective within 1.7 years
- DAA treatment becomes cost-saving within 19.8 years
Select a Country

Morocco

Cost Inputs (US Dollars)

- Cost of treatment and testing
  - 4-week DAA regimen: $100
- Diagnosis of chronic HCV: $336
- Assessment of HCV treatment response: $99

Annual cost of health state

- F0-F2 fibrosis: $88
- F3 fibrosis: $88
- Compensated cirrhosis: $187
- Decompensated cirrhosis: $627
- Liver cancer: $2607

For each HCV-infected person, DAA treatment (as compared to no treatment) leads to:

- Discounted quality-adjusted life years: Improvement of 3.6 years
- Lifetime healthcare expenditure: Reduction of US$ 2,297

Cost-effectiveness of DAA treatment by time horizon

- DAA treatment becomes cost-effective within <1 year
- DAA treatment becomes cost-saving within 7.8 years