Cost-effectiveness of treating chronic hepatitis C virus with direct-acting antivirals in people who inject drugs

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Introduction and aims
Reduction of the burden of hepatitis C virus (HCV) related liver disease will require treating people who inject drugs (PWID), the group at most risk of infection and transmission.

We aim to determine the cost-effectiveness of treating PWID with interferon-free direct-acting antiviral therapy in Australia. This study considered:
- Treatment after initial infection (‘early-treatment’); and
- Treatment prior to developing liver fibrosis (‘late-treatment’).

Method 1: Deterministic model of HCV transmission, treatment and liver disease progression

Individuals were considered to be in one of the following compartments:
- S0—susceptible (uninfected);
- A—acutely infected;
- F0—chronically infected with METAVIR score indicating liver fibrosis in stage F0–F4;
- DC—decompensated cirrhosis;
- LT1—first year post liver transplant;
- LT2—two or more years post liver transplant;
- TO/T2—in treatment after either initial infection or prior to developing liver cirrhosis; or
- S2—susceptible after achieving sustained viral response from late-treatment.

Each compartment was stratified by:
- Injecting drug use status: People were able to cease from or relapse into current injecting drug use.

- Treatment failure: Re-treatment was not available for people who had previously failed to achieve sustained viral response.

Method 2: Running the model

- Start with: 100 newly HCV-infected current injecting drug users in the F0 compartment.
- Run the model and calculate:
  - Total discounted quality-adjusted life years (QALYs);
  - Total discounted healthcare and treatment costs, assuming $50,000 per treatment course;
  - Number of liver related deaths; and
  - Average life expectancy.

- Compare: No treatment, early-treatment and late-treatment.
- Calculate: Incremental cost-effectiveness ratios (ICERs) across scenarios.
- Conduct uncertainty analysis: Run multiple simulations with varying costs, health utilities and model parameters (Monte-Carlo uncertainty analysis) to get 95% confidence intervals.

Results

- Compared to no treatment:
  - Late-treatment was the most cost-effective option, with an ICER of $5,078 (95%CI $2,847–$5,294) per QALY gained; however
  - Early-treatment was also cost-effective with an ICER of $10,272 (95%CI $5,689–$13,690) per QALY gained.

- If treatments cost $10,000 per course, both early- and late-treatment were more effective and less costly than no treatment.

- If treatments cost $100,000 per course, early- and late-treatment were still cost-effective with ICERs of $23,854 and $13,259 per QALY gained respectively.

Both early- and late-treatment prevented a significant number of liver-related deaths and extended the life expectancy of newly infected PWID.

<table>
<thead>
<tr>
<th>Best estimates (95% confidence intervals)</th>
<th>Average discounted cost per infected person</th>
<th>Average discounted QALY per infected person</th>
<th>Life expectancy of an infected person</th>
<th>ICER compared to no treatment</th>
<th>ICER compared to next best case</th>
<th>Liver related deaths expected per 100 newly infected PWID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case (no arterial treatment)</td>
<td>$31,877 ($20,618–$27,294)</td>
<td>16.45 (13.26–18.13)</td>
<td>67.97 (63.55–68.27)</td>
<td>Reference case</td>
<td>40 (95%CI 39–44)</td>
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<tr>
<td>Early-treatment</td>
<td>$79,803 ($75,410–$79,130)</td>
<td>21.70 (20.58–22.00)</td>
<td>74.43 (73.58–74.56)</td>
<td>Early-late treatment</td>
<td>$10,272 ($5,689–$13,690)</td>
<td>7 (95%CI 6–11)</td>
</tr>
<tr>
<td>Late-treatment</td>
<td>$87,009 ($83,745–$87,772)</td>
<td>19.43 (15.84–21.16)</td>
<td>74.14 (73.11–74.44)</td>
<td>No treatment</td>
<td>$5,078 ($2,847–$5,294)</td>
<td>8 (95%CI 7–13)</td>
</tr>
</tbody>
</table>

For a willingness-to-pay threshold of $50,000 per QALY gained:
- Early-treatment and late-treatment were cost-effective compared to no treatment in all simulations.
- Early-treatment was cost-effective compared to late-treatment in more than 90% of simulations, with an ICER of $17,992 (95%CI $2,847–$6,382) per QALY gained.

Uncertainty analysis

Conclusions

- Treating HCV-infected PWID with new therapies is cost-effective in Australia, and could prevent a significant number of liver related deaths.
- Although late-treatment was more cost-effective than early-treatment, the cost per QALY gained for early-treatment was below unofficial Australian willingness to pay thresholds.

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