Economic Impact of Hepatitis C: Highlights of Cost-Effectiveness Modeling

Presented at: Viral Hepatitis Action Coalition Biannual Meeting
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Overview

• Cost-effectiveness review
• AIM paper
• Other published cost-effectiveness studies
• Scenario modifications
• New results
• Implications and questions
Cost-effectiveness Review

• A comparison of the relative costs and outcomes of two or more policy alternatives
• Incremental cost-effectiveness ratio
  \[
  \frac{(\text{Cost}_{\text{Intervention}} - \text{Cost}_{\text{Baseline}})}{(\text{QALY}_{\text{Intervention}} - \text{QALY}_{\text{Intervention}})}
  \]
• Price or cost per each additional unit of benefit (QALY) provided by the intervention
• Cost-effectiveness provides information about value
• Financing is a separate and independent issue
Source of Benefits

• Testing → Awareness → Antiviral Tx → SVR → No HCV Complications

• No Testing → No Awareness → No Antiviral Tx → HCV Complications → High costs and death

• Testing costs money, and the benefits of testing are hard to achieve
Cost-Effectiveness Studies: CDC

• Rein, et al (2012)¹
  • What is the cost effectiveness of a one time HCV antibody test of all individuals born during 1945 to 1965 compared to risk-based testing?
  • Assuming pegylated interferon and ribavirin (PR) treatment only for risk-based and birth cohort
  • Assuming direct acting antiviral (DAA) treatment (such as Telaprevir or Boceprevir added to PegIFN + Ribavirin) for birth cohort testing only

• Assumed intervention increased testing from 18.5% to 91% of the birth cohort
• Assumed 44% initiated treatment
### Cost-Effectiveness Studies: CDC

<table>
<thead>
<tr>
<th>Δ Variable</th>
<th>PegIFN + Riba</th>
<th>PegIFN + Riba + PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discounted QALYs</td>
<td>348,800</td>
<td>532,200</td>
</tr>
<tr>
<td>Costs</td>
<td>$5.5 billion</td>
<td>$19.0 billion</td>
</tr>
<tr>
<td>Deaths Averted</td>
<td>82,000</td>
<td>121,200</td>
</tr>
<tr>
<td>ICER</td>
<td>$15,700</td>
<td>$35,700</td>
</tr>
</tbody>
</table>
Cost-Effectiveness Studies: Others

- At least 5 other studies of the cost-effectiveness of HCV testing (4/5 roughly comparable)
    - Evaluated population testing not BC testing
Cost-Effectiveness Studies: Differences

- Size of target population
- Percentage tested by risk-based testing
- Percentage tested by birth-cohort testing
- Staging/timing of intervention
- Percentage diagnosed that initiate treatment
- SVR in base case and intervention
- Cost of clinical management of untreated but diagnosed HCV
- Cost of antiviral treatment
- Prevalence (Eckman only)
<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>QALYs</th>
<th>Costs ($b)</th>
<th>ICER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rein, et al (2012)</td>
<td>PR</td>
<td>348,800</td>
<td>5.5</td>
<td>$15,700</td>
</tr>
<tr>
<td>Coffin, et al (2012)</td>
<td>PR</td>
<td>213,883</td>
<td>0.9</td>
<td>$4,438</td>
</tr>
<tr>
<td>Coffin, et al (2012)</td>
<td>DAA</td>
<td>570,222</td>
<td>19.8</td>
<td>$34,794</td>
</tr>
<tr>
<td>Liu, et al (2013)</td>
<td>DAA</td>
<td>562,023</td>
<td>37.7</td>
<td>$68,980</td>
</tr>
<tr>
<td>Eckman, et al (2013)</td>
<td>DAA</td>
<td>856,986</td>
<td>40.0</td>
<td>$47,276</td>
</tr>
</tbody>
</table>
Comparison of Per Person Results

![Graph showing QALY/Person vs. Cost/Person with data points for Liu, PR, Liu, DAA, McGarry, DAA, Coffin, PR, Coffin, DAA, Eckman, DAA, Rein, PR, and McEwan, 2013.]
Comparison of Per Person Results

- Liu, DAA
- Rein, DAA
- McGarry, DAA
- Coffin, DAA
- Eckman, DAA
- McEwan, 2013
- Coffin, PR
- Rein, PR

Cost/Person vs. QALY/Person
Comparison of Per Person Results

Cost = $37,458 \times Q + 13.628

$R^2 = 0.3544$

Cost/Person

QALY/Person
Study Consensus

• Birth Cohort test and treat strategies are cost effective
• First Derivative of the line that describes the points
• Cost = $37,458 x QALY + $13.6
  • \( \Delta C/\Delta Q = $37,458 \)
• Mean = $39,834
Specific Factors that Alter that Conclusion

- What if testing costs more?
- What if treatment costs increase/decrease?
- What if effectiveness of treatment increases?
- What if treatment uptake is limited?
- What if HCV results in a lower percentage of ESLD?
• Altered comparator

• Leaving all other variables in the model constant, changed treatment in the comparator to match the intervention.
  • ICER $28,500 (compared to $35,700)
    – Difference in costs (numerator shrinks)
    – Incremental benefits of intervention decrease also (-48,000 deaths)
    – Nearly identical results to McEwan
Testing Costs

Cost of Antibody Testing

ICER vs Cost of Antibody Testing
Treatment Costs

ICER vs. Cost of Treatment

- ICER values range from $0 to $100,000.
- Cost of Treatment ranges from $0 to $100,000.

The graph shows a linear relationship between ICER and the cost of treatment.
Treatment Effectiveness

ICER vs. SVR Rate

ICER:
- $100,000
- $90,000
- $80,000
- $70,000
- $60,000
- $50,000
- $40,000
- $30,000
- $20,000
- $10,000
- $0

SVR Rate:
- 0%
- 20%
- 40%
- 60%
- 80%
- 100%
Treatment Uptake

- normal treatment
- SVR = 90%, Treatment cost = $80,000

% of Positive Test Patients who Initiate Treatment

ICER

- $100,000
- $90,000
- $80,000
- $70,000
- $60,000
- $50,000
- $40,000
- $30,000
- $20,000
- $10,000
- $0
Proportion of Intervention Costs from Testing Alone

10% Uptake
- Test Costs: 25%
- Other Costs: 75%

25% Uptake
- Test Costs: 20%
- Other Costs: 80%

50% Uptake
- Test Costs: 16%
- Other Costs: 84%

75% Uptake
- Test Costs: 13%
- Other Costs: 87%
45-year Death Rate

ICER

$0 $10,000 $20,000 $30,000 $40,000 $50,000 $60,000

45 Year HCV Mortality Rate

0.059 0.109 0.159 0.209 0.259
Remaining Questions

• Costs of untreated diagnoses?
• HCV and QALYs prior to ESLD?
• Testing implementation?
• Linkage to care?
• Additional benefits of treatment?
  • Treatment as prevention
  • Systemic effects of HCV
  • Life gained from averted transplants
Potential Impact
Key Findings

• Cost-effectiveness of birth-cohort testing is robust to a very wide range of variation in input parameters.

• Testing accounts for only a small percentage of the total intervention costs
  • Prevalence not large concerns
  • Treatment uptake potentially can be

• Birth-cohort testing is different than most testing policies
  • One time, inexpensive test

• Increasing treatment linearly increases benefits
Acknowledgements

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Thank You!

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What do we not know?

• Implementation
  • Outreach
  • Electronic health record prompts, standing orders

• Prevalence detected
  • Does birth-cohort testing reach the right people?

• Health system capacity

• Treatment uptake
  • Health system utilization and linkages to care

• Incidence
BEST-C Testing Study

• 3 clinical sites
  • New York City
  • Michigan
  • Birmingham Alabama

• Fully experimental designs to determine
  • Yield of birth cohort testing implementations
  • Cost of implementation
  • Linkage to care and treatment initiation
  • SVR
• Do provider incentives exist to treat patients with hepatitis C?
• Two clinical implementation sites
• Direct observations of the resource and labor force requirements of hepatitis C treatment
• Comparisons to insurance reimbursements
• Why do some drug users become infected by HCV while others do not?
• Computer assisted survey combined with HCV rapid test.
  • 5 hypotheses to explain risk of infection
• Two community areas
  • Suburban Milwaukee (Waukesha)
  • Suburban Chicago (Naperville)
• Respondent driven sampling
  • Representative of both occasional and heavy drug users
New Cost Effectiveness Results

• Updated with clinical evidence
  • Testing effectiveness
  • Linkage to treatment/actual utilization
  • SVR
  • Observed costs

• Medicare data analysis
  • Unit costs of HCV treatment and ESLD treatment
  • Estimates of morbidity from HCV in Medicare
  • Budgetary impact of birth cohort testing on Medicare