Economics of Chronic Hepatitis B and Hepatitis C
Viral Hepatitis Prevention Board
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Health Budget Limitations

- 2009 U.S. health care expenditures estimated to be $2.4 trillion or 17% of GDP
  - 40% more on health care: ~$650 billion in 2008
- “Every country spends 100% of its gross domestic product on something”
- What is important is the value obtained by the spending: opportunity costs

Public Health Burden of HCV for 2010-2019

• Predicted 1.5-2-fold ↑ HCV mortality for US, France, Spain, Switzerland, England, Australia and Canada
  – 1 million years of advanced liver disease
  – $11 billion direct medical care costs

• Observed increase
  – resource use England, US, Canada
  – mortality rates in England, US

1-Year Average Wholesale US HBV Drug Costs

- Lamivudine: $4,524
- Emtricitabine: $5,024
- Tenofovir: $8,063
- Entecavir: $8,297
- Telbivudine: $9,031
- Adefovir: $10,197
- PegIFN2a: $28,277

Drug Redbook 2009
24-Week Average Wholesale US HCV GT2-3 Drug Costs

![Graph showing drug costs for different weight ranges and treatment combinations.]

- **Peg-IFN-α-2a + ribavirin**
  - <75 kg: $23,071
  - ≥76 kg: $23,071
  - <40 kg: $19,226
  - ≤65 kg: $20,466
  - ≤85 kg: $22,246
  - <105 kg: $24,694
  - >105 kg: $26,474

*Drug Redbook 2009*
Management algorithms decrease drug costs by ~43%

Cost-Effectiveness Analysis

• Considers costs of drugs, drug monitoring, side effects, and effects of disease

• Relies on understanding natural history of the disease and effect of therapy, accounting for death and morbidity

• Randomized lifetime clinical trial impractical, so use computer simulation Markov model
“Essentially, all models are wrong, but some are useful.”

-George EP Box
Hepatitis B Model

Initial State

Chronic Hepatitis HBeAg+ HBsAg+

Chronic Hepatitis HBeAg- HBsAg+

Post Hepatitis HBeAg- HBsAg-

Hepatocellular Carcinoma

Compensated Cirrhosis HBeAg+ HBsAg+

Compensated Cirrhosis HBeAg- HBsAg+

Compensated Cirrhosis HBeAg- HBsAg-

 Decompensated Cirrhosis

Dead

# Hepatitis B Model

<table>
<thead>
<tr>
<th></th>
<th>Lifetime Cost</th>
<th>Life Expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBeAg+</td>
<td>$63,200</td>
<td>24.0</td>
</tr>
<tr>
<td>HBsAg+</td>
<td>$20,500</td>
<td>34.0</td>
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</table>

*aExcludes liver transplantation, HCC screening, and nucleoside analogues for compensated or decompensated cirrhosis*

“Our advice: Beware of geeks bearing formulas.”

-Warren Buffett
Marginal or Incremental Cost-Effectiveness Analysis

- Additional cost divided by additional benefit

Cost With New Drug – Cost With Standard Care
Effectiveness With New Drug – Effectiveness With Std Care
Incremental Effectiveness

Incremental Costs

Cost-Saving

Cost-Effectiveness Ratio

Dominated
Incremental Cost-Utility Analysis

Buying Health for $1 Million

- Colon CA Screen
- ART for HIV
- Intense Rx NIDDM
- Hemodialysis
- Fundoplication

Does HBV or HCV Treatment Provide Good Value?

Cost per Life Year Gained

- HBV or HCV Rx
- Colon CA Screen
- ART for HIV
- NIDDM
- Hemodialysis
- Fundoplication

>$1 million

References:
- Pignone M. Ann Intern Med 2002;137:96
- Freedberg KA. N Engl J Med 2001;344:824
- CDC Diabetes Cost Effectiveness Group. JAMA 2002;287:2542
- Heudebert GR. Gastroenterology 1997;112:1078
Hepatitis C Costs

![Graph showing costs of different treatments for Hepatitis C]

Lifetime Costs

Which Option Would You Prefer:

$100 Now

$100 in 1 Year

Annual discount rate = 3%
$10 000 10 years from now = $7441 now
Discounted Lifetime Costs

Would You Prefer to Live
1 Year With:

?  

<table>
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<tr>
<th>Perfect Health</th>
<th>Hepatocellular CA</th>
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<tr>
<td>6 quality-adjusted months</td>
<td>1 year</td>
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Quality weights adjust life expectancy for the morbidity or toxicity associated with the disease or drug.
Effectiveness

Discounted Quality-Adjusted Life Expectancy (years)

Cost-Effectiveness Analyses

• Depend on comparative effectiveness of the therapies examined and patient population
  ▪ Chronic HBV therapy (15 studies)
    • Cost-saving to $33 900 per QALY gained
  ▪ Chronic HCV therapy (24 studies)
    • Cost-saving to $120 000 per QALY gained

• WHO: highly cost-effective < GDP; 1-3x GDP = cost-effective ($23 000-91 000 in 2005)
Cost-effectiveness Frontier vs. Lamivudiine 1 year

Incremental Cost vs. Incremental QALY

5 yr LAM

5 yr ADV (+LAM)

5 yr ADV (+ADV)

Lacey LF J Viral Hepat 2007;14:751
Institute of Medicine: Comparative Effectiveness Research

- Direct comparison of effective interventions in patients typical of day-to-day clinical care
- Identify the clinical characteristics that predict which intervention would be most successful in an individual patient
- “Improve health care at both the individual and population levels”

Translating Research

Clinical

Provider X
Alternative 1
Alternative 2

Provider Y
Alternative 1
Alternative 2

Provider Z
Alternative 1
Alternative 2

Research
Future Research Agenda

Knowledge-Based

- Alternative 1
- Alternative 2

Patient-Centered

- Alternative 1
- Alternative 2

Health Professionals

Policy Makers

Patients and Family

Aggregate outcomes

1%
90%
9%
10%
80%
20%
10%
90%
20%
Conclusions

• Hepatitis B and C are associated with substantial morbidity, mortality, and costs

• Prior studies suggest that treatments for hepatitis B and C should be cost-saving or cost-effective

• There is a need to continue to perform health economic analyses to assess value