Health Economics of Hepatitis C

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<table>
<thead>
<tr>
<th>COMPETING INTEREST OF FINANCIAL VALUE &gt; £1,000:</th>
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<tr>
<td><strong>Speaker Name</strong></td>
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<td>Andrew Hill</td>
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<td><strong>Date</strong></td>
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Africa, 1999: mass treatment for HIV/AIDS is not feasible
A key moment in the history of HIV

“My generics company can manufacture HIV antiretrovirals for a dollar per day”

Dr Yussef Hamied
Cipla,
G8 summit,
2000
Could we eliminate Hepatitis C worldwide by producing treatments cheaply?
Total deaths worldwide from HIV, Viral Hepatitis, TB and malaria, 1990-2013
Global Burden of Disease database.

Worldwide deaths from HCV, HBV, HIV, tuberculosis, and malaria in 2013

- **HBV & HCV**
  - Cirrhosis: 1,389,800
  - Liver cancer: 686,000
  - Acute HCV, 3.5: 703,800

- **HIV**
  - Cirrhosis: 1,341,000
  - Liver cancer (HBV): 686,000

- **TB**
  - Cirrhosis: 1,290,300

- **Malaria**
  - Acute HCV: 854,600

Global chronic HCV prevalence

![Map showing global chronic HCV prevalence](image)

<table>
<thead>
<tr>
<th>Prevalence (Viremic)</th>
<th>Total Infected (Viremic)</th>
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<tr>
<td>0.0%-0.6%</td>
<td>0-200K</td>
</tr>
<tr>
<td>0.6%-0.8%</td>
<td>200K-650K</td>
</tr>
<tr>
<td>0.8%-1.3%</td>
<td>650K-1.9M</td>
</tr>
<tr>
<td>1.3%-2.9%</td>
<td>1.9M-3.5M</td>
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<tr>
<td>2.9%-7.8%</td>
<td>3.5M-9.2M</td>
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Gower E et al. J Hepatol 2014
HCV genotypes 1-6 worldwide

Fig. 1. Relative prevalence of each HCV genotype by GBD region. Size of pie charts is proportional to the number of seroprevalent cases.
Sofosbuvir + Daclatasvir ± RBV (12-24 wks)
Percentage of people cured, by Genotype

Sources: A1444040 trial; ALLY-1; ALLY-2; ALLY-3; 3 French EAPs
Estimating minimum costs of treatment from current export data

Tracking import-export databases to find costs of API (Active Pharmaceutical Ingredient – drug substance before formulation and packaging).

www.indiainfodrive.com

Then add costs of final formulation and profit margin using established methods.

Collaboration with experts in chemical synthesis and mass production of medicines to evaluate prices. Cross-checks using different methods.

Surveys of costs of drugs by country
Sofosbuvir API exported from India in 2015, weighted by size of shipment

Date of shipment

Cost/kg, US$

www.indiainfodrive.com
**Current Costs of production - sofosbuvir**

- **Cost of API = $2,501/kg**
- **API needed per person = 33.6g (400mg x 84 days)**
- **API per 12 weeks = $84**
- **Formulation = 40%**
- **Formulated drug = $118**
- **Packaging = $0.35/month**
- **Packaged drug = $119**
- **Profit margin = 50%**
- **Final generic price = $178**
Price of sofosbuvir by country
(US dollars per 12 week course)

Sofosbuvir (Sovaldi)
US price: $84,000
Cost price: $178
Total sales: >$25 billion
Daclatasvir API exported from India in 2015, weighted by size of shipment

www.indiainfodrive.com
Current Costs of production - daclatasvir

Cost of API = $1,897/kg

API per 12 weeks = $9.56

API needed per person = 5g (60mg x 84 days)

Formulation = 40%

Formulated drug = $13

Packaging = $0.35/month

Packaged drug = $14

Profit margin = 50%

Final generic price = $22
Price of daclatasvir by country
(US dollars per 12 week course)
5g of diamonds
25 1-carat ($1900 each)
Cost = $48,000

5g of daclatasvir
12 weeks of treatment, 60mg/day
Cost = $63,000 (US price)
Health Economics

1. Cost-effectiveness
2. Budget Impact
Cost-effectiveness models for HCV DAAs – are they reliable?

1. Treating HCV is not cost-effective over 5 years – shown in several models – only cost-effective over a lifetime.

2. However in a lifetime, treatments will become generic and much cheaper.

3. Even in the short-term, treatment costs are falling rapidly.

4. So why pay high prices now, when costs could be 50-80% lower in 1-2 years?

5. In the USA, cost of DAAs per course fell 50% when AbbVie negotiated with Express Scripts.
Sofosbuvir is not cost-effective for some Genotype 2 and 3 patients in USA

“At their current cost, sofosbuvir-based regimens for treatment naïve non-cirrhotic patients exceed willingness to pay thresholds in USA”

Linas et al. Ann Intern Med
2015, 162: 619-629
“Budget impact” of treating Hepatitis C in USA (assume 3.4 million infected)

Unit cost of a cure = $50,000 per person (discounted)  
Cost = $170 billion, not including medical care, diagnostics

Units cost of a cure = $200 per person (minimum)  
Cost = $680 million, not including medical care, diagnostics
“Budget impact” of treating Hepatitis C in USA – not cost-saving

“Compared with the Standard of Care, treating eligible HCV-infected people in the USA with new DAAs would cost an additional $65 billion in the next 5 years, whereas the resulting cost offsets would be $16 billion”

What happens when drugs are too expensive?
Sofosbuvir Medicaid restrictions in US

Liver disease stage
Sofosbuvir Medicaid restrictions in US

Illicit drug use
HCV diagnosis and treatment uptake - worldwide

Bubble Area: Viremic HCV Prevalence

- France
- Germany
- England
- Austria
- Sweden
- Canada
- Australia
- Denmark
- Portugal
- Switzerland
- Belgium
- Spain
- Turkey
- Brazil
- Egypt

Diagnosis Rate (%)

Treatment Rate (%)
What about funding R&D from the pharmaceutical industry?

Gilead has already sold over $25 billion of sofosbuvir and ledipasvir. No sign of sales slowing.

How many billions of dollars in sales will be enough to “repay” the $11 billion of investment? When can countries access these drugs cheaply?

Gilead made $12 billion in profits in 2014.

Pharmaceutical companies spend more money on marketing and advertising then research and development.

The pharmaceutical industry has higher profit margins than oil, gas, media, banking or automobiles.

Many pharmaceutical companies use offshore schemes to avoid taxation.
What can be done, if medicines are not locally available?
Buyers clubs in 2015

High quality generic drugs accessed in low-income countries: India, Bangladesh, Egypt, Thailand.

UK and Australian law allows the legal import of up to 3 months supply of any medicine, provided this is for personal use and supported by a doctors prescription.

Over 1000 people in Australia have been cured of Hepatitis C in this way, plus a few people in UK, USA and other countries.

HIV drugs for pre-exposure prophylaxis are being imported legally into the UK in 2015

Websites:  
www.fixhepc.com  
www.iwantprepnnow.com
**Hepatitis C PCR**

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<tr>
<th>Specimen</th>
<th>Serum</th>
<th>Serum</th>
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<tbody>
<tr>
<td>Code Key</td>
<td>HCVL RNA</td>
<td>HCVL RNA</td>
</tr>
<tr>
<td>Pos</td>
<td>Neg</td>
<td>&lt;&lt;&lt;&lt;</td>
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**Comments on Collection 04/08/15 1140:**
HCV RNA viral load was performed using the COBAS Ampliprep/COBAS TaqMan HCV assay, version 2.0.
The lower limit of detection is 15 HCV RNA IU/mL.
The linear range is 15 (log 1.2) to 100,000,000 (log 8.0).
HCV RNA IU/mL.
Viral loads are considered high if >800 000 (>log 5.9) HCV RNA IU/mL.
Early viral treatment response (EVR) is defined by at least a 2-log reduction in viral load following 12 weeks of therapy.
HIV drugs imported from India to UK
Conclusions

The current prices of treatment to cure Hepatitis C are too high to allow elimination of this epidemic within the next 15 years. Cost-effectiveness models for HCV DAAs have serious flaws which undermine their reliability.

Worldwide, there are more people newly infected with Hepatitis C than being cured – the current situation is not working.

The drugs to cure Hepatitis C are fundamentally very cheap to produce.

Pharmaceutical companies need to be more flexible – cure more people for a lower unit price, and they will still make money.

There will be increased competition in the near future (AbbVie, Merck, Janssen), which should lower prices, but this is not guaranteed.

Some countries have started access schemes via buyers clubs and local production to lower their prices. This system is leading to thousands of people being cured, who would not otherwise be treated.
Universal access to HIV treatment is one of the greatest success stories in medicine (>15 million treated).

This should not stand alone, but be repeated for mass treatment of Hepatitis C – this time, more quickly