Modelling HCV elimination

Is it achievable and what role would a vaccine play?

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What is elimination?

- The World Health Organization have set some global HCV ‘elimination’ targets:
  - 80% reduction in HCV incidence by 2030 (30% by 2020)
  - 65% reduction in HCV-related deaths by 2030 (10% by 2020)
Where did these targets come from?

- Informed from modelling by the World Health Organization
- The WHO suggest that the elimination targets could be achieved (globally) if five synergistic service coverage targets are reached:

<table>
<thead>
<tr>
<th>Service coverage targets</th>
<th>Current</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood safety</td>
<td>89% of donations screened</td>
<td>95% of donations screened</td>
<td>100% of donations screened</td>
</tr>
<tr>
<td>Safe injections: percentage of injections administered with safety engineered devices in and out of health facilities</td>
<td>5%</td>
<td>50%</td>
<td>90%</td>
</tr>
<tr>
<td>Harm reduction: number of sterile needles and syringes provided per PWID per year</td>
<td>20</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>HCV diagnosis</td>
<td>&lt;5% diagnosed</td>
<td>30%</td>
<td>90%</td>
</tr>
<tr>
<td>HCV treatment</td>
<td>&lt;1% receiving treatment</td>
<td>3 million people treated (~2%)</td>
<td>80% of people with HCV treated</td>
</tr>
</tbody>
</table>

Australia has already attained:

- Safe injections
- Harm reduction

The challenging area:

- HCV treatment

Source: WHO draft global health sector strategies viral hepatitis, 2016–2021
Core components for Australia

- Treatment
  - Direct-acting antivirals
- Testing
  - Antibody testing, RNA testing
- Harm reduction
  - Needle and syringe distribution, opioid substitution therapy
- Vaccines

Modelling can determine the interplay between these, and how they can best work together.
HCV incidence target in Australia

- In Australia, treatment scale-up must be among PWID to reach the WHO’s incidence target.
- Targeting treatments is necessary.

**Annual incidence**

_Treatment numbers: 4,700 per year_

Scott et al, _Gut_, 2016
HCV mortality target in Australia

• Need to also target people with late stage liver disease.

• Treating PWID also achieves the WHO mortality target because of the cases that are prevented.
  – *This can save on countries’ treatment budgets.*
HCV cascade of care

Treatment scale-up models suggest it will be difficult but possible **BUT**, treatment can not be scaled up unless patients are in care.

- Consider programs to improve the cascade of care, e.g. screening programs to improve diagnosis.
- *Identify and remove bottlenecks from the cascade.*
  - How do we get the most people on treatment?
  - Which modalities of which programs are required, e.g. nurse-led models of care.
Current cascade of care

• Once infected, people require:
  – Antibody test (to determine Ab+)
  – PCR test (to determine RNA+, i.e. active infection)
  – Genotype test (to determine treatment protocol)
  – Liver disease test (to assess risks)

Not required in future?
• Rapid RNA tests being developed
• Increasing number of people with Ab+ but no infection

Not required in future for people with APRI test < 1?
Projecting treatment scale-up alone

Scott et al, Unpublished
Projecting treatment scale-up alone

Scott et al., Unpublished
Projecting treatment scale-up alone

RNA testing only

How do these correspond to the elimination targets?

Scott et al, Unpublished
More harm reduction or regular testing of PWID is also required.

Additional harm reduction or regular testing of PWID is also required.
Harm reduction and vaccines can play a key role

- In terms of HCV transmission, vaccines have a similar effect to harm reduction:
  - Minimize infection / reinfection
- Benefit from once off administration for longer term protection (compared to maintaining NSP / OST coverage)
- A vaccine could be administered following treatment to increase the impact
  - Patients already engaged in care
Impact of vaccinating after treatment

• Even “minimal” coverage, vaccinating PWID following treatment, could have impact.

• Particularly important for settings with:
  – High prevalence
  – High cost treatments

Comparing vaccines and treatment

- Prevalence can be halved with a vaccine alone.

- Increasing vaccine coverage reduces treatment requirements:
  - Increases the feasibility of elimination.

International settings

Models can be used to ask how we can achieve the elimination targets:

• What are the priority populations? Are there benefits in treating by:
  – Age group (birth cohort screening)
  – Disease stage
  – Geography
  – Risk population, e.g. treatment as prevention

• What is the most cost-effective way to scale-up treatments:
  – Through prioritisation of sub-populations.
  – Across delivery methods to sub-populations.

• How much will it cost to reach our targets? If we don’t have that much:
  – What is the best we can do with what we have?
  – Does this change our priorities?
Conclusions

• Modelling shows that elimination is possible *but will require a multi-pronged approach.*

• Treatment, testing, harm reduction and vaccines programs play synergistic roles:
  – Treatment can provide significant initial impact
  – Testing is required to find undiagnosed cases and prevent transmission
    • Future novel tests such as rapid RNA likely to be required
  – Harm reduction and vaccines are required to prevent infection / reinfection
  – Together the strategy becomes feasible

• Even more critical for international settings with limited resources.
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