Does (early) cART have a public health benefit?

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State of the cART
5 June 2012
Effect of HIV Treatment

What is contribution to new infections from HIV-infected men who have sex with men on suppressive antiretroviral therapy?

Van Sighem, A.I. 2nd International HIV Workshop on Treatment as Prevention Vancouver, 23 April 2012
Infectiousness and treatment

relative infectiousness: \[
\frac{0.46}{5.64} = 8\%
\]

Cohen et al: 0.04 (95% CI 0.01-0.27)
Infectiousness and treatment

<table>
<thead>
<tr>
<th>HIV-1 RNA copies/ml</th>
<th>On ART</th>
<th>Not on ART</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥400</td>
<td></td>
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</tbody>
</table>

**All studies**

<table>
<thead>
<tr>
<th>HIV-1 RNA copies/ml</th>
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<td>≥400</td>
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</tbody>
</table>

**Rate per 100 person-years**

<table>
<thead>
<tr>
<th>No. of studies</th>
<th>No. of events</th>
<th>No. of person years</th>
<th>Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>291</td>
<td>0.0 (0–1.27)</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>52</td>
<td>0.0 (0–5.79)</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>1098</td>
<td>0.46 (0.19–1.09)</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>631</td>
<td>0.16 (0.02–1.13)</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>457</td>
<td>2.06 (0.57–7.47)</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>456</td>
<td>4.17 (0.84–20.65)</td>
</tr>
<tr>
<td>6</td>
<td>47</td>
<td>668</td>
<td>8.12 (2.78–23.77)</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
<td>534</td>
<td>9.03 (3.87–21.09)</td>
</tr>
<tr>
<td>10</td>
<td>456</td>
<td>9998</td>
<td>5.64 (3.28–9.70)</td>
</tr>
</tbody>
</table>
Infectiousness and treatment

Relative infectiousness

\[
\frac{0}{5.64} = 0\% \\
\frac{1.27}{5.64} = 23\%
\]

95% UCL
What is the impact of non-zero probability of transmission during successful treatment on the HIV epidemic amongst MSM?
Transmission model

- Mathematical model explaining observed trends in HIV and AIDS diagnoses since 1980 (Bezemer et al., AIDS 2008; Epidemics 2010).

- Simultaneously estimate changes in
  - transmission rates (“risk behaviour”)
  - time from infection to diagnosis

- Infectiousness (probability of transmission correcting for risk behaviour) depends on stage of infection:
  - higher during primary infection and AIDS (Hollingsworth et al., JID 2008)
  - higher for patient unaware of their infection (Marks 2005)
  - high during episodes of viral rebound
  - zero or very low during viral suppression
Contributions to new infections 1

relative infectiousness 0%

2009: 899 infections

Bezemer et al., AIDS 2008; Epidemics 2010 (updated)
Contributions to new infections 2

relative infectiousness: infectiousness during suppressive treatment compared to diagnosed but untreated
Controlling the epidemic

status quo  N=1470
immediate cART  N=917
annual testing  N=629
reduced risk  N=139
relative infectiousness: infectiousness during suppressive treatment compared to diagnosed but untreated
Infections 2010 – 2018

more patients on treatment

relative infectiousness: infectiousness during suppressive treatment compared to diagnosed but untreated
Infections 2010 – 2018

relative infectiousness: infectiousness during suppressive treatment compared to diagnosed but untreated

smaller reduction in risk behaviour
Summarising...

- The contribution to new infections by patients on suppressive treatment is limited.

- Transmission from treated patients becomes more important in the presence of interventions.

- The risk of transmission may be larger
  - in the presence of other STIs.
  - when perceived protection leads to increased risk behaviour.
PrEP, using truvada, reduced the risk of transmission of healthy gay men and among HIV-negative heterosexual partners of people who are HIV positive by between 44% and 73% Grant, R et al., AIDS 2010
MSM and PrEP

Bezemer et al., AIDS 2008; Epidemics 2010 (updated)
MSM on PrEP

- All MSM 5% per year
- All MSM 10% per year
- New MSM
- New MSM + 5% other MSM

Calendar year

# MSM on PrEP
Number of new infections 2010-2019

<table>
<thead>
<tr>
<th>Category</th>
<th>% Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>No PrEP</td>
<td></td>
</tr>
<tr>
<td>New MSM</td>
<td>↓28%</td>
</tr>
<tr>
<td>All MSM 5%</td>
<td>↓33%</td>
</tr>
<tr>
<td>All MSM 10%</td>
<td>↓46%</td>
</tr>
<tr>
<td>New MSM + 5% all MSM</td>
<td>↓45%</td>
</tr>
</tbody>
</table>
Summarising...

- The contribution to new infections by patients on suppressive treatment is limited.

- Transmission from treated patients becomes more important in the presence of interventions.

- The risk of transmission may be larger
  - in the presence of other STIs.
  - when perceived protection leads to increased risk behaviour.

- PrEP of MSM may have a substantial impact on reducing the annual number of new infections.
Acknowledgements

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