Using Hepatitis C (HCV) incidence trends to disentangle the likely impact of anti-retroviral treatment (ART) on decreasing HIV incidence amongst injecting drug users (IDUs) in Vancouver

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Background

- Studies have shown that early ART can reduce HIV transmission among sero-discordant couples by > 90%.
- Uncertainty exists surrounding the real impact of ART – a large retrospective cohort in China recently found that ART reduces the risk of HIV transmission by 26% among sero-discordant couples.
- Direct evidence on the possible prevention effects of ART among high risk groups (sex workers, IDUs, men who have sex with men) that drive HIV transmission in many settings is lacking.
- Some studies have used ecological correlations between community measures of ART coverage or HIV (or community) viral load and HIV incidence to postulate that scaled-up ART has decreased HIV transmission amongst IDUs, MSM or the community as a whole.
Background

- These studies controlled for numerous individual risk factors, but it is impossible to determine whether all factors that may have affected HIV incidence were adequately controlled for.

- Two studies (among IDUs) have shown ecological correlations between HIV community viral load (CVL) and HIV incidence:
  - Postulate scaled-up ART has decreased HIV transmission amongst IDUs and concluded strong evidence for HIV treatment as prevention.

- However, in both studies, HCV incidence decreased concurrently.

- HCV, a blood borne virus, is highly transmissible through parenteral exposure but not through sexual exposure.

- Since ART does not directly reduce HCV transmission:
  - Reductions in HCV incidence act as proxy markers for changes in injecting risks which could also have decreased HIV incidence.
Vancouver incidence and community viral load (CVL) data 1996 – 2007
(Wood et al., BMJ 2009)

- HIV incidence decreased by >70% and HCV incidence by >50%.
- Reductions in HIV incidence also correlated strongly with HCV incidence.
- Use HCV incidence trends to estimate change in injecting risk and so:
  - Estimate the degree to which ART may have decreased HIV incidence
**AIM**: Use modelling to estimate the importance of ART in producing the observed reductions in HIV incidence in Vancouver from 1996 to 2007.
Methods and analysis

- Develop joint HIV and HCV transmission model
  - 3 stages of HIV and 2 stages of HCV with all co-infection states.
  - Low and high risk IDUs.
- Parameterise and calibrate model to baseline HIV and HCV prevalence and incidence in Vancouver for 1996:
  - Prevalence: HIV 21%, HCV 61% (+/- 20% uncertainty bounds)
  - Incidence: Negative exponential curves were fit to observed HIV, HCV incidence trends (95% CI)
- Efficacy of ART and reduction in injecting risk varied to give observed decreases in HIV and HCV incidence from 1996-2007.
Decrease in HCV and HIV incidence

- From the curve fits, the observed relative reduction in incidence for HIV is 84% (95%CI 76-86%) and HCV is 80% (95%CI 76-89%).
- To achieve these reductions: ART efficacy of 10% (95%CI 0.4-37%) and reduction in injecting risk of 50% (95%CI 42-59%) are required.
For the model: 80% (73-87) decrease with injecting risk only, 83% (75-88) decrease with ART and injecting risk.

ART on its own contributes up to 17% decrease in HIV incidence and injecting risk contributes about 67% of the decrease in HIV incidence.
How much does ART contribute when decrease in HIV is 80%?

- The projected added benefit of ART reduces for greater decreases in HCV incidence.
- For 20% decrease in HCV, ART adds about 70% decrease in HIV incidence.
- For a 60% decrease in HCV, ART adds about 10% decrease in HIV incidence.
Discussion

- Model was able to use HCV incidence trends to determine importance of ART and injecting risks for reducing HIV incidence.
- Analyses suggest much of observed decrease in HIV incidence could be due to reductions in injecting risk, not ART provision and so suggest existing evidence for ART impact in IDUs is limited.
- This study highlights the importance of considering HCV incidence trends in similar analyses as they may help explain contributing factors to the overall impact.

LIMITATIONS

1. Do not assume specific intervention (for injecting risk).
2. Assume IDU population is constant – it could be declining.