The relative impacts of antiretroviral therapy and harm reduction initiatives on HIV incidence in British Columbia, Canada: 1996-2013

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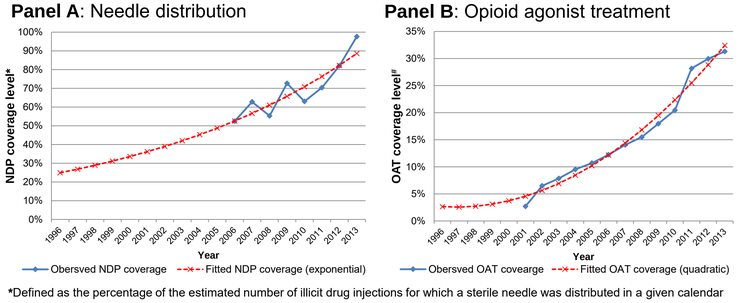
Background

- Access to antiretroviral therapy (ART) and harm reduction services have been cited as key contributors to the control of the HIV epidemic.
- The specific contribution of harm reduction has been questioned due to uncertainty in the true efficacy of ART in prevention of HIV transmission through needle sharing.
- We aimed to isolate the independent effects of harm reduction services and the secondary preventive benefits of ART through needle sharing on HIV incidence in British Columbia, from 1996-2013.

Methods

- Using comprehensive linked population-level data, we populated a dynamic, compartmental transmission model to simulate the HIV/AIDS epidemic in BC from 1996-2013.
- We used publicly-available records of the number of needles distributed and the number of person-years on opioid agonist treatment (OAT), as a proxy for harm reduction services (**Figure 1**).
- We estimated scenarios designed to isolate the independent effects of harm reduction services and ART (assuming 50% (10%-90%) efficacy) in reducing HIV incidence through needle sharing.
- HIV incidence, mortality, and quality-adjusted life years (QALYs) were estimated.

Figure 1. Rates of utilization of harm reduction services in British Columbia, Canada, 1996-2013



*Defined as the percentage of the estimated number of illicit drug injections for which a sterile needle was distributed in a given calendar year; #Defined as the percentage of the total number of PWID that accessed OAT in a given calendar year.

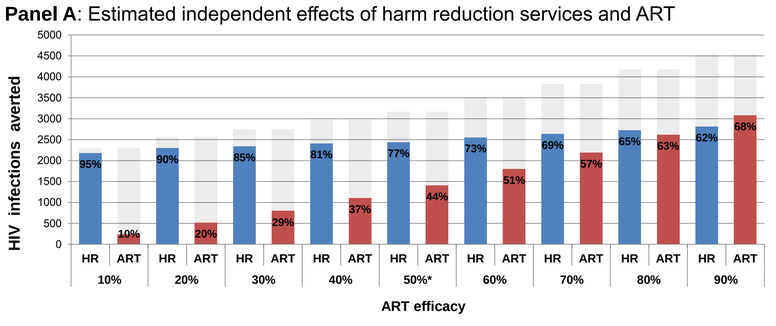
Results

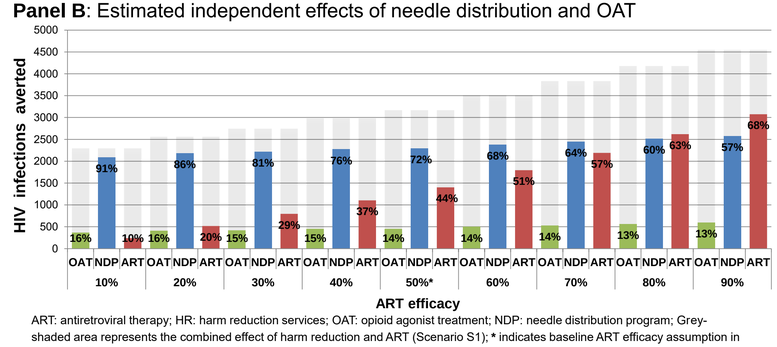
Table 1. Six scenarios of harm reduction scale up and ART efficacy in preventing HIV transmission

	Scenario	Incidence, PWID	Incidence, PLHIV	Deaths among PLHIV	Total QALYs
Observed scale-up of harm reduction, 50% ART efficacy	S1	2,324	7,987	3,720	52,570,329
Observed scale-up of harm reduction, 0% ART efficacy	S2	2,861	8,718	3,856	52,569,855
No scale-up in harm reduction, 50% ART efficacy	S3	3,811	9,782	3,980	52,561,200
No scale-up in harm reduction, 0% ART efficacy	S4	4,927	11,191	4,181	52,560,486
Observed scale-up of OAT, 0% ART efficacy, no NDP	S5	4,498	10,701	4,084	52,569,012
Observed scale-up of NDP, 0% ART efficacy, no OAT	S6	3,001	8,885	3,929	52,563,104
		Difference in Scenarios	Difference in Scenarios	Difference in Scenarios	Difference in Scenarios
Estimated effect of harm reduction and ART, 50% efficacy	S4 - S1	2,602	3,204	461	9,843
Estimated effect of harm reduction, with no ART efficacy	S4 - S2	2,065	2,473	325	9,369
Estimated effect of ART in the absence of harm reduction, 50% ART efficacy	S4 - S3	1,116	1,409	200	714
Estimated effect of OAT, with no NDP and no ART efficacy	S4 - S5	429	490	96	8,526
Estimated effect of NDP, with no OAT and no ART efficacy	S4 - S6	1,925	2,307	252	2,618

ART: antiretroviral therapy; PWID: people who use injection drugs; PLHIV: people living with HIV; QALYs: quality adjusted life-years

Figure 2. Percentage of incident HIV infections averted attributable to the preventive benefits of ART via needle sharing and harm reduction services among PLHIV





ART: antiretroviral therapy; HR: harm reduction services; OAT: opioid agonist treatment; NDP: needle distribution program; Grey-shaded area represents the combined effect of harm reduction and ART (Scenario S1); * indicates baseline ART efficacy assumption in reducing HIV transmission via needle sharing.

- We estimated that 3169 (2294-4548) incident HIV cases were averted between 1996 and 2013 as a result of the combined effect of the expansion of harm reduction services and ART coverage on HIV transmission via needle sharing (**Table 1**, scenarios: (S4-S1)).
- In a hypothetical scenario assuming ART had zero effect on transmission through needle sharing, we estimated harm reduction services alone would have accounted for 77% (62%-95%) of averted HIV incidence (**Figure 2, Panel A**).
- In a separate hypothetical scenario where harm reduction services remained at 1996 levels, we estimated ART alone would have accounted for 44% (10%-68%) of averted HIV incidence (**Figure 2, Panel A**).
- Due to high distribution volumes, needle distribution predominantly accounted for incidence reductions attributable to harm reduction (**Figure 2, Panel B**), however OAT provided substantially greater QALY gains (**Table 1**).

Conclusion

- If the true efficacy of ART in preventing HIV transmission through needle sharing is closer to its efficacy in sexual transmission (96%), ART's impact on incident cases averted may be greater than that of harm reduction.
- Nonetheless, harm reduction services played a vital role in reducing HIV incidence in BC, and should be viewed as critical and cost-effective tools in combination implementation strategies to reduce the public health and economic burden of HIV/AIDS.

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