The cost-effectiveness of population level HAART expansion in British Columbia

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Background

- Scientific advances in HIV/AIDS have demonstrated that immediate access to highly-active antiretroviral therapy (HAART) provides both individual and public health benefits.
- However, the cost-effectiveness of a Treatment as Prevention (TasP)-oriented public health response to HIV/AIDS has yet to be assessed at a population-level in a real world setting.
- We aimed to determine the cost-effectiveness of HAART scale-up in British Columbia (BC), Canada (1997-2010) compared to scenarios of constrained treatment access.

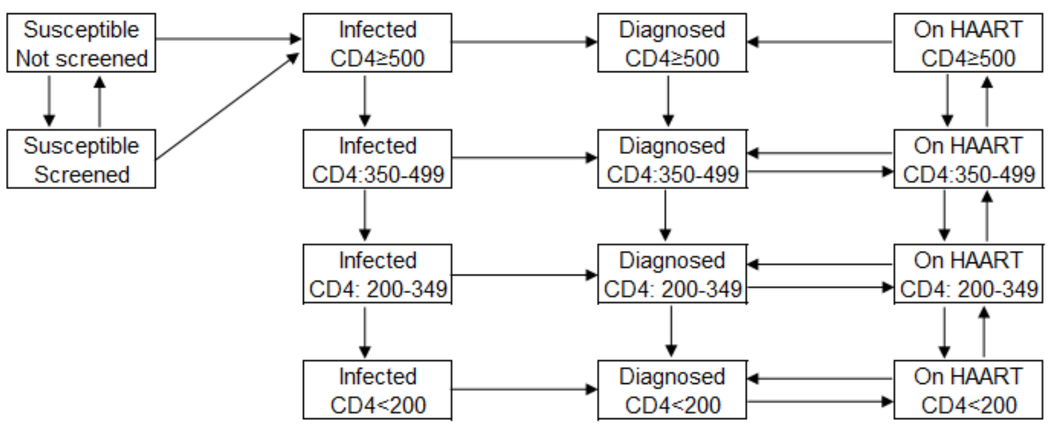
Methods

- Using comprehensive linked population-level data, we populated a dynamic, compartmental transmission model to simulate the HIV/AIDS epidemic in BC from 1997-2010 (**Figure 1**).
- HIV incidence, prevalence, mortality, costs (in 2010$CDN) and quality-adjusted life years (QALYs) were estimated as a function of HIV risk group and disease progression.
- Incremental cost-effectiveness ratios (ICERs) were calculated from societal and third party payer (TPP) perspectives to compare actual practice (true numbers of individuals accessing HAART) to scenarios of constrained expansion (75% and 50% probability of accessing HAART).

$$ICER = (Cost_{observed} - Cost_{75\%/50\% observed})/(QALY_{observed} - QALY_{75\%/50\% observed})$$

- Structural and parameter uncertainty was investigated in sensitivity analysis.

Figure 1. The dynamic compartmental transmission model



Results

Epidemiological estimates (**Table 1**)

- Constraining the probability of accessing treatment to 75% of observed access resulted in 3,585 fewer patient years in treatment (92.3% of observed access, or a 7.7% reduction), and 9,364 fewer patient years on HAART (79.8% of observed access, or a 20.2% reduction) in the 50% constrained access scenario.
- Actual practice resulted in an estimated 263 averted incident cases compared with the 75% HAART access scenario, and 624 averted cases compared to the 50% access scenario.

Cost-effectiveness analysis of HAART (**Table2**)

- Within the study timeframe and using a TPP perspective, actual practice led to substantially greater QALY gains, resulting in ICERs of $23,679/QALY compared to 75% expansion, and $24,250/QALY compared to 50% expansion.
- From a societal perspective, actual practice was cost saving within the study period.

Table 1. Epidemiological results of dynamic transmission model: British Columbia, 1997-2010

	Observed HAART Access	75% of Observed Access	50% of Observed Access
No. Patient-Years on HAART	46,350	42,765	36,986
Incident Cases of HIV			
Overall	6,230	6,493	6,906
MSM	2,509	2,599	2,745
IDU	1,629	1,719	1,855
HETERO	2,091	2,176	2,307
Deaths among PLHIV			
Overall	3,193	3,272	3,394
MSM	994	1,009	1,034
IDU	1,645	1,701	1,786
HETERO	554	562	574
HIV Prevalence (2010)			
Overall	11,326	11,523	11,825
MSM	4,662	4,738	4,859
IDU	3,429	3,473	3,537
HETERO	3,236	3,312	3,429

Sensitivity Analysis **(Table2)**

- Holding ART access, reduced HIV screening resulted in a slightly lower QALY loss, resulting in an incremental cost-effectiveness ratio of $5,920 per QALY gained for observed versus 75% access of observed HIV screening.
- Without the observed decreases in injection risk behaviours, the model estimated an increment of $42M in HAART costs and a detriment of approximately 2,000 QALYs.
- Had high risk sexual behaviours remained constant (as opposed to their observed increase), the model estimated lower healthcare costs and an additional 1,000 QALYs gained within the study population.

Long-term implications (**Figure 2**)

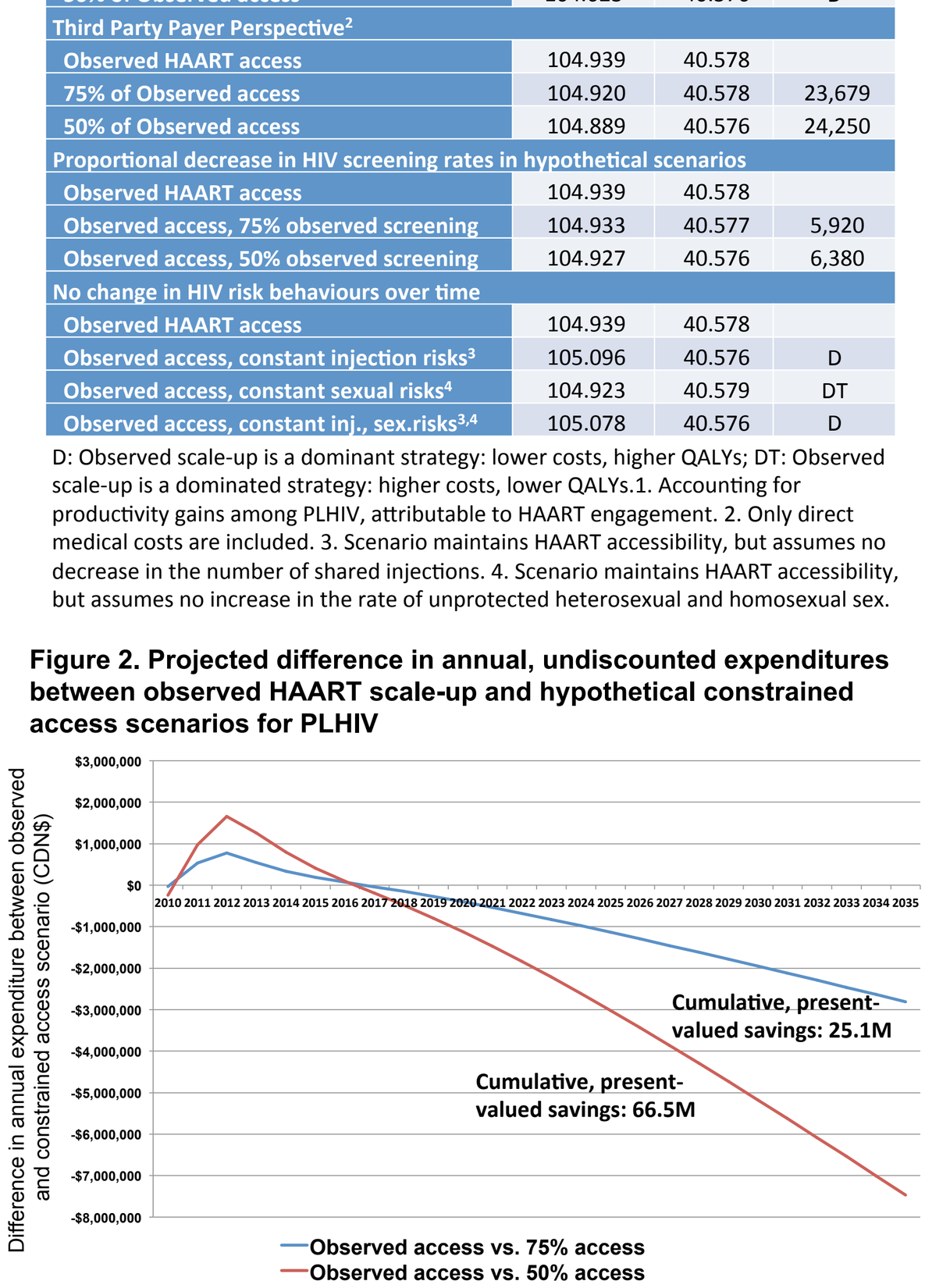
- By extending the time horizon an additional 25 years, we estimated that annual expenditure on PLHIV in the actual practice scenario fell below the constrained access scenarios from 2017.
- Extending the observed practice to 2035 resulted in a (discounted) savings of $25.1M in total cumulative costs,1997-2035, compared to the 75% access scenario, and a savings of $66.5M compared to the 50% access scenario**.**

Table 2. Results of incremental cost-effectiveness analysis

	Costs $CDN (Billions)	QALYs (Millions)	ICER
Societal Perspective[1]			
Observed HAART access	104.606	40.578	
75% of Observed access	104.613	40.578	D
50% of Observed access	104.623	40.576	D
Third Party Payer Perspective[2]			
Observed HAART access	104.939	40.578	
75% of Observed access	104.920	40.578	23,679
50% of Observed access	104.889	40.576	24,250
Proportional decrease in HIV screening rates in hypothetical scenarios			
Observed HAART access	104.939	40.578	
Observed access, 75% observed screening	104.933	40.577	5,920
Observed access, 50% observed screening	104.927	40.576	6,380
No change in HIV risk behaviours over time			
Observed HAART access	104.939	40.578	
Observed access, constant injection risks[3]	105.096	40.576	D
Observed access, constant sexual risks[4]	104.923	40.579	DT
Observed access, constant inj., sex.risks[3,4]	105.078	40.576	D

D: Observed scale-up is a dominant strategy: lower costs, higher QALYs; DT: Observed scale-up is a dominated strategy: higher costs, lower QALYs.1. Accounting for productivity gains among PLHIV, attributable to HAART engagement. 2. Only direct medical costs are included. 3. Scenario maintains HAART accessibility, but assumes no decrease in the number of shared injections. 4. Scenario maintains HAART accessibility, but assumes no increase in the rate of unprotected heterosexual and homosexual sex.

Figure 2. Projected difference in annual, undiscounted expenditures between observed HAART scale-up and hypothetical constrained access scenarios for PLHIV



Conclusion

- The expansion of HAART in BC was cost-effective within the study period and cost-saving when accounting for forgone productivity.
- These results confirm the value of HAART scale-up as a public health strategy to reduce morbidity, mortality and transmission of HIV/AIDS.

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