The Need for Targeting People Who Inject Drugs and Baby Boomer Populations Independently in the Fight against the HCV Epidemic in British Columbia, Canada

Jielin Zhu[1], Ignacio Rozada[1], Jason Grebely[2], Lianping Ti[1,3], Mark W. Hull[1,3], Julio S.G. Montaner[1,3], Viviane D. Lima[1,3]

1. British Columbia Centre for Excellence in HIV/AIDS, Vancouver, British Columbia, Canada; 2. The Kirby Institute, UNSW Sydney, Sydney, NSW, Australia; 3. Division of AIDS, Department of Medicine, Faculty of Medicine, University of British Columbia, Vancouver, British Columbia, Canada

Background

- In North America, people who were born between 1945 and 1964 (so-called baby boomers) and people who inject drugs (PWID) contribute to the majority of prevalent and new HCV infections, respectively.
- As of March 2018, direct-acting antiviral agents (DAA) are fully subsidized for any chronically-infected individual in British Columbia (BC), regardless of the severity of liver damage.
- Gaps in HCV testing and linkage to care may potentially delay treatment initiation and undermine the impact of treatment rollout.

Objective

- We explored the long-term impact of the rollout of unrestricted DAA treatments and the impact of enhancing the HCV cascade of care, such as reducing the delays in diagnosis, linkage to care and treatment initiation in British Columbia (BC).

Methods

- We modified a published deterministic dynamic compartmental model to simulate HCV transmission, disease progression along the stages of the HCV cascade of care for PWID and baby boomer populations.

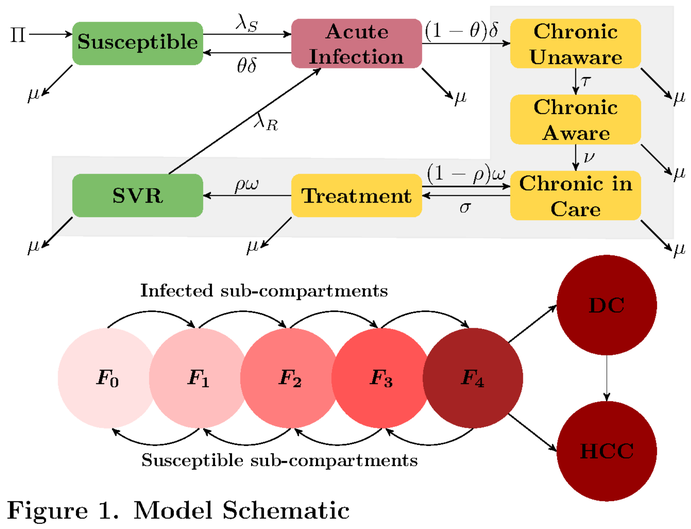

Figure 1. Model Schematic

- Besides the expansion of DAA eligibility, we explored the impact of interventions that enhance the HCV cascade of care under low, medium and high scenarios, described in Table 1.

Table 1. Modeling scenarios.

Scenario	Baseline		Low	Medium	High
	PWID	Baby Boomers			
TEST: increase the rate of diagnosis	11.7*	3.3	12.5	25	41.7
LINK: increase the rate of linkage to care	3.1	7.1	41.7	166.7	1000
TREAT: increase the rate of treatment initiation	4.5	26.7	41.7	166.7	1000
TEST&LINK: combination of TEST and LINK	The corresponding parameters are the same as the scenario above				
LINK&TREAT: combination of LINK and TREAT					
TEST&LINK&TREAT: combination of TEST, LINK and TREAT					

*unit: per 1000 individuals per month

Results

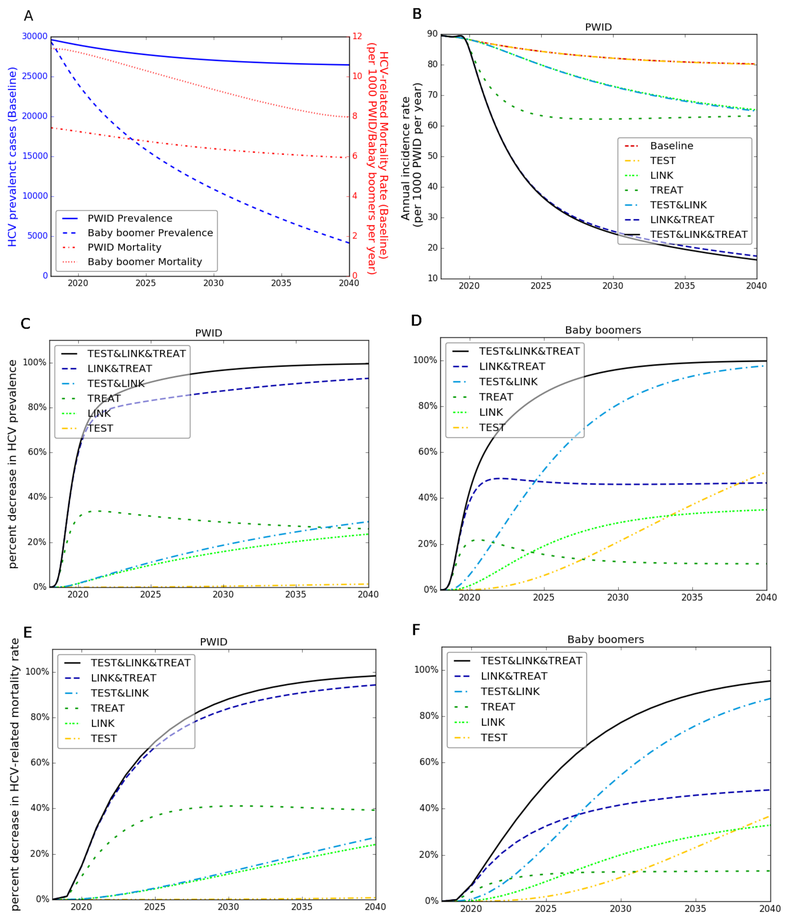

Figure 2. Point prevalence and HCV-related mortality rate under the Baseline scenario (A); Incidence for PWID under medium scenario for each intervention (B); Percent decrease of prevalence for PWID (C) and baby boomers (D); Percent decrease of HCV-related mortality rate for PWID (E) and baby boomers (F).

- For each intervention, from the low to the high scenario and for all outcomes, the LINK&TREAT scenario for PWID and the TEST&LINK scenario for baby boomers achieved comparable results to the optimal TEST&LINK&TREAT scenario up to 2040 (Figure 2 and Table 2).
- The TEST&LINK&TREAT scenario was the most effective intervention for both populations, and it achieved HCV elimination by reducing the incidence in 2040 to less than 1 case per 1000 PWID per year (medium and high scenarios).
- The combination of treatment rollout and time reduction on treatment initiation (TREAT), can only reduce prevalence by at most 27% for PWID and 13% for baby boomers, and reduce HCV-related mortality by at most 40% for PWID and 15% for baby boomers.

Results (continued)

- Rollout of unrestricted DAA treatment had limited impact on reductions of HCV incidence and prevalence for the PWID population, in comparison to 2018 (Figure 2A and 2B).

Table 2. HCV incidence, point prevalence and mortality in 2040 under scenarios TEST&LINK, LINK&TREAT and TEST&LINK&TREAT, and percent changes in comparison to baseline scenario.

Scenarios	Incidence	Point Prevalence		HCV-related Mortality	
	n/1000 (% change)	n (% change)	n (% change)	n/1000 (% change)	n/1000 (% change)
	PWID	PWID	Baby boomers	PWID	Baby boomers
Baseline	80.24 (--)	26448 (--)	4159 (--)	5.93 (--)	7.97 (--)
TEST&LINK					
Low	64.84 (-19.20%)	20866 (-21.1%)	612 (-85.3%)	4.65 (-21.59%)	2.31 (-70.98%)
Medium	58.76 (-26.77%)	18730 (-29.2%)	98 (-97.6%)	4.31 (-27.29%)	0.99 (-87.62%)
High	55.96 (-30.27%)	17759 (-32.9%)	43 (-99.0%)	4.17 (-29.66%)	0.69 (-91.30%)
LINK&TREAT					
Low	17.38 (-78.34%)	5243 (-80.2%)	2540 (-38.9%)	0.85 (-85.70%)	4.90 (-38.46%)
Medium	6.28 (-92.17%)	1853 (-93.0%)	2220 (-46.6%)	0.34 (-94.28%)	4.13 (-48.15%)
High	4.30 (-94.64%)	1263 (-95.2%)	2142 (-48.5%)	0.25 (-95.76%)	3.95 (-50.39%)
TEST&LINK&TREAT					
Low	16.15 (-79.88%)	4855 (-81.6%)	443 (-89.4%)	0.80 (-86.52%)	1.79 (-77.53%)
Medium	0.49 (-99.39%)	135 (-99.5%)	12 (-99.7%)	0.10 (-98.26%)	0.38 (-95.22%)
High	0.00 (-99.99%)	1 (-100.0%)	0 (-100.0%)	0.06 (-99.01%)	0.21 (-97.35%)

*Green: relative change ≤60%; blue: relative change >60%

Sensitivity Analyses

- For both populations, the effect of each parameter on the outcomes decreased from the low to the high intervention scenario under each intervention.
- The TEST&LINK scenario for PWID and the LINK&TREAT scenario for baby boomers were more sensitive than the other interventions.
- Besides the parameters for interventions, the PWID population was most sensitive to the relative risk of HCV transmission for the high-risk category, and the baby boomer population was most sensitive to the SVR rate of DAA treatment.

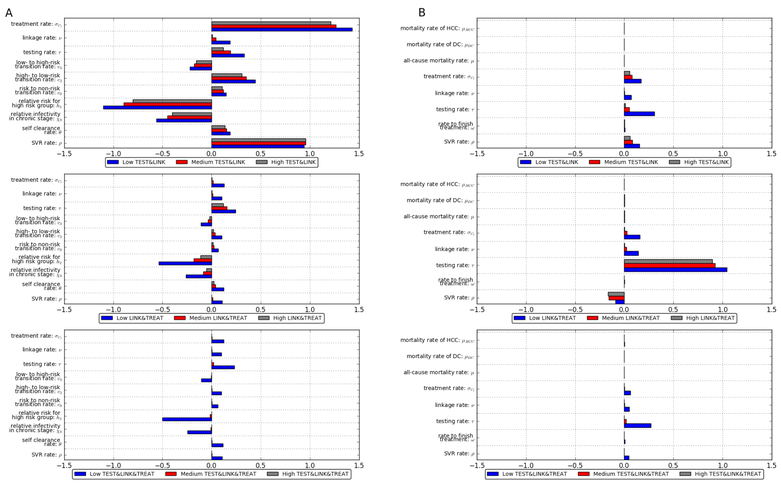

Figure 3. Sensitivity coefficients for percent decrease of HCV point prevalence in 2040 under the TEST&LINK, LINK&TREAT, and TEST&LINK&TREAT scenarios for PWID (A) and baby boomers (B).

Conclusion

- In order to significantly reduce the HCV burden, the priorities for the improvements on the HCV cascade of care should be different for PWID and baby boomers: it is of most importance to expedite treatment initiation for PWID and enhancing HCV screening for baby boomers, combined with expedited linkage to HCV care.
- Enhancement of the HCV cascade of care in testing, linkage to care and treatment initiation can lead to HCV elimination, defined as less than 1 new case per 1000 susceptible individuals per year.
- Unlimited and unrestricted access to DAA treatments without other improvements on the HCV cascade of care has limited impact on the PWID population who contribute to the majority of new infections.

CONFERENCE CAHR 2018
MICHAEL SMITH FOUNDATION FOR HEALTH RESEARCH Discover. Connect. Engage.
CIHR IRSC Canadian Institutes of Health Research / Instituts de recherche en santé du Canada
BRITISH COLUMBIA CENTRE for EXCELLENCE in HIV/AIDS
Providence HEALTH CARE How you want to be treated.
UBC

Conflict of Interest Disclosure: We have no conflicts of interest.