

# Estimating the number of potential HIV and HCV cases averted through the introduction of federal prison-based needle exchange programs in Canada

Dan Werb, PhD

Division of Global Health, University of California San Diego; BC Centre for Excellence in HIV/AIDS, Vancouver



## Introduction

Injection drug use in Canadian federal prisons remains a major source of HIV and hepatitis C virus (HCV) transmission (CSC, 2010). Evidence suggests that prison-based needle and syringe programs (PNSPs) are highly effective at reducing the use of non-sterile injection equipment among incarcerated people who inject drugs (PWIDs). However, PNSPs in Canadian prisons have not yet been implemented. We sought to estimate the number of HIV and HCV cases potentially averted through the implementation of PNSPs.

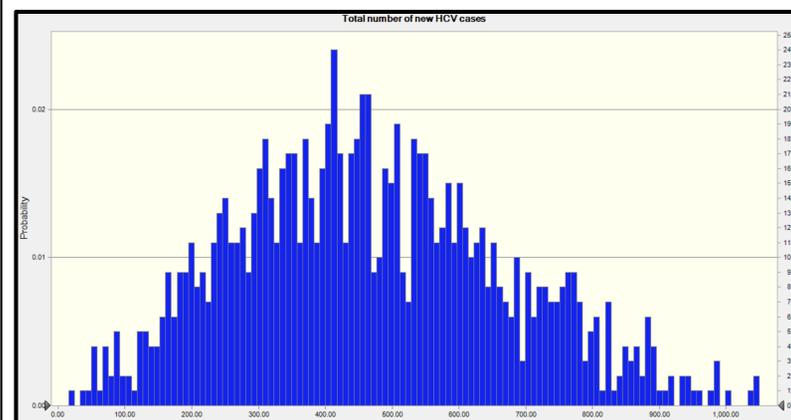
## Materials and methods

Monte Carlo Markov Chain modeling approaches were employed to generate a median value and 95% credibility intervals for the annual number of HIV and HCV cases in Canadian prisons, as well as the number of cases potentially averted by PNSPs. Model parameters were obtained for the HIV and HCV prevalence among incarcerated PWID; the probability that PWID share syringes with an HIV-seropositive or HCV-seropositive prisoner; the risk of transmission per syringe sharing event; the mean number of syringe sharing events per incarcerated PWID per year; the number of active incarcerated PWID; and the effectiveness of PNSPs in curtailing syringe sharing.

Table 1. Model Parameters, Data Sources, and values

Data Parameters	References	Variable Estimate
Number of federal prisoners	2014 Spring Report of the Auditor General of Canada (Correctional Service Canada)	15,224
Number of federal PWID prisoners (proportion)	Correctional Service Canada National Inmate Infectious Diseases and Risk Behaviour Survey (CSC NIIDRBS)	2,436 (16%)
HIV prevalence among federal PWID prisoners	Public Health In Federal Corrections: Correctional Service of Canada's Infectious Diseases Newsletter (Fall 2008 Vol. 6, No. 1)	2.1%
HCV prevalence among federal PWID prisoners	Remis, 2007. Modelling the incidence and prevalence of hepatitis C infection and its sequelae in Canada, Public Health Agency of Canada, page 31.	70.0%
Number of HIV-seropositive PWID prisoners	Number of PWID prisoners x 2.1%	51
Number of HCV-seropositive PWID prisoners	Number of PWID prisoners x 70.0%	1,705
Probability of sharing with HIV+ or HCV+ prison	4.89% of all federal prisoners report sharing with someone with HIV/HCV or unknown status (CSC NIIDRBS Report R-207). 4.89% / 16% total PWID in prison = 30.6%.	30.6%
Risk of HIV transmission per injection	Public Health Agency of Canada, 2013	0.7-0.8%
Risk of HCV transmission per injection	Hagan, Meta-Regression of Hepatitis C Virus Infection in Relation to Time Since Onset of Illicit Drug Injection: The Influence of Time and Place, Am J Epidemiol, 2008.	27.6%
Number of injections annually	If 2,436 (16%) of all inmates inject in prison (CSC NIIDRBS R-211), and 31% inject at least weekly (CSC NIIDRBS R-211), then 755 inmates inject weekly (2,436 x 31%) and 1,681 inject on average 12 times a year (conservatively). Inmates who inject drugs therefore inject 24.4 annually on average.	24.4
Annual cost of HCV treatment per prisoner	CSC, File #394-2-39, Evaluation Report: Correctional Service Canada's Safer Tattooing Practices Pilot Initiative, Table 2	21,993
Annual cost of HIV treatment per prisoner	CSC, File #394-2-39, Evaluation Report: Correctional Service Canada's Safer Tattooing Practices Pilot Initiative, Table 2	29,000

## Results



- Median annual estimated incident HIV cases among PWID in Canadian federal prisons is 2 (95% Credibility Interval [CI]: 1 – 5).
- Median annual estimated incident HCV cases among PWID in Canadian federal prisons is 501 (95% CI: 295 – 724).
- Annual direct treatment costs for incident HIV cases were estimated at \$67,800 (95% CI: \$33,900 – \$138,000).
- Annual direct treatment costs for incident HCV cases were estimated at \$10,934,700 (95% CI: \$6,282,400 – \$16,197,700).
- Assuming a 90% effective PNSP service, HIV incidence is estimated to decrease to 0 cases, while HCV incidence is estimated to decrease to 49 cases annually (95% CI: 28 – 74).
- Assuming PNSPs are 95% effective, the annual incidence of HIV is estimated to decrease to 0, while the annual incidence of HCV is estimated to decrease to 25 cases (95% CI: 15 – 36).

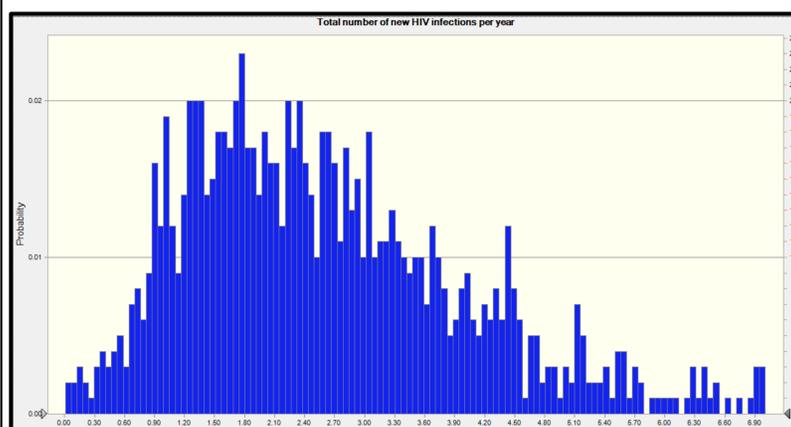
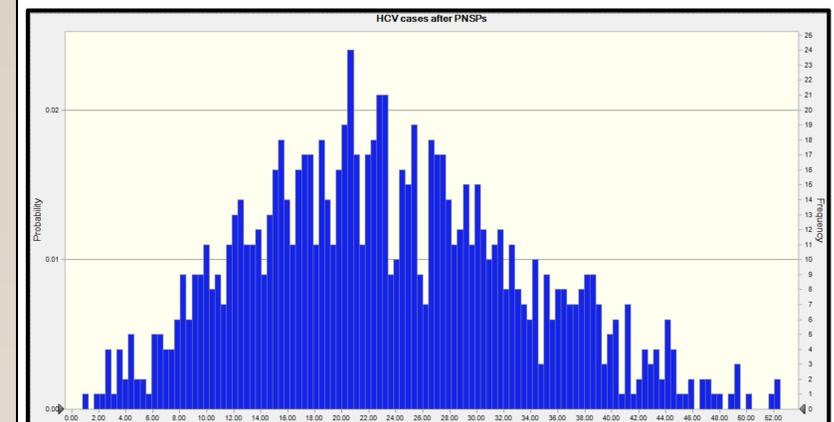


Table 2. Estimated annual HIV and HCV incident cases among people who inject drugs in Canadian federal prisons

	Point estimate	95% Credibility Interval
<i>Estimates of current incidence</i>		
Annual HIV incidence	2	1 – 5
Annual HCV incidence	501	295 – 724
<i>With 90% effective needle and syringe distribution programs</i>		
Annual HIV incidence	0	0 – 1
Annual HCV incidence	49	28 – 74
<i>With 95% effective needle and syringe distribution programs</i>		
Annual HIV incidence	0	0 – 0
Annual HCV incidence	25	15 – 36



## Conclusions

The current model suggests that the incidence of HIV and HCV transmission among PWID in Canadian federal prisons is high, consistent with data collected by the Correctional Services Canada. This is problematic, particularly given scientific evidence regarding the effectiveness harm reduction interventions in reducing the incidence of risk behaviours for blood-borne disease transmission. In particular, evidence suggests that PNSPs are effective at curtailing prison-based syringe sharing, and have been effective in reducing blood-borne disease incidence (Dolan et al., 2002). The implementation of PNSPs should therefore be immediately considered in Canadian federal correctional institutions to alter the risk environment for HIV and HCV infection among PWID prisoners.

## Acknowledgments

Dan Werb is supported by the Canadian Institutes of Health Research and the Trudeau Foundation.

## References

- Auditor General of Canada. 2014. 2014 Spring Report of the Auditor General of Canada. Chapter 4: Expanding the Capacity of Penitentiaries - Correctional Service Canada. Office of the Auditor General of Canada, Ottawa.
- Correctional Service Canada. 2009. Evaluation Report: Correctional Service Canada's Safer Tattooing Initiative. Correctional Service Canada, Ottawa.
- Correctional Service Canada. 2010. National Inmate Infectious Diseases and Risk Behaviour Survey, 2007. Correctional Services Canada, Ottawa.
- Dolan, K., Rutter, S., Wodak, A.D., 2003. Prison-based syringe exchange programmes: a review of international research and development. *Addiction* 98, 153-158.
- Hagan, H., Pouget, E.R., Des Jarlais, D., Leluti-Weinberger, C., 2008. Meta-regression of hepatitis C virus infection in relation to time since onset of illicit drug injection: The influence of time and place. *Am J Epidemiol* 168, 10.
- Remis, R.S., 2007. Modelling the incidence and prevalence of Hepatitis C infection and its sequelae in Canada, 2007. Public Health Agency of Canada, Ottawa.
- Rubinstein, R.Y., Kroese, D.P., 2008. *Simulation and the Monte Carlo method*. Wiley-Interscience.