

Injection drug use, low income, & severe food insecurity in HIV-HCV co-infected individuals in Canada: a **mediation** analysis

HIV ENDGAME II: Stopping the Syndemics that Drive HIV
November 21, 2016

Authors: McLinden T, Moodie EEM, Hamelin A-M, Paradis G, Rourke SB, Cooper C, Klein MB, Cox J

Presenter: **Taylor McLinden**, MSc
PhD Candidate, Epidemiology

taylor.mclinden@mail.mcgill.ca
www.taylormclinden.ca



Presenter Disclosure



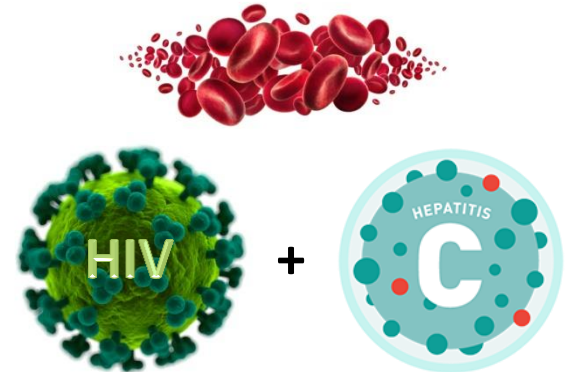
- **Presenter:** Taylor McLinden
- **Relationships with commercial interests:**
 - None to declare

- **Food insecurity (FI):**
 - **Common** issue in **HIV-hepatitis C virus (HCV)** co-infected ^[1]
 - FI in HIV-HCV co-infected (Canada): **59%** (2012-2014) ^[2]
 - Much higher than general Canadian population (**8%**) ^[3]
 - Co-infected: majority of food insecure experienced **severe FI** ^[2]
 - Most extreme: “disrupted eating patterns & reduced food intake”

- **FI:** Limited or uncertain -
 - **Availability** of nutritionally adequate & safe foods
 - or
 - **Ability** to acquire acceptable foods in socially acceptable ways ^[4]

- **General population:** low income as primary risk factor for FI ^[5,6]
- FI is **context-specific:** general population **vs.** sub-groups of population

- **20% of HIV-positive: HIV-HCV co-infected** ^[7]
 - Vulnerable sub-set of HIV-positive population ^[8-10]
 - High prevalence of **injection drug use** (IDU)
 - High prevalence of **severe FI** ^[2]
- **FI is associated with:**
 - Sub-optimal HIV treatment adherence ^[11]
 - Incomplete HIV viral load suppression ^[12]
 - Lower CD4 cell counts ^[13]
 - Higher rates of mortality ^[14]
- **Due to consequences of FI:**
 - Important to study:
 - Mechanisms
 - Pathways: **risk factors** → **mediators** → **outcome**



Objective

- **Given:**



- Importance of **low income**
- High prevalence of **IDU** & **severe FI** (in co-infected)

- **Objective:**

- **Mediation** analysis:

- Pathways: **IDU** → **low income** → **severe FI**
 - Temporally-ordered longitudinal cohort data
 - HIV-HCV co-infected in Canada

- Potential insights into **interventions**:

- Reduce severe FI & consequences of being severely food insecure

- **Data sources:**

- **Food Security & HIV-HCV Study:**



- Canadian Co-infection Cohort (**CCC**) ^[15]
 - Multi-centre study of co-infected in care
 - 17 HIV clinics, 6 provinces
 - Questionnaires & blood samples (every 6 months)
- FI-related:
 - Integrated in CCC: Nov 2012 - May 2015 ^[3]
 - Additional questionnaire
 - Household Food Security Survey Module (HFSSM)

Methods

- **Measurements:**

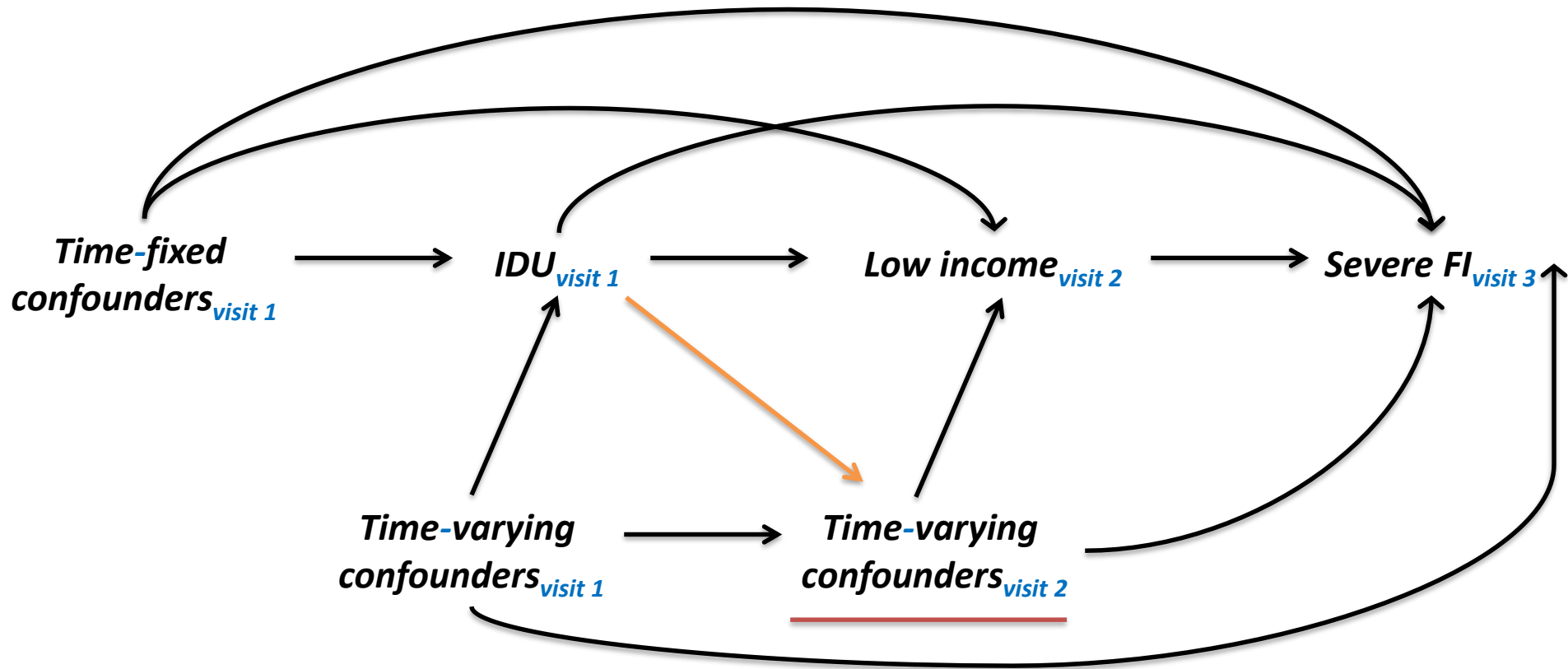


- **Temporal-ordering:** exposure [visit 1] → mediator [visit 2] → outcome [visit 3]

-
- **Exposure:** self-reported IDU (*in the past 6 months*)
 - none **vs.** any IDU
 - **Mediator:** average personal monthly income (*over the past 6 months*)
 - Dichotomized at StatsCan “low income measure before tax” (LIM-BT)^[16]
 - \$1,847 / month (single-person household)
 - Above **vs.** below the LIM-BT
 - **Outcome:** severe food insecurity (*in the past 6 months*)
 - 10-item adult scale: Household Food Security Survey Module (HFSSM)^[17]
 - **# of affirmative (✓) responses:**
 - ≥ 6 affirmative responses: severely food insecure

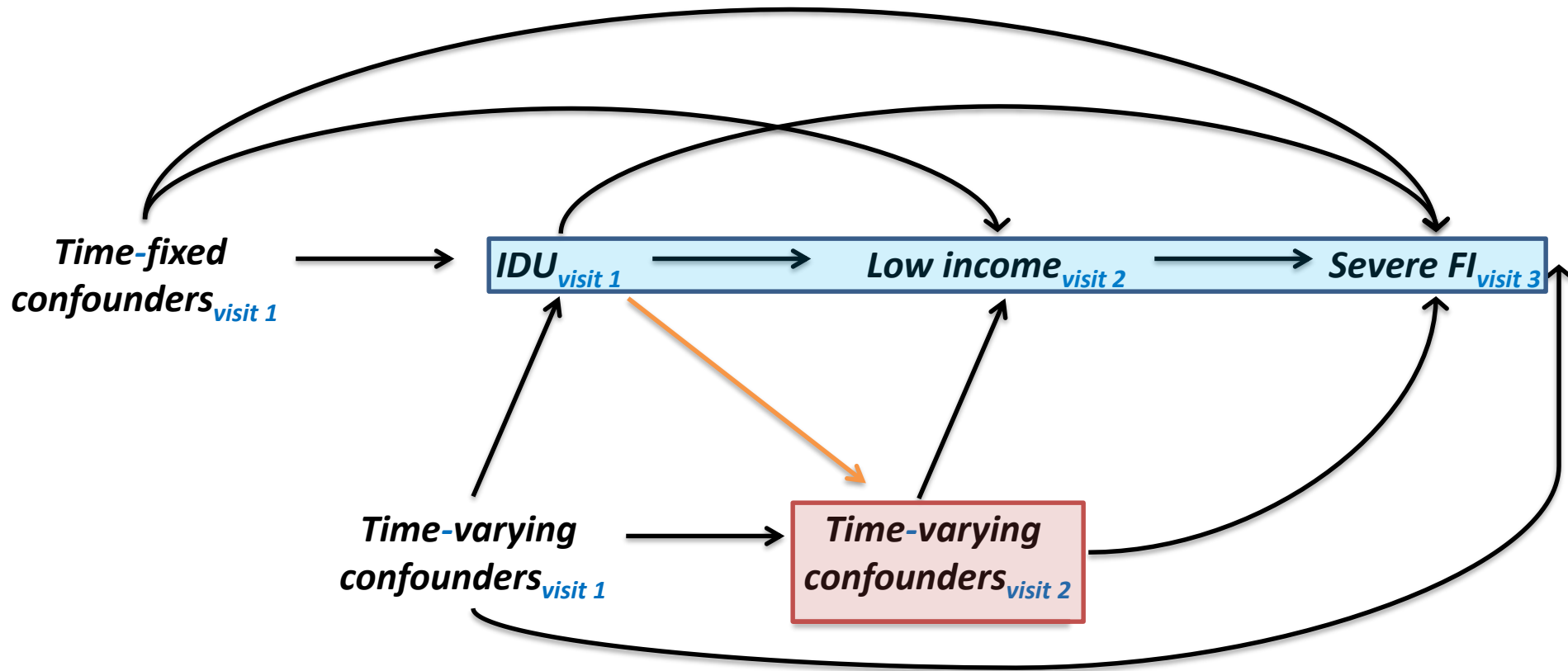
Conceptual framework

IDU [visit 1] → Low income [visit 2] → Severe FI [visit 3]



Conceptual framework

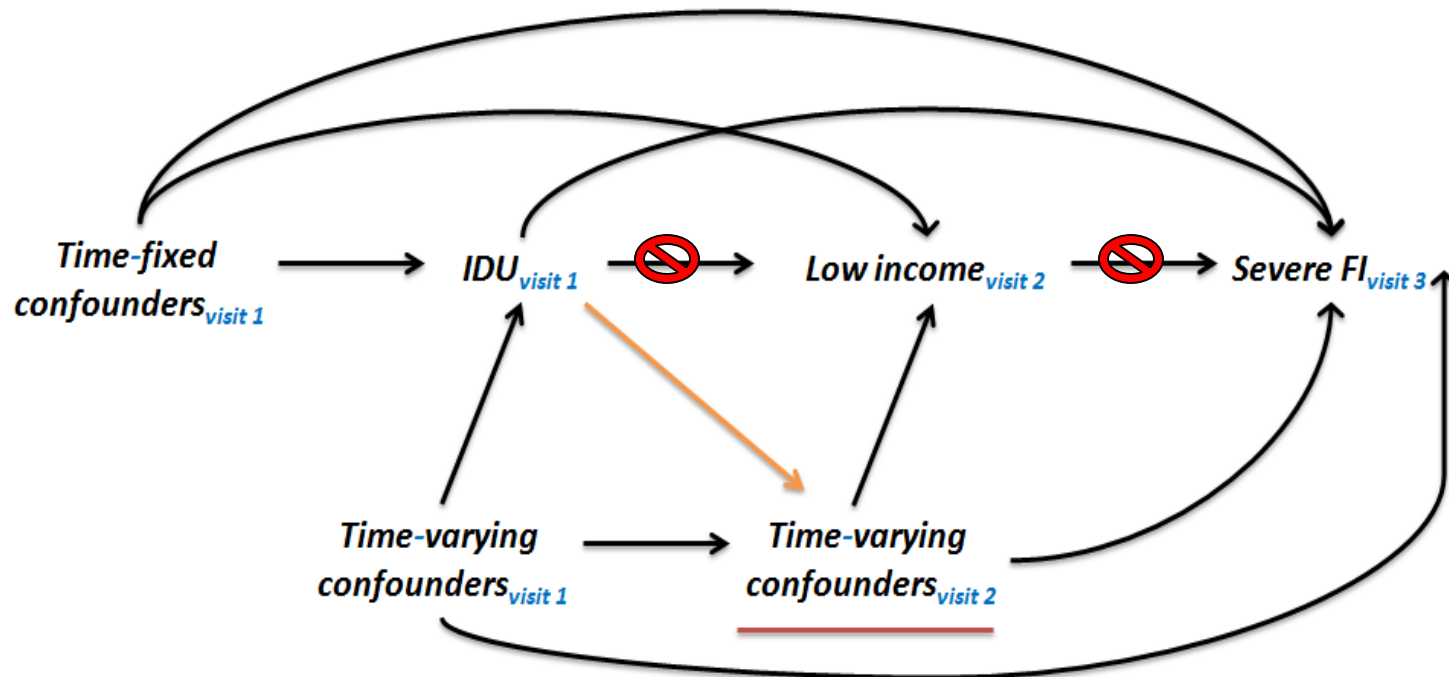
IDU [visit 1] → Low income [visit 2] → Severe FI [visit 3]



- **Measurements:**
 - **Time-fixed confounders** [visit 1]:
 - Education at enrolment, sex, ethnicity, country of origin
 - **Time-varying confounders** [visit 1] **of IDU → FI:**
 - Age, living situation, unstable housing, illicit substances by non-injection, issues with usual activities (EQ-5D), moderate / severe anxiety or depression (EQ-5D), significant liver fibrosis (APRI > 1.5), HIV viral suppression (≤ 50 copies/mL), HCV treatment status, & low income
 - **Time-varying confounders** [visit 2] **of low income → FI:**
 - All of the above (excluding low income) & monetary / non-monetary dietary support, use of nutritionist

- **Data analyses:**




- Estimate an **overall effect**: association via all pathways
- Estimate a **controlled direct effect**:^[18]
 - Association via pathways except that of low income




- **Data analyses:**
 - Direct **regression adjustment** for visit 2 confounders
 - **Blocks** some of IDU's association with FI
 - Alternative to direct adjustment:
 - **Inverse probability weighting**
 - Log-linear **marginal structural models**
 - Risk ratios (RRs)
 - Robust standard errors (for repeated measures)

Results

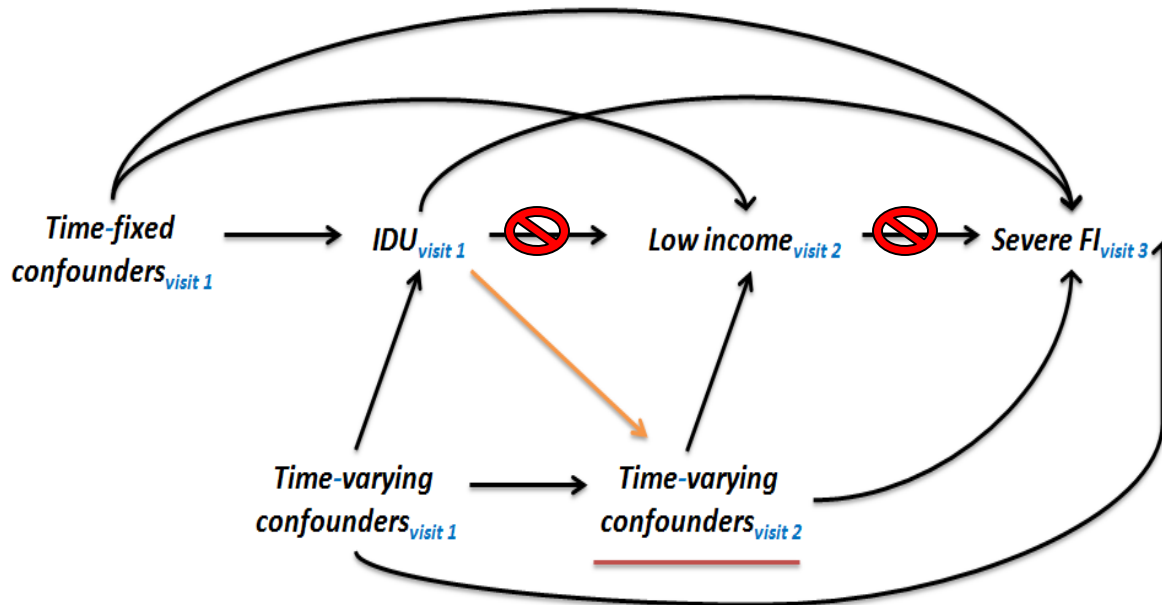
- N = **725** co-infected participants: 17 centres, 6 provinces

Number of participants / total with factor measured (%)	Study visit (2012 – 2015)		
	Visit 1 (N = 725)	Visit 2 (N = 608)	Visit 3 (N = 475)
 Injection drug use (IDU): exposure <i>(in the past 6 months)</i>	230 / 698 (33%)	-	-
 Below LIM-BT (<\$1,847 CAD/month): mediator <i>(over the past 6 months)</i>	-	419 / 508 (83%)	-
 Severe food insecurity (FI): outcome <i>(in the past 6 months)</i>	-	-	118 / 422 (28%)

Results

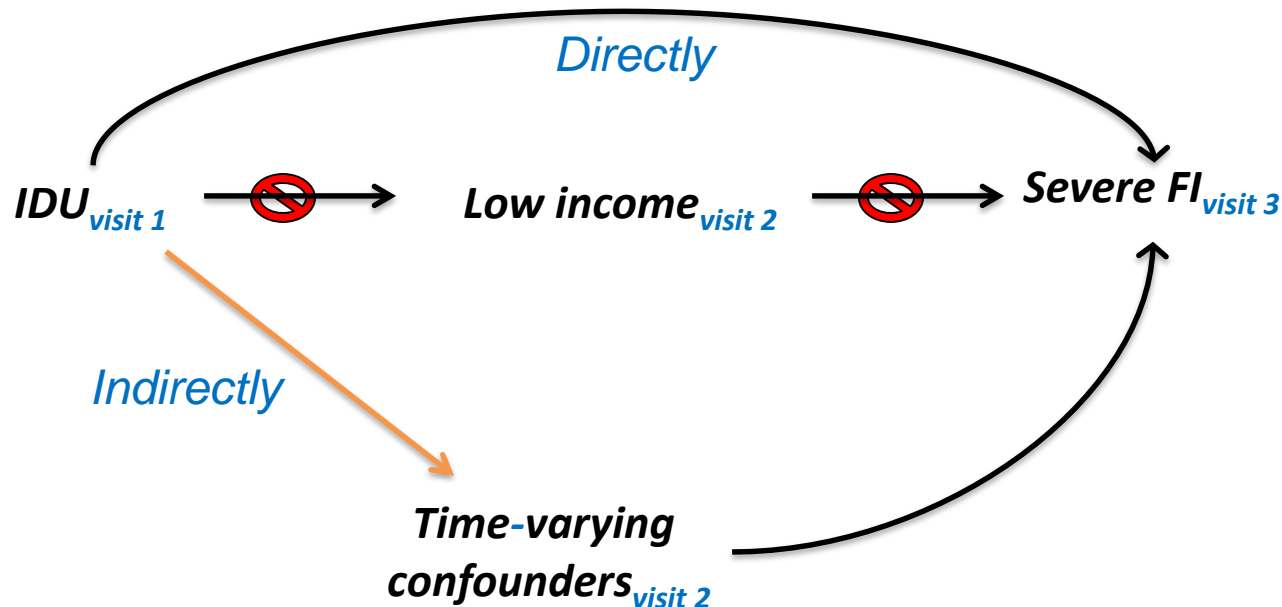
Modeled relationship	Risk Ratio [RR] (95% CI)
Adjusted overall association (via <u>all</u> pathways)	1.61 (1.08-2.40)
Controlled direct effect (all pathways <u>except</u> that of low income) 	1.54 (1.03-2.31)

- Overall association (RR = **1.61**) \approx controlled direct effect (RR = **1.54**)
- Minimal association through low income pathway
- **Therefore:** IDU associated with severe FI primarily through pathways other than low income



Discussion

- Potentially acting **directly**: IDU → severe FI
 - Biologic impact on: appetite & metabolism ^[19]
 - Disrupting food intake patterns
- Potentially acting **indirectly**: IDU → time-varying confounders [visit 2]
 - e.g., IDU → depressive symptoms → FI ^[19]



Limitations

- Unable to model exposure as multi-category indicator of IDU:
 - Frequency, duration, or drug-type
- LIM-BT varies by household size:
 - Single-person: \$1,847 CAD / month
 - 49% live alone (however: no data on household size)
- Unknown: how much of association is through other mediators?
 - e.g., depression / unstable housing
- Observational: residual confounding
 - Unmeasured factors / imperfect measurement
- Numerous self-reported factors: misclassification

Conclusions

- **Evidence:**
 - (1) IDU: independently associated with severe FI (overall)
 - (2) Association between IDU → severe FI may be primarily through pathways other than low income
- **Recommendation:**
 - Given high prevalence of IDU & severe FI in this co-infected population, interventions aimed at injection drug users (e.g., substance abuse treatments) may mitigate severe FI
- **Future research:**
 - Does incorporation of food supports in harm reduction programming reduce severe FI?

Acknowledgements

- **Study participants** across Canada
- **My PhD co-supervisors:** Drs. Joseph Cox & Erica Moodie
- **FS & HIV-HCV Study PIs:** Drs. Anne-Marie Hamelin & Joseph Cox
 - **Funding:** CIHR & CIHR Canadian HIV Trials Network
 - www.hivnet.ubc.ca/clinical-trials/ctn264
- **Canadian Co-infection Cohort:** Dr. Marina Klein & co-investigators & staff
- **Personal stipend support:** **CANOC Centre Doctoral Scholarship Award**
- **Travel support:** **Ontario HIV Treatment Network** (Thank you! 😊)

References



- **[1]** Weiser SD, Young SL, Cohen CR, Kushel MB, Tsai AC, Tien PC, et al. Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. *Am J Clin Nutr* 2011; 94(6):1729S-1739S.
- **[2]** Cox J, Hamelin A-M, McLinden T, Moodie EMM, Anema A, Rollet-Kurhajec KC, et al. Food Insecurity in HIV-Hepatitis C Virus Co-infected Individuals in Canada: The Importance of Co-morbidities. *AIDS Behav* 2016.
- **[3]** Roshanafshar SH, Hawkins E. Health at a glance—food insecurity in Canada. Ottawa: Statistics Canada; 2015.
- **[4]** Andersen SA. Core indicators of nutritional state for difficult to sample populations. *J Nutr*. 1990;120(Suppl. 11):1559–600.
- **[5]** McIntyre L, Lukic R, Patterson PB, Anderson LC, Mah CL. Legislation Debated as Responses to Household Food Insecurity in Canada, 1995–2012. *Journal of Hunger & Environmental Nutrition* 2016:1-15.
- **[6]** McIntyre L, Patterson PB, Anderson LC, Mah CL. Household Food Insecurity in Canada: Problem Definition and Potential Solutions in the Public Policy Domain. *Canadian Public Policy* 2016; 42(1):83-93.
- **[7]** Remis RS. Modelling the incidence and prevalence of hepatitis C infection and its sequelae in Canada, 2007. Ottawa: Public Health Agency of Canada; 2007.
- **[8]** Braitstein P, Montessori V, Chan K, et al. Quality of life, depression and fatigue among persons co-infected with HIV and hepatitis C: outcomes from a population-based cohort. *AIDS Care*. 2005;17(4):505–15.
- **[9]** Mrus JM, Sherman KE, Leonard AC, Sherman SN, Mandell KL, Tsevat J. Health values of patients coinfecting with HIV/Hepatitis C: are two viruses worse than one? *Med Care*. 2006;44(4): 158–66.
- **[10]** Rourke SB, Sobota M, Tucker R, et al. Social determinants of health associated with hepatitis C co-infection among people living with HIV: results from the Positive Spaces, Healthy Places study. *Open Med*. 2011;5(3):e120.
- **[11]** Singer AW, Weiser SD, McCoy SI. Does Food Insecurity Undermine Adherence to Antiretroviral Therapy? A Systematic Review. *AIDS Behav* 2015; 19:1510-1526.
- **[12]** Aibibula W, Cox J, Hamelin AM, McLinden T, Klein MB, Brassard P. Association between food insecurity and HIV viral suppression: a systematic review and meta-analysis (Abstract 009). *Am J Epidemiol* 2016; 184(1):78-80.
- **[13]** Aibibula W, Cox J, Hamelin AM, Mamiya H, Klein MB, Brassard P. Food insecurity and low CD4 count among HIV-infected people: a systematic review and meta-analysis. *AIDS Care* 2016; 28(12):1577-1585.
- **[14]** Anema A, Chan K, Chen Y, Weiser SD, Montaner JS, Hogg RS. Relationship between food insecurity and mortality among HIV-positive injection drug users receiving antiretroviral therapy in British Columbia, Canada. *PLoS ONE*. 2013;8(5):e61277.
- **[15]** Klein MB, Saeed S, Yang H, et al. Cohort profile: the Canadian HIV-hepatitis C co-infection cohort study. *Int J Epidemiol*. 2010;39(5):1162–9.
- **[16]** Statistics Canada. Low-income measure before tax (LIM-BT). In. Ottawa; 2016. pp. <https://www12.statcan.gc.ca/nhs-enm/2011/ref/dict/fam2022-eng.cfm>.
- **[17]** Health Canada. Canadian Community Health Survey, Cycle 2.2, Nutrition (2004): Income-Related Household Food Security in Canada Ottawa 2004. http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/income_food_sec-sec_alim-eng.php. Accessed 25 Oct 2016.
- **[18]** VanderWeele TJ. *Explanation in Causal Inference: Methods for Mediation and Interaction*. Oxford University Press; 2015.
- **[19]** Anema A, Mehra D, Weiser SD, Grede N, Vogenthaler N, Kerr T. Drivers and Consequences of Food Insecurity Among Illicit Drug Users (Chapter 20). New York: Elsevier Publishing Inc; 2015.