Incidence of Diabetes Mellitus among people living with HIV compared with HIV negative individuals in British Columbia between 2001-2013

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Background

- Significant progress has been made in the treatment and control of HIV, narrowing the gap in life expectancy compared to the general population.

- Due to their complex medical and social histories, people living with HIV (PLHIV) are increasingly at risk of developing age-related comorbidities such as Diabetes Mellitus (DM).

- While DM is associated with elevated mortality and morbidity worldwide, there is limited understanding of DM-related risks among PLHIV.

- The association between HIV serostatus and incidence of DM is a controversial issue; while some studies have found an increased burden of DM amongst PLHIV compared to the general population, there is also evidence suggesting that the risk of developing DM is similar between the two populations, and some studies found that DM incidence is lower in HIV-positive individuals.

Objective: *This study aims to assess the incidence of DM amongst PLHIV and their matched HIV-negative counterparts in British Columbia (BC) by exploring the relationship between HIV serostatus and DM incidence in BC between 2001-2013.*

Methods

Data sources: *The Comparative Outcomes and Service Utilization Trends (COAST) Study*, which includes longitudinal clinical data linked with administrative health and demographic data for all PLHIV ≥19 years of age in BC and a 10% random sample of BC general population ≥19 years of age.

Study design: population-based longitudinal cohort study.

Study population:

- We included all PLHIV who were ARV naïve at COAST baseline, and a comparison sample including 1:5 age-sex-matched HIV-negative individuals who were assigned the same baseline as their matched PLHIV. All participants had ≥5 years history data prior to baseline, and ≥1-year follow-up post baseline.

- *Sensitivity analysis*: We applied the same inclusion criteria as above and censored all PLHIV at their first ART date.

Observation period: Individuals were followed up from April 1st, 2001 or upon individuals' entry in COAST, until DM diagnosis, loss to follow-up, or end of COAST follow-up (March 31st , 2013).

Incidence of DM (outcome):

- DM cases were identified using the DM case definition published by the BC Ministry of Health and applied to hospitalization, physician billing and drug dispensation datasets.

- Incident cases of DM were identified using a 5-year run-in period. All DM cases identified within the run-in period were considered prevalent cases and were therefore excluded from the analyses.

Statistical analysis:

- We estimated the incidence rate ratio per 1000 person-years (PYs) using a Poisson regression model adjusted for the following *key confounders*: sex, age at baseline, health authority, neighborhood income quintile, history of intravenous drug use prior to baseline, and history of hypertension prior to baseline.

- A two-sided Mann- Kendall trend test, was used to analyze the trend in incident DM across follow-up time for the HIV-positive and HIV-negative samples between 2001-2013.

British Columbia Centre for Excellence in HIV/AIDS · COAST · UBC · SFU · populationdata BC · CIHR IRSC · Providence Health Care · British Columbia Ministry of Health

Results

Among the 2,792 PLHIV and 13,869 people without HIV included in our study, 129 PLHIV and 636 matched HIV-negative individuals had incident DM.

Post age-sex-matching, all participants had a median age of 40.3, and were predominantly male (79%).

Table 1. Characteristics of people living with HIV and their HIV-negative counterparts included in the study

	PLHIV (n=2,792)	People without HIV (n= 13,869)	p-values
DM incidence (n, %)	129 (4.6)	636 (4.6)	0.9365
Median age in years at baseline (Q1, Q3)	40.3 (33, 48)	40.3 (33, 48)	0.7900
Median follow-up time in months (Q1, Q3)	74.5 (43.6, 106.8)	76.5 (44.7, 108.9)	0.0847
Male (n, %)	2220 (79.5)	10967 (79.1)	0.6038
Health Authority (n, %)			
Interior	175 (6.3)	2225 (16)	
Fraser	601 (21.5)	4617 (33.3)	<.0001
Vancouver Coastal	1466 (52.5)	3453 (24.9)	
Vancouver Island	348 (12.5)	2254 (16.3)	
Northern	193 (6.9)	990 (7.1)	
Neighborhood income (SES) quintile, (n, %)			
Lowest (1)	1092 (39.1)	2732 (19.7)	
Second lowest (2)	547 (19.6)	2751 (19.8)	
Middle (3)	500 (17.9)	2839 (20.5)	<.0001
Second highest (4)	360 (12.9)	2695 (19.4)	
Highest (5)	269 (9.6)	2559 (18.5)	
IDU* (n, %)	931 (33.4)	511 (3.7)	<.0001
Hypertension* (n, %)	183 (6.6)	1193 (8.6)	0.0003

Abbreviations: DM- diabetes mellitus; PLHIV- people living with HIV; SES- socio-economic status; IDU- injection drug use. *Notes*: *prior to baseline

Figure 1: Diabetes Mellitus Incidence Rates per 1000 person-years (PYs) from 2001 to 2013 among HIV+ and HIV- individuals

Kendall trend tests:
HIV+ P= 0.5833
HIV- P= 0.4106
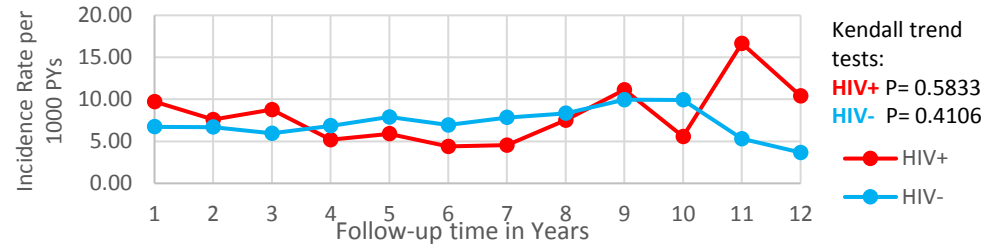
- After adjusting for key confounders, HIV serostatus was not associated with DM incidence (Table 2).
- However, when PLHIV were followed up to the time of ART initiation in our sensitivity analysis (median [Q1-Q3] follow-up time in months: 12.7 [2.1, 38.6)]), PLHIV had 4.05 higher risk of developing DM when compared to their HIV-negative counterparts (Table 2).
- Incidence of DM did not significantly increase with duration of follow-up time (Figure 1).

Table 2. Association between HIV serostatus and DM incidence

Main Model	aRR	95% CI
HIV serostatus		
Negative (ref)	1.00	
Positive	1.03	0.83- 1.27
Sensitivity analysis*		
HIV serostatus		
Negative (ref)	1.00	
Positive	4.05	3.27- 5.03

Abbreviations: DM- diabetes mellitus; aRR: adjusted (incidence) rate ratio; CI: confidence interval.
Notes: *person years for PLHIV were included up to ART initiation; *key confounders for both models* included: age at baseline, sex, health authority, neighbourhood income quintile, intravenous drug use prior to baseline, and history of hypertension prior to baseline

Only prior to ART initiation, we observed a **significantly higher DM incidence in PLHIV** compared to their HIV-negative counterparts in BC between 2001-2013.

Discussion and Conclusion

- *HIV seropositivity was **not** associated with DM incidence in the presence of ART exposure*; this could be explained by the increased healthcare engagement of PLHIV on ART. Regular HIV monitoring of these individuals could mean that their risk of DM is also monitored, which could potentially be beneficial in terms of addressing DM risk factors early on.

- After adjustment for confounding, *HIV seropositivity **was strongly associated** with the risk of developing DM **among PLHIV who were never exposed to ART** in BC between 2001- 2013.*

- Further studies should investigate the impact of ART on the risk of developing DM among people with HIV when compared to HIV-negative individuals

Disclaimer: All inferences, opinions, and conclusions drawn in this paper are those of the authors, and do not reflect the opinions of policies of the Data Stewards or funders.

Conflict of Interest Declaration: I have no conflicts of interest.