Western University
Scholarship@Western

Epidemiology and Biostatistics Publications

Epidemiology and Biostatistics Department

10-1-2018

Substance Use Patterns Among Women Living with HIV Compared with the General Female Population of Canada

Mostafa Shokoohi
mshokooh@uwo.ca

Greta R Bauer

Angela Kaida

Ashley Lacombe-Duncan

Mina Kazemi

See next page for additional authors

Follow this and additional works at: https://ir.lib.uwo.ca/epidempub

Part of the Biostatistics Commons, and the Epidemiology Commons

Authors

Mostafa Shokoohi, Greta R Bauer, Angela Kaida, Ashley Lacombe-Duncan, Mina Kazemi, Brenda Gagnier, Alexandra de Pokomandy, and Mona Loutfy

Full length article

Substance use patterns among women living with HIV compared with the general female population of Canada

Mostafa Shokoohi[a, *]

mshokooh@uwo.ca

Greta R. Bauer[a]

Angela Kaida[b]

Ashley Lacombe-Duncan[c]

Mina Kazemi[d]

Brenda Gagnier[d]

Alexandra de Pokomandy[e, f]

Mona Loutfy[d, g, h]

On Behalf of the CHIWOS Research Team

[a]Epidemiology and Biostatistics, Schulich School of Medicine and Dentistry, The University of Western Ontario, London, Ontario, Canada

[b]Faculty of Health Sciences, Simon Fraser University, Burnaby, British Columbia, Canada

[c]Factor-Inwentash Faculty of Social Work, University of Toronto, Toronto, Ontario, Canada

[d]Women's College Research Institute, Women's College Hospital, Toronto, Ontario, Canada

[e]Department of Family Medicine, McGill University, Montreal, Quebec, Canada

[f]McGill University Health Centre, Montreal, Quebec, Canada

[g]Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada

[h]Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

*Corresponding author at: Department of Epidemiology and Biostatistics, The University of Western Ontario, K201 Kresge Bldg., London, Ontario, N6A 5C1, Canada.

Abstract

Background

HIV infection and substance use synergistically impact health outcomes of people with HIV. In this study, we assessed the prevalence of substance use among women living with HIV (WLWH) and compared them with expected values from general data.

Methods

Cigarette smoking, frequency of alcohol consumption, last-month non-prescribed cannabis use (vs. last-year use), and last 3 months regular (≥once/week) and occasional (<
2015 Canadian HIV Women's Sexual and Reproductive Health Cohort Study (CHIWOS; N = 1422) and compared with general population women from the 2013–2014 Canadian Community Health Survey (CCHS; N = 46,831). Age/ethnoracial-standardized prevalence differences (SPD) and 95% confidence intervals (CI) were reported.

Results

Compared to expected estimates from general population women, a higher proportion of WLWH reported daily cigarette smoking (SPD: 26.8% [95% CI: 23.9, 29.7]), smoking ≥20 cigarettes/day (SPD: 11.6% [9.8, 13.6]), regular non-prescribed cannabis use (SPD: 8.0% [4.1, 8.6]), regular crack/cocaine use (SPD: 16.7% [13.1, 20.9]), regular/occasional speed use (SPD: 2.4% [1.2, 4.7]), and heroin use (SPD: 11.2% [8.3, 15.0]). However, WLWH reported lower frequencies of alcohol consumption and binge drinking than their counterparts in the general population.

Conclusions

Cigarette smoking and illicit drug use, but not alcohol use or binge drinking, were more prevalent in WLWH than would be expected for Canadian women with a similar age and ethnoracial group profile. These findings may indicate the need for women-centered harm reduction programs to improve health outcomes of WLWH in Canada.

1 Introduction

Substance use is a common health risk behavior among people living with HIV (PLWH), who have a demonstrated greater prevalence than their general population counterparts (Ikeda et al., 2016; Mdodo et al., 2015; Tron et al., 2014). Substance use is considered a major barrier to successful HIV care and treatment (Cofrancesco et al., 2008; Cook et al., 2009; Durvasula and Miller, 2014; Gonzalez et al., 2011; Hicks et al., 2007; Malta et al., 2008) despite the substantial advances obtained from combination antiretroviral therapy (cART), e.g., improved life expectancy in PLWH (Antiretroviral Therapy Cohort Collaboration, 200 (Here is the reference that looked like being missed but it should be actually cited here as: (Antiretroviral Therapy Cohort Collaboration, 2008))8). Substance use independently or by interaction with other factors such as psychiatric disorders and socioeconomic marginalization has the potential to limit the remarkable benefits of cART and pose additional barriers to HIV prevention efforts and medical care (Durvasula and Miller, 2014; Feldman et al., 2006; Gonzalez-Serna et al., 2014; Gonzalez et al., 2011; Hicks et al., 2007; Malta et al., 2008; Petoumenos and Law, 2016; Vagenas et al., 2015).

Previous studies have reported the negative impacts of tobacco smoking (Feldman et al., 2006), problematic alcohol consumption (Vagenas et al., 2015), and illicit drug use (e.g., heroin) (Cofrancesco et al., 2008; Hicks et al., 2007) on HIV care cascade outcomes such as cART non-adherence. The optimal levels of these outcomes are critical in promoting the health of PLWH and maintaining treatment as prevention (TasP) targets (Cohen et al., 2016). Beyond its interruption of care and treatment, substance use can also interfere with cART metabolism and virological response (Barve et al., 2010; Kumar et al., 2015), and contribute to excess mortality (Feldman et al., 2006; Helleberg et al., 2015). For example, in a study of 17,995 PLWH on treatment, smoking increased the rate of death by 1.94 times, with 1.84 and 2.41 times in men and women with HIV, respectively (Helleberg et al., 2015).

Substance use vulnerability appears to have greater impacts on HIV and clinical outcomes among women than men with HIV. For example, women with injection drug use (IDU) history and Indigenous ancestry had lower optimal adherence to treatment (47.8%) relative to their male HIV-positive counterparts with (57.7%) and without (83.8%) such vulnerabilities (Puskas et al., 2017). Women with IDU history were also found to be 18% less likely to achieve HIV RNA viral suppression than their male counterparts (Cescon et al., 2013). Other than the unique experiences of HIV infection among women (e.g., pregnancy), drug use along with greater experiences of other psychosocial, economic and structural challenges may account for gender-related differences in HIV outcomes (Cescon et al., 2013; Kuyper et al., 2004; Wood et al., 2008).

However, substance use prevalence among women living with HIV (WLWH) has not been well-characterized, particularly in Canada. Population-based research has either overlooked collecting data on WLWH or has not had the adequate sample size to provide estimates for WLWH and comparisons to the broader population (Loutfy et al., 2013; Webster et al., 2018). Women now constitute more than half of all individuals living with HIV worldwide (UNAIDS, 2014) and represent nearly one-fourth of the estimated 75,500 PLWH in Canada; almost doubled from the 1990s (Public Health Agency of Canada, 2015). Understanding the prevalence of substance use in a geographically diverse sample of WLWH relative to general population women is important because of the profound implications for HIV management and to assess the need for harm reduction and socio-structural supports for women who use substances.

Therefore, the objective of this research was to characterize the prevalence of cigarette smoking, alcohol consumption, non-prescribed cannabis use, and illicit drug use from the Canadian HIV Women's Sexual and Reproductive Cohort Study (CHIWOS), a large community-based research of WLWH in Canada. We estimated the prevalence for substance use in CHIWOS and compared them with data from HIV-negative women of the general population, standardized to the age/ethnoracial distribution of WLWH. Our aim was to document substance use disparities between WLWH, to explore differences based on HIV status and to identify needs with regard to resource allocation, particularly given the implications of substance use in the context of HIV-related medical care.

2 Methods

2.1 Participants

2.1.1 CHIWOS Sample

We used data from the baseline survey of the Canadian HIV Women's Sexual and Reproductive Health Cohort Study (CHIWOS) conducted between 2013 and 2015. CHIWOS is a large community-based research of WLWH (≥16 years; trans-inclusive: 3.8%), residing in British Columbia (BC), Ontario, and Quebec. Study design and sampling procedure were published elsewhere (Loutfy et al., 2017). Briefly, applying the Meaningful Involvement of Women Living with HIV/AIDS (MIWA) principle, reflecting the recognition of the rights and responsibilities of individuals living with HIV as equal partners to actively engage throughout the design and delivery of HIV/AIDS services to strengthen the responses to HIV/AIDS epidemics (UNAIDS, 2007). A sample of 1422 WLWH was recruited from HIV clinics, AIDS Service Organizations, peers, and online networks (Webster et al., 2018). The survey was administered by Peer Research Associates (PRAs), many of whom also shared the experience of living with HIV were hired and trained in community-based research conduction (Loutfy et al., 2017). The averaged 120-minute-long surveys were administered either through in-person interviews at the clinic, community sites, at the participants' homes or via phone/Skype. CHIWOS was approved by the Research Ethics Boards of Simon Fraser University, University of British Columbia/Providence Health, Women's College Hospital and McGill University Health Centre.

2.1.2 CCHS Sample

We used data from the 2013–2014 cycle of the Canadian Community Health Survey (CCHS), a nation-wide cross-sectional survey administered by Statistics Canada. Detailed documentation is available elsewhere (Canadian Community Health Survey, 2013). Briefly, CCHS is designed to provide nationally representative estimates on health status, health care utilization, and health determinants of Canadians aged 12 years or older residing in private dwellings of all provinces and territories (~98% coverage), excluding populations living on reserves/Indigenous settlements, institutions, Canadian Force Bases, and some remote regions. Data are collected using computer-assisted personal and telephone interview software. Consistent with CHIWOS, CCHS analyses were restricted to women aged ≥16 years old, residing in the three provinces (analytic sample = 46,851). Measures of cigarette smoking, alcohol consumption, non-prescribed cannabis use and illicit drug use with similar content and wording were compared between the two surveys.

2.2 Measures

Although cigarette smoking and alcohol consumption were collected from all CCHS respondents, measures of drug use were not collected in Ontario and Quebec; for comparability, we provided estimates of drug use for only BC in CHIWOS.

2.2.1 Cigarette Smoking

In CHIWOS, cigarette smoking history was measured as, "What is your cigarette (tobacco) smoking history?" with four response options (regular, occasional, former, and never). In CCHS, the same question was asked with three response options (daily, occasionally, not at all). To be consistent with the CCHS definition, we categorized WLWH who reported at least one cigarette/day (equivalently, at least 30 cigarettes/month) as "daily" smokers irrespective of how they were self-identified. As such, 67 self-identified occasional smokers were re-coded as daily smokers, and two cases who reported cigarette smoking regularly were re-coded as occasional smokers. Two measures were created to compare the two surveys: a) nonsmokers at the time of interview (i.e., former or none) versus current smokers (i.e., daily or occasional), and b) a three-category measure: nonsmokers, occasional smokers, and daily smokers. We also reported cigarette smoking intensity/quantity among current smokers. A five-category measure was created to compare the two surveys: nonsmokers (former or never), <1 cigarette/day or <30 cigarettes/month, 1–10 cigarettes/day, 11–19 cigarettes/day, and ≥20 cigarettes/day.

2.2.2 Alcohol Consumption

Last-year alcohol consumption pattern was examined in both CHIWOS and CCHS. A four-category comparable measure was created in each survey: none (did not drink in the past 12 months), ≤1 time/week, 2–3 times/week, and ≥4 times/week.

CCHS measured the monthly pattern of binge drinking as, "How often in the past 12 months have you had 4 or more drinks on one occasion?" with six response categories: never, less than once a month, once a month, 2–3 times a month, once a week, and more than once a week. The same question but in the last month was measured in CHIWOS, with an open-ended response option indicating the number of times. Binge drinking was compared between the two surveys under the assumption that past-year binge drinking patterns were consistent with past month. We created a measure with similar response categories: no alcohol consumed, alcohol consumed but no binge drinking, binge drinking less than once a week (i.e., equivalently, less than 3 times a month), and binge drinking at least once a week (i.e., equivalently, four times or more a month). In CHIWOS, 33 women reported last-month binge drinking without specifying the number of times over the last month; therefore, instead of treating them as missing values, we categorized them into "less than once a week."

2.2.3 Drug Use

We compared the use of the following drugs available in the two surveys in BC: cannabis, cocaine or crack, speed (amphetamine), and heroin. CCHS asked respondents, "Have you used [any of these drugs] in the past 12 months?", affirmative responses were further followed, "How often [did you use any of these drugs in the past 12 months]?" with the following response options: less than once/ month, 1–3 times/month, once/week, more than once/week, and every day. CHIWOS measured cannabis use as, "What is your cannabis use history?" with the following response categories: a) regularly in the last 30 days, b) occasionally in the last 30 days, c) used in the past year but not in the past 30 days, d) used in the past but not in the past year,

e) never used or only ever used it once or twice. To be consistent with CCHS, CHIWOS's response options 'b' and 'c' were considered as occasional cannabis use. CHIWOS participants with a positive history of cannabis use were also followed, "Have you used cannabis mainly for medicinal reasons or recreational reasons, or both?" We re-coded medicinal (prescribed) use of cannabis use as non-recreational use, while any other recreational reasons (alone or in combination with medicinal use) were considered as non-prescribed cannabis use. This distinction was made as CCHS aimed to measure the use of illicit drugs, but not prescription drugs.

CHIWOS assessed the use of crack or cocaine, speed, and heroin over the last 3 months. Positive responses were additionally followed to measure the frequency of use as, daily, at least once/week, and less than once/week. The same information was assessed in CCHS, but over the past year. Crack and cocaine use were measured in one single question in CCHS, while CHIWOS measured them separately. Therefore, daily use of any of these two drugs was considered as daily crack or cocaine use.

For comparison, we created a three-category measure for cannabis use and crack or cocaine use as: none (i.e., former or never), occasional (< once/week), and regular use (≥ once/week). As the absolute "n" for speed (amphetamine) and heroin use did not meet the minimum CCHS vetting guideline, we combined regular and occasional use and then created a binary variable for each of these two drugs: none vs. occasional/regular use.

2.3 Data Aanalysis

We reported the prevalence and the 95% confidence intervals (CI) of each substance from the CHIWOS sample. We then obtained the prevalence of the same substances from the CCHS sample, using sampling weights that Statistics Canada assigned each respondent to correspond to the number of Canadian residents they represent. The bootstrap variance estimation technique using a set of 500 replicates was used to obtain the 95% CI of the CCHS estimates (Rust and Rao, 1996). To address the imbalanced distribution of age and ethnoracial groups, we used a standardization method which combines stratum-specific prevalence into a single summary estimate through taking a weighted average (Rothman et al., 2008). Standardization obtains these weights in averaging from a *standard* population. In the present study, these weights were obtained from the CHIWOS dataset and applied to CCHS data. To do this, we created a 16-category variable representing CHIWOS's age and ethnoracial group distribution (i.e., four age categories: 16-35, 36-45, 46-35, 36-45, 46-55, or >55; four ethnoracial categories: white, African, Caribbean, Black (ACB), Indigenous, or other/multi-ethnicities). We then applied CHIWOS's age and ethnoracial group distribution to CCHS in order to produce a second set of estimates in which CCHS and CHIWOS samples had a similar distribution with respect to these two variables.

The standardized prevalence differences (SPD) were reported to quantify the differences between the two surveys for each substance use. The SPD is a commonly used measure for the purpose of population health assessment and provides information on the public health impact. The SPD was computed by subtracting the CCHS *expected* estimates standardized to age and ethnoracial groups from the CHIWOS *observed* estimates; with an SPD greater than zero (i.e., the null) denoting a greater prevalence of the given substance in WLWH. The SPD's 95% CI was provided using the methods of variance estimates recovery (MOVER) (Zou and Donner, 2008), with 95% CI excluding 0 indicating statistical significance at $p < 0.05$. The analyses were performed using Stata version 15.

3 Results

3.1 Demographics

WLWH differed from the unstandardized general population data by age and ethnoracial groups as well as relationship status, education and yearly personal income levels (Table 1). Greater proportions of women in the unstandardized general population were older and belonged to the white ethnoracial group than WLWH. Other characteristics of these two samples are presented in Table 1, along with the prevalence in the standardized CCHS data. After standardization, the CCHS estimates had identical age and ethnoracial group structure. All subsequent comparisons of substance use were conducted using standardized data.

Table 1 The distribution of age, ethno-racial groups, relationship status, education status, and yearly personal income in the cohort of women with HIV compared with the assumed HIV-negative women of the general population in Canada.

alt-text: Table 1

	CHIWOS estimates (N = 1422)		CCHS estimates (N = 46,851)[a]		
	N	% (95% CI)	N	Unstandardized % (95% CI)	Standardized % (95% CI)[d]
Ethno-racial and age groups					
White					
16-35 (years)	145	10.2 (8.7, 11.9)	8,749	21.1 (20.6, 21.7)	10.2[e]
36-45	162	11.4 (9.8, 13.2)	4,582	11.2 (10.6, 11.5)	11.4

46–55	178	12.5 (10.9, 14.3)	5,775	13.9 (13.4, 14.5)	12.5
>55	99	7.0 (5.7, 8.4)	12,020	29.0 (28.5, 29.6)	7.0
Black					
16 351077.5 (6.3, 9.0)4571.1 (0.9, 1.3)7.5 36–35	107	7.5 (6.3, 9.0)	457	1.1 (0.9, 1.3)	7.5
36–45	163	11.5 (9.9, 13.2)	280	0.7 (0.5, 0.9)	11.5
46–55	111	7.8 (6.5, 9.3)	333	0.8 (0.6, 1.1)	7.8
>55	37	2.6 (1.9, 3.6)	268	0.7 (0.5, 0.8)	2.6
Indigenous					
16–35	100	7.0 (5.8, 8.5)	424	1.0 (0.9, 1.2)	7.0
36–55	120	8.4 (7.1, 10.0)	161	0.4 (0.3, 0.5)	8.4
36–45	74	5.2 (4.2, 6.5)	176	0.4 (0.3, 0.5)	5.2
46–55	24	1.7 (1.1, 2.5)	255	0.6 (0.5, 0.7)	1.7
Others					
16 16–35	20	1.4 (0.9, 2.2)	3,286	7.9 (7.4, 8.4)	1.4
36–45	34	2.4 (1.7, 3.3)	1,837	4.4 (4.0, 4.9)	2.4
46–55	37	2.6 (1.9, 3.6)	1,271	3.1 (2.7, 3.5)	2.6
>55	11	0.8 (0.4, 1.4)	1,539	3.7 (3.4, 4.1)	0.8
Relationship status					
Single	689	48.7 (46.1, 51.3)	10,438	24.3 (23.7, 24.8)	26.6 (24.6, 28.7)
Married, common-law	545	32.1 (29.7, 34.6)	24,971	58.0 (57.3, 58.7)	55.3 (52.7, 57.9)
Separated/divorced/widowed	271	19.2 (17.2, 21.3)	7,636	17.7 (17.2, 18.3)	18.1 (15.8, 20.4)
Education status					
Less than high school	227	16.1 (14.2, 18.1)	6,568	15.4 (14.9, 16.0)	12.3 (11.0, 13.6)
High school completed	532	37.6 (35.1, 40.2)	10,514	24.7 (24.0, 25.4)	23.9 (21.9, 25.9)
Diploma/trade/college	456	32.2 (29.8, 34.7)	12,998	30.6 (29.8, 31.3)	35.9 (33.4, 38.4)
University degree (≥Bachelor's degree)	200	14.1 (12.4, 16.1)	12,474	29.3 (28.6, 30.1)	27.9 (25.4, 30.4)
Yearly personal income[b]					
<20,000 CAD[c]	997	70.3 (67.8, 72.6)	12,263	29.1 (28.4, 29.9)	28.1 (26.1, 30.0)
20,000 to <40,000 CAD	244	17.2 (15.3, 19.3)	10,425	24.8 (24.1, 25.5)	24.5 (22.4, 26.7)
≥ 40,000 CAD	144	10.1 (8.7, 11.8)	12,620	30.0 (29.2, 30.8)	33.1 (30.4, 35.8)
Not stated	34	2.4 (1.7, 3.3)	6,795	16.1 (15.5, 16.8)	14.3 (12.3, 16.3)
Trans women	54	3.8 (2.9, 4.9)	--- [f]	---[f]	---[f]

Overall 83% and 87% of WLWH reported taking HIV medication and having a suppressed viral load (i.e., <50 c/mL), respectively. The median time living with HIV since diagnosis was 11 years (IQR: 7, 17) (data not shown).

3.2 Cigarette smoking (Table 2)

A higher prevalence of cigarette smoking frequency and intensity was reported among WLWH compared with estimates expected based on the age-/ethnoracial-standardized women of the general population. Current cigarette smoking (i.e., daily/occasional) was reported by 43.7% of WLWH relative to 17.8% of the expected estimates of general population (SPD 25.9%), indicating that 25.9% (i.e., 259 per 1000) of WLWH reported current cigarette smoking, in excess of what would be expected of Canadian women of similar ages/ethnoracial backgrounds. Daily cigarette smoking was reported by 40.7% of WLWH versus 13.9% of expected estimates from general population women (SPD 26.8%). WLWH tended to smoke a cigarette more intensely than the expected estimates of the general population.

Table 2 Comparison of cigarette smoking between women with HIV (N = 1422) and assumed HIV-negative women of the general population (N = 46,851).

alt-text: Table 2

Cigarette smoking measures	CHIWOS	CCHS estimates		SPD[d]
		CCHS[b]	AER Std.[c]	
Overall cigarette smoking				
Non-smoker (i.e., former/never)	56.3 (53.7, 58.9)[a]	84.3 (83.7, 84.9)	82.2 (80.8, 83.7)	-25.9 (-28.9, -25.9 (−28.9, −22.9)
Current smokers (i.e., daily/occasional)	43.7 (41.1, 46.3)	15.7 (15.1, 16.3)	17.8 (16.3, 19.2)	25.9 (22.9, 28.9)
Current cigarette smoking status				
Non-smoker (i.e., former/never)	57.0 (54.4, 59.6)	84.3 (83.7, 84.9)	82.2 (80.8, 83.7)	-25.2 (-28.2, -25.2 (−28.2, −22.2)
Occasional smokers[e]	2.3 (1.6, 3.2)	3.8 (3.5, 4.2)	3.9 (3.2, 4.6)	-1.6 (-2.6, -1.6 (−2.6, −0.5)
Daily smokers[f]	40.7 (38.1, 43.3)	11.9 (11.3, 12.4)	13.9 (12.5, 15.2)	26.8 (23.9, 29.7)
Intensity of cigarette smoking				
Non-smoker (i.e., former/never)[g]	57.0 (54.4, 59.6)	84.4 (83.8, 85.0)	82.4 (80.9, 83.9)	-25.4 (-28.4, -25.4 (−28.4, −22.4)
<1 cig/day or <30 cig/month	2.3 (1.6, 3.2)	2.5 (2.3, 2.8)	2.5 (2.1, 2.9)	-0.2 (-−0.2 (−1.0, 0.8)
1 to 10 cig/day	20.4 (18.3, 22.6)	6.6 (6.2, 7.0)	7.8 (6.7, 9.0)	12.6 (10.2, 15.1)

| >10 to <20 cig/day | 5.4 (4.4, 6.8) | 3.2 (2.9, 3.4) | 4.0 (3.2, 4.8) | 1.4 (0.1, 3.0) |
| ≥ 20 cig/day | 14.9 (13.1, 16.9) | 3.3 (3.0, 3.6) | 3.3 (2.8, 3.8) | 11.6 (9.8, 13.6) |

[a] Data are % (95% CI).

[b] Unstandardized weighted estimates are reported and the 95% CI was constructed using bootstrap method.

[c] Age- and ethno-racial-standardized expected estimates based on women of the general population from CCHS.

[d] SPD: standardized prevalence difference (% (95% CI)); the 95% CI was constructed using MOVER algorithm.

[e] Occasional smokers (<1 cigarette/day or <30 cigarettes/month).

[f] Daily smokers (≥1 cigarettes/day or ≥30 cigarettes/month).

[g] Because of missing values in variable intensity of cigarette smoking, the proportion of the first and second categories if different from the same categories in variable current cigarette smoking status, while the absolute numbers is the same.

3.3 Alcohol ~~C~~consumption (Table 3)

WLWH more frequently reported no alcohol consumption compared with the expected estimates (40.7% vs. 28.0%). The proportion of alcohol consumption categories among WLWH than expected estimates from standardized general population data was: 46.8% vs. 52.2% consumed alcohol ≤1 time/week, 7.0% vs. 12.9% consumed alcohol 2–3 times/week, and 5.5% vs. 6.9% consumed alcohol 4+ times/week. The monthly pattern of binge drinking in WLWH was: 15.4% vs. 30.6% for less than once/week (SPD −15.2%), and 4.6% vs. 3.9% for at least once/week (SPD 0.7%). The combination of these two categories showed that 20.0% of WLWH reported binge drinking at least once/month compared with 34.5% in women of the general population.

Table 3 Comparison of alcohol consumption between women with HIV (N = 1422) and assumed HIV-negative women of the general population (N = 46,851).

alt-text: Table 3

	CHIWOS	CCHS estimates		SPD[d]
		CCHS[b]	AER Std.[c]	
Alcohol consumption frequency				
None (Never/none in specified time)	40.7 (38.2, 43.3)[a]	24.5 (23.7, 25.4)	28.0 (25.4, 30.5)	12.7 (9.1, 1.4)
≤1 time a week	46.8 (44.2, 49.4)	51.3 (50.4, 52.1)	52.2 (49.6, 54.8)	~~-5.4(-9.1, -1.7)2~~ −5.4 (−9.1, −1.7)
2–3 times a week	7.0 (5.7, 8.4)	15.1 (14.5, 15.7)	12.9 (11.5, 14.1)	~~-5.9(-7.7, -~~ −5.9 (−7.7, −3.9)
4+ times a week	5.5 (4.4, 6.8)	9.1 (8.7, 9.5)	6.9 (5.8, 8.1)	~~-~~ −1.4 (-3.0, 0.4)
Binge drinking categories[e]				
No alcohol consumed	41.0 (38.5, 43.7)	24.6 (23.8, 25.5)	28.0 (25.4, 30.6)	13.0 (9.4, 16.7)
Alcohol consumed, not binge	39.0 (36.4, 41.5)	40.3 (39.5, 41.1)	37.5 (34.9, 40.0)	1.5 (-−2.1, 5.1)
Binge drinking less than once a week	15.4 (13.6, 17.4)	30.9 (30.1, 31.7)	30.6 (28.7, 32.4)	~~-15.2(-17.8, -~~ −15.2 (−17.8, −12.6)

Binge drinking at least once a week	4.6 (3.6, 5.9)	4.2 (3.9, 4.5)	3.9 (3.3, 4.4)	0.7 (−0.3, 2.1)

[a] Data are % (95% CI).

[b] Unstandardized weighted estimates are reported and the 95% CI was constructed using bootstrap method.

[c] Age- and ethno-racial-standardized expected estimates based on women od the general population from CCHS.

[d] SPD: standardized prevalence difference (% (95% CI)), and the 95% CI was constructed using MOVER algorithm.

[e] CHIWOS measured the last-month pattern of binge drinking, while CCHS measured the last-year pattern of binge drinking.

3.4 Drug use (Table 4)

Last-month non-prescribed cannabis use in WLWH from BC was almost two times greater than the last-year use of this drug from women of the general population in BC: 14.6% vs. 6.6% reported regular use (SPD 8.0%), and 18.1% vs. 6.1% reported occasional use (SPD 12.0%). The results of last 3 months use of illicit drug use compared with last-year use of these drugs showed a higher proportion of WLWH in BC reported cocaine or crack use: 16.8% vs. 0.1% for regular use (SPD 16.7%), and 8.2% vs. 1.5% for occasional use (SPD 6.7%), regular/occasional speed use (2.5% vs. 0.1%; SPD 2.4%), and regular/occasional heroin use (11.3% vs. 0.1%; SPD 11.2%).

Table 4 Comparing illicit drug use between women living with HIV and assumed HIV-negative women of the general population[a].

alt-text: Table 4

Drug use[g]	CHIWOS	CCHS estimates		SPD[e]
		CCHS[c]	AER Std.[d]	
Non-prescribed cannabis use[h]				
Regular use[i]	14.6 (11.3, 18.7)[b]	4.5 (3.4, 5.2)	6.6 (4.7, 8.6)	8.0 (4.1, 8.6)
Occasional use[j]	18.1 (14.4, 22.4)	7.1 (6.1, 8.1)	6.1 (4.9, 7.2)	12.0 (8.1, 16.5)
None[k]	67.3 (62.2, 72.1)	88.4 (87.2, 89.6)	87.3 (83.5, 91.1)	−20.0 (−26.3, −13.9)
Cocaine or crack use				
Regular use[l]	16.8 (13.2, 21.0)	0.1 (0.01, 0.2)	0.1 (0.00, 0.2)	16.7 (13.1, 20.9)
Occasional use[m]	8.2 (5.78, 11.61)	0.7 (0.4, 1.0)	1.5 (0.2, 2.9)	6.7 (3.9, 10.3)
None (never or former)	75.0 (70.2, 79.2)	99.2 (98.8, 99.5)	98.4 (95.0, 101.7)	−23.4 (−29.2, −17.9)
Speed (amphetamine) use				
Regular/occasional use[l,m,n]	2.5 (1.3, 4.8)	0.1 (0.01, 0.2)	0.1 (0.00, 0.2)	2.4 (1.2, 4.7)
None (never or former)	97.5 (95.2, 98.68)	99.9 (99.8, 100.0)	99.9 (96.8, 100.0)	−2.4 (−6.2, 0.9)
Heroin use				

Regular/occasional use[l,m,n]	11.3 (8.4, 15.1)	0.1 (0.02, 0.2)	0.1 (0.01, 0.2)	11.2 (8.3, 15.0)
None (never or former)	88.7 (84.9, 91.6)	99.9 (99.7, 100.0)	99.9 (96.8, 100.0)[f]	−11.2(-16.1, −11.2 (−16.1, −7.0)

[a] CHIWOS-BC (N = 356) and CCHS-BC (N = 7698).

[b] Data are % (95% CI).

[c] Unstandardized weighted estimates are reported and the 95% CI was constructed using bootstrap method.

[d] Age- and ethno-racial-standardized expected estimates based on women of the general population from CCHS.

[e] SPD: standardized prevalence difference (% (95% CI)), and the 95% CI was constructed using MOVER algorithm.

[f] The upper limit was 102.96% but we made is to the maximum proportion 100.0%.

[g] CCHS collected data for the period of last 12 months for all drugs, while CHIWOS collected data on cannabis use for last month and other drugs in last three months.

[h] Any non-prescribed use of cannabis (i.e., non-medicinal, non-prescribed, self-medicating, or both medicinal and non-medicinal use simultaneously).

[i] CCHS: every day or at least once a week, while it was measured as using regularly in CHIWOS.

[j] CCHS: Occasional use (1--3 times a month or less than once a month), CHIWOS: occasional use (occasionally or used but not in the past 30 days).

[k] No non-prescribed or medicinal cannabis use.

[l] Regular use: at least once a week.

[m] Occasional/episodic: less than once a week.

[n] Regular and occasional use were merged in Amphetamine and Heroin use as the absolute "n" did not meet the minimum vetting guideline.

4 Discussion

We found that a considerable proportion of WLWH reported current cigarette smoking, were intensive cigarette smokers (i.e., ≥20 cigarettes/day), reported binge drinking, and reported regular/occasional use of non-prescribed cannabis, and other illicit drugs including crack or cocaine, speed, and heroin. We also provided evidence for an excess prevalence of cigarette smoking and the use of non-prescribed cannabis, and other illicit drugs, but a lower to similar frequency of alcohol consumption, in WLWH compared to their age- and ethnoracial group-similar general population counterparts.

While a considerable difference was found between WLWH and their general population counterparts with regard to drug use and cigarette smoking, but not hazardous alcohol drinking, we acknowledge that these differences could in part be because of other uncontrolled population background characteristics. For example, prior studies have highlighted the contribution of socioeconomic factors (e.g., low income, unemployment) and mental health conditions to substance among WLWH (Cook et al., 2009). Moreover, HIV-specific factors such as HIV-related stigma may play a role in substance use as a maladaptive or avoidant coping strategy (Turan et al., 2017). However, control of these in cross-sectional analysis can be problematic in ignoring potential mediation and creating artificially similar groups that obscure real differences that can result from age (or life stage) and systemic discrimination and differential life options across ethnoracial groups.

Our findings were consistent with the findings of the few available studies comparing WLWH with HIV-negative women. A higher proportion of cigarette smoking was found among WLWH in a 2015 US study (34.6% vs. 18.0% were current cigarette smokers; with an age-ethnoracial-education-poverty adjusted prevalence difference of 16.6%) (Mdodo et al., 2015) and a 2014 French study (32% regular tobacco smokers, with an age-education adjusted prevalence rate ratio of 1.32) (Tron et al., 2014). Consistent with previous research (Ikeda et al., 2016), alcohol consumption was comparatively lower in WLWH than that in the general population; however, it was still one of the most prevalent substances reported by WLWH in the current study. The reason for the observed lower frequency of alcohol consumption among WLWH of the current study is unclear. Further research is needed to explore whether such lower frequency of alcohol use among WLWH is due to the higher use of other drugs such as recreational cannabis use. Given the negative impacts of alcohol consumption on care and treatment outcomes (Zhang et al., 2018), our findings in line with other studies of women with HIV (Jones et al., 2010) suggest that there is a need for screening of alcohol drinking and targeted interventions within HIV care.

The comparison of our findings on illicit drug use with extant literature is difficult because there are few such comparison analyses specifically for WLWH. However, identifying a higher prevalence of drug use in individuals with HIV than the general population is relevant to the HIV setting, and suggests the need to ensure that factors that affect substance use among WLWH are identified and addressed and that adequate resources are provided for

addressing drug use in the context of HIV care. Limited descriptive studies have also indicated high prevalence of substance use in WLWH; for example, current cigarette smoking (56%) and concomitant use of other drugs in smokers (24% vs. 4% in nonsmokers) (Feldman et al., 2006), past-year hazardous drinking over an 11-year follow-up period (ranged from 14% to 24%) (Cook et al., 2009), current marijuana use (from 21% to 14% over the 16-year follow-up period) and daily marijuana use (from 3.3% to 6.1% in all studied women) (D'Souza et al., 2012). Future research could examine which factors may contribute to WLWH using or avoiding substances, including discrimination, HIV-related stigma, intimate partner violence, and other factors that can lead to initiation or continuation of substance use. The identified substance use disparities, particularly smoking and illicit drug use, can help researchers explore pathways leading to greater vulnerability among WLWH.

Given the contribution of substance use to suboptimal HIV outcomes, considering the mixed evidence for the role of cannabis (Bonn-Miller et al., 2014; Okafor et al., 2017), the high substance use prevalence identified in the current research has important implications for the clinical management of HIV (Cook et al., 2008; Feldman et al., 2006). This is particularly important as substance use frequently co-presents with other health-related problems such as psychiatric comorbidities and socio-structural barriers, that interactively impact HIV outcomes in individuals with HIV including WLWH (Cook et al., 2007; Krusi et al., 2010; Nahvi and Cooperman, 2009). These findings highlight the need to make interventions available to women who use both drugs and antiretroviral therapy, particularly in cases where the substance use interferes with maintenance of effective HIV treatment (Sharpe et al., 2004; Zhang et al., 2018). Integration of substance use treatment services into HIV primary care settings may contribute to enhancing the quality of HIV care and care delivery (Altice et al., 2011; Cook et al., 2008; Malta et al., 2008). Our findings also advocate for tailored, women-centered harm reduction strategies in which women's unique needs are effectively recognized (O'Brien et al., 2017), and peer-driven interventions through which peers can also contribute to the care and treatment programs delivery (Simoni et al., 2011). Having access to pharmacologic and psychotropic substance use and harm reduction services through this model of care is essential to reduce use and harms of substance use (Durvasula and Miller, 2014; Gonzalez et al., 2011; Malta et al., 2008). To improve greater involvement and adherence to treatment, one recommendation is that such a model of care delivery also provides sustained follow-up with regular evaluations of HIV therapies to substance-using WLWH (Cohen et al., 2004; Cook et al., 2008; Sharpe et al., 2004).

This study had some limitations. CHIWOS recruited WLWH through Peer Research Associates (PRAs) – a non-random sampling design. Additionally, self-report data on substance use, a potentially stigmatizing behavior, is subject to social desirability bias; however, this concern might have been mitigated in CHIWOS by using the PRAs, who also shared the experience of living with HIV. This was an attempt to build trust with WLWH, to allow for them to better contribute to the research in sharing their sensitive information (Webster et al., 2018). Moreover, we compared the measure of substance use in WLWH with the *assumed* HIV-negative women of the general population. Because of small population estimates of WLWH in Canada – 97 per 100,000 females (Public Health Agency of Canada, 2015), the inclusion of WLWH in the assumed HIV-negative group would not substantially change our estimates. Furthermore, while CHIWOS collected data on cisgender (non-trans) women and trans women with HIV, CCHS does not contain data identifying trans women; therefore, it is both likely that there are also trans women in CCHS and it is impossible to adjust for gender identity.

In conclusion, substance use was prevalent among women living with HIV, with prevalence of cigarette smoking and illicit drug use in excess of what would be expected, but not of alcohol consumption and binge drinking. Due to their negative impacts on HIV outcomes, morbidity, and mortality, these results highlight the need for future research and programming to better understand factors that may contribute to substance use within the group of WLWH, and to intervene on these factors, or on health risk factors within HIV care settings. Future research may also be useful in identifying substance users through screening methods, in educating HIV care providers concerning screening for substance use problems, and in addressing specific causal pathways for the use of substances and their impacts on HIV outcomes.

Role of ~~Funding S~~funding sources

6 Contributors

MS and GRB proposed and developed research idea; MS conducted the statistical analysis and drafted the manuscript. ML, AdP, and AK are the principal investigators of CHIWOS, and designed the study and led data collection. All co-authors significantly contributed to the interpretation of the results, critically reviewed, commented on, and edited the manuscript, and approved the final version for publication.

Conflict of Iinterest

No conflict declared.

Uncited reference

Antiretroviral Therapy Cohort Collaboration (2008). Life expectancy of individuals on combination antiretroviral therapy in high-income countries: a collaborative analysis of 14 cohort studies. Lancet 372, 293-299. (Please change this reference as: **Antiretroviral Therapy Cohort Collaboration**, 2008. Life expectancy of individuals on combination antiretroviral therapy in high-income countries: a collaborative analysis of 14 cohort studies. Lancet 372, 293-299. It is already in the list of the references (No. 2). There is author's names in the original format of this reference. Sorry for the confusions we might have made. It is also specified in the Introduction, in the corresponding section. Thank you.)

Acknowledgment

We would like to express our thanks to CHIWOS participants, women living with HIV who provided their valuable experience and information on their health; Peer Research Associates (PRAs) for their contribution to all stages of the research including participants recruitment, survey administration, and data collection; the members of the CHIWOS Research Team; the entire national team of Co-Investigators; Collaborators; the three provincial Community Advisory Boards; the national CHIWOS Indigenous Advisory Board; CHIWOS African, Caribbean and Black Advisory Board; all partnering organizations for their supports; the BC Centre for Excellence in HIV/AIDS for CHIWOS data management and support. We also acknowledge that a part of the data used in this research was obtained from Statistics Canada's Canadian Community Health Survey (CCHS, 2013-14). Statistics Canada's Research Data Centre at The University of Western Ontario provided researchers of the current study with access to the CCHS microdata. Our special thanks to the Statistics Canada's Research Data Centre at The University of Western Ontario for their valuable guides and supports.

References

Altice F.L., Bruce R.D., Lucas G.M., Lum P.J., Korthuis P.T., Flanigan T.P., Cunningham C.O., Sullivan L.E., Vergara-Rodriguez P., Fiellin D.A., Cajina A., Botsko M., Nandi V., Gourevitch M.N. and Finkelstein R., HIV treatment outcomes among HIV-infected, opioid-dependent patients receiving buprenorphine/naloxone treatment within HIV clinical care settings: results from a multisite study, *J. Acquir. Immune Defic. Syndr.* **56** (Suppl. 1), 2011, S22–32.

Antiretroviral Therapy Cohort Collaboration, (Here is the correct format of this reference: Antiretroviral Therapy Cohort Collaboration, 2008. Life expectancy of individuals on combination antiretroviral therapy in high-income countries: a collaborative analysis of 14 cohort studies. Lancet 372, 293-299.)Life expectancy of individuals on combination antiretroviral therapy in high-income countries: a collaborative analysis of 14 cohort studies, *Lancet* **372**, 2008, 293–299.

Barve S., Kapoor R., Moghe A., Ramirez J.A., Eaton J.W., Gobejishvili L., Joshi-Barve S. and McClain C.J., Focus on the liver: alcohol use, highly active antiretroviral therapy, and liver disease in HIV-infected patients, *Alcohol Res. Health* **33**, 2010, 229–236.

Bonn-Miller M.O., Oser M.L., Bucossi M.M. and Trafton J.A., Cannabis use and HIV antiretroviral therapy adherence and HIV-related symptoms, *J. Behav. Med.* **37**, 2014, 1–10.

Canadian Community Health Survey, Annual component user files, 2013 microdata fComponent User Files, 2013 Microdata Files. Statistics Canada, [cited 25 Oct 2017]2013.

Cescon A., Patterson S., Chan K., Palmer A.K., Margolese S., Burchell A.N., Cooper C., Klein M.B., Machouf N., Montaner J.S., Tsoukas C., Hogg R.S., Raboud J.M. and Loutfy M.R., Gender differences in clinical outcomes among HIV-positive individuals on antiretroviral therapy in Canada: a multisite cohort study, *PLoS One* **8**, 2013, e83649.

Cofrancesco J., Jr, Scherzer R., Tien P.C., Gibert C.L., Southwell H., Sidney S., Dobs A. and Grunfeld C., Illicit drug use and HIV treatment outcomes in a US cohort, *AIDS* **22**, 2008, 357–365.

Cohen M.H., Cook J.A., Grey D., Young M., Hanau L.H., Tien P., Levine A.M. and Wilson T.E., Medically eligible women who do not use HAART: the importance of abuse, drug use, and race, *Am. J. Public Health* **94**, 2004, 1147–1151.

Cohen M.S., Chen Y.Q., McCauley M., Gamble T., Hosseinipour M.C., Kumarasamy N., Hakim J.G., Kumwenda J., Grinsztejn B., Pilotto J.H., Godbole S.V., Chariyalertsak S., Santos B.R., Mayer K.H., Hoffman I.F., Eshleman S.H., Piwowar Manning E., Cottle L., Zhang X.C., Makhema J., Mills L.A., Panchia R., Faesen S., Eron J., Gallant J., Havlir D., Swindells S., Elharrar V., Burns D., Taha T.E., Nielsen-Saines K., Celentano D.D., Essex M., Hudelson S.E., Redd A.D. and Fleming T.R., Antiretroviral therapy for the prevention of HIV-1 transmission, *N. Engl. J. Med.* **375**, 2016, 830–839.

Cook J.A., Grey D.D., Burke-Miller J.K., Cohen M.H., Vlahov D., Kapadia F., Wilson T.E., Cook R., Schwartz R.M., Golub E.T., Anastos K., Ponath C., Goparaju L. and Levine A.M., Illicit drug use, depression and their association with highly active antiretroviral therapy in HIV-positive women, *Drug Alcohol Depend.* **89**, 2007, 74–81.

Cook J.A., Burke-Miller J.K., Cohen M.H., Cook R.L., Vlahov D., Wilson T.E., Golub E.T., Schwartz R.M., Howard A.A., Ponath C., Plankey M.W., Levine A.M. and Grey D.D., Crack cocaine, disease progression, and mortality in a multicenter cohort of HIV-1 positive women, *AIDS* **22**, 2008, 1355–1363.

Cook R.L., Zhu F., Belnap B.H., Weber K., Cook J.A., Vlahov D., Wilson T.E., Hessol N.A., Plankey M., Howard A.A., Cole S.R., Sharp G.B., Richardson J.L. and Cohen M.H., Longitudinal trends in hazardous alcohol consumption among women with human immunodeficiency virus infection, 1995–2006, *Am. J. Epidemiol.* **169**, 2009, 1025–1032.

D'Souza G., Matson P.A., Grady C.D., Nahvi S., Merenstein D., Weber K.M., Greenblatt R., Burian P. and Wilson T.E., Medicinal and recreational marijuana use among HIV-infected women in the Women's Interagency HIV Study (WIHS) cohort, 1994–2010, *J. Acquir. Immune Defic. Syndr.* **61**, 2012, 618–626.

Durvasula R. and Miller T.R., Substance abuse treatment in persons with HIV/AIDS: challenges in managing triple diagnosis, *Behav. Med.* **40**, 2014, 43–52.

Feldman J.G., Minkoff H., Schneider M.F., Gange S.J., Cohen M., Watts D.H., Gandhi M., Mocharnuk R.S. and Anastos K., Association of cigarette smoking with HIV prognosis among women in the HAART era: a report from the women's interagency HIV study, *Am. J. Public Health* **96**, 2006, 1060–1065.

Gonzalez A., Barinas J. and O'Cleirigh C., Substance use: impact on adherence and HIV medical treatment, *Curr. HIV/AIDS Rep.* **8**, 2011, 223–234.

Gonzalez-Serna A., Chan K., Yip B., Chau W., McGovern R., Samji H., Lima V.D., Hogg R.S. and Harrigan R., Temporal trends in the discontinuation of first-line antiretroviral therapy, *J. Antimicrob. Chemother.* **69**, 2014, 2202–2209.

Helleberg M., May M.T., Ingle S.M., Dabis F., Reiss P., Fatkenheuer G., Costagliola D., d'Arminio A., Cavassini M., Smith C., Justice A.C., Gill J., Sterne J.A. and Obel N., Smoking and life expectancy among HIV-infected individuals on antiretroviral therapy in Europe and North America, *AIDS* **29**, 2015, 221–229.

Hicks P.L., Mulvey K.P., Chander G., Fleishman J.A., Josephs J.S., Korthuis P.T., Hellinger J., Gaist P. and Gebo K.A., The impact of illicit drug use and substance abuse treatment on adherence to HAART, *AIDS Care* **19**, 2007, 1134–1140.

Ikeda M.L., Barcellos N.T., Alencastro P.R., Wolff F.H., Moreira L.B., Gus M., Brandao A.B., Fuchs F.D. and Fuchs S.C., Alcohol drinking pattern: a comparison between HIV-infected patients and individuals from the general population, *PLoS One* **11**, 2016, e0158535.

Jones A.S., Lillie-Blanton M., Stone V.E., Ip E.H., Zhang Q., Wilson T.E., Cohen M.H., Golub E.T. and Hessol N.A., Multi-dimensional risk factor patterns associated with non-use of highly active antiretroviral therapy among human immunodeficiency virus-infected women, *Womens Health Issues* **20**, 2010, 335–342.

Krusi A., Wood E., Montaner J. and Kerr T., Social and structural determinants of HAART access and adherence among injection drug users, *Int. J. Drug Policy* **21**, 2010, 4–9.

Kumar S., Rao P.S., Earla R. and Kumar A., Drug-drug interactions between anti-retroviral therapies and drugs of abuse in HIV systems, *Expert Opin. Drug Metab. Toxicol.* **11**, 2015, 343–355.

Kuyper L.M., Wood E., Montaner J.S., Yip B., O'Connell J.M. and Hogg R.S., Gender differences in HIV-1 RNA rebound attributed to incomplete antiretroviral adherence among HIV-Infected patients in a population-based cohort, *J. Acquir. Immune Defic. Syndr.* **37**, 2004, 1470–1476.

Loutfy M.R., Sherr L., Sonnenberg-Schwan U., Walmsley S.L., Johnson M. and d'Arminio Monforte A., Caring for women living with HIV: gaps in the evidence, *J. Int. AIDS Soc.* **16**, 2013, 18509.

Loutfy M., de Pokomandy A., Kennedy V.L., Carter A., O'Brien N., Proulx-Boucher K., Ding E., Lewis J., Nicholson V., Beaver K., Greene S., Tharao W., Benoit A., Dubuc D., Thomas-Pavanel J., Sereda P., Jabbari S., Shurgold J.H., Colley G., Hogg R.S. and Kaida A., Cohort profile: the Canadian HIV women's sexual and reproductive health cohort study (CHIWOS), *PLoS One* **12**, 2017, e0184708.

Malta M., Strathdee S.A., Magnanini M.M. and Bastos F.I., Adherence to antiretroviral therapy for human immunodeficiency virus/acquired immune deficiency syndrome among drug users: a systematic review, *Addiction* **103**, 2008, 1242–1257.

Mdodo R., Frazier E.L., Dube S.R., Mattson C.L., Sutton M.Y., Brooks J.T. and Skarbinski J., Cigarette smoking prevalence among adults with HIV compared with the general adult population in the United States: cross-sectional surveys, *Ann. Intern. Med.* **162**, 2015, 335–344.

Nahvi S. and Cooperman N.A., Review: the need for smoking cessation among HIV-positive smokers, *AIDS Educ. Prev.* **21**, 2009, 14–27.

O'Brien N., Greene S., Carter A., Lewis J., Nicholson V., Kwaramba G., Menard B., Kaufman E., Ennabil N., Andersson N., Loutfy M., de Pokomandy A. and Kaida A., Envisioning women-centered HIV care: perspectives from women

living with HIV in Canada, *Womens Health Issues* **27**, 2017, 721–730.

Okafor C.N., Zhou Z., Burrell L.E., 2nd, Kelso N.E., Whitehead N.E., Harman J.S., Cook C.L. and Cook R.L., Marijuana use and viral suppression in persons receiving medical care for HIV-infection, *Am. J. Drug Alcohol Abuse* **43**, 2017, 103–110.

Petoumenos K. and Law M.G., Smoking, alcohol and illicit drug use effects on survival in HIV-positive persons, *Curr. Opin. HIV AIDS* **11**, 2016, 514–520.

Public Health Agency of Canada, HIV and AIDS in Canada: Surveillance Report to December 31, 2014, 2015, Minister of Public Works and Government Services Canada; Ottawa.

Puskas C.M., Kaida A., Miller C.L., Zhang W., Yip B., Pick N., Montaner J.S. and Hogg R.S., The adherence gap: a longitudinal examination of men's and women's antiretroviral therapy adherence in British Columbia, 2000–2014, *AIDS* **31**, 2017, 827–833.

Rothman K., Greenland S. and Lash T., Modern Epidemiology, 3rd ed., 2008, Lippincott Williams and Wilkins; Philadelphia.

Rust K.F. and Rao J.N., Variance estimation for complex surveys using replication techniques, *Stat. Methods Med. Res.* **5**, 1996, 283–310.

Sharpe T.T., Lee L.M., Nakashima A.K., Elam-Evans L.D. and Fleming P.L., Crack cocaine use and adherence to antiretroviral treatment among HIV-infected black women, *J. Community Health* **29**, 2004, 117–127.

Simoni J.M., Nelson K.M., Franks J.C., Yard S.S. and Lehavot K., Are peer interventions for HIV efficacious? A systematic review, *AIDS Behav.* **15**, 2011, 1589–1595.

Tron L., Lert F., Spire B. and Dray-Spira R., Tobacco smoking in HIV-infected versus general population in France: heterogeneity across the various groups of people living with HIV, *PLoS One* **9**, 2014, e107451.

Turan B., Hatcher A.M., Weiser S.D., Johnson M.O., Rice W.S. and Turan J.M., Framing mechanisms linking HIV-related stigma, adherence to treatment, and health outcomes, *Am. J. Public Health* **107**, 2017, 863–869.

UNAIDS, The Greater Involvement of People Living With HIV (GIPA), Available from (Last accessed: 25 April, 2018)UNAIDS Policy Brief, Joint United Nations Programme on HIV/AIDS; Geneva, http://data.unaids.org/pub/BriefingNote/2007/JC1299_Policy_Brief_GIPA.pdf, 2007.

UNAIDS, The Gap Report 2014, [cited 2018 Jan 04]. Available from:http://www.unaids.org/sites/default/files/en/media/unaids/contentassets/documents/unaidspublication/2014/UNAIDS_Gap_report_en.pdf, 2014.

Vagenas P., Azar M.M., Copenhaver M.M., Springer S.A., Molina P.E. and Altice F.L., The impact of alcohol use and related disorders on the HIV continuum of care: a systematic review: alcohol and the HIV continuum of care *Curr. HIV/AIDS Rep.* **12**, 2015, 421–436.

Webster K., Carter A., Proulx-Boucher K., Dubuc D., Nicholson V., Beaver K., Gasingirwa C., Ménard B., O'Brien N., Lin S.Y., Mitchell K., Pereira Bajard M., Jabbari S., Ding E., de Pokomandy A., Loutfy M. and Kaida A., Strategies for recruiting women living with HIV in community-based research: Lessons from Canada, *Prog. Community Health Partnersch.* **12**, 2018, 21–34.

Wood E., Kerr T., Tyndall M.W. and Montaner J.S., A review of barriers and facilitators of HIV treatment among injection drug users, *AIDS* **22**, 2008, 1247–1256.

Zhang Y., Wilson T.E., Adedimeji A., Merenstein D., Milam J., Cohen J., Cohen M. and Golub E.T., The impact of substance use on adherence to antiretroviral therapy among HIV-infected women in the United States, *AIDS Behav.* **22**, 2018, 896–908.

Zou G.Y. and Donner A., Construction of confidence limits about effect measures: a general approach, *Stat. Med.* **27**, 2008, 1693–1702.

Highlights

- Women with HIV (WLWH) were 26.8% excess daily smokers vs. general population women.

- WLWH were 8.0% excess regular cannabis users vs. general population women.

- WLWH were 16.7% excess regular crack/cocaine users vs. general population women.

- WLWH were 11.2% excess regular heroin users vs. general population women.

- Alcohol use was either similar or lower in WLWH vs. general population women.

Queries and Answers

Query: Please check the presentation of 'Tables 1-4', and correct if necessary.
Answer: The presentation of the tables is correct

Query: Your article is registered as a regular item and is being processed for inclusion in a regular issue of the journal. If this is NOT correct and your article belongs to a Special Issue/Collection please contact s.hubbard@elsevier.com immediately prior to returning your corrections.
Answer: Correct, this article is registered as a regular item and regular issue of the journal.

Query: The author names have been tagged as given names and surnames (surnames are highlighted in teal color). Please confirm if they have been identified correctly.
Answer: Yes

Query: Please note that the significance of footnote '#' link to the 'On Behalf of the CHIWOS Research Team' has not been provided. Therefore it has been removed. Please check and correct if necessary.
Answer: Please see the attached file. We provided (in the initial submission) the list of the names of our survey research team. The sign "#" refers to the list that is now attached.
Attachments: CHIWOS research team.docx

Query: Please check the presentation of all affiliations, and correct if necessary.
Answer: They are correct.

Query: One or more sponsor names and the sponsor country identifier may have been edited to a standard format that enables better searching and identification of your article. Please check and correct if necessary.
Answer: Yes

Query: Uncited reference: This section comprises reference that occur in the reference list but not in the body of the text. Please position the reference in the text or, alternatively, delete it. Any reference not dealt with will be retained in this section.
Answer: This reference refers to this section of the introduction (first paragraph in the Introduction): "... despite the substantial advances obtained from combination antiretroviral therapy (cART), e.g., improved life expectancy in PLWH (**2008**)." We only have the "2008" in the body of the text not the list of the authors of this reference. The reason is that there is no list of co-authors for this publication/reference. The suggestion is this: A) Please add this "**Antiretroviral Therapy Cohort Collaboration**" to the first paragraph of the Introduction in the corresponding section (specified) and change it as, "... despite the substantial advances obtained from combination antiretroviral therapy (cART), e.g., improved life expectancy in PLWH (**Antiretroviral Therapy Cohort Collaboration,** 2008)." Then, B) please revise this reference in the reference list as, **Antiretroviral Therapy Cohort Collaboration**, 2008. Life expectancy of individuals on combination antiretroviral therapy in high-income countries: a collaborative analysis of 14 cohort studies. Lancet 372, 293-299.