HHS Public Access

Author manuscript

AIDS Behav. Author manuscript; available in PMC 2018 February 01.

Published in final edited form as:

AIDS Behav. 2017 February ; 21(2): 402–409. doi:10.1007/s10461-016-1470-2.

ANTIRETROVIRAL THERAPY INTERRUPTION AMONG HIV POSITIVE PEOPLE WHO USE DRUGS IN A SETTING WITH A COMMUNITY-WIDE HIV TREATMENT-AS-PREVENTION INITIATIVE

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Abstract

HIV Treatment as Prevention (TasP) initiatives promote antiretroviral therapy (ART) access and optimal adherence (≥95 %) to produce viral suppression among people living with HIV (PLHIV) and prevent the onward transmission of HIV. ART treatment interruptions are common among PLHIV who use drugs and undermine the effectiveness of TasP. Semi-structured interviews were conducted with 39 PLHIV who use drugs who had experienced treatment ART interruptions in a setting with a community-wide TasP initiative (Vancouver, Canada) to examine influences on these outcomes. While study participants attributed ART interruptions to "treatment fatigue," our analysis revealed individual, social, and structural influences on these events, including: (1) prior adverse ART-related experiences among those with long-term treatment histories; (2) experiences of social isolation; and, (3) breakdowns in the continuity of HIV care following disruptive events (e.g., eviction, incarceration). Findings reconceptualise 'treatment fatigue' by focusing attention on its underlying mechanisms, while demonstrating the need for comprehensive structural reforms and targeted interventions to optimize TasP among drug-using PLHIV.

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Author Contributions

RM, TK, LM, MJM and WS conceptualized the study. RM, BC, and WS developed the interview guide and revised it based on input from TK. RM, BC, and SA (Solanna Anderson) conducted the interviews. RM and BC undertook the analysis in consultation with TK, LM, MJM and WS. RM drafted the manuscript. All authors provided feedback on the manuscript draft and approved the final version.

Conflicts of Interest

We declare that we have no competing interests.

Ethical Approval

All research activities performed for this study were approved by the University of British Columbia and Providence Health Care research ethics board and undertaken in accordance with the Tri-Council policy statement for research involving human participants.

Informed Consent

Informed consent was obtained from all individuals participating in this study.

Keywords

HIV/AIDS; Antiretroviral therapy; Treatment discontinuation; Qualitative research; Drug users; HIV; Treatment as Prevention

INTRODUCTION

A growing body of evidence confirms that population-level increases in exposure to antiretroviral therapy (ART) result in substantial reductions in HIV-related morbidity and mortality [1–4], as well as decreases in the incidence of new HIV infections [5, 6]. Optimal engagement in HIV treatment (i.e., adherence to ART ≥ 95 %) is strongly associated with undetectable HIV viral loads among people living with HIV (PLHIV) [7, 8], putting HIV disease into remission and preventing onward transmission [9–11]. HIV Treatment-as-Prevention (TasP) initiatives seek to promote viral suppression at the individual and community-levels through universal and immediate access to ART, as well as improved HIV testing and retention in care [12–15]. TasP is now central to the global response to the HIV epidemic [16–18] and forms the basis of the UNAIDS 90-90-90 campaign to eliminate the HIV/AIDS pandemic as a significant public health concern [18].

Current HIV/AIDS treatment requires PLHIV to maintain continuous, lifelong adherence to ART to achieve and maintain viral suppression [12]. Accordingly, ART interruptions (defined as ≥30 consecutive days without taking ART [19]) undermine the effectiveness of TasP by prompting viral load rebound [20, 21], thereby increasing the risk of HIV-related morbidity, onward HIV transmission, and the development of viral drug resistance [22, 23]. Despite the beneficial impact of optimal adherence to treatment on disease outcomes, ART interruptions remain common among some key populations, particularly people who use drugs (PWUD) [24–26]. Understanding the mechanisms that contribute to sub-optimal ART-related outcomes among these populations will be critical to the success of TasP.

PWUD have long been identified as being more likely to experience ART interruptions [27–29] and a recent study undertaken in a setting implementing TasP similarly documented this phenomenon [30]. The concept of structural vulnerability focuses attention on how the interplay of structural inequities (e.g., disparities in incarceration rates under drug criminalization, housing instability) and socio-cultural processes (e.g., racism, sexism) render marginalized populations susceptible to harm [31, 32], and is particularly useful in understanding adverse ART outcomes among PWUD. For example, previous studies have demonstrated that factors associated with structural vulnerability, such as incarceration and homelessness [33, 34], contribute to ART discontinuation among PLHIV who use drugs in Vancouver, Canada, a setting with a community-wide TasP initiative. In addition to social-structural influences, concerns remain regarding the potential of decreased desire or willingness to adhere to ART (commonly known as ‘treatment fatigue’) to drive treatment interruptions [35, 36]. However, this phenomenon has not been systematically studied in the context of TasP generally, or among PLHIV who use drugs, specifically. Moreover, previous research on treatment fatigue has prioritized individual and clinical influences (e.g., pill counts, length of time in treatment) [35, 37] and overlooked other potential social and

structural drivers of ART interruptions. Greater attention to the potential for interactions between exogenous forces and treatment fatigue to produce ART interruptions will help to inform interventions to optimize HIV treatment outcomes. We undertook this ethno-epidemiological study to examine individual, social, and structural dimensions of ART interruptions among structurally vulnerable PLHIV who use drugs in Vancouver, Canada. We were particularly concerned with the potential role of treatment fatigue in shaping ART interruptions, as well as social-structural influences underlying this phenomenon. Finally, we sought to identify ways in which TasP programmes could be optimized to improve ART adherence among structurally vulnerable PLHIV who use drugs.

METHODS

This ethno-epidemiological study was undertaken in connection with the AIDS Care Cohort to Evaluate Exposure to Survival Services (ACCESS), which has been described in detail elsewhere [38]. In brief, ACCESS is an open prospective cohort study in Vancouver, Canada comprised of PLHIV (aged ≥ 19 years) with histories of illicit drug use. At baseline and every 6 months, cohort participants provide blood samples for HIV disease monitoring and complete interviewer-administered questionnaires. A linkage with the province-wide ART dispensary provides a complete retrospective and prospective profile of exposure to treatment and adherence. Consistent with ethno-epidemiological methods [39, 40], we deployed qualitative methods alongside this epidemiological research program to explore individual, social, and structural influences on ART interruptions in a setting implementing TasP, and thus inform the refinement of this structural intervention. This study was approved by the Providence Healthcare/University of British Columbia Research Ethics Board.

We purposefully sampled ACCESS participants who had not filled an ART prescription for a period of at least 30 days (consistent with previous analyses of ART interruptions in this setting [19]) between January 2011 and December 2012. This observation period was chosen to minimize biases due to poor recall of events. The study coordinator (BC) contacted eligible cohort participants by phone in accordance with approved recruitment procedures to invite them participate. ACCESS staff also invited eligible individuals to participate when they visited the office for research appointments. Participant recruitment and data collection were halted when it was determined that data saturation had occurred.

Three researchers (BC, man; RM, man; and SA, woman) with graduate-level training and extensive experience in qualitative methods conducted the interviews. All interviews were conducted at the ACCESS office between October 2013 and March 2014. Interviewers explained the study to participants, answered questions, and obtained written informed consent. No one refused to participate or dropped out of the study and participants were provided an honorarium ($30 CAD). Interviews were facilitated using an interview guide adapted from our previous qualitative studies with PLHIV who use drugs [41–43] and revised to focus on influences on ART adherence identified through analyses of ACCESS data [34, 44, 45]. Interviews were 20–70 min in length, audio recorded, and transcribed. One participant was interviewed twice to obtain further information relating to their ART interruptions.

Interview transcripts were imported into Atlas.ti, a qualitative analysis software program. The lead author and study coordinator coded data using deductive and inductive methods [46]. A preliminary coding framework comprised of codes derived from the interview guide was initially used to code data, and revised to include emerging codes. Treatment fatigue was identified as a salient theme early in the analysis, and the coding framework was revised to focus attention on social-structural influences related to this phenomenon. Once the final thematic categories were established, data were recoded to ensure their trustworthiness. The concept of structural vulnerability was employed when interpreting these themes to focus attention on how social-structural factors and sociocultural processes produced treatment fatigue [31, 32].

RESULTS

Participant Demographics

After a review of cohort data, we determined that 147 individuals were eligible to participate in this study. We recruited 39 individuals to participate in this study, including 21 (54 %) men, 16 (41 %) women, and two (5 %) transgender persons. Table 1 contains a full overview of participant demographics. More than half of participants identified as Indigenous (n = 23, 59 %) and 38 (97 %) participants reported ever using injection drugs. Nearly all participants had experienced multiple ART interruptions (n = 38) with a mean of 7.2 interruption events (interquartile range [IQR]: 5–9 interruption events) according to linked ART dispensation data. The mean time since HIV diagnosis and ART initiation was 14.8 years (IQR: 10–19 years) and 11.3 years (IQR: 6–16 years), respectively.

Individual and Contextual Influences on ‘Treatment Fatigue’

When describing their ART interruptions, nearly all participants expressed that they “wanted to have a break” from treatment regimens. However, while participants positioned recurring ART interruptions as the result of treatment fatigue, our analysis revealed that underlying social-structural factors drove ART interruptions. The following themes illustrate the role of these social-structural influences within the broader context of the structural vulnerability of PLHIV who use drugs in producing ART interruptions.

Negotiating Prior Adverse ART Experiences

At the time of their most recent ART interruption, one third of participants were on complex ART regimens (≥4 pills per day). All of these individuals had been diagnosed with HIV during the explosive outbreak of HIV among PWUD in Vancouver (beginning in the early to mid-1990s [47]). Among these participants, their most recent ART interruptions were often related to the trauma associated with their diagnosis and subsequent adverse experiences with early ART regimens. Participants emphasized that receiving an HIV diagnosis during the early years of antiretroviral therapy was “like a death sentence.” While these participants welcomed the opportunity to initiate ART when these medications became available, they were prescribed complex ART regimens (e.g., high pill counts, complex dosing regimens) with severe side effects. This group characterized their experiences with early ART regimens as negative due to the rigours of treatment compliance and severity of their side effects,

which included extreme fatigue, vomiting, and diarrhea. The following interview excerpt illustrates side effects common among these participants after initiating ART:

> [ART] made me nauseous and sleepy and I don't like that feeling. […] I was constantly having diarrhea, sick, nauseous…I had a hard time sleeping. […] I didn't like it at all…The dope [i.e., heroin] made me feel better than the drugs that keep me alive. [Participant #5, Indigenous Man, 50 years old].

These participants had all been transitioned to simplified ART regimens (e.g., single-pill, fixed dose regimens) following treatment advances throughout the late 1990s and early 2000s and viewed these as significant improvements over earlier regimens due to decreased side effects. However, most of these participants had since experienced the emergence of viral drug resistance as a result of both long treatment duration (i.e., ≥15 years) as well as structured and unplanned treatment interruptions. These participants were then prescribed more complex ART regimens to manage drug resistance and viral rebound. Some participants emphasized how these regimen changes evoked the stress of their diagnoses and negative experiences with early ART treatments. These accounts demonstrated that, while participants first emphasized that they were simply "tired" of ART, they interrupted treatment after being transitioned to more complex treatment regimens to avoid remembering and re-experiencing the hardships that they encountered when originally initiating ART.

> I just got sick of taking them. It reminded me of getting sick every time [i.e., due to side effects after initiating ART], every morning… I started with five pills. Every time I took them five pills [after being transitioned to a more complex regimen], I was almost in tears. I said, "Screw it! That's enough!" [Participant #29, White Man, 42 years old].

Social Isolation and Treatment Motivation

Social isolation stemming from structural vulnerability undermined participants' motivation to adhere to ART regimens. Most participants reported limited sources of social support, with many reporting that the stigma associated with drug use and their subsequent feelings of shame had led to estrangement from family and friends. Participants emphasized that there were few opportunities to obtain social support within the drug scene because relationships were framed by the everyday violence associated with negotiating drug dependency within the context of resource scarcity (e.g., exploitive relationships, interpersonal violence). While the intersection of anti-drug user stigma, shame, and drug scene dynamics constrained access to social support, participants emphasized that feelings of social isolation became most pronounced during holiday seasons and following the loss of intimate partner relationships, which commonly occurred due to incarceration or unexpected deaths (e.g., overdoses). Participants expressed that experiences of depression resulting from "feeling alone" reduced motivation to adhere to ART regimens and led to the intensification of drug use patterns, which fuelled ART interruptions. The following interview excerpt underscores how changes in drug use patterns resulting from feelings of social isolation contributed to ART interruptions:

> It's usually around the holidays [or] my birthday. [I get] down, alone thinking about the way life's supposed to be. The way people with families and everything are supposed to be 'cause I've never had that. Christmas and holidays come and everybody's fuckin' family, family, family, and the TV's always family, family, family. I haven't spoke to my family in a long time. […] The times I get depressed is when I'm doing drugs and, if I get depressed when I'm doing drugs, that's when I don't take my meds. [Participant #6, White Man, 39 years old].

Among Indigenous participants, the intergenerational impacts of family breakdown caused by settler colonialism (i.e., through displacement from traditional territories and social groups and forced enrollment in government and church-run residential schools) and structural discrimination (e.g., increased rates of child apprehension, overrepresentation in the criminal justice system) served to further exacerbate their experiences of social isolation. These participants spoke of having limited sources of social support across the life course due to, for example, placement in the foster care system. These dynamics continued to make it difficult to establish new relationships because, in the words of one participant, "I felt like everybody was leaving me behind". Furthermore, the overrepresentation of Indigenous persons among populations impacted by overlapping HIV and drug use epidemics meant that many participants had lost immediate friends and family members to HIV- or drug-related complications. The following interview excerpt illustrates how the cumulative impact of social isolation and loss fuelled depression and functioned to undermine motivation to adhere to ART:

> I couldn't take any more [emotional] pain. My dad, my brother, my sisters, they all had pain. They all took the same pills [i.e., ART regimens]. […] I get scared because there's times I don't even know what I'm doing or where I'm going. I'm feeling lost. I've lost three members of my family [to HIV-related complications]. [Participant #37, Indigenous Woman, 44 years old].

Structural Vulnerability and Discontinuities in the Continuity in HIV Care

Disruptions in everyday patterns and breakdowns in the continuity of HIV care occurring as a consequence of the intersection of extreme poverty (e.g., homelessness) and drug criminalization (e.g., incarceration) often led to ART interruptions. While some participants emphasized their individual responsibility for not adhering to ART, their descriptions of the circumstances surrounding these events illustrated that the hardships imposed by their structural vulnerability (e.g., food insecurity, homelessness) posed significant barriers to maintaining routines that enabled ART adherence. For example, the following interview excerpt illustrates how, although one participant reported "giving up" on ART regimens, disruptions associated with homelessness undermined adherence:

> There were times where I just more or less just gave up. I said, "Screw this." But at the time, it was kinda stupid of me. That was usually the reason I would stop taking them. […] It was usually because I was homeless and another reason was 'cause I'd lose them. [Participant #10, Indigenous Woman, 42 years old].

Treatment supports (e.g., directly-observed/maximally-assisted therapy, case management) implemented to increase access and adherence to ART had enabled many participants to

maintain optimal ART adherence despite their structural vulnerability. However, participant accounts demonstrated that transitions which increased their structural vulnerability, such as residential eviction or incarceration, led to breakdowns in the continuity of HIV care due to the limited responsiveness of treatment supports to their changing circumstances. For example, some participants reported that the concentration of treatment supports within Vancouver's primary drug scene (i.e., Downtown Eastside neighbourhood) made it difficult to access HIV care when displaced to other neighbourhoods due to evictions, while others emphasized that discontinuities in HIV care between community and correctional settings facilitated treatment interruptions. For example:

> I got evicted, which meant I went out of the area of these particular nurses. We did try to keep one of my regular nurses with me, [but] it didn't work out. So I had a year where I lived in [neighbourhood outside of the city's primary drug scene]. I just stopped taking them… Once you were there, it was nothing [i.e., HIV-related supports]. I didn't have a relationship with any nurses. [Participant #34, Indigenous Woman, 45 years old].

> Sometimes I'd go to jail for a couple weeks, sometimes I'd go for a couple months. This was quite a bit. Like, this was becoming habitual. Sometimes I was on medication, sometimes I was off [of] it. There were so many starts and stops. [Participant #27, White Man, 49 years old].

DISCUSSION

In summary, we observed that social-structural forces underlying experiences of 'treatment fatigue' functioned as primary drivers of ART interruptions among PLHIV who use drugs. Prior adverse experiences with early ART regimens influenced sub-optimal treatment outcomes among those with long-term treatment histories (≥15 years), including viral drug resistance, subsequent to being transitioned to complex ART regimens. Social isolation stemming from structural vulnerability (e.g., incarceration associated with drug criminalization, colonialism) also undermined the motivation of PLHIV who use drugs—particularly Indigenous persons—to adhere to ART regimens. Moreover, breakdowns in the continuity of HIV care stemming from increases in structural vulnerability due to events such as evictions and incarceration fostered ART interruptions despite the availability of treatment supports in the local setting.

While previous studies have focused on the contribution of clinical factors—such as prolonged treatment duration [36], pill burden [37, 48], and medication side effects [49]—on treatment fatigue among PLHIV, our study serves as an important corrective to this research by demonstrating that straightforward descriptions of treatment fatigue cannot be accepted at face value. Conversely, we found that the rhetoric of treatment fatigue was employed by participants to describe ART interruptions stemming from adverse early ART treatment experiences and social-structural factors. To this end, treatment fatigue might be better understood as decreased willingness and ability to adhere to ART as a consequence of complex and often overlapping individual (e.g., adverse treatment experiences, pill burden), social (e.g., social isolation), and structural (e.g., housing instability, incarceration) forces occurring within the context of the structural vulnerability of PLHIV. This understanding of

treatment fatigue underscores the need to move beyond individually-focused, behavioral interventions to promote treatment adherence, such as motivational interviewing and cognitive behavioral therapy, to targeted programmatic interventions responsive to the experiences of structurally vulnerable PLHIV. Furthermore, while structured treatment interruptions have been the most commonly employed intervention to address treatment fatigue [35], these are no longer supported by clinical evidence [50].

Our findings reveal that addressing the underlying conditions (e.g., colonialism, drug criminalization, poverty) that produce structural vulnerability among PLHIV who use drugs and drive episodic ART interruptions will be critical to the goals of TasP. Previous studies linking social-structural inequities, such as increased rates of incarceration [51] and homelessness [52], to suboptimal ART outcomes (inclusive of interruption events) have fuelled calls for structural reforms (e.g., drug law reform, investment in social housing) as a means to improve ART outcomes among PLHIV who use drugs [25, 53, 54]. However, while many TasP-based initiatives include helpful ancillary supports (e.g., directly-observed therapy/maximally assisted therapy) to promote retention in care, less attention has been given to the broader social-structural transformations needed to optimize ART adherence among structurally vulnerable drug-using populations. Our findings suggest that enhancing HIV care by prioritizing complementary structural interventions (e.g., drug decriminalization, provision of social housing) that address the social and structural inequities driving ART interruptions will be necessary to maximize adherence to ART and improve treatment outcomes among PLHIV who use drugs. Studies modelling the impacts of structural interventions (e.g., drug decriminalization, provision of housing) on population-level HIV outcomes in settings implementing TasP initiatives will likely prove instrumental in demonstrating their impacts and garnering political support. However, policymakers must also demonstrate a willingness to prioritize addressing HIV over conflicting and, in many cases, ineffective policy goals (e.g., drug prohibition).

Even in the event of comprehensive structural reforms, our findings demonstrate the need for continued improvements to HIV/AIDS treatment (e.g., long-acting injectable formulations) and the expansion of programmatic interventions across the continuum of HIV care in order to further maximize retention in care and ART adherence among structurally vulnerable PLHIV who use drugs. We found that PLHIV who use drugs with long-term treatment histories (i.e., ≥15 years) discontinued treatment after being transitioned from simplified to more complex ART regimens (i.e., higher pill counts, complex dosing regimens) after the development of drug resistance. Although these individuals are somewhat exceptional at this point in the global HIV pandemic (i.e., ≥15 years since initiating ART), continued advancements in ART regimens that simplify treatment for long-term patients and those developing ART resistance are likely to prove important as the life expectancies of PLHIV increase. Our findings also suggest that incorporating comprehensive psychosocial supports (e.g., counselling, peer support interventions) across the continuum of HIV care will also be necessary to address ART interruptions stemming from past adverse ART experiences, as well as the social isolation experienced by many structurally vulnerable PLHIV. Furthermore, expanding the coverage of programmatic interventions implemented as part of TasP (e.g., maximally assisted therapy) and extending them into key settings, such as jails and prisons, will also be necessary to mitigate patient attrition across the continuum of HIV

care. Such changes also have potential to address disparities in HIV-related outcomes experienced by populations (e.g., Indigenous peoples, African–American populations) overrepresented among homeless and incarcerated populations in many settings. However, it is important to note that our findings demonstrate that these largely individually-focused programmatic interventions may be of limited utility if not accompanied by more comprehensive structural reforms.

This study has several limitations. First, the majority of our participants were recruited through a prospective cohort study operating in a socially and spatially segregated drug scene. Second, while pharmacy refill records enabled us to identify individuals who experienced ART interruptions, we relied upon self-reported data regarding influences on ART interruptions, which is potentially subject to recall bias. Finally, because our study was undertaken in a setting with longstanding universal ART coverage and other treatment supports, most participants had long-term treatment histories. Research undertaken in settings without these supports (e.g., universal ART coverage, directly-observed therapy/maximally assisted therapy) might document financial and other barriers to treatment adherence.

In conclusion, our results indicate how the intersection of complex and overlapping individual, social, and structural factors contribute to ART interruption and discontinuation among structurally vulnerable PLHIV who use drugs in a setting implementing TasP. Findings highlight the need for structural reforms, as well as the implementation of targeted interventions across the continuum of HIV care, to maximize ART adherence among structurally vulnerable PLHIV who use drugs pursuant to the goals of TasP.

Acknowledgments

The authors thank the study participants for their contributions to this research, as well as current and past researchers and staff. We thank Solanna Anderson, Tricia Collingham, Jenny Matthews, and Kristie Starr for their research and administrative assistance.

Funding

This study was supported by the US National Institutes of Health (R01DA033147 and R01DA021525). RM and WS are supported by the Michael Smith Foundation for Health Research. The sponsors had no role in the design and conduct of this research study or preparation of this manuscript.

References

1. Montaner JSG, Lima VD, Harrigan PR, Lourenço L, Yip B, Nosyk B, et al. Expansion of HAART coverage is associated with sustained decreases in HIV/AIDS morbidity, mortality and HIV transmission: the “HIV Treatment as Prevention” experience in a Canadian setting. PLoS One. 2014; 9(2):e87872. [PubMed: 24533061]
2. Lima VD, Lourenço L, Yip B, Hogg RS, Phillips P, Montaner JSG. AIDS incidence and AIDS-related mortality in British Columbia, Canada, between 1981 and 2013: a retrospective study. Lancet HIV. 2015; 2(3):e92–7. [PubMed: 25780802]
3. Duncan KC, Chan KJ, Chiu CG, Montaner JSG, Coldman AJ, Cescon A, et al. HAART slows progression to anal cancer in HIV-infected MSM. AIDS. 2015; 29(3):305–11. [PubMed: 25686679]
4. Wood E, Hogg RS, Yip B, Harrigan PR, O’Shaughnessy MV. Montaner JSG. Effect of medication adherence on survival of HIV-infected adults who start highly active antiretroviral therapy when the

CD4 + cell count is 0.200 to 0.350 9 109 cells/L. Ann Intern Med. 2003; 139(10):810–6. [PubMed: 14623618]

5. Montaner JSG, Lima VD, Barrios R, Yip B, Wood E, Kerr T, et al. Association of highly active antiretroviral therapy coverage, population viral load, and yearly new HIV diagnoses in British Columbia, Canada: a population-based study. Lancet. 2010; 376(9740):532–9. [PubMed: 20638713]
6. Tanser F, Bärnighausen T, Grapsa E, Zaidi J, Newell M-L. High coverage of ART associated with decline in risk of HIV acquisition in rural KwaZulu-Natal. S Afr Sci. 2013; 339(6122):966–71.
7. Bangsberg DR. Less than 95 % adherence to nonnucleoside reverse-transcriptase inhibitor therapy can lead to viral suppression. Clin Infect Dis. 2006; 43(7):939–41. [PubMed: 16941380]
8. Yehia BR, Fleishman JA, Metlay JP, Moore RD, Gebo KA. Sustained viral suppression in HIV-infected patients receiving antiretroviral therapy. JAMA. 2012; 308(4):339–42. [PubMed: 22820781]
9. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, et al. Prevention of HIV-1 infection with early antiretroviral therapy. N Engl J Med. 2011; 365(6):493–505. [PubMed: 21767103]
10. Wood E, Kerr T, Marshall BD, Li K, Zhang R, Hogg RS, et al. Longitudinal community plasma HIV-1 RNA concentrations and incidence of HIV-1 among injecting drug users: prospective cohort study. BMJ. 2009; 338:b1649. [PubMed: 19406887]
11. De Cock KM, Fowler MG, Mercier E, de Vincenzi I, Saba J, Hoff E, et al. Prevention of mother-to-child HIV transmission in resource-poor countries: translating research into policy and practice. JAMA. 2000; 283(9):1175–82. [PubMed: 10703780]
12. Montaner JSG, Hogg R, Wood E, Kerr T, Tyndall M, Levy AR, et al. The case for expanding access to highly active antiretroviral therapy to curb the growth of the HIV epidemic. Lancet. 2006; 368(9534):531–6. [PubMed: 16890841]
13. Williams B, Wood R, Dukay V, Delva W, Ginsburg D, Hargrove J, et al. Treatment as prevention: preparing the way. J Int AIDS Soc. 2011; 14(S1):S6.
14. Hull MW, Wu Z, Montaner JSG. Optimizing the engagement of care cascade: a critical step to maximize the impact of HIV treatment as prevention. Curr Opin HIV AIDS. 2012; 7(6):579–86. [PubMed: 23076123]
15. Montaner JSG. Treatment as prevention: a double hat-trick. Lancet. 2011; 378(9787):208–9. [PubMed: 21763923]
16. Thompson MA, Aberg JA, Hoy JF, Telenti A, Benson C, Cahn P, et al. Antiretroviral treatment of adult HIV infection: 2012 recommendations of the International Antiviral Society–USA panel. JAMA. 2012; 308(4):387–402. [PubMed: 22820792]
17. World Health Organization. Antiretroviral treatment as prevention (TASP) of HIV and TB: programmatic update. Geneva: World Health Organization; 2012.
18. Joint United Nations Programme on HIV/AIDS. 90-90-90: an ambitious treatment target to help end the AIDS epidemic. Geneva: UNAIDS; 2014.
19. Nosyk B, Lourenço L, Min JE, Shopin D, Lima VD, Montaner JSG, et al. Characterizing retention in HAART as a recurrent event process: insights into ‘cascade churn’. AIDS. 2015; 29(13):1681–9. [PubMed: 26372279]
20. Hamlyn E, Ewings FM, Porter K, Cooper DA, Tambussi G, Schechter M, et al. Plasma HIV viral rebound following protocol- indicated cessation of ART commenced in primary and chronic HIV infection. PLoS One. 2012; 7:e43754. [PubMed: 22952756]
21. Lima VD, Bangsberg DR, Harrigan PR, Deeks SG, Yip B, Hogg RS, et al. Risk of viral failure declines with duration of suppression on HAART, irrespective of adherence level. J Acquir Immune Defic Syndr. 2010; 55(4):460. [PubMed: 20838225]
22. Wainberg MA, Zaharatos GJ, Brenner BG. Development of antiretroviral drug resistance. N Engl J Med. 2011; 365(7):637–46. [PubMed: 21848464]
23. Friedland GH, Williams A. Attaining higher goals in HIV treatment: the central importance of adherence. AIDS. 1999; 13:S61–72.
24. Milloy M-J, Montaner J, Wood E. Barriers to HIV treatment among people who use injection drugs: implications for ‘treatment as prevention’. Curr Opin HIV AIDS. 2012; 7(4):332–8. [PubMed: 22576468]

25. Wood E, Milloy MJ, Montaner JSG. HIV treatment as prevention among injection drug users. Curr Opin HIV AIDS. 2012; 7(2):151–6. [PubMed: 22227587]
26. Krüsi A, Wood E, Montaner J, Kerr T. Social and structural determinants of HAART access and adherence among injection drug users. Int J Drug Policy. 2010; 21(1):4–9. [PubMed: 19747811]
27. Kerr T, Marshall A, Walsh J, Palepu A, Tyndall M, Montaner J, et al. Determinants of HAART discontinuation among injection drug users. AIDS Care. 2005; 17(5):539–49. [PubMed: 16036240]
28. Hughes AJ, Mattson CL, Scheer S, Beer L, Skarbinski J. Discontinuation of antiretroviral therapy among adults receiving HIV care in the United States. J Acquir Immune Defic Syndr. 2014; 66(1): 80–9. [PubMed: 24326608]
29. Kempf M-C, Pisu M, Dumcheva A, Westfall AO, Kilby JM, Saag MS. Gender differences in discontinuation of antiretroviral treatment regimens. J Acquir Immune Defic Syndr. 2009; 52(3): 336–41. [PubMed: 19654551]
30. Samji H, Chen Y, Salters K, Montaner JSG, Hogg RS. Correlates of unstructured antiretroviral treatment interruption in a cohort of HIV-positive individuals in British Columbia. AIDS Behav. 2014; 18(11):2240–8. [PubMed: 24781638]
31. McNeil R, Kerr T, Anderson S, Maher L, Keewatin C, Milloy MJ, et al. Negotiating structural vulnerability following regulatory changes to a provincial methadone program in Vancouver, Canada: a qualitative study. Soc Sci Med. 2015; 133:168–76. [PubMed: 25875323]
32. Quesada J, Hart LK, Bourgois P. Structural vulnerability and health: Latino migrant laborers in the United States. Med Anthropol. 2011; 30(4):339–62. [PubMed: 21777121]
33. Joseph B, Kerr T, Puskas CM, Montaner J, Wood E, Milloy MJ. Factors linked to transitions in adherence to antiretroviral therapy among HIV-infected illicit drug users in a Canadian setting. AIDS Care. In press.
34. Milloy MJ, Kerr T, Bangsberg DR, Buxton J, Parashar S, Guillemi S, et al. Homelessness as a structural barrier to effective antiretroviral therapy among HIV-seropositive illicit drug users in a Canadian setting. AIDS Patient Care STDs. 2012; 26(1):60–7. [PubMed: 22107040]
35. Claborn KR, Meier E, Miller MB, Leffingwell TR. A systematic review of treatment fatigue among HIV-infected patients prescribed antiretroviral therapy. Psychol Health Med. 2015; 20(3): 255–65. [PubMed: 25110152]
36. Samji H, Taha TE, Moore D, Burchell AN, Cescon A, Cooper C, et al. Predictors of unstructured antiretroviral treatment interruption and resumption among HIV-positive individuals in Canada. HIV Med. 2015; 16(2):76–87. [PubMed: 25174373]
37. Hill S, Kavookjian J, Qian J, Chung A, Vandewaa J. Effects of pill burden on discontinuation of the initial HAART regimen in minority female patients prescribed 1 pill/day versus any other pill burden. AIDS Care. 2014; 26(5):595–601. [PubMed: 24111921]
38. Wood E, Hogg RS, Lima VD, Kerr T, Yip B, Marshall BDL, et al. Highly active antiretroviral therapy and survival in HIV- infected injection drug users. JAMA. 2008; 300(5):550–4. [PubMed: 18677027]
39. Lopez AM, Bourgois P, Wenger LD, Lorvick J, Martinez AN, Kral AH. Interdisciplinary mixed methods research with structurally vulnerable populations: case studies of injection drug users in San Francisco. Int J Drug Policy. 2013; 24(2):101–9. [PubMed: 23312109]
40. Moore D, Dray A, Green R, Hudson SL, Jenkinson R, Siokou C, et al. Extending drug ethno-epidemiology using agent-based modelling. Addiction. 2009; 104(12):1991–7. [PubMed: 19804460]
41. Krüsi A, Milloy MJ, Kerr T, Zhang R, Guillemi S, Hogg R, et al. Ongoing drug use and outcomes from highly active antiretroviral therapy among injection drug users in a Canadian setting. Antivir Ther. 2010; 15(5):789. [PubMed: 20710061]
42. McNeil R, Dilley LB, Guirguis-Younger M, Hwang SW, Small W. Impact of supervised drug consumption services on access to and engagement with care at a palliative and supportive care facility for people living with HIV/AIDS: a qualitative study. J Int AIDS Soc. 2014; 17(1):18855. [PubMed: 24629844]

43. Small W, Wood E, Betteridge G, Montaner J, Kerr T. The impact of incarceration upon adherence to HIV treatment among HIV- positive injection drug users: a qualitative study. AIDS Care. 2009; 21(6):708–14. [PubMed: 19806487]
44. Milloy MJ, Kerr T, Buxton J, Rhodes T, Guillemi S, Hogg R, et al. Dose-response effect of incarceration events on nonadherence to HIV antiretroviral therapy among injection drug users. J Infect Dis. 2011; 203(9):1215–21. [PubMed: 21459814]
45. Werb D, Milloy MJ, Kerr T, Zhang R, Montaner J, Wood E. Injection drug use and HIV antiretroviral therapy discontinuation in a Canadian setting. AIDS Behav. 2013; 17(1):68–73. [PubMed: 22249956]
46. Bradley EH, Curry LA, Devers KJ. Qualitative data analysis for health services research: developing taxonomy, themes, and theory. Health Serv Res. 2007; 42(4):1758–72. [PubMed: 17286625]
47. Strathdee SA, Patrick DM, Currie SL, Cornelisse PGA, Rekart ML, Montaner JSG, et al. Needle exchange is not enough: lessons from the Vancouver injecting drug use study. AIDS. 1997; 11(8):F60–5.
48. Yuan Y, L'Italien G, Mukherjee J, Iloeje UH. Determinants of discontinuation of initial highly active antiretroviral therapy regimens in a US HIV-infected patient cohort. HIV Med. 2006; 7(3): 156–62. [PubMed: 16494629]
49. Ammassari A, Murri R, Pezzotti P, Trotta MP, Ravasio L, De Longis P, et al. Self-reported symptoms and medication side effects influence adherence to highly active antiretroviral therapy in persons with HIV infection. J Acquir Immune Defic Syndr. 2001; 28(5):445–9. [PubMed: 11744832]
50. Lawrence J, Mayers DL, Hullsiek KH, Collins G, Abrams DI, Reisler RB, et al. Structured treatment interruption in patients with multidrug-resistant human immunodeficiency virus. N Engl J Med. 2003; 349(9):837–46. [PubMed: 12944569]
51. Milloy MJ, Montaner JSG, Wood E. Incarceration of people living with HIV/AIDS: implications for treatment-as-prevention. Curr HIV AIDS Rep. 2014; 11(3):308–16.
52. Milloy MJ, Marshall BDL, Montaner J, Wood E. Housing status and the health of people living with HIV/AIDS. Curr HIV AIDS Rep. 2012; 9(4):364–74.
53. Wood E, Werb D, Kazatchkine M, Kerr T, Hankins C, Gorna R, et al. Vienna declaration: a call for evidence-based drug policies. Lancet. 2010; 376(9738):310–2. [PubMed: 20650517]
54. Wolfe D, Cohen J. Human rights and HIV prevention, treatment, and care for people who inject drugs: key principles and research needs. J Acquir Immune Defic Syndr. 2010; 55:S56–62. [PubMed: 21045602]

Table 1

Participant characteristics

Participant characteristic	n (%) N = 39
Age	
Mean	46 years
Interquartile range	42–52.5 years
Gender	
Men	21 (53.8 %)
Women	16 (41.0 %)
Transgender persons	2 (5.1 %)
Race	
Indigenous	23 (59.0 %)
Caucasian	14 (35.9 %)
Other	2 (5.1 %)
Drug use (30 days prior to interview)[a]	
Crack cocaine (smoked)	22 (56.4 %)
Cocaine (injected)	22 (56.4 %)
Heroin (injected)	12 (30.8 %)
Crystal methamphetamine (injected or smoked)	10 (25.6 %)
Years since ART diagnosis	
Mean (interquartile range)	14.8 (10–19)
Years since ART initiation	
Mean (interquartile range)	11.3 (6–16)
ART interruption events (≥30 days) since treatment initiation	
Mean (interquartile range)	7.2 (5–9)

[a]Participants were able to select more than one response