

# Sex differences in houselessness, injection drug use, and mental health conditions among people newly diagnosed with HIV in Manitoba, Canada from 2018 to 2021: a retrospective cohort study



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## Summary

**Background** Manitoba saw the highest number of new HIV diagnoses in the province's history in 2021 and is the only Canadian province not meeting any of the previous UNAIDS 90-90-90 targets. Our goal was to describe sex differences and syndemic conditions within an incident HIV cohort in Manitoba, and the HIV treatment initiation and undetectable viral load outcomes.

**Methods** This was a retrospective cohort study of all people 18 years and older newly diagnosed with HIV in Manitoba, Canada between January 1st, 2018 and December 31st, 2021. Data was collected as follows: *before HIV diagnosis*: chlamydia, gonorrhoea, syphilis, and/or hepatitis C antibodies. *At the time of HIV diagnosis*: age, sex, gender, race/ethnicity, sexual orientation. *During follow-up*: CD4 counts, viral load, HIV treatment, hospitalizations, and number of visits to HIV care. Main exposures evaluated: methamphetamine use, injection drug use, houselessness, and mental health conditions. Outcomes: started antiretroviral treatment and achieved an undetectable viral load. A descriptive statistical analysis was used.

**Findings** There were 404 new HIV diagnoses in Manitoba from 2018 to 2021; 44.8% were female, 55.2% male; 76.0% self-identified as Indigenous, 13.4% white/European, 4.7% African/black; 86.6% cis-gender; 60.9% heterosexual, 13.4% gay, bisexual and men who have sex with men, and 1.7% lesbian. Injection drug use was reported by 71.8% and 43.5% of females and males respectively. Methamphetamine was the most frequently injected drug (62.4%). Amongst females, 81.8% experienced at least one of the following: houselessness (43.1%), mental health comorbidities (46.4%), and injection drug use (71.8%). Only 64.9% of all individuals had an undetectable viral load (61.1% females and 67.9% males), 56.5% among people experiencing houselessness, 59% among young people ( $\leq 29$  years), and 60.1% among people who inject drugs.

**Interpretation** People newly diagnosed with HIV in Manitoba are disproportionately experiencing houselessness, mental illness, and injection drug use (mostly methamphetamine). This pattern is more pronounced for female individuals. These findings highlight the need for syndemic and gender-specific approaches, simultaneously addressing social and health conditions, to treat HIV.

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**Keywords:** HIV; Syndemics; Houselessness; Methamphetamine; Mental health condition; Sex and gender; Injection drug use; Intersectionality; HIV cascade of care; Canada; Cohort study

### Research in context

#### Evidence before this study

Canada, like many high-income countries, reported achieving the 90-90-90 treatment targets for HIV and the focus shifted to 95-95-95. However, Manitoba, Canada, recorded the highest-ever incidence of HIV in 2021–2023 with many people unsuccessfully engaged in the HIV cascade of care. Both the UNAIDS and World Health Organization HIV reports alluded to increasing numbers among people who inject drugs and females, however, these were seen as separate populations in Eastern Europe and Africa respectively. There has been concentrated HIV incidence in some populations in North America that report high rates of injection drug use (IDU), however this is not seen as a growing problem. Finally, people living with HIV who are not connected/linked to care are largely seen as a problem of under-resourced countries while North American/Western populations are seen as well connected. The PubMed database was searched between February and November 2021 and updated on April 2024, using the following keywords; HIV, syndemic, houselessness, unstably housed, methamphetamine, substance use, SAVA, mental health, and HIV outcomes. In North America, there is increasing recognition of the overlap of houselessness, injection drug use, and mental health conditions driving new HIV diagnoses and creating barriers to the cascade of HIV care. Almost all studies focused on the gay, bisexual, and men who have sex with men (gbMSM) and transgender populations as they make up the majority of the HIV population in North America. In the last five years, there have been several reports of HIV outbreaks related to injection drug use. The main drug of use in these outbreaks is opioids, but methamphetamine use is on the rise across North America. As injection drug use continues to play a major risk factor for HIV transmission, further evidence has demonstrated that houselessness is also an independent risk factor for HIV. Houselessness also serves as a barrier to connection to HIV care, as do mental health conditions. In Canada, the majority of people living with HIV identify as gbMSM, with only approximately 30% female. A recent study in Canada's three major cities showed most of the gbMSM community has achieved the 90-90-90 targets and has a 2–10% rate of unsuppressed viral load depending on the city. The Tracks survey, a Canadian national survey from 2017 to 2019 of people who inject drugs (PWID), identified that of PWID the majority were cisgender males who were unstably housed with an over-representation of Indigenous people. There was an HIV prevalence of 10.3% among survey participants. The two most common drugs injected were cocaine and hydromorphone.

In summary, what we know is that in North America there are clusters of new HIV diagnoses largely driven by people who inject drugs, who have a high burden of houselessness and mental health conditions. The demographics of PWID in Canada are different than the majority HIV population. Many studies have looked at the syndemic interaction of injection drug use, houselessness, and mental health, but almost exclusively in the gbMSM community. The impact of rising methamphetamine use in North America continues to be understudied and is not yet fully understood.

#### Added value of this study

Our research was co-designed and co-developed with people living with HIV, HIV clinicians and frontline workers, and HIV and public health program managers and administrators with equity, sex and gender-based and intersectional lenses. This study describes a unique North American population newly diagnosed with HIV with growing incident rates of HIV and lower proportions of undetectable viral load. Nearly 50% of this population were female. A significant proportion of females and males newly diagnosed with HIV have at least one or more intersections between houselessness, injection drug use, and mental health. While many individuals in the cohort started antiretroviral treatment (81.2%), only 64.9% achieved an undetectable viral load (61.1% among females and 67.9% among males, and around 60% among people experiencing houselessness, PWID, and people who use methamphetamine).

#### Implications of all the available evidence

This study highlights the need for a syndemic and sex- and gender-based approach to treating HIV. Several structural, social and health conditions are driving new HIV diagnoses in Manitoba, Canada. As Canada and other high-income countries face a housing affordability crisis, people experiencing houselessness in this study were least likely to have an undetectable viral load. Worldwide, the number of people reporting IDU, particularly methamphetamine use, is increasing. The syndemics reported herein are distinct due to a lack of methamphetamine replacement therapy, associated behavioural factors and limited implementation of harm reduction programs, and thus more HIV diagnoses will be expected in this population. Our paper has implications for other countries, especially in North America and Western Europe where there is increasing methamphetamine use. Achieving the 95-95-95 UNAIDS goals will require a syndemic lens that appreciates the structural, social, and health conditions of those unacceptably left behind.

## Introduction

The Joint United Nations Program on HIV/AIDS (UNAIDS) outlines the cascade of human immunodeficiency virus (HIV) care as an individual being aware of their diagnosis; taking sustained anti-retroviral treatment (ART); and achieving a suppressed viral load.<sup>1</sup> In 2022, the UNAIDS increased their treatment target goals to 95 per cent of all people living with HIV achieving each step of this cascade (95-95-95). Still, organizations, including UNAIDS, are continuing to recognise the need to consider the interaction of structural and social inequities, such as poverty, with HIV diagnosis to reach the last 5% of people.<sup>2</sup>

Syndemic theory is a framework that examines the interaction between biological and social factors on a person's health.<sup>3</sup> Syndemic literature suggests that understanding the interaction between biological variables such as mental health and HIV, social variables such as houselessness and food insecurity, and biological and social variables such as addiction, can lead to better health outcomes.<sup>3,4</sup> Syndemics have been described for decades in the HIV literature, and studies continue to demonstrate that the additive power of syndemic factors such as mood disorders, drug use, and stigma, amongst people living with HIV, leads to worse health outcomes.<sup>5</sup>

People living with HIV who inject drugs are a particularly stigmatised and vulnerable population. They are also more likely to have lower engagement in care and experience poorer health outcomes such as decreased viral load suppression and increased mortality.<sup>5</sup> It has been demonstrated that screening for, and treating, substance use disorder within HIV care leads to increased retention in care and improved outcomes on the HIV continuum of care, adding further proof of concept to the application of syndemic theory.<sup>5</sup>

In North America and Western Europe, the majority of people living with HIV are gay-bisexual men who have sex with men (gbMSM).<sup>6</sup> In Canada, less than 30% of people living with HIV are female and the main method of HIV acquisition is sex amongst gbMSM. Manitoba is a province in Canada that is not following these HIV population trends. Manitoba was the only Canadian province that did not meet the 90-90-90 targets,<sup>7</sup> as initially defined in the United Nations General Assembly's Political Declaration on Ending AIDS in 2016. While most of North America and Western Europe have reported decreasing HIV incident diagnoses and increasingly engaged populations in care, Manitoba moved in the opposite direction.<sup>6</sup> Manitoba reported HIV incident diagnoses above the Canadian national rate five years in a row prior to 2018, and observed increasing numbers of females living with HIV.<sup>8</sup> There is a gap in understanding why HIV is increasing in Manitoba, especially amongst females. Therefore, our aim was to address this knowledge gap

by describing the sex differences and syndemic conditions within an incident HIV cohort in Manitoba diagnosed between 2018 and 2021 and to identify characteristics associated with those unsuccessfully engaged in care.

## Methods

### Context

All persons with new diagnoses of HIV in the province of Manitoba, Canada, are referred to a central HIV care program called the Manitoba HIV Program. Persons are seen, treated and followed up at one of three clinics: Health Sciences Centre Clinic or Nine Circles Community Health Centre in Winnipeg; and 7th Street Health Access Centre in Brandon.

### Community partnership and engagement

The first meetings aimed to create open and honest discussions, listen to people's stories and gain insight into the needs and priorities of their communities, share experiential knowledge, and brainstorm research priorities. Meetings with people with lived experience included the following agenda.

- We do not judge, and we want to listen to you
- Introductions of each person
- What are your needs, challenges and ideas about:
  - Drug use
  - Experiencing houselessness
  - Health
  - Sexually transmitted and blood-borne infections (STBBIs) and access and linkage to care
- Do you want to?
  - To participate as members of the research group to drive the direction of the research project (before, during, and after)
  - To help us to connect with people who inject drugs
  - To help us to develop educational material for people who inject drugs

In addition, more than 15 meetings were held with healthcare providers between March 2021 and August 2021 and had the following agenda.

- Presentation of trends of sexually transmitted infections from 2018 to 2020 among people living with HIV
- What are your needs?
- What do you think are the main challenges that people living with HIV are facing?
- What would be your priorities for research?
- Presentation of people's needs, a draft of the research objectives based on the meetings with peers and literature review, and an open question: what would you change, add, modify?

This consultation period provided a ground-up roadmap where the knowledge and priorities of key stakeholders, especially those with lived experience, guided the development of the project proposal. This consultation and stakeholder engagement affirmed to the researchers that this study was necessary to provide evidence that would further the advocacy efforts of those working on the frontlines.

Based on the previous consultations, we drafted the research proposal and shared it with people with lived experience, the Manitoba HIV Program leaders and other stakeholders. After more than 25 reviews and feedback on the project proposal, we proposed two objectives: one aimed to understand the epidemiology of people newly referred to the Manitoba HIV Program between 2018 and 2021; and a prospective second objective that aimed to understand the barriers and facilitators to access the HIV cascade of care and harm reduction services by interviewing people diagnosed with HIV and health care providers that participate in the care of people living with VIH. This article is focused on the first objective.

In addition, a Research Advisory Committee, composed of people living with HIV, Indigenous scholars, gender-sex experts and experienced community researchers provided guidance to ensure the study was designed applying culturally appropriate methods. People living with HIV were involved with the project since its conception and through all phases of the process. Preliminary and final findings were shared through extensive community consultations to identify the best way to present the data.

### Study design

This was a retrospective cohort study including all people newly diagnosed with HIV in Manitoba following a community-based research approach described above and additional details are provided elsewhere.<sup>9</sup>

### Ethical and institutional approval

We received approval from the University of Manitoba Health Ethics Research Board (HS25272 (H2021:415), First Nations Health and Social Secretariat of Manitoba, Nine Circles Community Health Centre, Shared Health Manitoba (SH2021:208), and 7th Street Health Access Centre.

### Participants

The Manitoba HIV Program and Manitoba Health Epidemiology and Surveillance Unit assisted in verifying the people diagnosed with HIV. All people 18 years or older who tested positive for HIV in Manitoba between January 1st 2018 and December 31st 2021 and whose HIV test result was previously unknown or negative for HIV were included. Adults with a previous HIV diagnosis who were transferred to care in Manitoba from out-of-province during the study period were

excluded. All charts were reviewed for a minimum of one year. Follow-up occurred at one of the three clinic sites listed above.

### Data collection

The data collection for the retrospective study was designed not only for research, but also to generate the Manitoba HIV Program Report, and a policy brief to support decision-making. To design the data collection form, we reviewed the reports from the Manitoba HIV Program; the Manitoba Government; the Public Health Agency of Canada; the US Centers for Disease, Control and Prevention; and the UNAIDS program indicators. We also performed a literature review of 150 papers regarding our research questions. In addition, we reviewed the Multicenter AIDS Cohort Study/Women's Interagency HIV Study (MACS/WIHS) combined cohort study data collection forms and manual of operations.<sup>10</sup> Finally, we co-defined with people with lived/living experience, clinicians, healthcare workers, policymakers, and researchers the variables and outcomes of interest. The data collection was piloted by two HIV clinicians who reviewed the clinical charts to ensure data were available and to reorganize the form to facilitate a better flow during the data collection. After adjustments, three resident physicians, clinical internal medicine and infectious diseases trainees collected the data, piloted the form and provided additional feedback and changes in the sequence of the forms. The final step was a review of the most updated version of the form by Manitoba HIV clinicians [Supplementary material (Data Collection Form)].

All variables were collected from the clinical charts. Further details of how variables were collected and definitions can be found in the [Supplementary Material \(Data Collection Form\)](#). The clinical chart was thoroughly reviewed by the data collectors to minimize missing data. Missing data was listed as "Unknown" where relevant and not excluded from statistical analyses.

### Variables collected

#### *Before HIV diagnosis*

Sexually transmitted and blood-borne infections (STBBIs) were defined as any of chlamydia, gonorrhea, syphilis, and/or hepatitis C antibodies prior to HIV diagnosis recorded in clinical chart. The associated tests used for detection of STBBIs included: urine nucleic acid amplification test; urogenital swabs of cervix and/or anus for gonorrhea and chlamydia; serologic tests for hepatitis C antibodies; and quantitative non-treponemal serologic tests and treponemal serologic tests for syphilis.

#### *At the time of HIV diagnosis*

Age in years. Sex was recorded as the sex assigned at birth. Gender, sexual orientation, and substance use

(methamphetamine, opioids, cocaine, alcohol, smoking, cannabis, and methods of use [injection, intranasal, inhaled, smoked]) were self-reported variables. Self-reported race/ethnicity was collected following Flanagan et al. format.<sup>11</sup> AIDS-defining illnesses and other communicable and non-communicable diseases/conditions were recorded and defined according to the United States Centers for Disease Control and Prevention.

*Exposures collected at the time of HIV diagnosis:* 1) Injection drug use. 2) Methamphetamine use. 3) Houselessness, including unstably housed. All three exposures were self-reported. 4) Mental health conditions were reported using the DSM-5 (Diagnostic and Statistical Manual of Mental Illness) definitions.<sup>12</sup>

*Variables collected at the time of HIV diagnosis and follow-up:* The first and last documented CD4 counts and HIV viral loads were recorded. ART treatment, number of follow-up visits, hospitalizations, and deaths were variables collected for the duration of each person's connection to care. Everyone had at least one year between diagnosis and chart review to guarantee at least one year of follow-up for each participant.

### Primary outcomes

1) Started ART, defined as if there was a prescription of an anti-retroviral medication in the clinical chart. Continuing ART was recorded if the person had an active prescription renewal at the time of chart review. 2) Achieved an undetectable viral load, defined as <20 copies/ml. The denominator for this outcome is all people who started antiretroviral therapy.

### Statistical methods

We collected all new diagnoses reported by the statistical update on HIV/AIDS from the Government of Manitoba<sup>8</sup> to depict the HIV incidence from 1985 to 2021. In this manuscript, we included sociodemographic and clinical information of all people whose HIV test results were previously unknown or negative for HIV, i.e. newly diagnosed with HIV between 2018 and 2021.

Sociodemographic and clinical characteristics for the population were determined using proportions for

categorical variables and medians for continuous variables with interquartile range. Results are reported in general and by sex (female and male). Proportions of started antiretroviral treatment and achieving an undetectable viral load are reported for each variable of interest. [Supplementary Table S1](#) reports the proportions of started ART and achieving an undetectable viral load in the imputed datasets that included four variables with missing data, sexual orientation, race/ethnicity, gender, and alcohol consumption. These variables were imputed using multiple imputation with chained equations, which generated 20 imputed datasets. Data was analyzed using Jamovi software (2022, Version 2.3) and R software (version 4.3.0).<sup>13</sup>

To avoid measurement bias, 40 charts were reviewed at random by two reviewers to ensure consistency in data collection with 97.5% intra-rater reliability. This study included all Manitobans diagnosed with HIV within the study period, which minimized a selection bias.

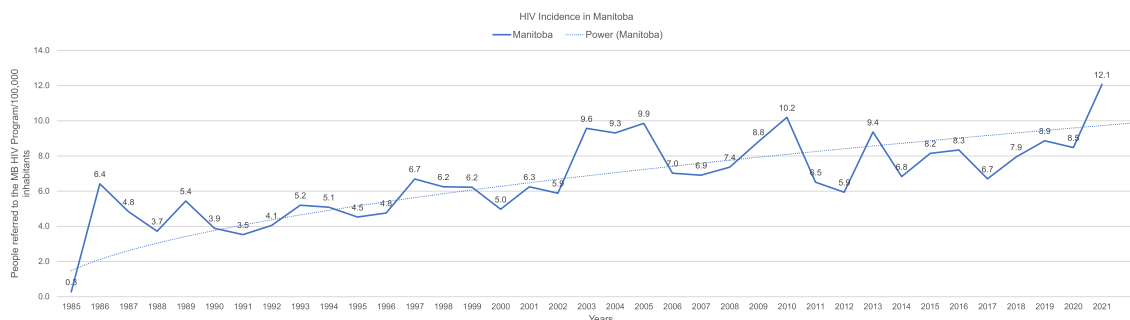
### Role of the funding source

Funders did not participate in study design, in the collection, analysis, and interpretation of data, in writing of the report, and in the decision to submit the paper for publication.

### Results

Between 2018 and 2021, 517 people were referred to the Manitoba HIV Program. Among them, 404 adults were newly diagnosed with HIV. These 404 people made up the study cohort. Considering the statistical updates on HIV/AIDS reported by the Government of Manitoba from 1985 to 2021, the incidence of people newly diagnosed with HIV increased yearly ([Fig. 1](#)) and the proportion of females increased from 37.0% (30/81) in 2018 to 48.2% (68/141) in 2021.

The median age of the cohort was 35 years (IQR: 29–42). Indigenous people accounted for 76% of all new diagnoses ([Table 1](#)). The majority (86.6%) of reported gender was congruent with sex at birth; 85.7% of males



**Fig. 1:** Yearly incident rate of HIV in Manitoba, Canada, from the first reported diagnosis in 1985 until 2021.

Characteristic	Female N = 181	Male N = 223	Total N = 404
	n (%)	n (%)	n (%)
Age, years median (IQR)	33.0 (27.0–39.0)	37.0 (30.0–46.0)	35.0 (29.0–42.0)
<b>Sexual orientation</b>			
Heterosexual	129 (71.3)	117 (52.5)	246 (60.9)
gbMSM <sup>a</sup>	0 (0.0)	54 (24.2)	54 (13.4)
Lesbian/Bisexual	7 (3.9)	0 (0.0)	7 (1.7)
Unknown	45 (24.9)	52 (23.3)	97 (24.0)
<b>Gender</b>			
Man	0 (0.0)	191 (85.7) <sup>2</sup>	191 (47.3)
Woman	159 (87.8) <sup>b</sup>	1 (0.4)	160 (39.6)
Transgender woman	0 (0.0)	4 (1.8)	4 (1.0)
Transgender man	2 (1.1)	0 (0.0)	2 (0.5)
Non-binary <sup>c</sup>	0 (0.0)	3 (1.3)	3 (0.7)
Unknown	20 (11.0)	24 (10.8)	44 (10.9)
<b>Race/ethnicity</b>			
Indigenous (First Nations, Inuit, Métis, unspecified)	154 (85.1)	153 (68.6)	307 (76.0)
White/European	13 (7.2)	41 (18.4)	54 (13.4)
African/Black	9 (5.0)	10 (4.5)	19 (4.7)
Other <sup>d</sup>	2 (1.1)	14 (6.3)	16 (4.0)
Unknown	3 (1.7)	5 (2.2)	8 (2.0)
<b>Urban/Rural</b>			
Urban	126 (69.6)	159 (71.3)	285 (70.5)
Rural	55 (30.4)	64 (28.7)	119 (29.5)
<b>Self-Reported HIV Mode of Transmission<sup>e</sup></b>			
Heterosexual	141 (77.9)	116 (52.0)	257 (63.6)
Injection drug use	130 (71.8)	97 (43.5)	227 (56.2)
gbMSM <sup>a</sup>	0 (0.0)	45 (20.2)	45 (11.1)
Sexual assault	2 (1.1)	0 (0.0)	2 (0.5)
Other <sup>f</sup>	11 (6.1)	14 (6.3)	25 (6.2)
Unknown	7 (3.9)	14 (6.3)	21 (5.2)
<b>Substance use</b>			
Drug use	156 (86.2)	167 (74.9)	323 (80.0)
≥2 Drugs used	154 (85.1)	167 (74.9)	321 (79.5)
<b>Drug/substance used</b>			
Methamphetamine	138 (76.2)	114 (51.1)	252 (62.4)
Opioids	46 (25.4)	32 (14.3)	78 (19.3)
Cocaine	34 (18.8)	51 (23.0)	85 (21.1)
Alcohol	104 (57.5)	142 (64.0)	246 (61.0)
Smoking	101 (55.8)	122 (55.0)	223 (55.3)
Cannabis	55 (30.4)	77 (34.7)	132 (32.8)
<b>Method of drug use</b>			
Injection	130 (71.8)	97 (43.5)	226 (56.2)
Intranasal	26 (14.4)	42 (18.9)	68 (16.9)
Inhaled	30 (16.6)	49 (22.1)	79 (19.6)
Smoked	83 (45.9)	97 (43.7)	180 (44.7)
<b>Houselessness</b>	78 (43.1)	64 (28.7)	142 (35.1)

<sup>a</sup>Gay, bisexual, and men who have sex with men. <sup>b</sup>Cis-gender: 159 females identified as a woman and 191 males identified as a man which accounts for 86.6% (350/404) of the total population. <sup>c</sup>Non-Binary: This category includes persons whose reported gender is not exclusively male or female. i.e. agender, pangender, genderqueer, genderfluid, two-spirit or gender nonconforming. We used the definition from Statistics Canada. <sup>d</sup>Latin American, East/Southeast Asian, Middle Eastern, South Asian. <sup>e</sup>People could report more than one mode of transmission. The number of people reporting heterosexual and gbMSM transmission does not match numbers reported for sexual orientation because some people had sexual exposures that did not align with their sexual orientation. <sup>f</sup>Tattoo, Bisexual, Perinatal, Occupational.

**Table 1: Clinical and demographic characteristics at the time of HIV diagnosis of all people newly diagnosed in Manitoba, Canada, by sex, from 2018 to 2021.**

identified as a man and 87.8% of females identified as a woman. Six people self-identified as transgender, three as non-binary, and 44 (10.9%) did not report. Regarding sexual orientation, 60.9% identified as heterosexual, 13.4% identified as gay, bisexual, and men who have sex with men (gbMSM), and less than five per cent identified as other; however sexual orientation was not reported by 24.0% (Table 1).

The most common self-reported modes of HIV acquisition included heterosexual sex (63.6%) and injection drug use (56.2%), followed by sexual activity among gbMSM (11.1%) (Table 1).

Eighty per cent of people self-reported drug use (323/404). Among people who use drugs by any route, 71.8% of females and 43.5% of males self-reported injection drug use (130/181 and 97/223, respectively). Among people who reported injection drug use, 93.4% used methamphetamine (212/227). The most common drug used was methamphetamine (62.4%; 252/404) and most people who use methamphetamine reported injection drug use (84.1%; 212/252). Methamphetamine use was self-reported by 76.2% of females and 51.1% of males (138/181 and 114/223, respectively). Less than 20% of people reported opioid use (78/404) (Table 1).

The main comorbidities were STBBI (53.2%; 215/404) and a mental health condition (40.3%; 163/404) (Table 2). Any STBBI (chlamydia, gonorrhoea, syphilis or hepatitis C) was diagnosed in 64.1% of females and 44.4% of males before HIV diagnosis (116/181 and 99/223, respectively; Table 2). At the time of diagnosis, 43.1% of females and 28.7% of males were experiencing houselessness (78/181 and 64/223, respectively; Table 1). Fig. 2 illustrates a greater percentage of females, compared to males, are experiencing houselessness and mental health conditions, using injected drugs and methamphetamine, and diagnosed with STBBI prior to HIV diagnosis.

Eighty-one percent of females and 61.9% of males newly diagnosed with HIV (148/181 and 138/223, respectively) have at least one or more intersections between houselessness, injection drug use and mental health (Fig. 3A and B). A quarter of females were experiencing these three conditions at the same time compared to 12.1% of males (43/181 and 27/223; respectively).

AIDS-defining illnesses were diagnosed in 8.7% of people (35/404). The median CD4 count at diagnosis was 419 cells/mm<sup>3</sup> (271–567), and initial CD4 counts were higher for females than males (Table 2).

Many individuals in the cohort started ART (81.2%; 328/404), however, it was below the previous 90% UNAIDS goal (currently 95%) in all variables. There were no differences in started ART by sex (Table 3). Among all 404 individuals, 336 people had at least one or more follow-up visits with the HIV team (150 females and 186 males) with a similar median number of visits between females and males (Table 2).

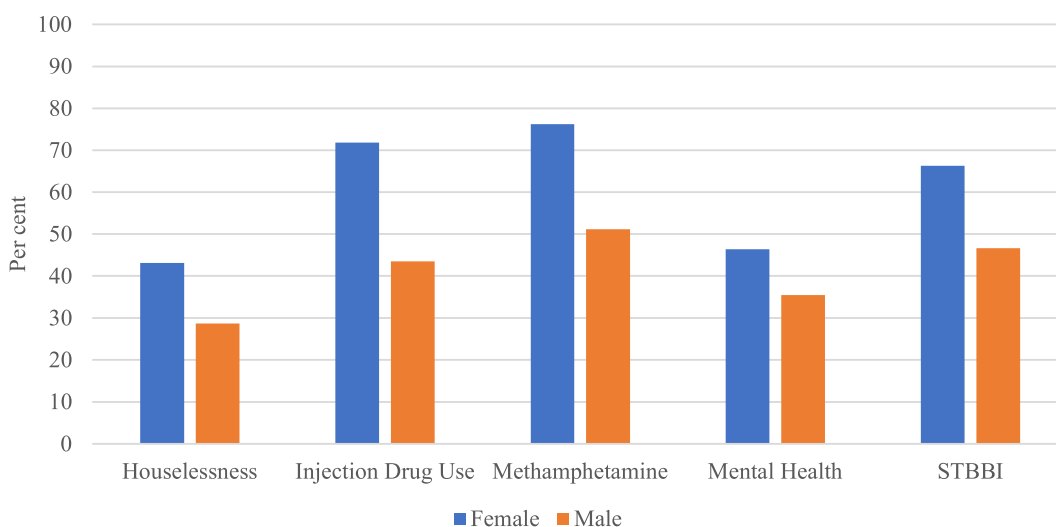
Characteristic	Female N = 181 (%)	Male N = 223 (%)	Total N = 404 (%)
<b>Comorbidities</b>			
Prior STBBI <sup>a</sup>	116 (64.1)	99 (44.4)	215 (53.2)
Mental health <sup>b</sup>	84 (46.4)	79 (35.4)	163 (40.3)
Metabolic	24 (13.3)	18 (8.1)	42 (10.4)
Respiratory	21 (11.6)	16 (7.2)	37 (9.2)
AIDS defining illness <sup>c</sup>	16 (8.8)	19 (8.5)	35 (8.7)
Hematologic	25 (13.8)	7 (3.1)	32 (7.9)
Cardiac	16 (8.8)	12 (5.4)	28 (6.9)
Neurologic	14 (7.7)	14 (6.3)	28 (6.9)
Autoimmune	9 (5.0)	6 (2.7)	15 (3.7)
Hepatology	6 (3.3)	9 (4.0)	15 (3.7)
Renal	2 (1.1)	6 (2.7)	8 (2.0)
Cancer	1 (0.6)	5 (2.2)	6 (1.5)
Gynecologic	5 (2.8)	0 (0.0)	5 (1.2)
Urologic	0 (0.0)	3 (1.3)	3 (0.7)
<b>HIV indicators</b>			
First viral load, copies/ml, median (IQR)	28,200 (10,800–134,000)	59,600 (13,050 to 245,500)	40,300 (11,630 to 180,500)
Last viral load, copies/ml, median (IQR)	22.8 (0.0–9562.5)	19.0 (0.0–471.5)	20.1 (0.0–3300.0)
First CD4 count, cells/mm <sup>3</sup> , median (IQR)	458.0 (305.5–614.2)	394.0 (245.0–534.5)	419.0 (271.0–567.0)
Last CD4 count, cells/mm <sup>3</sup> , median (IQR)	512.0 (316.5–719.5)	525.0 (347.5–703.5)	515.0 (342.2–716.8)
Number of visits to HIV care, median (IQR) <sup>d</sup>	6 (3–13)	6 (3–13)	6 (3–13)

<sup>a</sup>Sexually transmitted and blood-borne infections diagnosed before HIV diagnosis. Only including chlamydia, gonorrhoea, syphilis, and hepatitis C. <sup>b</sup>Any mental health condition defined by the DSM-5 (Diagnostic and Statistical Manual of Mental Illness). <sup>c</sup>As defined by the United States Center for Disease Control and Prevention. <sup>d</sup>336 persons attended at least one or more visits to the HIV care.

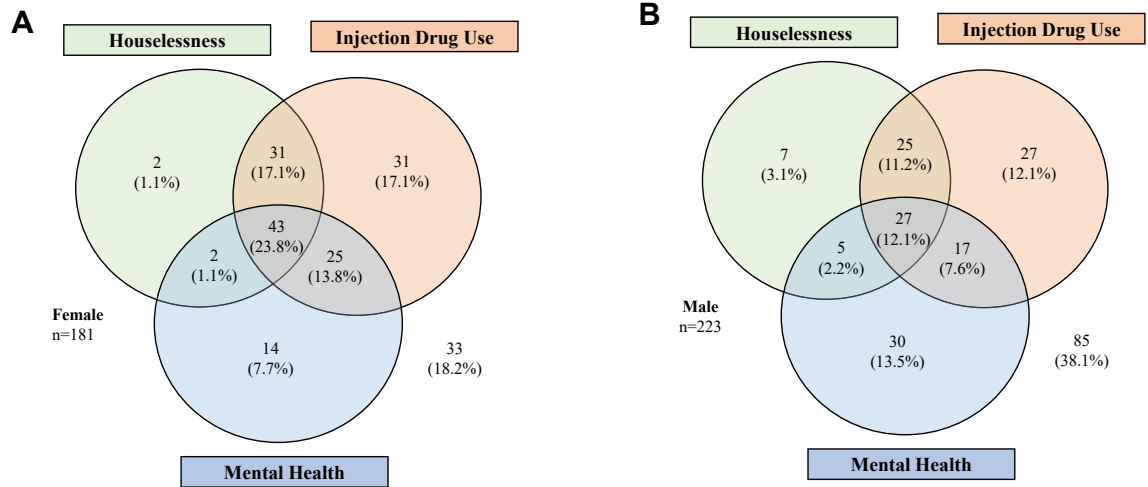
**Table 2: Comorbidities and HIV indicators, disaggregated by sex among people newly diagnosed with HIV in Manitoba, Canada, 2018–2021.**

Only 64.9% of people achieved an undetectable viral load (213/328). Sixty-one per cent of females achieved undetectable viral load compared to 67.9% of males (Table 3). Amongst people experiencing houselessness, 56.5% achieved an undetectable viral load (65/115).

Amongst people who inject drugs, use methamphetamine, opioids, and alcohol, 60.1% (113/188), 61.3% (125/204), 57.4% (39/68), and 63.2% (134/212) achieved an undetectable viral load, respectively (Table 3). A critical finding is that in most categories of the reported



**Fig. 2:** Current living experiences of females and males newly diagnosed with HIV in Manitoba, 2018–2021. Mental health conditions were reported using the DSM-5 (Diagnostic and Statistical Manual of Mental Illness) definitions. STBBI: Sexually transmitted blood-borne infection before HIV diagnosis; only including chlamydia, gonorrhoea, syphilis, and hepatitis C.



**Fig. 3:** Intersection of houselessness, injection drug use, and reported mental health condition among (A) females and (B) males newly diagnosed with HIV in Manitoba, Canada, 2018–2021. Females have a considerable vulnerability, 81.8% (148/181) of females and 61.9% (138/223) of males newly diagnosed with HIV have at least one or more intersections between houselessness, injection drug use, and mental health.

variables, people had low percentages of undetectable viral load (below 70%). Refer to Table 3 for a breakdown of these variables.

**Discussion**

The incidence of HIV in Manitoba has increased yearly, mostly amongst young people, with a large proportion of females; high rates of injection methamphetamine use; people who predominantly identify as heterosexual and cis-gendered; and with an overrepresentation of Indigenous people. The epidemiology of HIV in Manitoba is distinct from the rest of Canada, North America and Western Europe, which have majority male and gbMSM populations.<sup>6,14</sup> This study identifies the confluence of several social and biological factors associated with the people newly diagnosed in Manitoba, generating a particularly vulnerable population. The application of syndemic theory can help better conceptualize the barriers faced by this population and build a roadmap to improve connection to care and health.

We identified intersecting conditions of houselessness, mental health comorbidities, and injection drug use in our cohort of newly diagnosed people. In our cohort, 81.2% of people started treatment but only 64.9% achieved an undetectable viral load, compared to 2–10% in Canada’s largest cities,<sup>15</sup> suggesting barriers to ongoing care. An integrated approach that addresses each syndemic variable concomitantly is needed to increase engagement and retention in care. Integrated teams with infectious disease and addiction medicine specialists have been shown to increase care engagement among people living with HIV.<sup>16</sup> Through a syndemic lens, it is important to revisit models of service delivery by bolstering the outreach

of in-the-moment care provision,<sup>17</sup> addressing housing,<sup>18</sup> providing harm reduction services and substance use disorder treatment,<sup>19</sup> and including sex- and gender-specific interventions<sup>20</sup> in an integrated approach.

Less than 60% of people younger than 30 years old and people experiencing houselessness had an undetectable viral load in our study cohort. It is well established that houselessness is a barrier to accessing other health services such as addiction care.<sup>18</sup> A recent study in Vancouver, Canada found that 71.7% of a cohort of women living with HIV reported houselessness or unstable housing in the last six months,<sup>21</sup> and houselessness was associated with decreased progression through the cascade of HIV care.<sup>21</sup> Our data further adds to these findings by showing the confluence between methamphetamine (mostly injected use), female sex, and houselessness, highlighting the need to approach HIV treatment through a syndemic framework. Treating a person’s HIV in isolation does not lead to better health outcomes.

Contrary to most high-income countries where opioids are the main injected drugs, methamphetamine was the most frequently injected drug reported here.<sup>22</sup> Our cohort reported 76.2% and 51.1% methamphetamine use amongst females and males respectively, and 93.4% amongst people who inject drugs. In Manitoba, hospitalizations related to methamphetamine have increased 600%, while methamphetamine overdose-related deaths have increased 170% from 2015 to 2017.<sup>23</sup> Although methamphetamine use is particularly high in Manitoba, it is increasing across North America and Europe.<sup>22</sup> Sixty per cent of a North American cohort of people who inject drugs reported methamphetamine



Variables	Started antiretroviral treatment		Undetectable viral load <sup>a</sup>	
	Yes N = 328 (%)	No N = 76 (%)	Yes N = 213 (%)	No N = 115 (%)
<b>Age in years<sup>b</sup></b>	35 (29–43.5)	34 (27–39)	36 (30–45)	34 (28–41)
First Quartile (≤29)	83 (76.1)	26 (23.9)	49 (59.0)	34 (41.0)
Second Quartile (30–35)	88 (84.6)	16 (15.4)	57 (64.8)	31 (35.2)
Third Quartile (36–42)	70 (75.3)	23 (24.7)	45 (64.3)	25 (35.7)
Fourth Quartile (>42)	87 (88.8)	11 (11.2)	62 (71.3)	25 (28.7)
<b>Sex</b>				
Female	144 (79.6)	37 (20.4)	88 (61.1)	56 (38.9)
Male	184 (82.5)	39 (17.5)	125 (67.9)	59 (32.1)
<b>Place of residence</b>				
Living in rural area	97 (81.5)	22 (18.5)	62 (63.9)	35 (36.1)
Living in urban area	231 (81.1)	54 (18.9)	151 (65.4)	80 (34.6)
<b>Houselessness</b>				
Yes	115 (81.0)	27 (19.0)	65 (56.5)	50 (43.5)
No	213 (81.3)	49 (18.7)	148 (69.5)	65 (30.5)
<b>Methamphetamine use</b>				
Yes	204 (81.0)	48 (19.0)	125 (61.3)	79 (38.7)
No	124 (81.6)	28 (18.4)	88 (71.0)	36 (29.0)
<b>Injection drug use</b>				
Yes	188 (83.2)	38 (16.8)	113 (60.1)	75 (39.9)
No	140 (78.7)	38 (21.3)	100 (71.4)	40 (28.6)
<b>Opioid use</b>				
Yes	68 (87.2)	10 (12.8)	39 (57.4)	29 (42.6)
No	260 (79.8)	66 (20.2)	174 (66.9)	86 (33.1)
<b>Mental health</b>				
Yes	138 (84.7)	25 (15.3)	98 (71.0)	40 (29.0)
No	190 (78.8)	51 (21.2)	115 (60.5)	75 (39.5)
<b>Variables with missing data</b>				
	Started antiretroviral HIV treatment		Undetectable viral load <sup>a</sup>	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)
<b>Gender, total</b>	305 (84.7)	55 (15.3)	201 (65.9)	104 (34.1)
Man	164 (85.9)	27 (14.1)	112 (68.3)	52 (31.7)
Woman	133 (83.1)	27 (16.9)	82 (61.7)	51 (38.3)
Other	8 (88.9)	1 (11.1)	7 (87.5)	1 (12.5)
<b>Sexual orientation, total</b>	269 (87.6)	38 (12.4)	179 (66.5)	90 (33.5)
Heterosexual	214 (87.0)	32 (13.0)	137 (64.0)	77 (36.0)
gbMSM <sup>c</sup>	48 (88.9)	6 (11.1)	39 (81.3)	9 (18.8)
Lesbian/Bisexual	7 (100.0)	0 (0.0)	3 (42.9)	4 (57.1)
<b>Race/ethnicity, total</b>	326 (82.3)	70 (17.7)	212 (65.0)	114 (35.0)
Indigenous (First Nations, Inuit, Métis, unspecified)	252 (82.1)	55 (17.9)	153 (60.7)	99 (39.3)
White/European	47 (87.0)	7 (13.0)	36 (76.6)	11 (23.4)
African/Black	14 (73.7)	5 (26.3)	12 (85.7)	2 (14.3)
Other	13 (81.3)	3 (18.8)	11 (84.6)	2 (15.4)
<b>Alcohol use, total</b>	278 (86.1)	45 (13.9)	186 (66.9)	92 (33.1)
Yes	212 (86.2)	34 (13.8)	134 (63.2)	78 (36.8)
No	66 (85.7)	11 (14.3)	52 (78.8)	14 (21.2)

<sup>a</sup>The denominator is all people who started antiretroviral therapy. Everyone had at least one year between diagnosis and chart review to guarantee at least one year of follow-up for each person. <sup>b</sup>Median age was 35 (29–42). If the age equaled 29 or 35 individual was placed in quartile two. If the age equaled 42 individual was placed in quartile three. <sup>c</sup>Gay, bisexual, and men who have sex with men.

**Table 3: Antiretroviral treatment initiation and undetectable viral load among people newly diagnosed with HIV in Manitoba, Canada, 2018–2021.**

with,<sup>24</sup> and 65% of a Canadian cohort of women living with HIV reported methamphetamine use, suggesting the challenges Manitoba is facing may soon be seen in

other jurisdictions. Treatment options for methamphetamine use disorder are limited, however, growing evidence has demonstrated material incentives, such as

housing, and participation in behavioural interventions can lead to decreased stimulant use and decreased infections.<sup>25</sup> Utilizing material incentives for increased engagement in care amongst people living with HIV with methamphetamine use disorder needs further exploration.

Reducing the harms of substance use, particularly injection drug use, is an evidence-based and effective public health approach.<sup>19</sup> Needle exchange programs and supervised injection services have both been shown to significantly reduce HIV transmission, and combining harm reduction services with ART provision is even more effective.<sup>26</sup> Harm reduction services are an essential component of combating the rise in HIV diagnoses amongst people who inject drugs. Notably, Manitoba has limited harm reduction infrastructure and policy. During the time of this study, Manitoba lacked any harm reduction policy, had no supervised consumption facilities, and experienced cuts to funding for existing needle exchange programs, leading to an insufficient supply of clean needles. Evidence from other places and the data presented here support further investments from governments to ensure adequate funding for syringe and needle exchange programs and consider increasing, and or establishing supervised injection services.

Indigenous people were over-represented amongst people newly diagnosed with HIV, making up 76% of the cohort, while only 18.1% of Manitoba's population.<sup>27</sup> The reasons for this are multifactorial and reflect the complex social and structural barriers many Indigenous people face due to systematic oppression by all levels of government over generations. A syndemic lens is needed to properly understand the challenges faced by Indigenous people. The Truth and Reconciliation Commission (TRC) has documented the atrocities committed by the Canadian government through Residential Schools, provincial governments through forced relocation and economic disparity policies, and provides insight into why the burden of the confluence of structural and social inequalities has fallen on many of the Indigenous people of Canada.<sup>28</sup> The TRC calls for all levels of government to recognize the health disparities faced by Indigenous people, and to support and implement Indigenous-led strategies, as well as to collaborate, listen, and meaningfully engage with Indigenous peoples to close health care gaps. This paper identifies many disparities, highlighting the need for further partnership with Indigenous people in Manitoba to define a culturally appropriate, intersectional approach to close the HIV and wider care gaps.

In relation to sex, recent North American epidemiologic data demonstrated that females are less successfully engaged in HIV care than males, and an increasing number of females are reporting injection drug use.<sup>29</sup> In North America, women represent one-third of the HIV population, whereas in this cohort they represent nearly

half.<sup>6</sup> Women face unique barriers including disproportionate childcare responsibilities; experiences of intimate partner violence; and decreased access to sexual and mental health supports.<sup>20</sup> In our study's cohort there are increasing numbers of females newly diagnosed with HIV throughout the four-year period. Fig. 2 shows that females are experiencing higher rates of houselessness, methamphetamine use, injection drug use, mental health issues, and STBBIs, suggesting a particularly vulnerable group. In the Canadian HIV Women's Sexual and Reproductive Health Cohort Study (CHIWOS), 31% of women reported injection drug use history and among all CHIWOS cohort, 96% were retained in care, 88% were on ART, and 87% were virally suppressed.<sup>20</sup> Alarming, our cohort reported higher rates of injection drug use along with lower rates of ART initiation and viral suppression. This observation highlights the unique increased vulnerability and convergence of syndemic conditions among females. These have not been reported in prior studies or other Canadian Jurisdictions. Females had significantly higher CD4 counts compared to males, suggesting newer infections amongst females. This could reflect that the confluence of female sex, injection drug use, mental health, and houselessness is driving newly acquired HIV in Manitoba. Services and interventions that specifically address barriers unique to females and women, such as the approach outlined by the Women-Centered HIV Care model, have the potential to make a great impact in this particularly vulnerable population and are urgently needed.<sup>20</sup>

Finally, the effect of the COVID-19 pandemic must be acknowledged. In Manitoba, there was a decrease in HIV services/support.<sup>30</sup> The effect this had on the rising rates of HIV throughout the study period is unclear. Fig. 1 shows that HIV diagnoses have been rising prior to 2018, and the rate of increase began increasing around 2017. This suggests that the trends seen during this study period would likely have occurred regardless of the pandemic, however, it is possible that COVID-19 accelerated the changes observed here. Continuous surveillance of HIV incidence will be important to elucidate the real rate of increase and better define the trend.

This study also has limitations that must be considered when interpreting the results. Data was collected for varying timelines, meaning more data points were collected in the 2018 cohort than in 2021. However, all clinical charts were analyzed for at least one year to ensure an adequate amount of data was collected on each participant. Further exploration of the challenges faced by individuals in the cohort through qualitative interviews could have provided even richer data to identify barriers to engagement. An adjacent project is currently working on gathering this data. Several data points, such as injection drug use or risk factors for HIV acquisition, were self-reported and thus subjected to

external biases such as social desirability. Limitations of a retrospective cohort study based on chart review include incomplete documentation that varies by healthcare workers entering the data and the impossibility of inferring causality.

In conclusion, this study describes an incident cohort of people living with HIV in Manitoba, Canada from 2018 to 2021, that has a high proportion of females, Indigenous people, people who are heterosexual, and high rates of injection methamphetamine use, homelessness, and mental health conditions. This is different than the epidemiologic trends seen in other provinces in Canada and other high-income countries where females make up less than 30% of the population and the main risk factor for HIV acquisition is sex amongst gbMSM. Building on previous research regarding syndemic theory, this paper advocates for a syndemic framework in understanding the unique challenges of this particularly vulnerable population. The challenges faced by this population are relevant to other jurisdictions, as many high-income countries are reporting increasing methamphetamine use and homelessness. If this trend continues, other countries may see a similar HIV demographic shift as described in this study. As the global focus turns to meeting the new 95-95-95 targets, further consideration of syndemic conditions, as described in this paper, will be essential to reach all people living with HIV and leave no one behind.

#### Contributors

The study concept and design were conceived by ZVR, MH-B and YK with input from all authors. ZVR, MH-B, YK: Funding acquisition. The persons who collected the data are from the University of Manitoba, an academic institution: MS-J, AS, and CB collected the data. MS-J and AS verified the data. After data collection, we did a cross-verification performed by MS-J and AS and reported in the paper. All collected data was sent, centralized, and stored by the nominated principal investigator: ZVR. ZVR, LL, and YK performed data quality checks. ZVR and LL performed data curation and prepared the database for the analysis. AS, LL, JMV, ZVR analyzed the data. All authors participated in the interpretation of the results. AS, ZVR, YK prepared the first draft of the protocol manuscript. MS-J, MH-B, KK, LM, LI, KG, LL, JMB, JB, CB, JS, MP and KT revised drafts and provided significant input. All authors edited and revised it critically for important intellectual content.

#### Data sharing statement

The data underlying this article cannot be shared publicly because the original source data is not owned by the researchers and as such cannot be provided to a public repository. Where necessary, people interested in accessing source data specific to this project must contact Shared Health Manitoba, First Nations Health and Social Secretariat of Manitoba, Nine Circles Community Health Centre, and 7th Street Health Access Centre along with the required privacy and ethical review bodies. Data disaggregated by Indigenous persons are held by local Indigenous organizations. The clinical charts were accessed by the researchers under specific data-sharing agreements only for approved use stated in the broad research.

#### Declaration of interests

MHB declares work as a consultant for the Assembly of First Nations and the Canadian Institute for the Advancement of Women. There are no competing interests to report.

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#### Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.lana.2024.100805>.

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