IJID Regions 13 (2024) 100433

Contents lists available at ScienceDirect

IJID Regions

journal homepage: www.elsevier.com/locate/ijregi

Sexually transmitted and blood-borne infections by sex, methamphetamine use, and houselessness before, at, and after HIV diagnosis in Manitoba, Canada

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ARTICLE INFO

Keywords:
HIV
Sexually transmitted and blood-borne infections
Houselessness
Injection drug use, sex
Cohort study
Methamphetamines

ABSTRACT

Objectives: Describe the proportion of people newly living with HIV with sexually transmitted and blood-borne infections (STBBIs) before, at, and after HIV diagnosis in Manitoba, Canada.
Methods: A retrospective cohort study reviewed clinical charts of all 404 people ≥18 years old newly diagnosed with HIV in Manitoba, Canada between 2018 and 2021. Syphilis, hepatitis C and B, gonorrhea, and chlamydia infections before, at, and after HIV diagnosis were recorded and analyzed by sex at birth, injection drug use status, use of methamphetamines, and housing status.
Results: A total of 53% of people were diagnosed with syphilis, 44.1% with gonorrhea, 42.8% with chlamydia, and 40.6% with hepatitis C at least once. Among females, 64.1% had at least one or more STBBIs diagnoses before HIV diagnosis compared with 44.8% of males. Over 70% of people experiencing houselessness had at least one STBBI diagnosis before their HIV diagnosis compared with 43.9% of people not houseless. Among people who used methamphetamines, 68.3% had one or more STBBIs before HIV diagnosis compared with 28.9% of people who do not use methamphetamines. In a multivariable analysis houselessness, methamphetamine use, and younger age were associated with increased risk of any STBBIs.
Conclusions: In our Manitoba cohort of people living with HIV, disproportionately more females, people experiencing houselessness, and those who use methamphetamine were diagnosed with STBBIs. The proportion of new infections before HIV diagnoses highlights a missed opportunity to provide prevention modalities, including pre-exposure prophylaxis, and the proportion after HIV diagnosis emphasizes the importance of enhancing engagement, repeated testing, and educational strategies to ameliorate ongoing exposures.

Introduction

People living with human immunodeficiency virus (HIV) with additional sexually transmitted and blood-borne infections (STBBIs) have poorer health outcomes [1–4]. STBBIs can cause an inflammatory response, leading to the release of cytokines and immune cells in the genital tract, which can increase the risk of HIV transmission and acquisition [5]. Having a syphilis infection has been shown to nearly triple one's

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https://doi.org/10.1016/j.ijregi.2024.100433
Received 22 April 2024; Received in revised form 19 August 2024; Accepted 20 August 2024

risk of HIV acquisition [6] and in men who have sex with men, previous rectal gonorrhea or chlamydia and having multiple repeated sexually transmitted infections were associated with increased risk of HIV acquisition [7]. People diagnosed with HIV co-infected with syphilis progress more frequently to neurosyphilis than controls [4]. People living with HIV and concurrent hepatitis C virus (HCV) have accelerated liver fibrosis, which may be caused by HIV viremia, HIV-associated immune dysfunction, or a side effect of antiretroviral therapy [1]. Women living with HIV are more likely to have higher recurrence rates of genital herpes and genital ulcers from syphilis than women without HIV [3]. In addition, women living with HIV who have pelvic inflammatory disease experience increased severity of symptoms and a greater probability of progressing to tubo-ovarian or fallopian tube abscess [2].

In Manitoba, Canada, the total number of people newly living with HIV has increased 52% over the past 5 years [8]. The demographic composition of individuals newly diagnosed with HIV has changed dramatically in Manitoba, with a recent sharp increase in females, and injection drug use and heterosexual sex as primary risk factors for HIV acquisition [8]. The increase in new HIV diagnoses has been partially linked to increased methamphetamine use in the province. Between 2013 and 2018, there was a seven-fold increase in the number of people documented as using methamphetamines in Manitoba and those using methamphetamines were found to be younger adults, live in lowest-income areas, and have comorbid mental health conditions [9].

Alongside the increasing incidence of HIV, Manitoba also reported higher incidence of other STBBIs than national reports [10]. The provincial test positivity for syphilis has doubled between 2018 and 2021 and Manitoba continues to have the highest rate of infectious syphilis of all Canadian provinces. Furthermore, in 2019, there were 370.8 chlamydia and 94.3 gonorrhea diagnoses per 100,000 people nationally in Canada, but Manitoba reported 601.0 chlamydia and 272.7 gonorrhea diagnoses per 100,000 people [10]. Manitoba also reported the highest rate of HCV of any province in 2019 with 54.2 diagnoses per 100,000 people.

Substance use, houselessness severity, and female sex are associated with a greater prevalence of STBBIs. Previous research has shown that unstable housing was associated with HIV acquisition[11] and affects the HIV continuum of care, reduced treatment effectiveness, and not receive appropriate HIV care [12]. In a metanalysis of studies of STBBIs prevalence among American houseless adults, young women were found to have the highest prevalence of chlamydia and gonorrhea infections [13]. Women living with HIV in Canada are increasingly additionally burdened by houselessness, food insecurities, and use of illicit substances [14,15]. In three Canadian provinces, 79% of women living with HIV experienced food and/or housing insecurity [16]. Our study group recently found that females newly diagnosed with HIV are additionally burdened by houselessness, injection drug use, mostly methamphetamine, and mental health conditions [8].

As part of a larger investigation of HIV syndemics in Manitoba [17], our primary objective was to describe the proportion of people diagnosed with syphilis, HCV, hepatitis B virus, gonorrhea, and chlamydia before, at, and after HIV diagnosis among people newly diagnosed with HIV in Manitoba between 2018 and 2021 by sex, housing status, injection drug use, and methamphetamine use. Our secondary objective was to identify the factors associated with syphilis, HCV, gonorrhea, or chlamydia acquisition and any of the four STBBIs after HIV diagnosis.

Methods

Study design

All people referred to the Manitoba HIV Program in Manitoba, Canada, and confirmed to be newly diagnosed with HIV by the Manitoba Health Epidemiology and Surveillance Unit between January 1, 2018, and December 31, 2021 were considered in this retrospective cohort study. This centralized program provides care to all people living with HIV in the entire province of Manitoba and has three HIV care sites in Manitoba: Health Sciences Centre and Nine Circles Community Health Centre in Winnipeg and 7th Street Health Access Centre in Brandon.

Study population

Adults 18 years or older who received a new HIV diagnosis in Manitoba during the study period and whose previous HIV test result was unknown or negative for HIV were included. People previously diagnosed with HIV who were transferred to care in Manitoba from out-of-province or another country were excluded.

Variables

Data were collected from medical records. The variables gathered at the time of HIV diagnosis included age in years, sex assigned at birth (female and male, no intersex was reported), self-reported gender, sexual orientation, race/ethnicity [18], substance use and route, and living in a rural or urban area. Houselessness (yes or no) was defined by self-reported houselessness or if the treatment team documented houselessness or unstable housing.

The outcomes were all diagnoses of STBBIs that a participant had documented from the start of their medical record (earliest result in 2010) until the time of data collection and were recorded. The final date of data inclusion was December 31, 2022, allowing at least 1 year of follow-up after HIV diagnosis for all people included in the study. STBBIs detected more than 15 days before HIV diagnosis were classified as “before HIV diagnosis”. STBBIs within the time frame of 15 days before to 15 days after HIV diagnosis date were classified as “STBBIs at time of HIV diagnosis”. STBBIs diagnosed more than 15 days after HIV diagnosis were classified as “STBBIs after HIV diagnosis”.

STBBIs were defined as the following diagnoses and associated tests: gonorrhea and chlamydia (urine nucleic acid amplification test or swabs of the cervix and/or anus), syphilis (rapid plasma reagin, venereal disease reference laboratory test, and treponemal antibody serologic tests), hepatitis B (serologic tests for hepatitis B surface antigen and hepatitis B core antibody), and HCV (HCV antibody serology and HCV RNA).

Syphilis rapid plasma reagin and venereal disease reference laboratory test titers were used to determine the number of distinct syphilis diagnoses. Titers that remained stable or changed in one direction (i.e. decreased or increased four-fold over time) were recorded as single diagnoses. Titers that increased four-fold after a decrease were considered a syphilis reinfection and recorded as two separate diagnoses. Additional syphilis diagnoses were only recorded if there were decreasing titers, followed by increasing titers, suggestive of treatment between separate infections. Only the first positive treponemal antibody test was recorded because this test remains positive after syphilis infection.

For gonorrhea and chlamydia diagnoses, if a positive test was followed by a negative test and subsequent positive test, the participant was recorded as having two distinct diagnoses. Each additional gonorrhea and chlamydia diagnosis recorded had to be separated from the next recorded case by a negative test result. If the participant had repeated positive gonorrhea and chlamydia tests without an interim negative test, it was assumed that the person had one untreated infection. The date of hepatitis B and C results were recorded as the first positive results only, unless a person had evidence of HCV sustained virologic response, followed by repeat positive testing.

Biases

To avoid measurement bias, several records were reviewed by two reviewers to ensure consistency in data collection between reviewers. All people newly diagnosed with HIV in Manitoba during the study period were included, which minimized selection bias.

Table 1
Demographic data of people newly diagnosed with HIV in Manitoba from 2018 to 2021, stratified by sex assigned at birth.

		Female (n = 181)	Male (n = 223)	Total (N = 404)
Demographic Data				
Age in years	Median (interquartile range)	33.0 (27.0 to 39.0)	37.0 (30.0 to 46.0)	35.0 (29.0 to 42.0)
Sexual orientation	Heterosexual	129 (71.3)	117 (52.5)	246 (60.9)
	gbMSM[a]	0 (0.0)	54 (24.2)	54 (13.4)
	Lesbian/bisexual female	7 (3.9)	0 (0.0)	7 (1.7)
	Unknown	45 (24.9)	52 (23.3)	97 (24.0)
Gender	Man	0 (0.0)	191 (85.7)	191 (47.3)
	Woman	159 (87.8)	1 (0.5)	160 (39.6)
	Other[b]/Unknown	22 (12.2)	31 (14.0)	53 (13.1)
Race/ethnicity	Indigenous[c] (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[d]	2 (1.1)	14 (6.3)	16 (4.0)
	Unknown	3 (1.7)	5 (2.2)	8 (2.0)
Urban/rural dwelling	Rural	55 (30.4)	64 (28.7)	119 (29.5)
	Urban	126 (69.6)	159 (71.3)	285 (70.5)
Houselessness	Yes	78 (43.8)	64 (28.7)	142 (35.1)
Substance use				
Methamphetamine	Yes	138 (76.2)	114 (51.1)	252 (62.4)
Injection drug use	Yes	130 (71.8)	97 (43.5)	227 (56.2)

[a] Gay, bisexual, and other men who have sex with men.
[b] Transgender, and non-binary.
[c] As self-reported.
[d] Latin American, East/Southeast Asian, Middle Eastern, South Asian.

Statistical methods

The rates of individual STBBIs before, at, and after HIV diagnosis were analyzed by sex at birth, injection drug use status, use of methamphetamines, and housing status. We also calculated the proportion of concomitant STBBIs (none, one, two, three, four or more new STBBIs diagnoses) before, at, and after HIV diagnosis by sex at birth, injection drug use status, use of methamphetamines, and housing status. Finally, we calculated the number of new STBBIs diagnoses in females and males before, at, and after HIV diagnosis.

A Fisher's exact test was used when a chi-square could not be appropriately applied for qualitative variables and the Mann-Whitney U test for quantitative variables. The crude and adjusted relative risks (RRs) were calculated to identify the factors associated with syphilis, HCV, gonorrhea, or chlamydia acquisition and any of the four STBBIs after HIV diagnosis using a Poisson model with a log link and robust variance estimator with a 95% confidence interval (CI). Data were analyzed using Jamovi software (2022, version 2.3) and R software (version 4.3.0).

Results

Among 517 people referred to the Manitoba HIV Program between 2018 and 2021, 404 persons were newly diagnosed with HIV and met the inclusion criteria. Descriptive data reported by females and males are presented in Table 1. A total of 62% of the study population self-reported methamphetamine use, 56.2% self-reported injection drug use, and 35.1% were experiencing houselessness.

A total of 53% of people were diagnosed with syphilis, 44.1% with gonorrhea, 42.8% with chlamydia, 40.6% with HCV, and 9.7% with hepatitis B at least once during the study period. The proportion of people with a diagnosis of syphilis, HCV, gonorrhea, and chlamydia increased from 2018 to 2021, and females had higher proportions of STBBIs than males (Figure 1). In 2021, 71.0% of females were diagnosed with syphilis compared with 47.9% of males.

Before HIV diagnosis, females were more frequently diagnosed with syphilis, chlamydia, gonorrhea, and hepatitis C than males (Table 2 and Figure 2a). A total of 47% of females compared with 35.9% of males had at least one STBBI after their HIV diagnosis (Figure 2a).

People experiencing houselessness at entry into HIV care had higher proportions of STBBIs before, at the time of, and after HIV diagnosis (Table 2). Of note, 71.1% of people experiencing houselessness had at least one or more STBBIs diagnosis before their HIV diagnosis compared with 43.9% of people who were not houseless (Figure 2b).

People who used methamphetamines more frequently were diagnosed with all STBBIs before, at, and after HIV diagnosis (Table 2). Among people who used methamphetamines, 43.6% had at least two of the four STBBIs before HIV diagnosis and 30.6% had at least two STBBIs diagnoses after HIV diagnosis compared with 10.5% and 7.9% of people who do not use methamphetamines, respectively (Figure 2c).

Similar patterns were noted between STBBIs and injection drug use (Table 2 and Figure 2d). A higher proportion of people who inject drugs (vs those who do not) had gonorrhea and chlamydia before and after HIV diagnosis. A total of 63% of people who inject drugs had positive HCV antibodies or RNA and over 50% of them were diagnosed with HCV either at or after HIV diagnosis.

The maximum number of new distinct diagnoses of syphilis, hepatitis C, gonorrhea, and/or chlamydia before HIV diagnoses in females was 16 and in males was nine, and after HIV diagnoses, males had up to 17 new distinct diagnoses compared with 10 in females (Table 2). Similar numbers before and after HIV diagnosis were seen among people experiencing houselessness, those who inject drugs, and those who use methamphetamine (Table 2).

Tables 3 show the crude and adjusted relative risk of demographic and history factors on syphilis, HCV, gonorrhea, or chlamydia acquisition after HIV diagnosis, respectively. In the multivariate analysis, each STBBI was noted to have its own unique risks factor profiles. People who inject drugs were more likely to be diagnosed with HCV after their HIV diagnosis (RR 6.05, 95% CI 1.70-21.57). An STBBI diagnosis before HIV diagnosis was a significant risk factor for chlamydia (RR 1.60, 95% CI 0.98-2.60) and gonorrhea (RR 2.10, 95% CI 1.24-3.54) during HIV follow-up. People experiencing houselessness; using methamphetamines; gay, bisexual, and other men who have sex with men; and those successfully engaged in care had a higher likelihood of receiving a diagnosis of syphilis after their HIV diagnosis (Table 3). Age 18-30 years (RR 1.39, 95% CI 1.00-1.95), methamphetamine use (RR 1.72, 95% CI 1.20-2.48), and houselessness (RR 1.64, 95% CI 1.27-2.12)

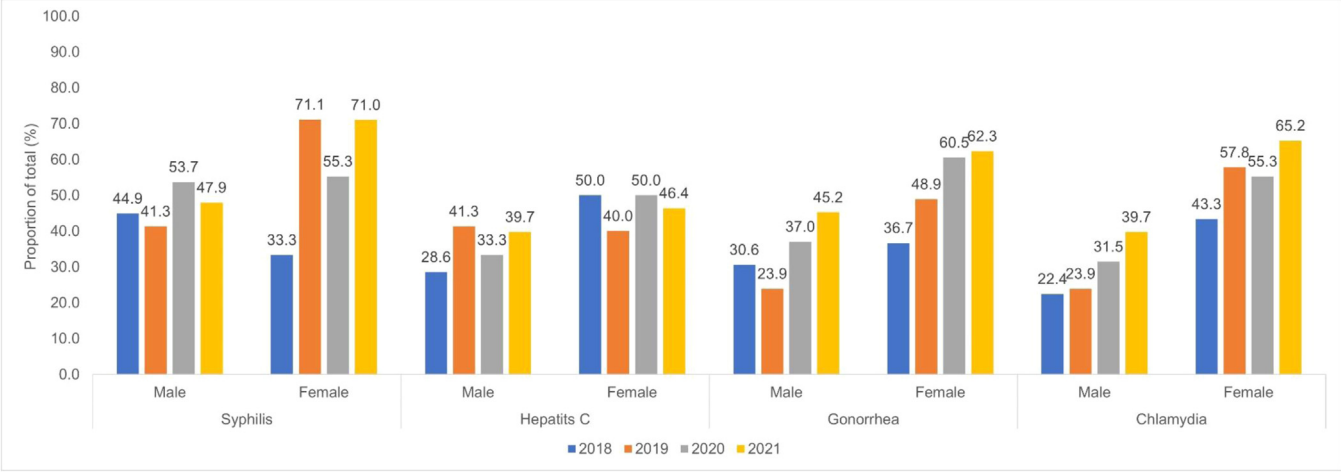

Figure 1. Proportion of females and males with at least one any-time diagnosis of syphilis, hepatitis C, gonorrhea, or chlamydia by year of HIV diagnosis.

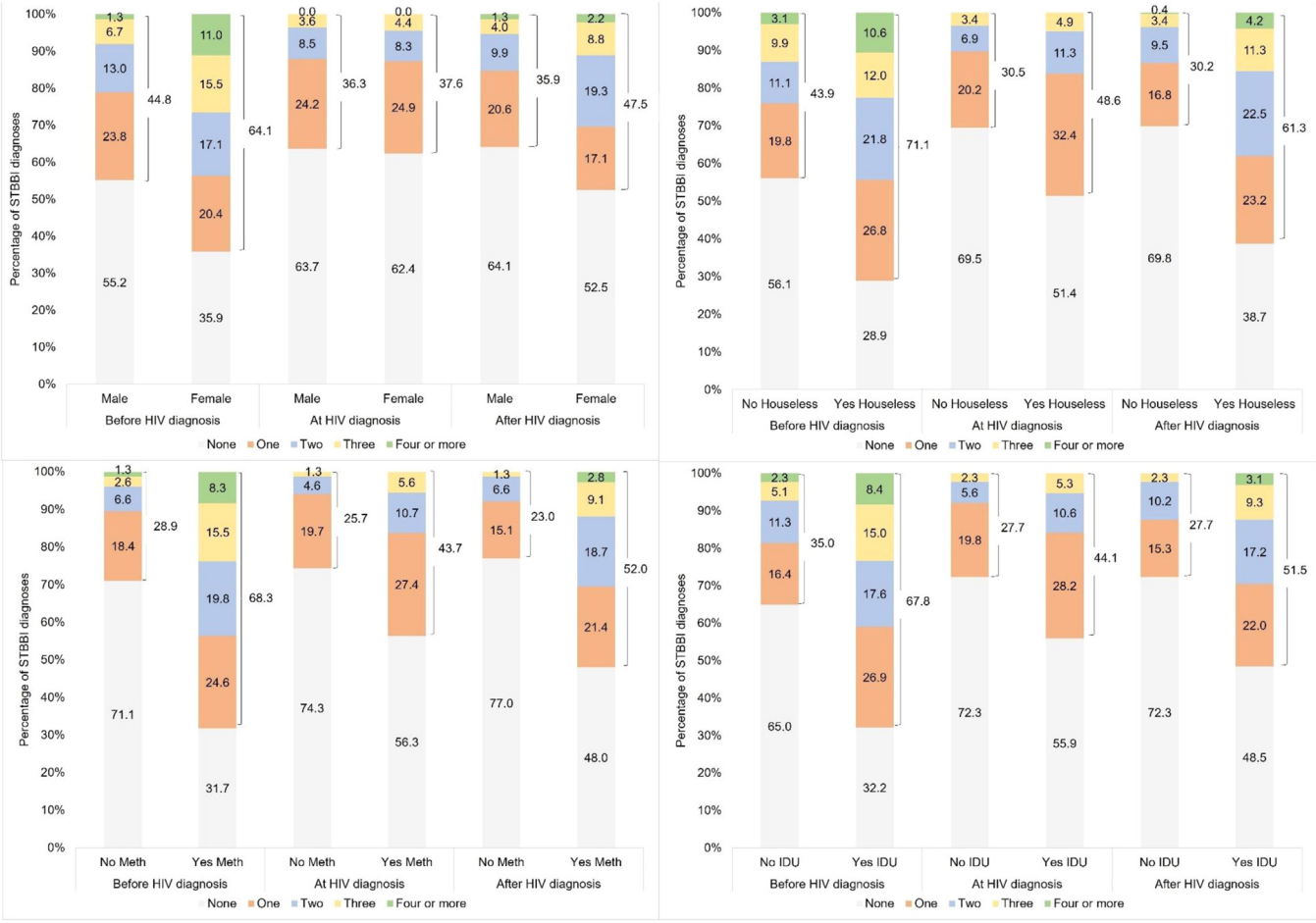

Figure 2. Proportion of people diagnosed with STBBIs before, at, and after HIV diagnosis. (a) Stratified by sex at birth. (b) Stratified by housing status. (c) Stratified by self-reported methamphetamine (meth) use. (d) Stratified by self-reported IDU. STBBIs diagnoses are reported as none or any of one/two/three/four, referring to how many syphilis, hepatitis C, gonorrhea, and chlamydia infections a person was diagnosed with. IDU, injection drug use; STBBI, sexually transmitted and blood-borne infection.

Table 2
STBBIs before, at, and after HIV diagnosis stratified by sex assigned at birth, houselessness, methamphetamine use, and injection drug use.

	STBBIs before HIV diagnosis			STBBIs at HIV diagnosis			STBBIs after HIV diagnosis		
	Sex								
	Female n (%)	Male n (%)	*P*-values[a]	Female n (%)	Male n (%)	*P*-values[a]	Female n (%)	Male n (%)	*P*-values[a]
Syphilis	62 (34.3)	40 (17.9)	**<0.001**	40 (22.1)	45 (20.2)	0.638	50 (27.6)	46 (20.6)	0.10
Hepatitis C	45 (24.9)	36 (16.1)	**0.030**	24 (13.3)	30 (13.5)	0.955	16 (8.8)	15 (6.7)	0.427
Gonorrhea	76 (42)	52 (23.3)	**<0.001**	18 (9.9)	17 (8.3)	0.409	45 (24.9)	39 (17.5)	0.069
Chlamydia	80 (44.2)	40 (17.9)	**<0.001**	17 (9.4)	24 (10.8)	0.650	54 (29.8)	29 (13.0)	**<0.001**
N	181	223	N = 404	181	223		181	223	
	Houselessness at the time of HIV diagnosis: yes = 142, no = 262								
	Yes n (%)	No n (%)	*P*-values[a]	Yes n (%)	No n (%)	*P*-values[a]	Yes n (%)	No n (%)	*P*-values[a]
Syphilis	43 (30.3)	59 (22.5)	0.086	39 (27.5)	46 (17.6)	**0.020**	54 (38.0)	42 (16.0)	**<0.001**
Hepatitis C	47 (33.1)	34 (13.0)	**<0.001**	28 (19.7)	26 (9.9)	**0.006**	18 (12.7)	13 (5.0)	**0.005**
Gonorrhea	63 (44.4)	65 (24.8)	**<0.001**	15 (10.6)	20 (7.6)	0.318	46 (32.4)	38 (14.5)	**<0.001**
Chlamydia	58 (40.8)	62 (23.7)	**<0.001**	17 (12.0)	24 (9.2)	0.372	51 (35.9)	32 (12.2)	**<0.001**
N	142	262		142	262		142	262	
	Methamphetamine use at the time of HIV diagnosis: yes = 252, no = 152								
	Yes n (%)	No n (%)	*P*-values[a]	Yes n (%)	No n (%)	*P*-values[a]	Yes n (%)	No n (%)	*P*-values[a]
Syphilis	83 (32.9)	19 (12.5)	**<0.001**	58 (23.0)	27 (17.8)	0.210	77 (30.6)	19 (12.5)	**<0.001**
Hepatitis C	71 (28.2)	10 (6.6)	**<0.001**	43 (17.1)	11 (7.2)	**0.005**	27 (10.7)	4 (2.6)	**0.003**
Gonorrhea	107 (42.5)	21 (13.8)	**<0.001**	31 (12.3)	4 (2.6)	**<0.001**	70 (27.8)	14 (9.2)	**<0.001**
Chlamydia	102 (40.5)	18 (11.8)	**<0.001**	33 (13.1)	8 (5.3)	**0.012**	71 (28.2)	12 (7.9)	**<0.001**
N	252	152	N = 404	252	152		252	152	
	Injection drug use at the time of HIV diagnosis: yes = 227, no = 177								
	Yes n (%)	No n (%)	*P*-values[a]	Yes n (%)	No n (%)	*P*-values[a]	Yes n (%)	No n (%)	*P*-values[a]
Syphilis	70 (30.8)	32 (18.1)	**0.003**	52 (22.9)	33 (18.6)	0.297	67 (29.5)	29 (16.4)	**0.002**
Hepatitis C	71 (31.3)	10 (5.6)	**<0.001**	46 (20.3)	8 (4.5)	**<0.001**	27 (11.9)	4 (2.3)	**<0.001**
Gonorrhea	93 (41.0)	35 (19.8)	**<0.001**	25 (11.0)	10 (5.6)	0.057	61 (26.9)	23 (13.0)	**<0.001**
Chlamydia	85 (37.4)	35 (19.8)	**<0.001**	25 (11.0)	16 (9.0)	0.515	64 (28.2)	19 (10.7)	**<0.001**
N	227	177	N = 404	227	177		227	177	
	Number of new distinct diagnoses of syphilis, hepatitis C, gonorrhea, and/or chlamydia infections								
	Me (P25- P75)	[Min - Max]	*P*-values[a,b]	Me (P25- P75)	[Min - Max]	*P*-values[b]	Me (P25- P75)	[Min - Max]	*P*-values[a,b]
Male	0 (0-1)	[1-9]	**<0.001**	0 (0-1)	[0-4]	0.679	0 (0-1)	[0-17]	**0.003**
Female	1 (0-4)	[0-16]		0 (0-1)	[0-4]		0 (0-2)	[0-10]	
No houselessness	0 (0-2)	[0-9]	**<0.001**	0 (0-1)	[0-4]	**<0.001**	0 (0-1)	[0-10]	**<0.001**
Yes houselessness	1 (0-3)	[0-16]		0 (0-1)	[0-4]		1 (0-2)	[0-17]	
No IDU	0 (0-1)	[0-9]	**<0.001**	0 (0-1)	[0-3]	**<0.001**	0 (0-1)	[0-10]	**<0.001**
Yes IDU	1 (0-3)	[0-16]		0 (0-1)	[0-4]		1 (0-2)	[0-17]	
No Methamphetamine	0 (0-1)	[0-9]	**<0.001**	0 (0-1)	[0-3]	**<0.001**	0 (0-0)	[0-7]	**<0.001**
Yes Methamphetamine	1 (0-3)	[0-16]		0 (0-1)	[0-4]		1 (0-2)	[0-17]	

IDU, injection drug use; Me, median; Max, maximum value; Min, minimum value; P25, percentile 25; P75, percentile 75; STBBIs, sexually transmitted and blood-borne infections.

[a] Chi-square test.

[b] Mann-Whitney U test.

were more likely to be diagnosed with any of the four STBBIs after HIV diagnosis.

Discussion

This cohort, encompassing all people newly diagnosed with HIV in Manitoba, Canada during 2018-2021, had a high burden of STBBIs before, at, and after their HIV diagnosis. Of note, 71.1% of people experiencing houselessness had an STBBI before HIV diagnosis, and females had a significantly greater number of each STBBI before HIV diagnosis.

The overrepresentation of Indigenous people newly diagnosed with HIV in this study reflects the structural and social inequalities and inequities experienced by Indigenous people and the ongoing influence of decades of intergenerational trauma, racism, and colonization in Canada [19]. Indigenous females experience poorer health outcomes and worse access to care than non-Indigenous females [20].

In our study, females had a higher incidence of STBBIs diagnosis before and after but not at the time of HIV diagnosis. This difference in STBBIs by sex at birth was also reported in a study conducted in KwaZulu-Natal, South Africa, which found higher prevalence of STBBIs among females than males [21]. We cannot confirm whether before and after HIV diagnosis testing practices differed for males and females; however, at time of diagnosis, people living with HIV in Manitoba are routinely tested for additional STBBIs. Testing differences by sex may be attributable to antenatal testing among childbearing-aged females [22].

Table 3
Factors associated with STBBIs (unadjusted and adjusted analysis) among people newly diagnosed with HIV in Manitoba.

Variable	Infection type Crude relative risk (95% confidence interval)				
	Chlamydia	Gonorrhea	Hepatitis C	Syphilis	Any
Female (sex assigned at birth)	2.29 (1.54-3.50)	1.42 (0.97-2.09)	1.31 (0.66-2.61)	1.34 (0.94-1.91)	1.32 (1.05-1.68)
Age in years					
18-30	3.27 (1.83-6.45)	1.79 (1.07-3.13)	2.31 (0.97-6.30)	1.90 (1.17-3.23)	1.74 (1.27-2.45)
31-40	2.34 (1.28-4.67)	1.56 (0.93-2.73)	1.30 (0.50-3.72)	1.78 (1.10-3.01)	1.45 (1.05-2.05)
>40	1	1	1	1	1
Houselessness	2.94 (2.00-4.4	2.23 (1.53-3.28)	2.56 (1.30-5.18)	2.37 (1.68-3.38)	2.03 (1.62-2.56)
Mental health	1.59 (1.08-2.34)	1.34 (0.92-1.97)	1.22 (0.61-2.40)	1.42 (1.00-2.01)	1.28 (1.01-1.61)
Methamphetamine	3.57 (2.09-6.72)	3.02 (1.29-5.41)	–	2.44 (1.59-4.00)	2.26 (1.68-3.15)
Heterosexual sex	2.01 (1.30-3.28)	1.35 (0.904-2.07)	1.02 (0.55-2.34)	1.06 (0.75-1.54)	1.12 (0.88-1.44)
gbMSM[a]	0.42 (0.15-0.89)	0.418 (0.15-0.88)	0.23 (0.01-1.03)	1.13 (0.66-1.76)	0.86 (0.56-1.21)
Engaged in care[b]	0.78 (0.53-1.15)	0.73 (0.49-1.07)	0.84 (0.42-1.66)	1.37 (0.96-1.96)	1.02 (0.81-1.29)
Prior STBBIs before HIV diagnosis	2.71 (1.73-4.48)	2.95 (1.87-4.94)	0.857 (0.43-1.70)	1.23 (0.86-1.77)	1.50 (1.17-1.94)
Injection drug use	–	–	5.26 (2.12-17.58)	–	–
	Infection type Adjusted relative risk (95% confidence interval)				
	Chlamydia	Gonorrhea	Hepatitis C	Syphilis	Any
Female (sex assigned at birth)	1.46 (0.93-2.30)	0.91 (0.61-1.36)	0.86 (0.40-1.85)	1.28 (0.86-1.91)	1.11 (0.86-1.43)
Age in years					
18-30	2.01 (1.05-3.84)	1.28 (0.76-2.16)	2.23 (0.87-5.73)	1.45 (0.87-2.43)	**1.39 (1.00-1.95)**
31-40	**1.72 (0.93-3.20)**	1.18 (0.70-2.00)	1.25 (0.48-3.29)	1.51 (0.92-2.49)	1.26 (0.91-1.76)
>40	1	1	1	1	1
Houselessness	**1.93 (1.25-2.99)**	1.44 (0.96-2.16)	1.31 (0.64-2.69)	**2.25 (1.51-3.34)**	**1.64 (1.27-2.12)**
Mental health	1.10 (0.76-1.59)	1.04 (0.72-1.51)	0.88 (0.44-1.79)	1.00 (0.71-1.41)	0.97 (0.77-1.22)
Methamphetamine	1.65 (0.85-3.20)	1.81 (1.02-3.22)	0.00 (0.00-0.00)	**1.78 (1.05-3.03)**	**1.72 (1.20-2.48)**
Heterosexual sex	**1.86 (1.13-3.05)**	1.12 (0.72-1.74)	0.92 (0.46-1.86)	1.17 (0.78-1.75)	1.11 (0.85-1.45)
gbMSM[a]	1.59 (0.59-4.33)	0.77 (0.29-2.05)	0.31 (0.04-2.53)	**2.01 (1.07-3.76)**	1.37 (0.87-2.18)
Engaged in care[b]	0.98 (0.68-1.41)	0.88 (0.61-1.29)	1.20 (0.63-2.28)	**1.59 (1.13-2.23)**	1.19 (0.96-1.49)
Prior STBBIs before HIV diagnosis	**1.60 (0.98-2.60)**	**2.10 (1.24-3.54)**	0.53 (0.26-1.07)	0.84 (0.57-1.24)	1.11 (0.86-1.45)
Injection drug use	–	–	**6.05 (1.70-21.57)**	–	–

STBBIs, sexually transmitted and blood-borne infections.
[a] Gay, bisexual, other men who have sex with men.
[b] Started treatment, continued treatment and suppressed viral load (<200 copies)

Prenatal screening programs can result in the majority of pregnant females being tested for HIV among other infections; however, prenatal care in Manitoba has previously been found to be inadequate for some young females [23].

People who inject drugs who are houseless have been shown to be at an increased risk of acquiring HIV and HCV compared with people with stable housing [24]. Previous studies have found that unstable housing is associated with suboptimal access to HIV treatment and that 10 or more nights of stable housing can improve viral loads in women living with HIV [25,26].

Over 60% of people who inject drugs in our study were also living with HCV. This strongly suggests a role for harm reduction strategies, such as substance use therapy and needle exchange programs, that have been shown to reduce the rates of HCV acquisition and be used to engage people diagnosed with HCV in treatment [27,28].

Gonorrhea and chlamydia are not transmitted through needle use; however, significantly more people who inject drugs had gonorrhea and chlamydia infections in our study, suggesting that people who inject drugs may be participating in sex without the use of prevention tools. Women who report transactional sex are more likely to report previous STBBIs diagnoses, methamphetamine use, and houselessness [29].

STBBIs acquired before HIV diagnosis represent a missed opportunity to provide education and access to prevention methods that can be used before, during, and after sex, such as routine STBBIs testing, condom use, pre-exposure prophylaxis (PrEP), and post-exposure prophylaxis. A previous study in Manitoba showed that having two or more positive serologic tests for STBBIs in a 5-year period was associated with an almost six-fold increased odds of new HIV diagnosis [30]. The current study results similarly support the need for greater STBBIs prevention initiatives without barriers in Manitoba.

Currently, the Canadian guidelines for PrEP do not include people who exclusively have heterosexual sex other than those with a partner living with HIV [31]. In 2015, the World Health Organization recommended that any person at a substantial risk for HIV acquisition be offered PrEP [32]. The American Centers for Disease Control currently recommends prescribing PrEP to heterosexually active men and women who have had gonorrhea or syphilis in the past 6 months [33]. Our results suggest PrEP prescribing practices in Manitoba should be reevaluated to consider previous STBBIs, particularly, among heterosexual females and males, people experiencing houselessness, people who inject drugs, and people who use methamphetamine.

Over 40% of the study population were diagnosed with an STBBI after their HIV diagnosis, with up to 10 and 17 new STBBIs diagnoses in females and males, respectively, suggesting that risk factor modification may not be occurring with connection to HIV care. Previous studies examining the risk factors associated with additional STBBIs among people living with HIV have shown that younger age, multiple sexual partners, and a preceding STBBI were associated with increased infections [34,35].

In the recent DoxyPEP trial, post-exposure prophylaxis with doxycycline in men who have sex with men and transgender females who were living with HIV found that the incidence of chlamydia, gonorrhea, and syphilis decreased in people who were randomly allocated to doxycycline after condomless sex [36]. In our study, more chlamydia and gonorrhea diagnoses were among females. Future work should consider studying doxycycline prophylaxis in females.

Limitations

Only positive STBBIs and HIV tests were recorded and, thus, we do not know the total number of times people were previously tested for STBBIs or if they were tested previously for HIV. Negative STBBIs results were available but not recorded during data collection for this study. It would be helpful to know whether HIV is being tested concurrently with other STBBIs and whether testing patterns are different among females, people who inject drugs, people who use methamphetamine, and people experiencing houselessness. Future studies will aim to acknowledge this limitation in our data. Many people had repeated chlamydia and gonorrhea results that remained positive for years. When there was no negative test between positive results, we defined these as single infections because we could not confirm whether treatment occurred. Thus, we suspect that chlamydia and gonorrhea infections are undercounted in this study. Generally, a limitation of this study is that we could not capture the tests completed in private clinics and those not included in our database, thus, we suspect that we have underestimated the total number of STBBIs in this population.

People with HCV antibodies and/or HCV RNA were considered to have chronic HCV, despite the possibility of false-positive antibodies or spontaneous clearance of HCV RNA [37]. In our study, many people were diagnosed with HCV at or after HIV diagnosis; however, we do not know how long they may have been living with HCV or if they had chronic HCV. However, from a public health perspective, given that HCV acquisition is associated with injection drug use, these results highlight the importance of harm reduction services to prevent HCV acquisition.

Conclusion

STBBIs among people newly diagnosed with HIV are overrepresented among females, people experiencing houselessness, and those who use methamphetamine. Funding harm reduction approaches, such as needle and syringe exchange, and substance use programs without barriers are desperately needed in Manitoba. Regular STBBIs testing, condom use, and PrEP are available preventive tools that health care providers should discuss with patients and their sexual partners, especially females, people who inject drugs, people experiencing houselessness, and those with a current or previous STBBIs diagnosis.

Declarations of competing interest

The authors have no competing interests to declare.

Funding

This work was supported by the Canadian Institute for Health Research (Grant number EG5-179453), The Manitoba Medical Service Foundation (grant number: 2021-13), and The James Farley Memorial Fund. This research was also supported, in part, by the Canada Research Chairs Program for ZVR (Award # 950-232963). The funders did not have any role in the study design; collection, analysis and interpretation of data; in the writing of this paper; and in the decision to submit the article for publication.

Ethical approval statement

The study was approved by 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.

Acknowledgments

The authors are thankful to the Peer Research Team members Clara Dan, Joel Baliddawa, Lisa Patrick, Nikki Daniels, Robert Russell, Rebecca Murdock, Freda Woodhouse, Ann Favel, Nadia Mancheese, and Marj Schenkels for their invaluable insights. The authors are also thankful to the members of the Research Advisory committee, including Dr. Jacqueline Gahagan, Elder Margaret Lavallee, Veda Koncan, Margaret Bryan, and Jody Jollimore. The authors thank Heather Pashe (Indigenous cultural advisor), some members of Sisters of Fire, Manitoba Harm Reduction Network, Main Street Project, Meeting the Moment, Nine Circles Community Health Centre, Street Connections, 7th Street Health Access Centre, and Canadian AIDS Treatment Information Exchange (CATIE) for their ongoing guidance in this project. Lastly, the authors thank Mrs. Mariana Echeverri, communications coordinator of this project. Mrs. Echeverri has designed the website, recruitment materials, and all communicational pieces regarding this research.

Author contributions

The study concept and design were conceived by ZVR and YK, with input from all authors. Funding acquisition: ZVR, YK, and MH-B. AS, MS-J, and CB collected the information. MS-J, LL, and JV analyzed the data. MS-J, ZVR, and YK prepared the first draft of the manuscript. All authors edited and revised it critically for important intellectual content.

Data availability policy

The data underlying this article cannot be shared publicly because the original source data are 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 medical records were accessed by the researchers under specific data sharing agreements only for approved use stated in the broad research.

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