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BRITISH COLUMBIA CENTRE for EXCELLENCE in HIV/AIDS

Cycle 2017-2019 Highlights

Momentum II Health Study—Vancouver site of the National Engage Study: Portrait of the health and wellbeing of gay, bisexual and other men who have sex with men in Metro Vancouver

ACKNOWLEDGEMENTS:

INTRODUCTION

Despite important advances in antiretroviral therapy (ART) resulting in the reduction of morbidity and mortality for individuals who are living with HIV, gay, bisexual, and other men who have sex with men (GBM) remain disproportionately affected by HIV in Canada. In 2018, GBM account for about half of all new HIV infections in Canada (49.5%), despite representing only 3 to 4% of the general population (1). This disparity is greater in British Columbia where GBM accounted for 69.8% of new HIV diagnoses in 2017. Similarly, diagnoses of bacterial sexually transmitted infections (STIs) are also disproportionately high among GBM (2, 3). The epidemiology of HIV and STIs in Canada makes GBM a high priority population for HIV/STI prevention, care and research. Different factors such as access to preventative health services, sexual behaviours, mental health and substance use are important. Recognizing the significant lack of understanding of the needs of GBM across Canada, and that GBM continue to be affected by HIV and STIs at alarming rates the Engage study was designed to address critical knowledge gaps in HIV and STI prevention.

The Engage Study is a longitudinal cohort of gay, bisexual and other men who have sex with men (GBM) from the community that collects detailed sociodemographic, behavioural, attitudinal, and biological information related to sexual health, HIV, hepatitis C, other STIs, substance use, and psychosocial health. The Engage study in Vancouver (known locally as Momentum II) was designed as the next phase of the Momentum Health Study, which was originally conducted from 2012-2019 (4). Building off this work, the Engage Study includes the two largest cities in Canada: Toronto and Montreal and represents a national partnership of researchers, public health leaders, and community leaders whose shared goal is to conduct, support, and facilitate high-quality and policy-relevant HIV research on GBM. The Momentum II/ Engage Study in Vancouver has six main objectives:

1. To measure self-reported HIV risk behaviour and determinants of risk behaviours among GBM in Vancouver. Acknowledging it's limitations, our definition of risk behavior was at least one episode of condomless anal intercourse with a known serodiscordant or unknown serostatus partner in the previous six months.
2. To measure the prevalence and determinants of recent HIV infection among GBM in Vancouver
3. To measure the proportion and determinants of community
4. viral load (i.e., a measured viral load ≥200 copies/mL) among GBM living with HIV in Vancouver.
5. To measure prevalence of recent and asymptomatic reportable STIs other than HIV (HBV, HCV, gonorrhea, chlamydia, and syphilis) and related determinants among GBM.
6. To document the exposure and uptake of socio-behavioural and biomedical HIV and STI prevention programs among GBM in Vancouver.
7. To examine associations between specific prevention initiatives with the occurrence of recent HIV, STI, and condomless anal intercourse.

Based on these objectives, this report provides an overview of selected indicators from the study. This report aims to provide health information about GBM in Vancouver for clinical and public health audiences. These findings can be used to further inform health service design and implementation for GBM in BC. A separate report for GBM addresses the interests and concerns of the GBM community in Vancouver.

More information regarding the study and related publications are available at the national Engage website (https://www.engage-men.ca/).

METHODS AND ANALYSIS

We used respondent driven sampling (RDS) to recruit participants in the Engage Study. This sampling uses an adapted form of chain referral sampling (e.g., participants were recruited through people who have already participated in the study) designed to approximate probabilistic samples by adjusting for selection bias (5). This sampling method was expected to result in a more current representative sample of GBM than previous studies in Vancouver. The data collected were then adjusted for the size of participants' social networks to improve representativeness of study estimates.

Recruitment for the Engage study in Vancouver started in February 2017 and ended in July 2019. The Vancouver site initially started with 30 "seed" participants, who were chosen from diverse racial and ethnic backgrounds, ages, gender identities and HIV statuses. Specifically, among the initial 30 "seed" participants, we selected at least 10 who represented ethnic minority groups, 10 who identified as GBM living with HIV, 2 who identified as transgender, 2 who identified as bisexual and 2 who were below the age of 18 years old. Recruitment was monitored and additional seed participants were added in order to retain steady recruitment and achieve our targeted sample size of 720 participants. We also used advertisements on social networking applications, such as Grindr, Growlr, and Squirt, as well as posts on Facebook and Craigslist to raise awareness of the study and to recruit potential "seed" participants.

Participant eligibility criteria included: gender identify as a man (including transgender men) sexually active with another man in the past 6 months, at least 16 years old, lived in Metro Vancouver, were either purposefully recruited into the study as a seed or recruited by another study participant. Participants provided written informed consent prior to participation and completed a self-administered questionnaire, where they answered questions related to sociodemographics, HIV and STI behaviors, sexual behaviors, substance use and mental health.

Participants also provided a venous blood sample permitting serological testing for HIV, hepatitis C virus (HCV), hepatitis B virus (HBV) and syphilis.

Infection with HIV was ascertained using either a point of care (INSTI®) test or venous blood draw for a 4th generation testing (detection of HIV antibodies and p24 antigen); reactive results were confirmed using the confirmatory testing assay at the BC CDC Public Health Laboratory. Participants known to be living with HIV, were offered the option of either confirming their diagnosis with a point of care (INSTI®) test, or by requesting confirmation from their primary care physician.

HCV infection or past exposure was determined based on a positive HCV antibody result. For men reporting or found to be HCV-infected, HCV RNA testing was also done to evaluate chronic HCV infection. HBV status was ascertained using testing for hepatitis B surface antigen (HBsAg). We defined HBV infection as HBsAg positivity.

A history of syphilis infection was based on a reactive Enzyme Immuno-Assay (EIA) test (indicating a current or resolved infection). A rapid plasmin reagin (RPR) titre ≥1:8 was used to define those participants with a recent or active infection.

Study participants also provided urine, pharyngeal swabs, and rectal swabs to test for bacterial STIs. Screening for Chlamydia trachomatis and Neisseria gonorrhoeae was done using nucleic acid amplification testing (NAAT)

or culture, based on provincial laboratory testing procedures. For gonorrhea and chlamydia, any positive result on a urine, pharyngeal, or rectal specimen was coded as a detected infection.

Test results were made available to study participants within two weeks after collection. Study staff provided all participants who tested newly positive for HIV or other STI's with linkage to care and treatment providers. We also provided treatment for gonorrhea, chlamydia and syphilis on site. Study staff also provided STI transmission risk reduction counselling.

All participants were encouraged to recruit additional participants through their social networks to a maximum of 6 people. Each participant was compensated $50 for completing the study procedures and an additional $15 for each person they successfully recruited into the study Individuals could only be recruited and participate in the study once. When asked about reasons for participating in the Engage study, participants in Vancouver indicated that they were interested in sexual health and HIV (30.3%) or interest in gay men's health (21.1%). Only 10.2% reported that they were mostly interested in the incentive for participation. When asked about the nature of their relationship from the person they received their invitation coupon from, 55.4% indicated they were recruited by a friend and 23.8% indicated they were recruited by a sexual or romantic partner.

We calculated homophily and number of waves required to reach equilibrium using age group, racial/ethnic identity, sexual identity, marital status, and reported HIV status. Homophily is a measure of connection to one's own group. The score ranges between -1 (completely recruiting outside one's group) and +1 (completely recruiting within one's group), and a score of 0.3 (or, −0.3) was referred as "substantial" in- group (or out-group) recruitment.

To increase the representativeness of estimates to the overall GBM population in Vancouver we applied RDS weighting adjustment methods data during analysis. We adjusted all data using RDS-II weights, which relies on social network size of participants (6). With this weighting method, data are adjusted according to the inverse of the size of each participant's social network to account for the fact that individuals with larger social networks are more likely to be recruited into the sample. A participant's social network size was based on their answer to the following question: "How many men who have sex with men aged 16 years or older, including trans men, do you know who live or work within the Metro Vancouver area (whether they identify as gay or otherwise)?"). For the lower limit, we set the minimum value to 1 as, to be eligible for the study, participants had to be sexually active with another man in the last six months. Due to unrealistic maximum values reported by some participants, we selected an upper limit of 150, following standards on the maximum number of possible current relationships from Dunbar et. al. (2010)(7).

All the tables below report both the crude (unadjusted) proportions as well as the RDS-adjusted proportions and their adjusted 95% confidence intervals. For some categories, we stratified participants based on their self-reported HIV serostatus at enrollment. In general, the RDS-adjusted values should be considered to be more representative of the underlying GBM community in Metro Vancouver.

RESULTS

RDS Recruitment in Vancouver

Between February 2017-July 2019, a total of 753 cisgender and transgender men took part in the Engage Vancouver study. In total, there were 117 "seed" participants in Vancouver and 71 of these "seeds" (61%) recruited at least one individual. The final sample of 753 participants were recruited in 29.8 months. The total number of coupons distributed was 4313, and the mean number of recruitment waves at which the participant was recruited was 2.7 (95%CI=2.5-2.8). The mean chain length among the 117 chains was 1.6 (95% CI=1.2-2.0) and mean chain size was 6.4 (95% CI=4.0-8.8). Overall, mean network size (total number of eligible participants the participant knows who live or work in this city) was 53.2 (95%CI=49.61-56.8). Homophily scores for age group indicate that the GBM tended to recruit GBM within their own age group. We also found participants tended to recruit GBM of the same serostatus then themselves (homophily for GBM living with HIV: 0.41; homophily for HIV-negative GBM: 0.54;). Homophily by ethnoracial identity and sexual identity were all < |0.4|. Regarding equilibrium, as waves of recruitment progress and recruitment chains grow, indicators (e.g., average annual income) are expected to stabilize, such that the addition of new participants introduces little change in the indicator. The investigation of data on selected sociodemographic, psychosocial and behavioural indicators and health outcomes showed that indeed equilibrium was reached before data collection ended. Numbers presented below in the text reflect adjustment for RDS.

Sociodemographic Characteristics of GBM living in Metro VancouverA (N=753)

The Engage study reached many GBM under 30 years of age but the lowest age of any participant was 16 years. The majority (57.3%) were born in Canada, with most reporting Canadian (40.0%), Asian (22.2%) or European (14.5%) ethnoracial identity. The majority of men (76.8%) had a greater than high school education. About 80% of the sample identified as gay and 9.5% identified as bisexual. Only 1.2% of the sample were transgender (based on different reported birth sex and current sex). Overall, 80.6% self-reported HIV-negative/unknown serostatus, while 19.4% identified as GBM living with HIV.

	Unadjusted %	RDS Adjusted BC %	Adjusted 95% Confidence Interval (CI)
Age group			
Less than 30	38.9	45.4	(38.5-52.4)
30 to 44	37.5	30.0	(23.8-36.2)
45 or more	23.6	24.6	(18.2-30.9)
Born in Canada			
No	36.0	42.7	(35.9-49.5)
Yes	64.0	57.3	(50.5-64.1)
Ethno-racial Identity			
Canadian	46.3	40.0	(33.2-46.9)
Aboriginal or Indigenous	3.1	4.0	(0.0-8.0)
European	19.3	14.5	(10.4-18.6)
Asian	17.4	22.2	(16.4-28.0)

African, Caribbean, or Black	1.3	1.8	(0.0-3.8)
Mixed Race	2.1	3.0	(0.6-5.4)
Another race/ethnicity	10.5	14.5	(9.3-19.7)
Highest level of education			
High school or less	20.1	23.2	(17.1-29.3)
Greater than high school	79.9	76.8	(70.7-82.9)
Annual personal income (CAD)			
Less than $30,000	45.6	61.3	(54.9-67.8)
$30,000 to $59,999	29.6	25.6	(19.6-31.5)
$60,000 or higher	24.8	13.1	(10.0-16.2)
Sexual orientation			
Gay	85.0	79.6	(73.2-86.1)
Bisexual	5.3	9.5	(5.4-13.6)
Straight	0.1	0.2	(0.0-0.6)
Queer	5.8	3.7	(1.9-5.5)
Questioning	0.1	0.3	(0.0-1.0)
Asexual	0.1	0.1	(0.0-0.4)
Pansexual	1.5	1.1	(0.1-2.1)
Two Spirit	0.8	2.8	(0.0-6.8)
Another sexual identity	1.2	2.6	(0.0-6.5)
Gender			
Cisgender	98.4	98.8	(97.7-99.8)
Transgender	1.6	1.2	(0.2-2.3)
Relationship status			
No current main partner	54.8	57.3	(50.4-64.2)
Has a current main partner	45.2	42.7	(35.8-49.6)
Self-reported HIV status			
HIV-negative/unknown	83.3	80.6	(74.8-86.4)
Living with HIV	16.7	19.4	(13.6-25.2)

Notes:

A. **Metro Vancouver:** Includes the city of Vancouver and the surrounding suburbs that form the Greater Vancouver Regional District (GVRD).

B. **Missing data:** depending on the variable, the proportion of missing data ("prefer not to answer" or "don't know/don't remember") varied between 0.1-3.5%. However, when scores are obtained from psychosocial-behavioural scales composed of several questions, the proportion of missing data varied between 2.1-3.9%.

C. **RDS-Adjusted data:** The indicators presented and their 95% confidence intervals were adjusted based on the size of the social network reported by each participant (6).

HIV Perceptions and Care (N=753)

Overall, 20.4% of the sample were confirmed to be living with HIV, with almost all GBM aware they were living with HIV who were, and 88.7% of those who were aware were currently on ART. Among those on ART, 98.4% had an undetectable viral load and 4.2% had a co-infection with HIV and HCV (based on HCV antibody status). Among self-reported HIV-negative/unknown GBM, 18.3% reported a high perceived risk of HIV acquisition, in comparison with 15.4% of self-reported GBM living with HIV who reported high self-perceived HIV transmission risk.

	Unadjusted %	RDS Adjusted	Adjusted 95% CI
Current risk of getting HIV			
High self-perceived risk (among self-reported HIV-negative/ unknown)	23.0	18.3	(13.5-23.1)
Current risk of passing HIV			
High self-perceived HIV transmission risk (among self-reported living with HIV)	10.1	15.4	(2.5-28.2)
Prevalence of HIV among all participants	17.5	20.4	(14.5-26.3)
Aware of HIV status (among participants who had a reactive (positive) HIV test)	99.2	99.8	(99.3-100.0)
Currently on HIV antiretrovirals treatment (among participants who were aware of their HIV status)	93.9	88.7	(78.6-98.8)
Viral load (among participants aware of HIV status and those who were currently on treatment)			
Less than 200 copies/mL	96.7	98.4	(96.3-100.0)
200 or higher copies/mL	3.3	1.6	(0.0-3.7)
Viral load (among participants aware of HIV status and currently on treatment)			
Less than 50 copies/mL	91.6	87.4	(74.1-100.0)
Living with HIV and ever had HCV	2.1	4.2	(0.0-8.4)

Attitudes about HIV

We stratified our sample based on self-reported HIV status to assess differences in attitudes about HIV stigma and treatment. We found results between HIV-negative/unknown and GBM living with HIV to be similar, with the exception of the level of agreement with the statement, "it is very hard to get HIV nowadays because most HIV-positive guys have undetectable viral loads". We found 41.4% of GBM who were living with HIV agreed or strongly agreed with the statement compared with 12.7% of HIV-negative/unknown GBM.

	HIV-Negative/Unknown (n=627)			Living with HIV (n=126)		
	Unadjusted %	RDS Adjusted %	Adjusted 95% CI	Unadjusted %	RDS Adjusted %	Adjusted 95% CI
"Agrees" or "strongly agrees" with the following statements:						
"If a guy is using pre-exposure prophylaxis it makes using condoms during anal sex less important"	48.5	34.7	(27.8-41.5)	61.9	49.5	(32.4-66.6)
"New HIV treatments will take the worry out of sex"	52.8	48.0	(40.3-55.7)	58.7	48.2	(31.0-65.3)
"HIV/AIDS is a less serious threat than it used to be because of new treatments"	70.3	60.3	(52.5-68.1)	70.6	56.0	(39.2-72.9)
"It is very hard to get HIV nowadays because most HIV-positive guys have undetectable viral loads"	15.0	12.7	(8.4-17.1)	34.9	41.4	(23.9-59.0)

Sexually Transmitted and Blood-Borne Infections (STBBI)

Sexually transmitted Infections (STI)
The Engage study both asked about diagnoses of STI's in the past year and tested for prevalence of STI's at nurse visits. The most common STI among GBM living with HIV was syphilis, with 18.3% of GBM living with HIV diagnosed in the past year. The most common STI among HIV-negative/unknown GBM was chlamydia with 9.4% of HIV-negative/unknown GBM diagnosed in the past year. From our testing biological samples in the study, we found syphilis to also be the most common STI (after HIV) among GBM in our sample. We found 41.0% of GBM living with HIV had a reactive Enzyme Immunoassay (EIA) (compatible with a current or resolved infection) and 5% had a reactive rapid plasma regain (RPR) ≥ 1:8 (comparable with an active infection) for syphilis. For GBM who self-reported as HIV-negative/unknown at enrollment, these values were 8.9% for current or resolved infection and 3.6% for acute infection.

	HIV-Negative/Unknown (n=627)			Living with HIV (n=126)		
	Unadjusted %	RDS Adjusted %	Adjusted 95% CI	Unadjusted %	RDS Adjusted %	Adjusted 95% CI
Diagnosed STI, Past Year						
Chlamydia	16.4	9.4	(4.4-14.4)	18.3	7.6	(2.9-12.3)
Gonorrhea	16.1	8.0	(5.4-10.6)	25.0	13.9	(5.4-22.5)
Syphilis	4.7	4.4	(0.0-9.2)	18.9	18.3	(5.4-31.2)
Biological results from study visit:						
Prevalence of chlamydia (pharyngeal, urinary, or rectal)	9.3	6.3	(3.2-9.3)	7.0	3.9	(0.0-7.9)
Prevalence of gonorrhea (pharyngeal, urinary, or rectal)	4.2	3.1	(1.2-4.9)	4.2	2.9	(0.0-6.7)
Prevalence of syphilis:						
Reactive Enzyme Immunoassy (EIA) (comparable with a current or resolved infection)	10.7	8.9	(3.7-14.0)	50.4	41.0	(25.0-57.0)
RPR titer ≥ 1:8 (comparable with an active infection)	2.1	3.6	(0.0-8.4)	5.6	5.0	(0.0-11.9)

Hepatitis B virus (HBV)

The majority of GBM in our sample were immune to HBV either due to vaccination (75.7% among HIV-negative/unknown GBM and 74.3% among GBM living with HIV). HIV-negative/unknown participants were more susceptible to HBV compared with participants living with HIV (16.7% vs. 7.2%, respectfully), and only 1.7% of participants living with HIV had a chronic or acute HBV infection. No HIV-negative/unknown status participants had a chronic or acute HBV infection.

	HIV-Negative/Unknown (n=627)			Living with HIV (n=126)		
	Unadjusted %	RDS Adjusted %	Adjusted 95% CI	RDS Adjusted %	Unadjusted %	Adjusted 95% CI
Susceptible to HBV (HbsAg, anti-HBc and anti-HBs non-reactive tests)	11.6	16.7	(9.9-23.6)	9.2	7.2	(0.0-14.8)
Immune due to vaccine (HbsAg non-reactive, anti-HBc reactive and anti-HBs reactive tests)	82.7	75.7	(68.4-82.9)	60.8	74.3	(61.8-86.9)
Immune due to hepatitis B infection (HbsAg non-reactive, anti-HBc reactive and anti-HBs reactive tests)	4.9	7.1	(3.3-10.9)	24.2	16.2	(6.3-26.1)
Chronic or acute infection (HbsAg reactive, anti-HBc reactive and anti-HBs reactive tests)	0.0	0.0	0.0	2.5	1.7	(0.0-4.1)

Hepatitis C Virus (HCV) (N=753)

We tested for the presence of HCV antibodies in our sample, where 5.9% of participants tested positive indicating previous exposure and/or infection with HCV. Prevalence of HCV was higher for both GBM who ever injected drugs (27.6%) and for those who also had a positive HIV test (20.7%) compared with GBM who had a HIV-negative test result (2.1%). Among those who had a reactive anti-HCV test, all participants were aware of their HCV status. Additionally, among all participants who had a current or past HCV infection, 94.1% of participants had received HCV treatment.

HCV Antibodies Present	Unadjusted %	RDS Adjusted %	Adjusted 95% CI
Among all participants	2.9	5.9	(1.3-10.5)
Among participants who have ever injected drugs	20.3	27.6	(6.5-48.8)
Among participants who ever used crystal methamphetamine	8.8	10.2	(2.7-17.7)
Among participants who had a reactive (positive) HIV test	12.3	20.7	(2.9-38.5)
Among participants who had a non-reactive (negative) HIV test	1.0	2.1	(0.0-4.6)
Among participants who had never injected drugs and who had a non-reactive (negative) HIV test	0.3	1.6	(0.0-4.1)
Among participants who were aware of their HCV status and received HCV treatment	84.2	94.1	(84.6-100.00)
HCV RNA detected (among participants Hep C Ab reactive)	27.3	11.3	(0.0-25.9)

Access to Health and Prevention Services

We found more GBM living with HIV had a regular primary care provider than HIV-negative/unknown GBM (99.2% vs. 59.3%), and that GBM living with HIV were more open about their sexual orientation with primary care providers than HIV-negative/unknown GBM (94.9% vs. 61.8%). Overall, HIV-negative/unknown participants reported high HIV testing in the past year (79.4%), with even higher rates for those who reported more than six sexual partners in the past six months (84.9%). STI testing was also higher for GBM who reported more than six sexual partners in the past six months (75.1% for HIV-negative/unknown and 82.6% for GBM living with HIV, respectively). Overall, only 15.7% of HIV-negative/unknown GBM reported any form of PrEP in the past six months

	HIV-Negative/Unknown (n=627)			Living with HIV (n=126)		
	Unadjusted %	RDS Adjusted %	Adjusted 95% CI	RDS Adjusted %	Unadjusted %	Adjusted 95% CI
Has a regular primary healthcare provider (for example, family doctor, nurse practitioner)	65.4	59.3	(51.7-66.8)	96.8	99.2	(98.2-100.0)
Regular primary healthcare provider is aware of his sexual orientation (among participants who have a regular primary healthcare provider)	79.5	61.8	(50.2-73.4)	99.2	94.9	(85.2-100.0)
Has received information about his sexual health from the following sources:						
On-line interaction with a worker or volunteer from a Community-Based Organization (for example, messaging/chat on a hook-up app or site)	7.2	6.8	(1.9-11.6)	7.1	10.2	(0.0-21.6)
Multiple-session programs or support groups	6.1	5.8	(1.0-10.6)	19.0	35.3	(16.9-53.6)
One-time workshop or presentation	8.9	8.4	(3.4-13.5)	7.9	15.5	(3.1-27.8)
In-person interaction with a worker or volunteer from a Community-Based Organization (for example, HIM, Qmunity)	29.7	23.8	(16.9-30.7)	22.2	26.1	(11.8-40.4)

Spends 50% or more or his social time (i.e., time spent with others outside of work) with gay/bi guys who he knows quite well, in the past 6 months	53.8	40.6	(33.2-47.9)	39.3	22.2	(9.7-34.8)
HIV Testing among participants self-reporting as HIV negative or unknown,						
tested at least once in the past 12 months	85.5	79.4	(72.8-86.0)			
participants who have had 6+ male sexual partners in the past 6 months, tested at least once in the past six months	84.8	84.9	(78.3-91.4)			
STI Testing[A]						
Among all participants, tested at least once in the past 12 months	77.1	65.3	(57.7-72.9)	84.6	86.4	(76.9-95.8)
Among participants who have had 6+ male sexual partners in the past 6 months, tested at least once in the past six months	79.0	75.1	(66.6-83.5)	85.1	82.6	(67.0-98.2)
Has ever received one or more doses of Hepatitis B vaccine, in his lifetime						
Has received one or more doses	71.8	62.1	(54.5-69.6)	74.6	80.3	(69.5-91.0)
Does not know if he has received a dose or not	17.5	23.7	(16.7-30.7)	13.5	10.5	(3.1-17.8)
Has ever received one or more doses of the vaccine against the human papillomavirus (HPV), in his lifetime						
Has received one or more doses	31.3	20.5	(15.6-25.4)	20.6	18.6	(7.2-30.1)
Has never heard of the HPV vaccine	16.6	25.2	(18.3-32.1)	18.3	36.5	(18.0-55.0)
Has ever received one or more doses of the HPV vaccine, in his lifetime (among participants 26 years old or younger)						
Has received one or more doses	45.5	26.0	(16.9-35.1)			
Has never heard of the HPV vaccine	13.1	18.7	(9.0-28.5)			

Has ever taken post-exposure prophylaxis (PEP) at least once, in his lifetime	11.1	10.9	(5.6-16.2)			
Pre-exposure prophylaxis (PrEP) use, in the past six months ("on demand" or "daily")						
Among all participants	23.8	15.7	(11.2-20.1)			
Among participants who have had 6+ male sexual partners in the past six moths	36.4	28.7	(20.1-37.2)			

Notes:

A. Testing for sexually transmitted infections other than HIV: The self-reported list of infections included chlamydia, gonorrhoea, syphilis, lymphogranuloma venerum (LGV), hepatitis A, hepatitis B, hepatitis C, anal and genital warts (condylomas), shigella, giardiasis, herpes simplex virus (HSV 1 or 2) and bacterial vaginosis (BV).

Sexual Activities in the Past Six Months

We assessed various sexual behaviors for GBM, stratified by self-reported HIV status. Prevalence of GBM reporting more than six male partners was very similar for HIV-negative/unknown and GBM living with HIV (41.9% vs. 40.1%, respectively), as well as the proportion of who had anal sex with male partners (88.8% vs. 89.8%, respectively). We found 23.4% of HIV-negative/unknown GBM had anal sex with six or more male partners, while the proportion was 31% for GBM living with HIV. Attending a bathhouse or sex club was more common among GBM living with HIV (41.1%) compared with 26.6% of GBM who self-reported HIV-negative/unknown serostatus. However, prevalence of attending group sex events was similar (20.6 vs. 22.4%, respectively). Altogether, 65.6% and 31.4% of HIV-negative/unknown GBM reported condomless anal sex with at least one male partner and with at least one male partners of unknown or sero-different HIV status. These rates were slightly higher for GBM living with HIV (73.1% and 47.9%, respectively).

	HIV-Negative/Unknown (n=627)			Living with HIV (n=126)		
	Unadjusted %	RDS Adjusted %	Adjusted 95% CI	RDS Adjusted %	Unadjusted %	Adjusted 95% CI
Has had sex with a female partner	3.5	5.1	(0.1-10.1)	4.0	9.0	(0.0-19.7)
Has had sex with 6 or more male partners	52.8	41.9	(34.5-49.4)	59.5	40.1	(24.6-55.7)
Has had anal sex with a male partner	91.2	88.8	(84.2-93.5)	92.9	89.8	(80.2-99.4)
Has had anal sex with 6 or more male partners	33.3	23.4	(17.4-29.3)	46.0	31.0	(16.9-45.1)

Has attended a group sex event (sexual relations between 4 or more men), at least once	26.4	20.6	(13.7-27.5)	34.9	22.4	(11.7-33.2)
Has gone to a bathhouse or sex club, at least once	35.6	26.6	(20.3-32.9)	49.2	41.1	(25.1-57.1)
Has given money in exchange for sex (regardless of the gender of the person paid)	2.3	0.7	(0.2-1.2)	4.0	4.0	(0.0-9.4)
Has received money in exchange for sex (regardless of the gender of the person providing the payment)	4.0	5.9	(0.7-11.0)	7.3	5.5	(0.0-11.9)
Has had anal sex without a condom with at least one male partner	75.1	65.6	(58.3-72.9)	84.1	73.1	(58.3-87.9)
Has had anal sex without a condom with a male partner of unknown or different HIV status, at least once	42.5	31.4	(24.8-38.1)	70.2	47.9	(31.2-64.7)

Experiences of Discrimination and Mental Health (N=753)

Overall, about half to two thirds of GBM in our study experienced each type of discrimination (verbal and enacted, by strangers, and family members) in the past year. Assessing self-rated mental health, the vast majority of GBM rated their mental health as good or excellent (90.3%). Based on the Hospital Anxiety and Depression Scale the majority of GBM also had low anxiety and depression scores (69.5% and 93.4%, respectively). About a third of GBM in our sample had moderate or severe anxiety scores (30.5%), while 6.6% of GBM had moderate or severe depression scores.

	Unadjusted %	RDS Adjusted %	Adjusted 95% CI
Has experienced the following forms of discrimination at least once in the past year[A]			
Have been called a name like homo/fag/other names in a derogatory manner	74.2	66.1	(59.1-73.2)
Have heard anti-gay/bisexual remarks from family members	59.0	57.4	(50.3-64.6)
Have been treated unfairly by strangers because you are a gay/bisexual man	73.2	66.2	(59.5-72.9)
Have been verbally insulted because you are a gay/bisexual man	60.1	55.5	(48.5-62.4)
Have been treated unfairly by your family because you are a gay/bisexual man	55.0	49.2	(42.1-56.3)
Self-rated Mental Health in the past six months[B]			
Good or excellent mental health	90.3	90.3	(86.6-94.0)
Poor mental health	9.7	9.7	(6.0-13.4)
Anxiety symptomology[C]			
Low anxiety scores (0 to 10)	70.2	69.5	(63.0-75.9)
Moderate or severe anxiety scores (11 to 21)	29.8	30.5	(24.1-37.0)
Depression symptomology[C]			
Low depression scores (0 to 10)	93.6	93.4	(90.5-96.2)
Moderate or severe depression scores (11 to 21)	6.4	6.6	(3.8-9.5)

Notes:

A. Discrimination Scale: The Heterosexist Harassment, Rejection and Discrimination Scale consists of 14 items. Respondents indicate the frequency at which each event occurred over the past year ("never", "once in a while", "sometimes", "a lot", "most of the time", "all of the time") (8).

B. Self-Rated Mental Health: Reporting "Excellent, very good, good, fair" mental health was defined as Excellent or Good mental health. Reporting "Poor" mental health was defined as Poor mental health.

C. Anxiety and Depression Scale: The Hospital Anxiety and Depression Scale consists of 14 items (7 measuring anxiety and 7 measuring depression). Participants choose the answer that best corresponds to how they had felt during the past week (e.g. "I feel tense or wound up"; answer choices include: "most of the time", "a lot of the time", "from time to time/occasionally", "not at all"). Scores are classified into the 4 following categories: normal, mild (low), moderate or severe (9).

Tobacco, Alcohol, Cannabis and other Substance Use in the Past Six Months

Previous research has demonstrated significant differences in substance use among GBM living with HIV and those who are HIV-negative or unknown serostatus. Our stratified results found mixed findings on substance use rates, varying by substance type. More GBM living with HIV reported daily or almost daily use of cigarettes (30.6% vs. 12.6%), and stimulant use, including the use of crystal meth (38.5% vs. 5.3%) compared with HIV-negative/unknown GBM, respectively. We also found use of injection drugs (11.5% vs. 1.1%) and chemsex (39.2% vs. 6.1%) was higher among GBM living with HIV than HIV-negative/unknown GBM, respectively. We found drinking one or more alcoholic drink, 4 times a week (10.0% vs 3.0%) was higher among HIV-negative/unknown GBM compared with GBM living with HIV. Using the ASSIST scale to assess developing substance use dependence and related problems, we found at least a quarter of GBM had moderate risk for developing alcohol-related (32.2% for GBM living with HIV and 27.2% for HIV-negative/unknown GBM) and stimulant-related dependency problems (27.4% for GBM living with HIV and 22.1% for HIV-negative/unknown GBM).

	HIV-Negative/Unknown (n=627)			Living with HIV (n=126)		
	Unadjusted %	RDS Adjusted %	Adjusted 95% CI	RDS Adjusted %	Unadjusted %	Adjusted 95% CI
Use of cigarettes daily or almost daily	11.8	12.6	(7.6-17.6)	28.0	30.6	(16.2-45.0)
Use of cannabis daily or almost daily	18.7	18.3	(12.9-23.7)	27.0	17.9	(6.4-29.4)
Use of alcohol						
1 drink or more, 4 times a week or more	12.3	10.0	(5.5-14.5)	7.4	3.0	(0.3-5.6)
6 drinks or more 4 times a week or more	10.3	7.7	(3.8-11.5)	5.8	2.1	(0.0-4.4)
Substance use reported at least once in the past six months						
Cocaine (snorted or sniffed)	22.7	11.8	(8.5-15.1)	21.8	19.1	(6.1-32.2)
Crack cocaine	2.4	2.6	(0.9-4.3)	12.8	18.6	(5.4-31.8)

Ketamine	9.7	6.1	(2.4-9.8)	13.7	18.7	(5.3-32.2)
Methamphetamine (crystal meth)	6.1	5.3	(2.3-8.2)	41.3	38.5	(22.6-54.3)
Steroids (not prescribed)	2.6	2.2	(0.5-3.9)	3.2	1.7	(0.0-3.9)
Any drugs by injection (non-medical use only)	2.2	1.1	(0.4-1.9)	18.3	11.5	(2.6-20.5)
Has used a syringe already used by someone else, at least once (among participants who have used drugs by injection for non-medical use)	28.6	30.5	(0.0-62.4)	13.0	3.8	(0.0-9.4)
Chemsex[A], with at least one of his last 5 sexual partners	9.3	6.1	(3.7-8.5)	43.9	39.2	(23.0-55.4)
Is at risk of developing a dependence or problem (health, social, financial, etc.) related to his use of alcohol[B]						
Moderate risk	30.1	27.2	(19.7-34.6)	20.3	32.2	(13.3-51.1)
High risk of dependence or already dependent and likely experiencing problems	6.4	6.4	(2.9-9.8)	6.5	6.2	(0.0-12.9)
Is at risk of dependence or developing problems (health, social, financial, etc.) related to use of stimulants[C]						
Moderate risk of developing	35.1	22.1	(16.1-28.2)	39.2	27.4	(14.3-40.4)
High risk of dependence or already dependent and likely experiencing problems	2.8	2.5	(0.0-5.0)	16.7	21.8	(7.8-35.9)

Notes:

A. **Psychoactive drugs used in the context of sexual activities (chemsex):** This includes any of the following 2 substances: gammahydroxybutyrate (GHB) or methamphetamine (crystal meth) used two hours before or during sex.

B. **ASSIST:** The types of amphetamines are grouped according to the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). ASSIST was developed for the World Health Organization (WHO) by an international group of substance abuse researchers to detect the risk of developing substance use dependence and related problems. ASSIST is a 7-item questionnaire; scores are classified into 3 categories: lower risk, moderate risk or high risk (10).

C. **Includes the following substances:** cocaine, amphetamines, inhalants, sedatives, hallucinogens, opioid.

CONCLUSIONS

The Engage Vancouver study recruited a total of 753 cisgender and transgender GBM from February 2017-August 2019. Our sample reached a diverse group of GBM from varying sociodemographic backgrounds and provided valuable behavioural and biological data on relevant health disparities among GBM.

In Engage we found about one in five GBM were living with HIV in Vancouver. Examining the HIV cascade of care, we found 99.8% of GBM living with HIV were aware of their HIV-positive status, 88.7% of those who were aware were also receiving ART, and 98.4% of those who were on ART were virologically suppressed. Our results are encouraging as we are on track to meet the 95-95-95 goals for 2030 developed by UNAIDS whereby 95% of individuals living with HIV are aware of their HIV-positive status, of whom 95% are receiving ART and of whom 95% reach viral suppression (11). In comparison with findings from Momentum Health Study, we have seen improvements in the cascade of care outcomes among GBM from 2012-2019 (12). Further intervention and research are needed to improve levels of GBM who are aware of their positive HIV status and consistently engaged in ART.

GBM in Vancouver are evidently very engaged in the HIV cascade of care, likely due in part to BC 's commitment to Treatment as Prevention (TasP), as a public health policy for HIV since 2010 (13). Despite these results, our findings on HIV attitudes related to TasP suggest that less than half of GBM living with HIV in our study, agreed with the statement, "It is very hard to get HIV nowadays because most HIV-positive guys have undetectable viral loads." While this was higher than findings for HIV-negative/unknown GBM, where 1 in 10 supported this statement, this finding suggests a clear need for further education and public health messaging around TasP and U=U.

Among self-reported HIV-negative GBM or those with an unknown status, we found four of five tested for HIV in the past year. Again, while this seems high, and resulted in very few GBM with undiagnosed infections in our study, it is well below the recommendation that 100% of sexually active GBM should be tested for HIV each year based on the BC HIV testing guidelines from the Office of the Provincial Health Officer (14). As well, only two-thirds of HIV-negative/unknown GBM indicate they had been tested for bacterial STI's such as gonorrhea, chlamydia and syphilis in the past year. However, one encouragement to our findings is that it appears HIV-negative/unknown GBM who reported six or more partners in the past six months also report higher HIV (85%) and STI (75%) testing compared with other GBM, suggesting that those who will benefit most from testing are more likely to seek it out. Still, when HIV-negative/unknown GBM are testing for HIV, it is a missed opportunity to not also provide testing for bacterial STIs as well as engagement in other care (e.g., vaccination for HPV and HBV, and HCV testing). Relatedly, when GBM living with HIV engage in regular health care related to management of HIV, this is also an opportunity to include regular STI testing and care. Data from our study found rates of HIV and STI testing are higher for GBM living with HIV compared to their HIV-negative/unknown counterparts, but disparities between HIV and STI testing still exist.

Related to our biological test results for other STIs, we found that among GBM living with HIV, approximately two out of five had a positive EIA result, indicating a current or resolved syphilis infection, compared with approximately one in ten HIV-negative/unknown GBM. These high rates of syphilis are aligned with surveillance data from the BC Centre for Disease Control, indicating rising trends of syphilis in BC especially among GBM living with HIV (15). Biological results from the study also found higher levels of prevalence for chlamydia and gonorrhea among HIV-negative/unknown GBM compared to GBM living with HIV. Finally,

HCV prevalence in the sample was approximately 6%, Of these 100% were aware of their infection and 94% of had received or were receiving treatment for HCV. This finding is a marked improvement from findings on HCV treatment in Momentum I where only 86% were aware of their infection and 34% had been treated at enrollment (16).

Findings from Engage provide further data on substance use patterns in the past six months among GBM, stratified by self-reported HIV status. Overall, about one in three GBM living with HIV reported daily cigarette smoking, a near three-fold increase compared to HIV-negative/unknown GBM. However, the inverse relationship was found for alcohol consumption 6 drinks or more 4 times a week or more), where HIV-negative/unknown GBM had an almost four-fold increase in consumption compared to GBM living with HIV. Additionally, we found approximately two out of five GBM living with HIV reported methamphetamine-use in the previous 6 months, which presents a near eight-fold increase compared to HIV-negative/unknown GBM. These reported proportions are similar to what we found at enrollment for GBM living with HIV in Momentum I (17). Lastly, we found approximately 6% of HIV-negative/unknown GBM reported using psychoactive substances in the context of sexual events. Evidently, findings demonstrate that substance use is still a pervasive issue within GBM communities.

About half to two thirds of GBM in our study experienced each type of discrimination in the past year (verbal and enacted, by strangers, and family members). Despite this finding, over 90% of GBM reported good or excellent mental health. Moreover, 70% of GBM reported low anxiety scores and 94% reported low depressive scores. Findings highlight the need for social justice change to reduce discrimination among GBM. Further research is also needed to explore the resiliencies of GBM with experiences of discrimination.

Taken together, our findings highlight various health and wellbeing outcomes among GBM in Metro Vancouver, including psychosocial health, substance use, STI and HIV testing and prevalence and HIV prevention, and community viral load. These baseline findings provide useful data specific to GBM who may often be overlooked in population health research. We expect that more detailed analyses of Engage/Momentum II baseline and follow-up data will provide a better understanding of these and related issues for GBM in Vancouver. Future longitudinal data collection from the Engage study will allow us to explore temporal associations between various exposures and health outcomes that further explain the lived realities of GBM.

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