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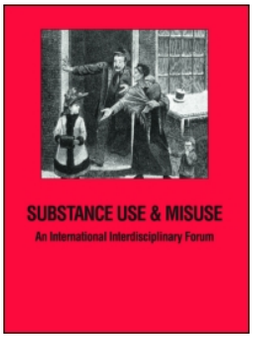

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ORIGINAL ARTICLE

Lifetime Doctor-Diagnosed Mental Health Conditions and Current Substance Use Among Gay and Bisexual Men Living in Vancouver, Canada

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ABSTRACT

Background: Studies have found that gay, bisexual, and other men who have sex with men (GBM) have higher rates of mental health conditions and substance use than heterosexual men, but are limited by issues of representativeness. *Objectives*: To determine the prevalence and correlates of mental health disorders among GBM in Metro Vancouver, Canada. *Methods*: From 2012 to 2014, the Momentum Health Study recruited GBM (≥16 years) via respondent-driven sampling (RDS) to estimate population parameters. Computer-assisted self-interviews (CASI) collected demographic, psychosocial, and behavioral information, while nurse-administered structured interviews asked about mental health diagnoses and treatment. Multivariate logistic regression using manual backward selection was used to identify covariates for any lifetime doctor diagnosed: (1) alcohol/substance use disorder and (2) any other mental health disorder. *Results*: Of 719 participants, 17.4% reported a substance use disorder and 35.2% reported any other mental health disorder; 24.0% of all GBM were currently receiving treatment. A lifetime substance use disorder diagnosis was negatively associated with being a student (AOR = 0.52, 95% CI [confidence interval]: 0.27–0.99) and an annual income ≥$30,000 CAD (AOR = 0.38, 95% CI: 0.21–0.67) and positively associated with HIV-positive serostatus (AOR = 2.54, 95% CI: 1.63–3.96), recent crystal methamphetamine use (AOR = 2.73, 95% CI: 1.69–4.40) and recent heroin use (AOR = 5.59, 95% CI: 2.39–13.12). Any other lifetime mental health disorder diagnosis was negatively associated with self-identifying as Latin American (AOR = 0.25, 95% CI: 0.08–0.81), being a refugee or visa holder (AOR = 0.18, 95% CI: 0.05–0.65), and living outside Vancouver (AOR = 0.52, 95% CI: 0.33–0.82), and positively associated with abnormal anxiety symptomology scores (AOR = 3.05, 95% CI: 2.06–4.51). *Conclusions*: Mental health conditions and substance use, which have important implications for clinical and public health practice, were highly prevalent and co-occurring.

KEYWORDS
Anxiety; depression; drug use; mental illness; sexual minority; syndemics

The prevalence of alcohol, tobacco, and other substance use is higher among gay, bisexual, and other men who have sex with men (herein "GBM") than in the overall population (Hughes & Eliason, 2002; King et al., 2008; Meyer, 2003; Ryan, Wortley, Easton, Pederson, & Greenwood, 2001). Although Hughes and Eliason (2002) noted that substance and alcohol use have declined in lesbian, gay, bisexual, and transgender populations, the prevalence of heavy alcohol and substance use remains high among younger lesbians and gay men, and in some cases older lesbians and gay men. Marginalization on the basis of sexual orientation increases the risk for problematic substance use. For example, GBM men were approximately one and half times more likely to have reported being diagnosed with a substance use disorder during their lifetime than heterosexual men (Meyer, 2003), and one and a half times more likely to have been dependent on alcohol or other substances in the past year (King et al., 2008).

GBM also have higher rates of mental health issues than their heterosexual counterparts (Brennan, Ross, Dobinson, Veldhuizen, & Steele, 2010; King et al., 2008; Meyer, 2003). In a review of 10 studies, Meyer (2003) found that gay men were twice as likely to have experienced a mental disorder during their lives as heterosexual men. More specifically, gay men were approximately two and a half times more likely to have reported a mood disorder or an anxiety disorder than heterosexual men. A review by King and colleagues (2008) found that lesbian, gay, and bisexual individuals were more than twice as likely as heterosexuals to attempt suicide over their lifetime and one and a half times more likely to experience depression and anxiety disorders in the past year, as well as over their lifetime.

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Few Canadian studies have explored population-based estimates for mental health outcomes among GBM. In one cross-sectional study of Canadian gay/"homosexual" and bisexual men using 2003 Canadian Community Health Survey data, Brennan and colleagues (2010) found participants were nearly three times as likely to report a mood or anxiety disorder than heterosexual men. Pakula & Shoveller (2013) conducted a more recent cross-sectional analysis that used 2007–2008 Canadian Community Health Survey data and found again that GBM were 3.5 times more likely to report a mood disorder compared with heterosexual males. These analyses used government-run population-based study data, which may limit self-disclosure of sexual minority status, and further relied on a single identity variable to measure sexual orientation, which ignores same-sex sexual behaviors.

There is an inextricable yet varied relationship between an individual's mental health and substance use. Substance use may lead to poorer mental health or, inversely, poor mental health may lead to increased substance use (Morisano, Babor, & Robaina, 2014). A variety of substances have been shown to be associated with negative mental health events or symptoms. For example, Clatts, Goldsamt, and Li (2005) found that a third of young MSM who used club drugs (e.g., speed, MDMA, and ketamine) on a regular basis reported having attempted suicide, and almost half of those who had attempted suicide, did so multiple times over their lifetime. They also found that more than half of regular club drugs users had high levels of depressive symptoms. McKirnan and colleagues (2006) found that GBM who showed signs of depression were nearly twice as likely to smoke. Stall and colleagues (2001) identified a "dose-response" relationship between self-rated mental wellbeing and alcohol related problems: GBM who self-rated their mental well-being as low were approximately three times more likely to have alcohol-related problems and those who rated it as moderate were nearly twice as likely to have alcohol related problems. Respondents who scored as depressed were also one and half times more likely to report using multiple drugs and nearly twice as likely to report weekly drug use. Syndemics [clusters of mutually reinforcing epidemics that interact with one another to make overall burden of disease within a population worse (Singer, 1996)] has been used in research with GBM to explain how various psychosocial variables such as polydrug use, mental health conditions, and intimate partner violence increase the likelihood of acquiring HIV (Stall et al., 2003). However, nearly all of these studies have relied on convenience samples through online and venue-based recruitment; thus, they may not be representative of the larger underlying population of GBM.

In order to address issues of representativeness and limitations of non-probability sampling in past research with GBM, we used respondent-driven sampling (RDS) to estimate population parameters that are more representative than convenience samples (Heckathorn, 1997). RDS is a type of chain-referral research technique in which participants are asked to recruit individuals from within their social networks in successive waves, and estimates population parameters using measures of network size and recruitment homophily. By utilizing RDS we sought to produce a more representative sample of the GBM population in Metro Vancouver in order to determine the prevalence of mental health issues and substance use as well as the association between these factors.

Methods

We analyzed cross-sectional data from participants enrolled in the Momentum Health Study, a longitudinal bio-behavioral prospective cohort study of HIV-positive and HIV-negative GBM (aged ≥16 years) in Metro Vancouver, Canada. The overall aim of this study was to examine the impact of a biomedical intervention—increased access to highly active antiretroviral therapy for HIV—on HIV risk behaviors among GBM. The present analysis utilized data collected from participants' first study visit that occurred between February 2012 and February 2014. We used RDS to recruit GBM in the Greater Vancouver area (Forrest et al., 2014). Initial seeds were selected in-person through partnerships with community agencies or online through advertisements on GBM socio-sexual networking mobile apps or websites (Lachowsky et al. 2016). These seeds were then provided with up to six vouchers to recruit other GBM they knew. All participants were screened for eligibility and provided written informed consent at the in-person study office in downtown Vancouver. A computer-assisted, self-administrated (CASI) questionnaire was used to collect socio-demographic, psychosocial, and behavioral variables. Subsequently, a nurse-administered structured interview collected information on history of mental health and substance-dependence diagnosis and treatment, and participants provided blood samples to test for HIV and other sexually transmitted infections (STIs). Participants received a $50 honorarium for completing the study protocol and an additional $10 for each eligible GBM they recruited into the study. All project investigators' institutional Research Ethics Boards granted ethical approval. Moore and colleagues (2016) have published additional detail on the Momentum Health Study protocol.

Dependent variable: Lifetime doctor-diagnosed conditions

On the nurse-administered structured interview, participants were asked the following question, "have you ever

been told by a doctor that you have any of the following mental health problems?": depression, anxiety, bipolar disorder, schizophrenia, alcohol use disorder, and other substance use disorders. We collapsed participants indicating any alcohol use disorder and substance use disorder versus neither for the first dependent variable. A second dependent variable was then derived for participants who indicated any other mental health disorder (depression, anxiety, bipoloar, and schizophrenia), excluding any participant who also indicated an alcohol or other substance use disorder, versus none. Participants who indicated any lifetime mental health diagnosis were also asked if they were, " …now under any treatment for any mental health condition?" and if so to, " …please describe [the] treatment."

Independent variables of interest

Independent variables included socio-demographics, sexual behaviors, substance use behaviors, Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monterio, 2001; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993) categorical scores (low risk: 0–7, medium risk: 8–15, harmful: 16–19, and possible dependence: >19), and the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) categorical scores of anxious and depressive symptoms (normal: 0–7, borderline: 8–10, and abnormal: >10). Socio-demographic characteristics include: age, sexual identity (gay, bisexual, and other), ethnicity (White, Asian, Aboriginal, Latin American, or other), immigration status (born in Canada, citizen / permanent resident, and refugee / visa), residence (downtown West End historic gay neighborhood, elsewhere in City of Vancouver, or outside City of Vancouver), highest formal education attained, current student status, annual income, being out as gay, HIV serostatus, and current regular partnership status. Sexual behaviors included engaged in sex work in the past 6 months and number of male anal sex partners in the past 6 months. Participants reported whether they had used a variety of substances in the past six months: cigarettes, cannabis, erectile dysfunction drugs, poppers (amyl nitrate), steroids (prescription or otherwise), cocaine, ecstasy, ketamine, gamma-hydroxybutyrate (GHB), hallucinogens (including mushrooms and LSD), crystal methamphetamine (including speed), crack, other stimulants (including Ritalin, Adderall, or Concerta), heroin, morphine, other opioids (including codeine, oxycodone, Percocet), benzodiazepines, and other prescription drugs (including barbiturates).

Statistical analyses

All analyses were conducted using SAS® version 9.3 (SAS, North Carolina, United States) and adjusted by weights generated using RDSAT version 7.1.46 to reflect better population estimates. Descriptive statistics include crude frequencies and RDS-adjusted population parameters, the latter of which will be reported in-text. Multivariable logistic regression was used to identify covariates for both dependent variables. AUDIT and HADS variables were excluded as independent variables from the multivariable modeling given their relationship with the dependent variables. Model selections were conducted using a backward elimination technique based on two criteria (Akaike Information Criterion (AIC) and Type III p-values) until the final model reached the optimum (minimum) AIC (Lima et al., 2007). Removal of any categorical variable from the multivatiable models was confirmed through the use of a likelihood ratio test. All statistical tests were two-sided and considered significant at $\alpha < .05$.

Results

A total of 719 individuals participated in our study and were included in the analysis ($n = 119$ seeds). Additional details regarding the RDS methods and results of this sample are published elsewhere (see Moore et al., 2016). Crude and RDS-adjusted descriptive statistics for our overall sample are shown in Table 1. Overall, the mean age of participants was 36 years [Q1–Q3: 26–41 years], 80.7% identified as gay (of all GBM, 72.1% reported being out), 23.4% were HIV-positive, 68.0% identified as White, 74.5% were born in Canada, 51.9% lived in downtown Vancouver, and 74.3% had an annual income less than $30,000. In terms of education, 65.6% had completed at least some education greater than high school, with only 19% currently enrolled in school. Nearly a quarter of participants were living with HIV (23.4%). Sexually, a median of three male anal sex partners were reported in the past six months, 8.7% reported having engaged in sex work in the past six months, and 62.8% reported no regular partner.

Table 1 also shows descriptive statistics regarding mental health and treatment. For the two primary outcomes, 17.4% of GBM reported a lifetime doctor-diagnosed alcohol or substance use disorder and a further 35.2% reported any other lifetime doctor-diagnosed mental health disorder. As such, over half of GBM reported having been diagnosed with a mental health disorder in their lifetime (52.1%). Moreover, 10.5% of GBM report three or more different mental health disorders. Nonexclusively, 42.4% had been diagnosed with depression, 25.9%

Table 1. Crude and adjusted descriptive statistics of the sample ($n = 719$).

	n	Crude %	RDS % (95% CI)
Demographics			
Age: *mean (Q1,Q3)*			*33 (26, 47)*
Sexual identity			
Gay	612	85.1	80.7 (76.0, 85.4)
Bisexual	66	9.2	15.3 (10.6, 19.7)
Other	41	5.7	4.0 (2.5, 6.2)
Race/ethnicity			
White	539	75.0	68.0 (60.7, 74.3)
Asian	72	10.0	9.8 (6.5, 15.1)
Aboriginal	50	7.0	10.5 (5.9, 16.2)
Latin American	31	4.3	7.0 (2.9, 11.4)
Other	27	3.8	4.7 (2.2, 7.9)
Immigration status			
Born in Canada	557	77.5	74.5 (67.1, 80.2)
Citizen or permanent resident	126	17.5	19.0 (14.1, 24.2)
Refugee or Visa	36	5.0	6.5 (2.9, 12.7)
Residence			
Downtown West End	356	49.5	51.9 (43.8, 59.1)
Other Vancouver	223	31.0	30.4 (24.1, 36.7)
Outside Vancouver	140	19.5	17.7 (12.8, 24.1)
Education			
No greater than high school	168	23.8	34.4 (28.0, 41.5)
Greater than high school	537	76.2	65.6 (58.5, 72.0)
Current student			
No	568	79.1	81.0 (75.9, 85.9)
Yes	150	20.9	19.0 (14.1, 24.1)
Annual income			
$< \$30,000$	457	63.6	74.3 (69.0, 79.4)
$\geq \$30,000$	262	36.4	25.7 (20.6, 31.0)
Sexual health			
Number of male anal sex partners, P6M: *mean (Q1,Q3)*			*3 (1, 7)*
Out as gay			
Yes	575	80.0	72.4 (66.9, 77.9)
Partially/no	62	8.6	9.8 (6.6, 14.3)
Not gay identified	66	11.4	17.7 (13.0, 22.1)
HIV serostatus			
HIV-negative	520	72.3	76.6 (68.5, 84.2)
HIV-positive	199	27.7	23.4 (15.8, 31.5)
Engaged in sex work, P6M			
No	673	93.6	91.3 (86.7, 95.8)
Yes	46	6.4	8.7 (4.2, 13.3)
Has a current regular partner			
No	446	62.0	62.8 (56.2, 68.7)
Yes	273	38.0	37.2 (31.3, 43.8)
Mental health			
Any substance use diagnosis, ever			
No	603	83.9	82.6 (77.7, 87.3)
Yes	116	16.1	17.4 (12.7, 22.3)
Any other mental health diagnosis (excluding substance user), ever			
No	495	68.9	64.8 (58.9, 70.5)
Yes	224	31.2	35.2 (29.5, 41.1)
Any substance use or mental health diagnosis, ever			
No	379	52.7	47.9 (41.6, 54.5)
Yes	340	47.3	52.1 (45.5, 58.4)
Currently on treatment for any substance use or mental health disorder			
No	157	22.0	28.1 (22.2, 34.1)
Yes	179	25.0	24.0 (18.9, 29.1)
No mental health disorder	379	53.0	47.9 (41.5, 54.3)
Number of lifetime doctor-diagnosed mental health disorders			
0	379	52.7	47.0 (40.4, 53.4)
1	136	18.9	23.5 (18.2, 29.1)
2	131	18.2	19.0 (13.9, 24.5)
3	50	7.0	7.7 (5.0, 11.9)
4	16	2.2	1.6 (0.6, 2.9)
5	7	1.0	1.2 (0.2, 2.4)

(*Continued on next page*)

Table 1. (Continued)

	n	Crude %	RDS % (95% CI)
Depression, ever			
No	451	62.7	57.6 (51.4, 63.9)
Yes	268	37.3	42.4 (36.1, 48.6)
Anxiety, ever			
No	535	74.4	74.1 (68.8, 79.9)
Yes	184	25.6	25.9 (20.1, 31.2)
Bipolar, ever			
No	676	94.0	94.2 (90.8, 96.8)
Yes	43	6.0	5.8 (3.2, 9.2)
Schizophrenia, ever			
No	715	99.4	99.3 (98.2, 99.9)
Yes	4	0.6	0.7 (0.1, 1.8)
Alcohol dependence, ever			
No	666	92.6	93.1 (89.7, 95.6)
Yes	53	7.4	6.9 (4.4, 10.3)
Other substance use dependence, ever			
No	624	86.8	85.2 (80.2, 89.7)
Yes	95	13.2	14.8 (10.3, 19.8)
Substance use in the past 6 months (mutually exclusive)			
Cigarettes	310	43.1	47.1 (40.4, 53.1)
Cannabis	429	59.7	63.6 (57.4, 69.8)
EDD	162	22.5	17.3 (12.4, 22.0)
Poppers	266	37.0	34.3 (28.7, 40.3)
Steroids	39	5.4	5.2 (2.6, 7.9)
Cocaine	180	25.0	29.5 (22.8, 36.0)
Ecstasy	176	24.5	18.9 (14.5, 24.1)
Ketamine	94	13.1	12.0 (7.9, 16.3)
GHB	126	17.5	19.1 (13.7, 24.5)
Hallucinogens	107	14.9	14.1 (10.1, 19.1)
Crystal methamphetamine	152	21.1	21.1 (15.2, 26.2)
Crack	69	9.6	17.2 (11.5, 22.4)
Other stimulants	44	6.1	5.5 (2.9, 8.4)
Heroin	27	3.8	4.6 (2.0, 7.8)
Morphine	10	1.4	3.2 (0.5, 6.1)
Other opioids	66	9.2	11.1 (7.2, 15.0)
Benzodiazepines	40	5.6	5.2 (2.7, 8.2)
Other prescription drugs	38	5.3	3.4 (1.9, 5.3)
Mental health symptomology			
AUDIT zone			
Low risk	430	60.2	65.0 (59.1, 71.2)
Medium risk	186	26.1	21.8 (17.5, 26.9)
Harmful	53	7.4	5.5 (3.2, 8.2)
Possible dependence	45	6.3	7.7 (3.9, 11.8)
HADS-anxiety			
Normal	350	49.2	42.9 (37.5, 48.9)
Borderline	180	25.3	28.0 (22.4, 33.3)
Abnormal	181	25.5	29.1 (23.5, 34.5)
HADS-depression			
Normal	602	84.7	80.9 (75.5, 86.2)
Borderline	68	9.6	12.6 (8.0, 17.2)
Abnormal	41	5.8	6.4 (3.5, 10.4)

RDS = respondent-driven sampling; 95% CI = 95% confidence interval; P6M = in the past 6 month.

with anxiety, 5.8% with bipolar disorder, and 0.7% with schizophrenia. In terms of substance use dependency, 6.9% had ever been diagnosed with alcohol use disorder specifically and 14.8% for another substance. At the time of survey, 24.0% were receiving treatment for a mental health disorder. Of the 179 GBM who reported currently receiving treatment for a mental health or substance-use disorder on the nurse-administered questionnaire, 177 (98.9%) provided information on what treatment they were receiving and 88.7% provided a specific medication name or class of medication. Specific medications were named for 130 participants, with antidepressants (n = 116, 73.3%) and anxiolytics (n = 37, 17.4%) being the most commonly reported followed by antipsychotics (n = 32, 19.8%), anticonvulsants (n = 12, 4.9%), and opioids (n = 10, 13.8%). Ancillary treatments, which included psychotherapy, were only named for 24 GBM (13.7%) and likely underreported given the biomedical-focused question wording.

Finally, Table 1 provides information on substance use in the past 6 months as well as scores on the Alcohol Use Disorders Identification Test (AUDIT) and

Hospital Anxiety and Depression Scale (HADS). Overall, 47.1% reported recent use of cigarettes and 63.6% use of cannabis. In terms of other recent substance use, 34.3% of individuals reported using poppers, 29.5% cocaine, 21.1% crystal methamphetamine, 19.1% gamma-hydroxybutyrate (GHB), 18.9% reported using ecstasy, 17.3% erectile dysfunction drugs (EDD), 17.2% crack, 14.1% hallucinogens, 12.0% ketamine, 11.1% other opioids, 5.5% other stimulants, 5.2% benzodiazepines, 5.2% steroids, 4.6% heroin, 3.4% other prescription drugs, and 3.2% morphine. The median score for the AUDIT was 6 [Q1–Q3: 3–11] and as a percentage, 5.5% of the sample would be considered at harmful risk for and 7.7% possibly dependent on alcohol. The median score for the HADS anxiety measure was 8 [Q1–Q3: 5–11] and for the depression measure was 3 [Q1–Q3: 2–6] and as percentages, 28.0% of participants scored as having borderline anxiety while 29.1% scored as having abnormal anxiety, and 12.6% of participants scored as having borderline depression while 6.4% scored as having abnormal depression.

Table 2 provides descriptive statistics of and univariable associations with the two outcomes of lifetime doctor-diagnosed substance use or any other mental health conditions for the independent variables of interest. Table 3 presents the multivariable model for each outcome.

Factors that were associated with increased odds of reporting a lifetime doctor-diagnosed substance use disorder were having an HIV-positive serostatus (adjusted odds ratio [AOR] = 2.54, 95% confidence interval [95% CI]: 1.63–3.96], use of crystal methamphetamine in the past 6 months (AOR = 2.73, 95% CI: 1.69–4.40), and use of heroin in the past six months (AOR = 5.59, 95% CI: 2.39–13.12). Factors associated with lower odds of reporting a lifetime doctor-diagnosed substance use disorder were being a current student (AOR = 0.52, 95% CI: 0.27–0.99) and reporting an annual income of at least $30,000 CAD (AOR = 0.38, 95%CI: 0.21–0.67).

Factors associated with increased odds of reporting any other lifetime doctor-diagnosed mental health disorder were abnormal HADS-Anxiety subscale scores (AOR = 3.05, 95% CI: 2.06–4.51) and reporting another minority racial/ethnic identity that was not Asian, Aboriginal or Latin American (AOR = 2.24, 95% CI: 1.03–4.84). Factors associated with lower odds of reporting any other lifetime doctor-diagnosed mental health disorder were reporting Latin American race/ethnicity (AOR = 0.25, 95% CI: 0.08–0.81), being a refugee or visa holder versus being born in Canada (AOR = 0.18, 95% CI: 0.05–0.65), and residing outside the City of Vancouver versus the downtown West End traditional gay neighborhood (AOR = 0.52, 95% CI: 0.33–0.82).

Discussion

We sought to determine the prevalence of doctor-diagnosed mental health conditions and self-reported substance use among GBM, as well as the association between these two domains, using cross-sectional data from the Momentum Health Study of GBM living in the Metro Vancouver, British Columbia, Canada. Substance use and mental health conditions were highly prevalent among GBM. As expected, there were strong associations found between a substance use disorder diagnosis and various substances in our study, which corroborate previous research regarding smoking (McKirnan et al., 2006) and alcohol-related problems (Stall et al., 2001) among GBM. Further, cigarette smoking and erectile dysfunction drugs were the only substances associated with any other mental health disorder diagnosis at the univariable level, and did not remain in the multivariable model.

Our findings suggest that GBM have higher rates of mental health disorders than the overall population. According to the 2012 Canadian Community Health Survey (CCHS), a third of Canadians reported a mental health or substance use disorder diagnosed in their lifetime (Pearson, Janz, & Ali, 2013), while more than half of the participants in our sample reported any lifetime doctor-diagnosed mental health disorder. Examining depression, anxiety, and drug abuse/dependence more specifically, our study reported population prevalence estimates approximately three times larger than the overall population: 8.7% of Canadians (CCHS) versus 25.9% of GBM (our study) report being diagnosed with anxiety in their lifetime, 11.3% of Canadians versus 42.4% of GBM report being diagnosed with depression in their lifetime, and 4.0% of Canadians versus 14.8% of GBM reported lifetime drug abuse or dependence. This discrepancy is greater than what was reported by Meyer (2003) and King et al. (2008), which found the prevalence of mental health conditions in GBM to be approximately two times greater than in heterosexual men across multiple studies. However, neither Meyer (2003) nor King et al. (2008) included Canadian data in their analyses, nor did previous studies utilize RDS, making our findings more representative, at least for urban GBM in Metro Vancouver, Canada. Our use of respondent-driven sampling to generate population parameter estimates indicated that we had over-sampled White GBM and under-sampled low-income GBM, GBM with less formal education and bisexual-identified men.

Our findings also indicate that GBM have higher rates of substance use than the overall population. According to the Canadian Tobacco Use Monitoring Survey (CTUMS), 18.4% of Canadian men are current smokers,

Table 2. Descriptive statistics and univariate associations for each of any substance use disorder and any other mental health disorder.

	Any substance use disorder ($n = 116/719$)				Any other mental health disorder ($n = 224/719$)			
	n	Crude %	RDS % (95% CI)	OR (95% CI)	*n*	Crude %	RDS % (95% CI)	OR (95%CI)
Demographics								
Age: *mean (Q1,Q3)*			*39 (31, 46)*	**1.02 (1.01–1.04)**			*37 (26, 49)*	**1.02 (1.01–1.03)**
Sexual identity								
Gay	90	14.7	16.3 (11.7–20.9)	Ref	186	30.4	34.9 (29.3–40.6)	Ref
Bisexual	15	22.7	20.8 (6.8–34.8)	1.35 (0.78–2.32)	24	36.4	37.8 (20.8–54.9)	1.13 (0.72–1.78)
Other	11	26.8	27.4 (10.6–44.3)	1.95 (0.87–4.27)	14	34.1	33.7 (16–51.5)	0.95 (0.46–1.98)
Race/ethnicity								
White	85	15.8	16.0 (11.7–20.4)	Ref	183	34.0	39.9 (33.9–46)	Ref
Asian	5	6.9	8.0 (0.0–16.9)	0.45 (0.18–1.11)	12	16.7	18.8 (7.5–30.1)	**0.35 (0.19–0.65)**
Aboriginal	19	38.0	42.2 (20.5–63.8)	**3.81 (2.25–6.46)**	15	30.0	27.9 (8.5–47.3)	0.58 (0.33–1.01)
Latin American	2	6.5	14.2 (0.00–36.8)	0.87 (0.38–2.01)	5	16.1	7.8 (0–19)	**0.13 (0.04–0.37)**
Other	5	18.5	8.5 (0.0–18.6)	0.49 (0.14–1.74)	9	33.3	56.1 (28.6–83.5)	1.92 (0.93–3.95)
Immigration status								
Born in Canada	101	18.1	19.6 (14.5–24.7)	Ref	189	33.9	40 (33.9–46.1)	Ref
Citizen or Permanent Resident	15	11.9	14.3 (4.3–24.4)	0.69 (0.41–1.16)	31	24.6	26.1 (15.2–36.9)	**0.53 (0.35–0.80)**
Refugee or Visa	0	0.0	0.0 (0.0–0.0)	N/A	4	11.1	6.3 (0.0–14.9)	**0.10 (0.03–0.34)**
Residence								
Downtown West End	65	18.3	18.8 (12.4–25.3)	Ref	118	33.1	39.7 (31.9–47.5)	Ref
Other Vancouver	33	14.8	17.2 (9.4–24.9)	0.89 (0.57–1.40)	65	29.1	33.5 (24–43.1)	0.77 (0.54–1.10)
Outside Vancouver	18	12.9	14.1 (6.5–21.7)	0.71 (0.41–1.20)	41	29.3	26.5 (17.7–35.2)	**0.55 (0.36–0.84)**
Education								
No greater than high school	41	24.4	23.5 (14.5–32.6)	Ref	62	36.9	39.4 (28.6–50.2)	Ref
Greater than high school	74	13.8	15.3 (10.4–20.2)	**0.59 (0.39–0.88)**	158	29.4	32.4 (26.8–38.1)	0.74 (0.53–1.03)
Current student								
No	102	18.0	19.7 (14.6–24.8)	Ref	193	34.0	38.8 (32.8–44.8)	Ref
Yes	14	9.3	8.9 (3.2–14.6)	**0.40 (0.22–0.73)**	30	20.0	20.8 (11.9–29.7)	**0.42 (0.27–0.64)**
Annual income								
$< \$30{,}000$	91	19.9	21.0 (15.4–26.7)	Ref	155	33.9	36.2 (29.7–42.7)	Ref
$\geq \$30{,}000$	25	9.5	8.0 (4.4–11.6)	**0.33 (0.19–0.57)**	69	26.3	32.8 (24.8–40.8)	0.86 (0.61–1.21)
Sexual health								
Number of male anal sex partners, P6M: *mean (Q1,Q3)*			*3 (1, 10)*	1.01 (1.00–1.02)			*3 (1, 9)*	1.00 (0.99–1.01)
Out as gay								
Yes	87	15.1	16.8 (11.9–21.8)	Ref	185	32.2	36.4 (30.5–42.3)	Ref
No/partially	7	11.3	10.8 (1.0–20.5)	0.60 (0.27–1.32)	10	16.1	24 (7.8–40.2)	**0.55 (0.31–0.99)**
Not gay–identified	22	26.8	24.1 (11.5–41.1)	1.57 (0.96–2.55)	29	35.4	36.6 (21.8–51.5)	1.01 (0.66–1.54)
HIV serostatus								
HIV–negative	61	11.7	12.1 (8.0–16.3)	Ref	144	27.7	34.3 (28.2–40.4)	Ref
HIV–positive	55	27.6	30.9 (20.7–41.1)	**3.24 (2.18–4.83)**	80	40.2	37.8 (27.8–47.9)	1.17 (0.83–1.64)
Engaged in sex work, P6M								
No	102	15.2	15.7 (11.7–19.8)	Ref	209	31.1	34.9 (29.6–40.1)	Ref
Yes	14	30.4	36.5 (12.6–60.4)	**3.07 (1.73–5.48)**	15	32.6	39.9 (15.7–64.1)	1.24 (0.71–2.17)
Has a current regular partner								
No	78	17.5	20.3 (14.3–26.4)	Ref	135	30.3	34.6 (27.9–41.3)	Ref
Yes	38	13.9	12.1 (7.4–16.8)	**0.54 (0.35–0.84)**	89	32.6	36.5 (28.3–44.7)	1.09 (0.79–1.49)
Substance use, P6M								
Cigarettes								
No	43	10.5	14.0 (8.3–19.8)	Ref	120	29.3	31.7 (25.1–38.3)	Ref
Yes, in the P6M	73	23.5	21.6 (15.1–28.2)	**1.69 (1.15–2.49)**	104	33.5	39.8 (31.7–48.0)	**1.43 (1.05–1.94)**
Cannabis								
No	46	15.9	18.2 (11.1–25.2)	Ref	81	27.9	31 (23.3–38.8)	Ref
Yes, in the P6M	70	16.3	16.9 (11.5–22.3)	0.91 (0.62–1.35)	143	33.3	37.9 (31.1–44.8)	1.36 (0.99–1.87)
EDD								
No	79	14.2	16.0 (11.3–20.7)	Ref	160	28.7	32.8 (27.1–38.5)	Ref
Yes, in the P6M	37	22.8	23.5 (13.2–33.9)	**1.62 (1.03–2.55)**	64	39.5	46 (34.3–57.8)	**1.75 (1.19–2.56)**
Poppers								
No	63	13.9	17.5 (12.0–22.9)	Ref	138	30.5	35.4 (28.9–42.0)	Ref
Yes, in the P6M	53	19.9	17.3 (10.6–24.0)	0.99 (0.66–1.49)	86	32.3	34.9 (26.4–43.4)	0.98 (0.71–1.35)
Steroids								
No	107	15.7	17.3 (12.9–21.7)	Ref	212	31.2	35.7 (30.3–41.0)	Ref
Yes, in the P6M	9	23.1	19.8 (3.2–36.5)	1.19 (0.49–2.87)	12	30.8	26.7 (6.6–46.8)	0.66 (0.30–1.45)
Cocaine								
No	72	13.4	12.8 (9.1–16.4)	Ref	166	30.8	34.5 (28.6–40.4)	Ref
Yes, in the P6M	44	24.4	28.9 (17.9–40.0)	**2.78 (1.87–4.14)**	58	32.2	37.2 (26.4–48.0)	1.13 (0.80–1.58)

(*Continued on next page*)

Table 2. (Continued)

	Any substance use disorder ($n = 116/719$)				Any other mental health disorder ($n = 224/719$)			
	n	Crude %	RDS % (95% CI)	OR (95% CI)	*n*	Crude %	RDS % (95% CI)	OR (95%CI)
Ecstasy								
No	85	15.7	15.1 (10.8–19.3)	Ref	170	31.3	35.6 (29.6–41.5)	Ref
Yes, in the P6M	31	17.6	26.0 (14.3–37.7)	**1.98 (1.29–4.03)**	54	30.7	34.1 (23.6–44.5)	0.94 (0.64–1.37)
Ketamine								
No	92	14.7	15.5 (11.4–19.7)	Ref	196	31.4	35.5 (30.0–41.1)	Ref
Yes	24	25.5	30.6 (14.2–47.1)	**2.40 (1.45–3.96)**	28	29.8	33.2 (17.8–48.6)	0.90 (0.56–1.45)
GHB								
No	82	13.8	14.3 (10.2–18.4)	Ref	183	30.9	34.8 (29.2–40.5)	Ref
Yes	34	27.0	31.6 (17.8–45.5)	**2.78 (1.79–4.30)**	41	32.5	37.2 (23.7–50.7)	1.11 (0.74–1.65)
Hallucinogens								
No	100	16.3	18.0 (13.2–21.8)	Ref	186	30.4	34.8 (29.1–40.4)	Ref
Yes	16	15.0	13.7 (5.5–22.0)	0.72 (0.40–1.30)	38	35.5	38.1 (24.3–51.8)	1.15 (0.76–1.76)
Crystal methamphetamine								
No	62	10.9	11.8 (7.9–15.8)	Ref	175	30.9	35.7 (30.0–41.5)	Ref
Yes	54	35.5	39.1 (26.6–51.6)	**4.79 (3.15–7.27)**	49	32.2	33.3 (21.3–45.2)	0.90 (0.61–1.32)
Crack								
No	85	13.1	13.4 (9.8–17.1)	Ref	200	30.8	34.3 (29.0–39.5)	Ref
Yes	31	44.9	41.1 (22.7–59.4)	**4.50 (2.85–7.09)**	24	34.8	41.3 (22.9–59.8)	1.35 (0.88–2.08)
Other stimulants								
No	107	15.9	16.4 (12.2–20.6)	Ref	207	30.7	35 (29.7–40.4)	Ref
Yes	9	20.5	33.8 (8.3–59.2)	**2.60 (1.31–5.13)**	17	38.6	38.8 (15.5–62.1)	1.18 (0.61–2.27)
Heroin								
No	100	14.5	15.1 (11.0–19.2)	Ref	216	31.2	35.3 (30.1–40.6)	Ref
Yes	16	59.3	67.1 (37.8–96.3)	**11.45 (5.31–24.68)**	8	29.6	33.3 (2.8–63.8)	0.91 (0.42–1.98)
Morphine								
No	109	15.4	16.5 (12.3–20.6)	Ref	221	31.2	35.1 (29.9–40.3)	Ref
Yes	7	70.0	61.3 (0.0–100.0)	**8.06 (2.81–23.08)**	3	30.0	41.9 (0.0–100.0)	1.33 (0.46–3.85)
Other opioids								
No	97	14.9	15.7 (11.4–20.1)	Ref	200	30.6	34.2 (28.8–39.6)	Ref
Yes	19	28.8	31.4 (14.5–48.3)	**2.45 (1.45–4.17)**	24	36.4	43.9 (25.8–61.9)	1.50 (0.93–2.44)
Benzodiazepines								
No	103	15.2	15.9 (11.7–20.1)	Ref	205	30.2	34.6 (29.3–39.9)	Ref
Yes	13	32.5	43.8 (17.9–69.7)	**4.11 (2.10–8.05)**	19	47.5	46.7 (21.5–72.0)	1.66 (0.85–3.22)
Other prescription drugs								
No	103	15.1	16.8 (12.4–21.1)	Ref	208	30.5	34.5 (29.2–39.9)	Ref
Yes	13	34.2	32.6 (13.4–51.8)	**2.40 (1.08–5.35)**	16	42.1	51.9 (31.1–72.7)	2.04 (0.97–4.29)
Mental health symptomology								
AUDIT zone								
Low risk	69	16.0	15.3 (10.3–20.3)	Ref	135	31.4	33.6 (27.0–40.2)	Ref
Medium risk	18	9.7	10.9 (3.1–18.6)	0.67 (0.39–1.18)	60	32.3	41.2 (30.7–51.7)	1.39 (0.96–2.00)
Harmful	8	15.1	17.3 (4.3–30.3)	1.16 (0.52–2.58)	14	26.4	26.9 (11.5–42.3)	0.73 (0.37–1.43)
Possible dependence	21	46.7	54.3 (31.4–77.1)	**6.56 (3.67–11.78)**	11	24.4	35.5 (12.2–58.8)	1.09 (0.60–1.98)
HADS–anxiety								
Normal	43	12.3	13.6 (8.7–18.6)	Ref	81	23.1	26.1 (19.3–32.9)	Ref
Borderline	33	18.3	15.5 (8.0–23.1)	1.17 (0.70–1.94)	51	28.3	33.0 (22.2–43.7)	1.39 (0.94–2.06)
Abnormal	37	20.4	22.2 (12.4–31.9)	**1.80 (1.13–2.87)**	90	49.7	53.8 (43.3–64.2)	**3.29 (2.26–4.78)**
HADS–depression								
Normal	85	14.1	15.0 (10.7–19.4)	Ref	167	27.7	32.0 (26.5–37.4)	Ref
Borderline	18	26.5	15.8 (6.4–25.3)	1.06 (0.56–2.01)	30	44.1	53.7 (35.9–71.6)	**2.47 (1.55–3.94)**
Abnormal	10	24.4	38.4 (13.3–63.5)	**3.52 (1.84–6.75)**	25	61.0	54.2 (30.5–77.9)	**2.52 (1.35–4.72)**

RDS = respondent-driven sampling; OR = odds ratio; 95% CI = 95% confidence interval; P6M = in the past six months; AUDIT = Alcohol Use Disorders Identification Test; HADS = Hospital Anxiety and Depression Scale. Numbers in boldface indicate significance at $p < .05$.

which includes those who do not smoke daily (Health Canada, 2012b), while in our study, 47.1% of GBM smoked cigarettes in the past 6 months. These percentages fall at the upper end of the 25–50% range in the review conducted by Ryan and colleagues (2001), which looked at the prevalence of smoking across multiple studies of GBM and found that GBM were much more likely to smoke than their heterosexual counterparts. Our study found that recent cannabis use among GBM was higher than lifetime use in the Canadian population: 63.6% recently used in our study versus 41.5% lifetime use in the Canadian Alcohol and Drug Use Monitoring Survey (CADUMS; Health Canada, 2012a). Other substances, such as cocaine and ecstasy, also had recent prevalence estimates at much greater magnitudes in our study at 29.5% and 18.9%, respectively, versus the 1.1% and 0.6% lifetime estimates found in CADUMS. These findings are consistent with the review by Hughes and Eliason (2002), whom found that GBM are more likely to use substances than heterosexual men.

Table 3. Factors independently associated with each of any substance use disorder and any other mental health disorder.

	Substance use disorder AOR (95% CI)	Other mental health disorder AOR (95% CI)
Race/ethnicity (referent: White)		
Asian		0.64 (0.31-1.31)
Aboriginal		0.56 (0.31-1.02)
Latin American		**0.25 (0.08-0.81)**
Other		**2.24 (1.03-4.84)**
Immigration status (referent: born in Canada)		
Citizen or Permanent Resident		0.65 (0.38-1.10)
Refugee or Visa		**0.18 (0.05-0.65)**
Residence (referent: Downtown West End)		
Other Vancouver		0.72 (0.49-1.06)
Outside Vancouver		**0.52 (0.33-0.82)**
Current student (referent: no)		
Yes	**0.52 (0.27-0.99)**	
Annual income (referent: < $30,000)		
≥ $30,000	**0.38 (0.21-0.67)**	
HIV serostatus (referent: HIV-negative)		
HIV-positive	**2.54 (1.63-3.96)**	
Used crystal methamphetamine, P6M (referent: no use)		
Yes	**2.73 (1.69-4.40)**	
Used heroin, P6M (referent: no use)		
Yes	**5.59 (2.39-13.12)**	
HADS-anxiety (referent: normal)		
Borderline		1.27 (0.85-1.92)
Abnormal		**3.05 (2.06-4.51)**

AOR = adjusted odds ratio; 95% CI = 95% confidence interval; P6M = in the past six months. Numbers in boldface indicate significance at $p < .05$.

AUDIT (10 items scored 0–40) and AUDIT-Consumption (AUDIT-C, 3 items scored 0–12) have been used previously in research with GBM to assess alcohol use. A larger proportion of GBM were categorized to be hazardous drinkers or possibly dependent on alcohol (AUDIT cut-point of eight or greater) in our study (35%) versus other studies: 9% among older LGB adults (D'Augelli et al., 2001) and 15.4% among HIV-positive men who have sex with men (Woolf-King, Neilands, Dilworth, Carrico, & Johnson, 2014). D'Augelli, Grossman, Hershberger, and O'Connell (2001) studied older lesbian, gay, and bisexual people and found a mean AUDIT score of 3.06, which is nearly half the median value of 6.0 in our study. For studies using the AUDIT-C that focused only on consumption patterns, hazardous drinking categorization was more prevalent: 71.4% among gay and bisexual youth aged 13–24 (cutpoint of 4 or greater in Kelly, Davis, & Schlesinger, 2015), 65.4% among gay men and 58.8% among bisexual men aged 18–25 (cutpoint of five or greater in Lea et al., 2013), and 58% of adult GBM (cutpoint of five or greater in Lea et al., 2015). These disparities in prevalence may be due to the age group or HIV-status specificity of the samples in other studies, differences in measurement approaches, benefits of using RDS to access hard-to-reach GBM subgroups, or may reflect a local phenomenon among GBM in Metro Vancouver.

Few studies have used the Hospital Anxiety and Depression Scale (HADS) to measure anxiety and depression in GBM, allowing our study to provide some of the first estimates using this scale in a nonclinical population and with RDS-weighted population parameters. However, this also makes it difficult to compare the results of our study with others. Gray and Hedge (1999) found that only 40% of gay men were in the normal range for the HADS-Anxiety measure and 77% of gay men were in the normal range for the HADS-Depression measure, which are similar to the percentages found in our study where 42.9% of GBM scored within normal range for the HADS-Anxiety measure and 80.9% scored in the normal range for the HADS-Depression measure.

Many studies assessing anxiety and depression in GBM have used the Composite International Diagnostic Interview (CIDI; Cochran, Sullivan, & Mays, 2003; Mays & Cochran, 2001; Sandfort, de Graaf, Bijl, & Schnabel, 2001; Wang, Häusermann, Ajdacic-Gross, Aggleton, & Weiss, 2007); a nonclinical, structured interview often used in epidemiological surveys and is based on the diagnostic criteria outlined in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III) as well as the *International Classification of Diseases* (ICD-10) (Robins et al., 1988). Cochran et al. (2003) found that 69% of GBM were not depressed and 97.1% were not anxious according to the CIDI, which differs from the 80.9% and 42.9% in our study for HADS-Depression and HADS-Anxiety respectively. The percentage of participants who scored within the normal range for the HADS-Depression measure in our study is similar to the percentage by Wang et al. (2007), which was 80.8% versus 80.9% in our study, while the anxiety measure differed greatly which was 78.1% in their study versus the 42.9% in our study. While the HADS is easier to use because it is a self-administered questionnaire, the CIDI has been shown to demonstrate high validity as a diagnostic instrument (Wittchen, 1994), which could be useful in future studies of GBM mental health.

A number of salient social factors were identified as important determinants of mental health. Our study found that GBM with lower annual incomes were more likely to have been diagnosed with a substance use disorder. Income is considered to be one of the most important social determinants of health (the social factors that have an influence on the health and well-being of

populations) because it effects whether one may access nutritious food, housing, transportation, and other basic health prerequisites (Mikkonen & Raphael, 2010). This upstream determinant impacts one's general and physical wellbeing, which in turn may explain this greater burden of mental health disorders. Lastly, we found that participants who were currently students were less likely to have a substance use disorder than participants who were not. This may be due to students generally being younger in age, and as such are biased towards a shorter lifetime reporting period within which to have been diagnosed with any mental health conditions.

Specific to being a sexual minority, GBM who were not out about their gay identity ("closeted") were less likely to report having any other mental health condition (e.g., depression, anxiety) at the univariable level than those who were open about being gay. We posit that this may be due to the fact that individuals who are public regarding their sexual orientation are easier targets for harassment or discrimination. This is supported by findings from D'Augelli and Grossman (2001), where GBM who came out at an earlier age and GBM who spent more years out of the closet were more likely to experience victimization than individuals who came out later or who spent less time out of the closet. More generally speaking, Meyer (2003) argues that experiences of victimization in the forms of stigma, prejudice, and discrimination that GBM experience may be the cause for the higher prevalence of mental health conditions in GBM populations and refers to this as minority stress (Meyer, 1995). Stigma may also help explain why HIV-positive GBM were more likely to report a substance use disorder in our study. HIV-related stigma has been linked to poorer mental health in a meta-analysis by Logie and Gadalla (2009) and a review by Smit and colleagues (2012).

Readers should be cautious when interpreting our results. Most notably our results rely on participants' retrospective self-report of recent substance use and sexual behavior and compare these data with lifetime mental health diagnoses. As such, we are limited in determining causal direction, but instead position these findings as a more representative profile of GBM who had ever been diagnosed with a mental health condition given our use of respondent-driven sampling. We did not conduct diagnostic interviews to account for undiagnosed conditions, and thus underestimated the true burden of mental health issues. We attempted to address current symptomology through the inclusion of AUDIT and HADS scores. However, given the paucity of validation studies for AUDIT, but particularly HADS within GBM populations, we caution the interpretation of these findings and call for new research validation studies with GBM populations. Regardless, our analyses demonstrate some measure of construct validity in that higher scores on both measures were linked to reporting mental health conditions in our study. Our measure of sexual orientation "outness" was only asked for gay-identified participants, and a general measure should be included in future studies. A nurse-administered structured interview was used to assess mental health diagnoses and current treatments to ensure these questions were more accurately understood and answered. Given the potential impact of social desirability (Klassen, Hornstra, & Anderson, 1975) and reporting bias (Mackesy-Amiti, Fendrich & Johnson, 2008), we used CASI to collect data regarding illicit substance use. However, we did not use drug testing to confirm or correct self-report data and likely underestimated the true prevalence of substances used (Mackesy-Amiti, Fendrich & Johnson, 2008). Despite these shortcomings, one of the strengths of our study is the use of RDS to overcome previous sampling shortfalls with GBM and produce a more accurate representation of the population parameters of these variables of interest for the GBM population of Metro Vancouver. Our study also adds new data regarding the detailed prevalence of substance use and mental health conditions among GBM populations in Canada filling a gap in currently available published literature. Finally, our work goes further to examine explicitly the relationship between substance use and mental health conditions among GBM identifying important relationships that have implications for counseling and public health services, interventions, and policy.

The greater burden of mental health conditions and higher prevalence of substance use in GBM populations highlight the need for a more explicit focus on these issues in research and service provision. Mental health specialists should be aware of the relationships with sexuality and substance use when working with GBM clients, particularly issues regarding identity disclosure, number of sexual partners, and higher background community prevalence of substance use (especially regarding sex drugs such as poppers and EDD, and party drugs such as cocaine and ecstasy). Future research should seek to validate current measures (e.g., HADS and AUDIT) and to confirm the relationship between substance use and mental health conditions, which has been demonstrated to produce a syndemic including suicidal ideation among GBM (Mustanski, Andrews, Herrick, Stall, & Schnarrs, 2014) and HIV acquisition (Stall et al., 2003). Our study was based in a major metropolitan area, which may limit generalizability to GBM in rural or remote regions, whom are a population with distinct needs and challenges that should be further examined. In order to evaluate generalizability, additional research is needed to explore these issues among GBM populations in other urban and non-urban centers across Canada, particularly if these

studies employ RDS or other more representative sampling methods. Given the role of social factors in mental well-being, future research should directly examine experiences of homophobia or heterosexism as possible precursors to substance use and/or mental health issues, along with potential mediators and protective factors. Examining demographic factors independent of one another may not reflect the diversity of experiences that exists among GBM. Using an intersectional approach, which looks at how multiple identities such as race, sexual orientation, and class, interact with one another to shape experiences (Crenshaw, 1989), may also explain the distribution and experiences of mental health and substance use within diverse communities of GBM. In spite of experiences of marginalization and discrimination, many GBM do not go on to develop mental health conditions or engage in harmful substance use. Shilo, Antebi, and Mor (2015) found that factors such as support of family and friends, meaningful connections with the LGBT community, and having a steady partner, protect against developing poorer mental health in lesbian, gay, bisexual, queer, and questioning adults. Thus, more focus on factors such as these that promote resiliency in GBM would be beneficial to include in future research on mental health and substance use in these populations.

Compared with the Canadian population, GBM living in Metro Vancouver have increased levels of substance use and mental health conditions. The strong link between substance use (particularly crystal methamphetamine and heroin) and mental health among GBM has important implications for public health promotion programming and care service provision. A number of social determinants increase the likelihood of mental health diagnosis among GBM, including disclosure of sexuality, low income, and race/ethnicity. GBM living with HIV were significantly more likely to have a lifetime doctor-substance use disorder compared with HIV-negative GBM. Greater attention to these issues is needed across all health and social services given their disproportionate effect on GBM populations. Health promotion and interventions should address issues of substance use, mental health, and sexuality in unison and future research can help direct these efforts by examining possible precursors of these issues, which may be the result of discrimination, prejudice, and stigma.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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