HIV diagnoses and testing patterns among young gay, bisexual and other men who have sex with men: an analysis of HIV surveillance data in British Columbia, 2008–2015

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Abstract

Background We examined changes in HIV testing indicators following a recent increase in diagnoses among young gay, bisexual and other men who have sex with men (GBMSM) in BC that accompanied implementation of a provincial HIV strategy.

Method Surveillance and laboratory testing data were used to compare case counts and testing characteristics among GBMSM < 30 and ≥ 30 years diagnosed in 2008–2011 and 2012–2015. We tested differences in the proportion diagnosed on first testing episode, proportion diagnosed at late stage of infection and the median inter-test interval ((ITI) time in months between last negative test and first positive test) using χ^2 and Wilcoxon rank-sum tests.

Results In 2008–2011, 657 diagnoses were made among GBMSM: 24% among men < 30 years and 76% among men ≥ 30 years. In 2012–2015, 590 diagnoses were made: 28% among < 30 years and 28% among ≥ 30 years. Among men < 30 years, diagnoses made on first testing episode decreased (39.4% vs. 28.7% in 2012–2015; $p = 0.042$) and there were few late-stage diagnoses (5.1% in 2008–2011 vs. 9.1% in 2012–2015). The median ITI was 10 months in both periods. No changes were observed over time among men ≥ 30 years. However, in both periods, late-stage diagnosis was more common in men ≥ 30 years (2008–2011, 18.8%; 2012–2015, 18.6%; $p < 0.01$ for both). The ITI was also longer for men ≥ 30 years (2008–2011, 24.5 months; 2012–2015, 20 months; $p < 0.001$ for both).

Conclusion Testing indicators suggested better testing practices among GBMSM diagnosed at < 30 years compared to those diagnosed at older ages. However, there are clear needs for additional prevention measures in both age groups.

Résumé

Objectif Nous avons examiné les changements dans les indicateurs de dépistage du VIH à la suite d'une hausse récente des diagnostics chez les jeunes hommes gais, bisexuels et autres hommes ayant des relations sexuelles avec des hommes (gbHARSAH) en Colombie-Britannique ayant accompagné la mise en œuvre d'une stratégie provinciale de lutte contre le VIH.

Méthode Des données de surveillance et d'épreuves de laboratoire ont servi à comparer le nombre de cas et les caractéristiques du dépistage chez les gbHARSAH de < 30 ans et chez ceux de ≥ 30 ans diagnostiqués entre 2008 et 2011 et entre 2012 et 2015. Nous avons testé les différences dans la proportion de diagnostics au premier test, la proportion de diagnostics au dernier stade de l'infection et l'intervalle inter-dépistage médian [l'IID, en mois, entre le dernier test négatif et le premier test positif] à l'aide des tests du χ^2 et de Wilcoxon.

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Résultats En 2008–2011, 657 diagnostics ont été posés chez les gbHARSAH : 24 % chez des hommes de < 30 ans et 76 % chez des hommes de ≥ 30 ans. En 2012–2015, 590 diagnostics ont été posés : 28 % chez des hommes de < 30 ans et 72 % chez des hommes de ≥ 30 ans. Chez les hommes de < 30 ans, les diagnostics posés au premier test ont diminué (39,4 % c. 28,7 % en 2012–2015; $p = 0,042$), et les diagnostics au dernier stade étaient rares (5,1 % en 2008–2011 c. 9,1 % en 2012–2015). L’IID médian était de 10 mois pour les deux périodes. Aucun changement n’a été observé dans le temps chez les hommes de ≥ 30 ans. Par contre, durant les deux périodes, les diagnostics au dernier stade étaient plus courants chez les hommes de ≥ 30 ans (2008–2011, 18,8 % 2012–2015, 18,6 %; $p < 0,01$ dans les deux cas). L’IID était aussi plus long chez les hommes de ≥ 30 ans (2008–2011, 24,5 mois; 2012–2015, 20 mois; $p < 0,001$ dans les deux cas).

Conclusion Les indicateurs de dépistage indiquent que les pratiques de dépistage sont meilleures chez les gbHARSAH diagnostiqués avant l’âge de 30 ans que chez ceux qui sont diagnostiqués à un âge plus avancé. Des mesures de prévention supplémentaires sont toutefois clairement nécessaires dans les deux tranches d’âges.

Keywords HIV · HIV testing · GBMSM · Young GBMSM

Mots-clés VIH · Dépistage du VIH · gbHARSAH · Jeunes gbHARSAH

Introduction

Gay, bisexual and other men who have sex with men (GBMSM) continue to be disproportionately affected by HIV, accounting for more than half of all annual diagnoses in British Columbia (BC) in recent years (British Columbia Centre for Disease Control 2015). Overall, trends have remained relatively stable among this group despite having been significantly reduced among other groups such as people who inject drugs (British Columbia Centre for Disease Control 2015), reflective of statistics seen throughout Canada and the United States (US) (Centers for Disease Control and Prevention 2016; Public Health Agency of Canada 2015). In BC, approximately 70% of annual diagnoses among GBMSM are regularly made among men 30 years of age and older; however, the 2014 HIV surveillance report revealed increases in new HIV diagnoses among those aged 20–24 years in 2013 and 2014 (see Fig. 1; BC Centre for Disease Control 2015). Surveillance of HIV is critical for monitoring disease trends and assessing changes that may signal increased transmission; however, inherent limitations exist that can lead to challenges in interpreting these changes based on diagnoses alone. These include the long latency of HIV infection and the inability to determine testing rates specifically among the GBMSM population that may inform whether an increase was related to improved case ascertainment or to an increase in transmission (Hall et al. 2017).

Previous literature has examined risk factors for HIV acquisition among GBMSM with numerous studies suggesting a high acquisition risk among younger men due to a combination of behavioural and psychosocial factors in addition to a low self-perceived risk (Bogowicz et al. 2016; MacKellar et al. 2007). Some of these factors include the use of the internet or apps to seek sexual encounters (Lewnard and Berrang-Ford 2014), use of alcohol or other substances prior to sexual encounters

(Newcomb 2013) and experiences of marginalization or other negative psychosocial health influences (Ferlatte et al. 2014), all of which have been found to be associated with higher odds of engaging in unprotected anal intercourse. A Vancouver study conducted in 2008–2009 demonstrated that although men under 30 had the lowest prevalence of HIV, among men who were HIV positive, this age group had the highest proportion of men who were unaware of their infection (previously undiagnosed) (Moore et al. 2012). Similar findings have been reflected in the US, with one study reporting 60% of HIV-positive men aged 18–22 years and 43% of those aged 23–39 years to be unaware of their infection (Oster et al. 2014). Encouragingly, other studies, both in Vancouver (Bogowicz et al. 2016; Gilbert et al. 2014) and in cities in the US (Helms et al. 2009), have found that younger men and those who are at highest risk for HIV acquisition are more likely to engage with testing services, and that testing frequency appears to be increasing over time (Helms et al. 2009; Oster et al. 2014).

The 2013–2014 increase in diagnoses occurred in the context of province-wide efforts to increase HIV testing, a key objective of which was to identify previously undiagnosed infections (British Columbia Ministry of Health 2012). It is therefore plausible that the increase may have been related to successfully finding and testing those who had been living with HIV but had not previously engaged in testing. However, given the literature suggesting an increased acquisition risk among some younger men, in addition to the inability to examine changes in testing rates among this population, an increase in incidence could not be ruled out. We designed an analysis of HIV surveillance data to examine indicators of HIV testing behaviour among recently diagnosed GBMSM to determine whether the observed trend was more likely due to a change in incidence or to improved case ascertainment.

Fig. 1 New HIV diagnoses among GBMSM in BC by age group, 2005 to 2014 (BCCDC, 2015). Abbreviations: *HIV* human immunodeficiency virus; *GBMSM* gay, bisexual and other men who have sex with men; *BC* British Columbia; *BCCDC* British Columbia Centre for Disease Control

Methods

Setting/study design

BC HIV surveillance data were examined in the periods before and after the implementation of the expanded provincial HIV strategy, “Seek and Treat to Optimize Prevention for HIV (STOP HIV)”, now known as “From Hope to Health” (British Columbia Ministry of Health 2012). This strategy was implemented in 2010 in the cities of Vancouver and Prince George with provincial expansion announced in 2012. A key focus of the expansion was on increasing the reach of testing in both general and targeted populations through the promotion of new HIV testing guidelines in 2014, additional testing methods such as rapid testing, and adoption of routine HIV testing in general healthcare settings (Gustafson et al. 2014; STOP HIV/AIDS 2012). Quarterly monitoring reports demonstrate provincial testing rates increasing substantially beginning in 2011 and continuing through 2015, though testing rates are not available by exposure category (British Columbia Centre for Excellence in HIV/AIDS 2016).

Data collection

Data were obtained from the HIV/AIDS Information System (HAISYS), a provincial surveillance database maintained at the BC Centre for Disease Control (BCCDC) that contains

information derived from HIV case report forms (CRFs). CRFs are completed by nursing staff during the case management process and contain a variety of information, including demographics, exposure information and CD4+ cell count following diagnosis. Over 90% of HIV screening tests and all HIV confirmatory tests in BC are performed by the BCCDC Public Health Laboratory. A probabilistic matching algorithm of five unique identifiers was used to estimate case testing history (Gilbert et al. 2014).

Indicators of interest for this analysis included (1) whether diagnoses were made on first known testing episode or repeat testing episode; (2) the inter-test interval (ITI) for those with previous negative tests on record, representing the time in months between last negative test and first positive test; and (3) whether diagnosis was made at late stage, also referred to as “Stage 3”, (defined as CD4+ cell count < 200 cells/mm³ and laboratory findings not consistent with acute HIV infection) (British Columbia Centre for Disease Control 2016b). These indicators have been used in previous analyses to evaluate testing programs and to assist in estimating incidence and prevalence (Gilbert et al. 2014; Hall et al. 2015; Hall et al. 2017). For this analysis, a decrease in the proportion of diagnoses made on first test, a reduced ITI, and a lower proportion of late-stage diagnoses would be considered indicative of improved testing practices (British Columbia Ministry of Health 2012; Gilbert et al. 2014; Hall et al. 2015, 2017; Rank et al. 2011).

Data analysis

Cases were grouped for comparison by age < 30 years and ≥ 30 years; this was chosen to reflect the change in trend observed in the annual report in addition to potential differences in risk and testing behaviours between younger and older GBMSM discussed previously. Periods for comparison were also based on the observed increase among young GBMSM in addition to the time frame of observed expansion in HIV testing rates in the province. The period of interest included diagnoses made in 2012–2015, which was compared against diagnoses made in the period immediately prior (2008–2011).

Descriptive analyses included examining the proportion of cases diagnosed on first versus repeat testing episode, median and interquartile range (IQR) for ITI, and the proportion of cases diagnosed at late stage versus any other stage (CD4^+ cell count ≥ 200 cells/mm³). These figures were then compared across periods for each age group, and between younger and older GBMSM within each period. χ^2 tests were used to compare proportion diagnosed on first versus repeat testing episode, and proportion diagnosed at late stage versus other stage diagnoses. As some CD4^+ cell count data were missing in each period, the degree of missing data was compared across periods with final results representing those for whom staging data were available. Wilcoxon rank-sum test was used to compare changes in median ITI. Statistical significance was defined as a p value of < 0.05 . Analysis was performed using SAS v9.4 (SAS Software, version 9.4 2013).

This analysis was conducted as a part of the public health mandate of the BCCDC and the data linkages are a component of routine surveillance reporting. As such, research ethics approval was not required.

Results

Total diagnoses

Distribution of cases and testing indicators by age and period are displayed in Table 1. A total of 657 HIV diagnoses were made among GBMSM in 2008–2011, and 590 were made in 2012–2015, representing a decrease of 10.2%. However, when disaggregated by age, there was little change in the number of new diagnoses among men < 30 years of age (160 in 2008–2011 vs. 164 in 2012–2015) and a 14.3% decrease (497 in 2008–2011 vs. 426 in 2012–2015) among men ≥ 30 years. As such, younger MSM accounted for a higher proportion of new HIV diagnoses in the later study period than they did in the earlier period (27.8% vs. 24.3%; $p = 0.04$).

Diagnoses on first test

The proportion of diagnoses made on first known testing episode decreased among the younger group over the two periods (39.4% to 28.7%, $p = 0.04$) but did not change significantly among the older group (31.6% to 33.8%, $p = 0.47$). The difference in proportion of first test diagnoses between age groups was not significant in either period (39.4% among < 30 years vs. 31.6% among ≥ 30 years in 2008–2011, $p = 0.07$; 28.7% among < 30 years vs. 33.8% among ≥ 30 years in 2012–2015, $p = 0.23$).

Inter-test interval

Among those < 30 years who had previously had a negative HIV test, there was no change in the median inter-test interval (10 months [IQR 6–26 months] in 2008–2011 vs. 10 months [IQR 4–20 months] in 2012–2015, $p = 0.95$). There was also no significant change in the inter-test interval for individuals diagnosed with HIV aged ≥ 30 years over the two periods: 24.5 months (IQR 8–61) in 2008–2011; and 20 months (IQR 6–64) in 2012–2015 ($p = 0.18$). However, the interval was considerably longer among men ≥ 30 years when compared to the younger group in both periods (2008–2011, $p < 0.001$; 2012–2015, $p < 0.001$).

Stage of infection at diagnosis

Among those < 30 years with staging data available, 5.1% were diagnosed at late stage in the earlier period compared to 9.1% in the later period ($p = 0.24$). No change was observed in the older group, with 18.8% diagnosed late in the first period compared to 18.6% ($p = 0.92$) in the later period. Late-stage diagnosis was significantly associated with age ≥ 30 years in both periods (2008–2011, $p = 0.001$; 2012–2015, $p = 0.007$). Staging data was more complete for both ages in the later period, with 6.1% and 8.9% missing in the < 30 and ≥ 30 groups respectively in 2012–2015, a reduction from 38.8% and 27.4% missing in these groups in the earlier period.

Discussion

Using HIV surveillance data, we observed an overall decrease in diagnoses among GBMSM in BC from 2008–2011 to 2012–2015, largely driven by a reduction in diagnoses among older GBMSM. This is an encouraging finding in the context of increased testing rates in the province. Our findings suggest that men diagnosed before the age of 30 appeared to be more engaged in testing in the time before their diagnoses than their older counterparts. This is evidenced by the decrease in the proportion diagnosed on first test that was only observed among the younger group, and, among those with repeat tests,

Table 1 Testing characteristics among GBMSM in BC diagnosed with HIV by age and period

	2008–2011 (<i>n</i> = 657)		2012–2015 (<i>n</i> = 590)		Chi-square results <i>p</i> value			
	< 30 years	≥ 30 years	< 30 years	≥ 30 years				
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)				
Diagnoses	160 (24.3)	497 (75.7)	164 (27.8)	426 (72.2)	0.04			
					Comparing age		Comparing period	
Diagnoses made on first test	63 (39.4)	157 (31.6)	47 (28.7)	144 (33.8)	2008–2011	2012–2015	< 30 years	≥ 30 years
Diagnoses made on repeat test	97 (60.6)	340 (68.4)	117 (71.3)	282 (66.2)	0.07	0.23	0.04	0.47
Late stage ^a at diagnosis (% of total with CD4 counts)	5 (5.1)	68 (18.8)	14 (9.1)	72 (18.6)				
Other stage at diagnosis (% of total with CD4 counts)	93 (94.9)	293 (81.2)	140 (90.9)	316 (81.4)	0.001 ^b	0.01 ^b	0.24 ^b	0.92 ^b
Missing staging data at diagnosis (% of total)	62 (38.8)	136 (27.4)	10 (6.1)	38 (8.9)				
					Wilcoxon rank-sum results <i>p</i> value			
Inter-test interval ^c median (IQR)	10 (6–26) (<i>n</i> = 97)	24.5 (8–61) (<i>n</i> = 340)	10 (4–20) (<i>n</i> = 117)	20 (6–64) (<i>n</i> = 282)	< 0.001	< 0.001	0.95	0.18

GBMSM gay, bisexual and other men who have sex with men; BC British Columbia; HIV human immunodeficiency virus; IQR interquartile range

^a Late stage defined as CD4 count of < 200 cells/mm³

^b Those missing staging data excluded from statistical test

^c Only for those with a previously documented negative HIV test

Significance level *p* < 0.05.

the median time between tests of less than a year. This is further reflected in the fact that less than 10% of young HIV-positive GBMSM in this study were diagnosed at a late stage of disease, a proportion much less than those diagnosed at older ages. Despite these promising results, the fact that the number of diagnoses is not decreasing among younger men indicates that additional primary prevention efforts are needed to reduce acquisition risk. Traditional prevention approaches like sexual risk counselling and condom promotion continue to be important to prevent HIV, but additional methods should be considered. These may include increasing awareness of and access to pre-exposure prophylaxis, a prevention method that has shown high efficacy yet remains at a relatively low level of awareness and use among younger GBMSM (Lachowsky et al. 2016), as well as supports that take into account the unique developmental needs of adolescent and young adult GBMSM, such as the influence of social networks, potential issues related to bullying and discrimination, and life-stage transitions (Ferlatte et al. 2014; Hergenrather et al. 2016). Behavioural interventions that are developed with consideration of these factors have demonstrated an ability to influence risk factors among young GBMSM, at least in the short term (Hergenrather et al. 2016).

Previous literature from BC and the US have suggested a higher proportion of undiagnosed infections among younger age groups (Moore et al. 2012; Oster et al. 2014). However, when comparing only those recently diagnosed, the indicators

in our analysis are suggesting that undiagnosed, or late diagnosis, continues to be a problem for GBMSM over 30 years. This is evidenced by a high proportion of cases diagnosed on first testing episode that did not decrease over time, a longer inter-test interval among those with previous tests, and a higher proportion diagnosed at late stage than among the younger group. Tendency towards later stage diagnosis at older ages in addition to longer inter-test intervals among older age groups has been shown in previous works in BC (Gilbert et al. 2014; Rank et al. 2011), and in the US, both nationally and in specific comparable jurisdictions such as Seattle (Hall et al. 2015; Katz et al. 2013). A reason for this may be that as older men accumulate more negative results, they experience less positive reinforcement and are inclined to extend time between testing appointments (Mustanski et al. 2014). This may also be reflective of differences in risk behaviour between age groups. Although HIV surveillance data in BC does not collect information on sexual risk behaviours beyond sexual orientation, other studies from BC and elsewhere have suggested that those who most frequently engage in high-risk behaviours also tend to test more frequently (Bogowicz et al. 2016; Katz et al. 2013). Furthermore, men from the older age groups may be more likely to be in partnered relationships than those under 30 years, with evidence to suggest that those with main partners may continue to be at risk of infection (Community Based Research Centre 2011; Stephenson et al. 2015), but perceive their risk to be negligible (Stephenson et al. 2015). The fact

that most late-stage diagnoses also tend to be made on a first testing episode suggests a subgroup of the population at risk was not engaged in testing, possibly due to a low self-perceived risk (Rank et al. 2011). All of these reasons highlight the shift away from risk-based to population-based testing to improve the proportion of people living with HIV who are aware of their HIV status (British Columbia Centre for Disease Control 2016b). Promoting earlier and more frequent testing among GBMSM of all age groups is important to achieve this goal.

Certain limitations exist in this analysis. Use of surveillance data only allows for examination of testing indicators among those who engage in testing and eventually test positive. This analysis can therefore not provide any direct insight into those who are not engaged in the healthcare system, or who regularly test negative. Additionally, only limited information is collected on CRFs relating to behavioural factors and even less relating to the complex social factors that are likely to be influencing acquisition risk among these cases specifically (Ferlatte et al. 2014). A high percentage of cases were missing staging data in the earlier period, leading to challenges in making accurate comparisons across periods. However, it was promising to see a much higher degree of completeness in the later period (see Table 1). Although the BCCDC Public Health Laboratory handles the vast majority of HIV screening tests in the province, those who previously tested anonymously, non-nominally, or negatively out of province would not be captured in indicators relating to previous testing episodes. However, the proportion of those diagnosed through non-nominal or anonymous testing has been declining over time, with diagnosis by non-nominal testing making up less than 10% of diagnoses in 2015 (T. Consolacion, personal communication, June 13, 2018), and testing and diagnosis through anonymous testing also quite low, with only 283 tests conducted and only five reactive results reported over the 2013–2014 period in BC (British Columbia Centre for Disease Control 2016a). As most late-stage diagnoses are diagnosed on first testing episode (Rank et al. 2011; T. Consolacion, personal communication, March 29, 2019), we are unable to determine the probable time of infection by examining ITI for this group, but it can be expected that these diagnoses had a long duration of infection. While it is possible that some of the late-stage diagnoses among the ≥ 30 age group were acquired before the age of 30, given the age of the men at the time of diagnosis (see Fig. 1) and literature demonstrating higher engagement in testing among those with higher risk profiles (Bogowicz et al. 2016; Katz et al. 2013), we expect that most were acquired in their 30s or later. Finally, this analysis examined case counts and characteristics within large age groupings and aggregated at the provincial level, which may have a result of masking trends that exist regionally or within more specific age categories.

Conclusion

Overall, the number of HIV diagnoses among GBMSM in BC decreased in the presence of the “From Hope to Health” strategy, driven by a reduction in diagnoses among men 30 years of age and older. However, lengthy intervals between testing and a high proportion of late-stage diagnoses reveal that room for improvement exists in encouraging earlier and more frequent testing among this age group. Although no change was seen in the number of diagnoses among younger men, testing indicators suggest that men who were diagnosed before 30 years of age were relatively well engaged in testing and that testing practices improved in the later period. The fact that this was not accompanied by a reduction in diagnoses suggests that additional prevention measures, such as increased awareness of and access to pre-exposure prophylaxis, are needed to reduce incidence in this age group.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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