



## Full length article

## Changes in smoking status among a longitudinal cohort of gay, bisexual, and other men who have sex with men in Vancouver, Canada



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## ABSTRACT

**Background:** Cigarette smoking is common among gay, bisexual, and other men who have sex with men (GBMSM) and most of the mortality gap between HIV-positive and HIV-negative individuals is attributable to smoking.

**Methods:** We recruited sexually active HIV-positive and HIV-negative GBMSM age  $\geq 16$  years using respondent-driven sampling. Study visits occurred every six months for up to four years and included a computer-assisted self-interview and clinical assessment. We conducted bivariate analyses to compare factors associated with “never”, “former”, “daily”, or “non-daily” smoking at baseline and longitudinal mixed effects models to examine factors associated with cessation and (re)initiation.

**Results:** 774 participants completed a baseline visit and 525 enrolled in the cohort and completed at least one follow-up visit. At baseline, the median age was 34 years and 31.5% were daily smokers. In follow-up (median = 2.5 years), 116 daily or non-daily smokers (41%) quit at least once and of these, 101 (87%) remained former smokers at their last visit. Smoking cessation was positively associated with incomes  $\geq \$60,000$  and self-reported excellent health. Alcohol use, ecstasy use, and having a partner who smokes were associated with decreased odds of cessation. Substance use (cannabis, GHB, and crystal methamphetamine) and having a partner who smokes were positively associated with increasing to/resuming daily smoking. HIV-positive GBMSM were more likely to smoke but not more likely to quit.

**Conclusions:** Targeted, culturally relevant smoking cessation resources are needed, especially for HIV-positive GBMSM. Engaging couples in cessation interventions may be useful.

## 1. Introduction

While prevalence of cigarette smoking has declined in general (Reid et al., 2015), rates remain high in many marginalized subpopulations including gay, bisexual, and other men who have sex with men (GBMSM; Clarke and Coughlin, 2012; Haley et al., 2014). Among GBMSM, prevalence of smoking ranges between 28 and 50% across North America (Akhtar-Khaleel et al., 2016a; Gamarel et al., 2015;

O’Cleirigh et al., 2015a; Robinson et al., 2011; Storholm et al., 2011). A 2014 cross-sectional study of 1115 GBMSM in Vancouver, Canada found 37% of participants self-identified as current smokers (Haley et al., 2014). Rates were highest among HIV-positive GBMSM (50%), those with annual incomes  $< \$20,000$  (51.6%), and those  $< 30$  years old (40.4%; Haley et al., 2014). Higher incidence of smoking among GBMSM has been associated with isolation and trauma, cultural community factors, and targeted marketing strategies (American Lung

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Association, 2010; Dilley et al., 2008; Gamarel et al., 2015; Newcomb et al., 2014; O’Cleirigh et al., 2015a; Robinson et al., 2011). Studies of urban GBMSM have also found smoking rates to be higher and cessation rates lower in HIV-positive men (Robinson et al., 2011). People living with HIV/AIDS (PLWHA) who smoke are at elevated risk for several comorbid conditions including pulmonary infectious diseases, cancer, cardiovascular disease, and tuberculosis (Helleberg et al., 2015; Torres et al., 2014). Further, PLWHA who smoke report lower treatment adherence, higher viral load counts, and are less likely to attend routine medical visits (O’Cleirigh et al., 2015b). Even among those who are treated and virally suppressed, mortality rates are significantly higher among PLWHA who smoke, suggesting that smoking-related mortality may be greater than HIV-related mortality among HIV-positive GBMSM (Helleberg et al., 2015) and accentuating the need for targeted smoking cessation resources.

Because of the high prevalence of cigarette smoking among GBMSM, there is a growing body of literature examining smoking cessation in this population. However, the majority of this research has been cross-sectional (e.g., Gamarel et al., 2015; Lifson et al., 2010; Levinson et al., 2012; Newcomb et al., 2014; O’Cleirigh et al., 2015a; Robinson et al., 2011; Torres et al., 2014; Tron et al., 2014) and almost none have adopted a longitudinal design. Cross-sectional studies in the United States found that 45–72% of GBMSM report attempted cessation in the previous year, and preparation to quit was associated with daily (vs. non-daily) smoking, having a smoke-free home, asking a doctor for advice, and having used nicotine replacement therapy (Levinson et al., 2012; Robinson et al., 2011). These studies, however, provide information only on intentions to quit, not long term cessation success, and they offer no details on characteristics associated with different patterns of smoking over time. One longitudinal analysis has been conducted using data from the Multicenter AIDS Cohort Study (Akhtar-Khaleel et al., 2016b). In this study, the majority of participants showed consistent smoking behaviour across the study with only 34% demonstrating a change in behaviour with a third of these reducing their smoking from between 0.5–1 pack a day to almost no daily smoking.

Longitudinal examination of changes in smoking habits is important as transitions from daily to non-daily smoking may highlight potential steps toward complete cessation and increases in smoking consumption may highlight potential risk factors and targets for public health intervention. Between 2001–2005, a large longitudinal study in the US found that smoking status was constant for the majority of current, former, and never smokers (Weinberger et al., 2014). However, among non-daily smokers at baseline, the majority (54%) had quit by follow-up, while 22% increased to daily smoking (Weinberger et al., 2014). Smoking cessation was associated with younger age, being married, and having some college education. A 3-year longitudinal study of 4355 smokers in Ontario, Canada (Bondy et al., 2013), also examined transitions in smoking habits and similarly found that the majority of current and recent non-smokers did not change their smoking status; however, occasional smokers reported more changes in smoking status during follow-up. Among occasional smokers who reported past daily use, 19% reported complete cessation in follow-up but 50% resumed daily smoking. Those who resumed daily smoking were more likely to describe themselves as addicted. Therefore, smoking reduction from daily to non-daily use may be a step toward cessation, but may also be associated with higher likelihood of smoking reinitiation.

Since GBMSM are more likely to smoke and more likely to be living with HIV than the general population – estimated population prevalence of HIV among GBMSM in Vancouver is 23.4% (Moore et al., 2016)– understanding factors associated with changes in smoking status can assist local campaigns and programs to support cessation in this marginalized subpopulation. To address this need, we conducted longitudinal analyses to examine patterns of smoking cessation, initiation, reinitiation, and sustained abstinence in a cohort of Vancouver GBMSM.

## 2. Methods

Data were collected as part of the Momentum Health Study (Moore et al., 2016), a longitudinal cohort study of GBMSM in Vancouver, British Columbia. Eligibility criteria included being  $\geq 16$  years old, having had sex with a man in the past 6 months, identifying as male (including trans men), living in Metro Vancouver, and ability to complete the study in English. Participants were recruited through respondent-driven sampling (RDS), a formalized peer-recruitment strategy that uses purposefully chosen “seed” participants to target hidden and hard-to-reach populations (Heckathorn, 1997). Participants received a \$50 honorarium per study visit and an additional \$10 for each person they successfully recruited into the study. A detailed description of full study procedures is published elsewhere (Moore et al., 2016). Participants were recruited from February 2012–February 2015 with follow-up every six months, up to a maximum of 4 years.

Participants provided written informed consent before any study activities occurred and all visits took place in the downtown study office. All eligible participants who attended the first visit were also offered enrollment in the cohort study but participation in both was not required. At each visit, eligible participants completed a computer-assisted self-interview assessing a range of health behaviors, including tobacco use, and relevant psychosocial and demographic factors. A study nurse collected additional health information and conducted HIV and STI testing as part of the larger study.

At each visit, participants reported their smoking history over the past 6 months as: “never used tobacco”, “have used tobacco, but not in the past 6 months”, “daily”, “regularly but not every day”, “not regularly at all, just every now and then”, or “only when drunk or high, or mixed with cannabis”. Based on their answers, participants were placed into four groups: “never smoker”, “non-daily smoker”, “daily smoker”, and “former smoker”. We aimed to understand factors associated with transitions between categories over the course of the study including: relationship status, HIV status, quality of overall physical and mental health, method of access to primary health care, past medical history, substance use, partner’s tobacco use, gay community involvement, and demographics. Additionally, the Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983), the Alcohol Use Disorder Identification Test (AUDIT; Saunders et al., 1993), and the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST; World Health Organization, 2002) were administered. All study procedures were approved by the research ethics boards of the University of British Columbia, Simon Fraser University, and the University of Victoria.

We conducted bivariate analyses of factors associated with each category of smoking status at enrollment using the Kruskal-Wallis test for continuous variables and Chi-square or Fisher’s Exact Test for categorical variables. RDS weighting was used for all analyses conducted at baseline and RDS recruitment chains were treated as clustered data for longitudinal modeling. Independent variables were then tested across all four categories of the dependent variable, and between each pair of categories. Univariable and multivariable mixed effects models using PROC GLIMMIX subroutine, with log link function, treating RDS referrer as first level cluster and participant as second level cluster, were constructed and adjusted risk ratios calculated for daily smoking initiation and smoking cessation. Variables of interest with  $p$ -value  $< 0.2$  in the univariable model were included for consideration in the multivariable model. We selected the final model using a backward selection technique based on two criteria (AIC and Type III  $p$ -values), with the least significant variable dropped until minimum AIC was attained (Lima et al., 2007). This technique balances the trade-off between goodness of fit and model complexity and allows determination of significance of predictors after adjusting for potential confounding effects of other variables in the model (Card et al., 2016; Dohoo et al., 2012). Daily smoking initiation was defined as a transition from “never”, “former”, or “current non-daily smoker” to “current daily smoker” between any two consecutive visits. Smoking cessation was

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