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Prevalence and Patterns of Smoking, Alcohol Use, and Illicit Drug Use in Young Men Who Have Sex with Men

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Abstract

Background—Young men who have sex with men (YMSM) are substantially more likely to use illicit drugs and other substances compared to their heterosexual peers. Substance use during adolescence has critical implications for long-term physical and mental health, and among YMSM may lead to HIV infection. The goal of the current study was to describe lifetime and past six month prevalence and patterns of substance use across multiple substances in a community sample of racially-diverse YMSM.

Methods—Participants were 450 YMSM aged 16–20 living in Chicago and surrounding areas who were recruited beginning December, 2009 using a modified form of respondent driven sampling. Analyses were conducted with multivariate logistic regression and latent class analysis (LCA).

Results—Prevalence of substance use was high in this sample of majority racial minority YMSM, and only 17.6% reported no substance use during the past six months. Black YMSM had lower prevalence of use of all substances except marijuana compared to White YMSM, while Latino YMSM had lower prevalence of alcohol, marijuana, and club drug use. Bisexual YMSM reported higher prevalence of cigarette smoking, stimulant use, and club drug use compared to gay/mostly gay YMSM but lower numbers of bisexual participants limited the ability to detect statistically significant differences. LCA found that YMSM fell into three general categories of substance users: alcohol and marijuana users, polysubstance users, and low marijuana users.

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Conclusions—Analyses reveal important group differences in prevalence and patterns of substance use in YMSM that have important implications for intervention.

Keywords

young men who have sex with men; substance use; alcohol; cigarette smoking

1. INTRODUCTION

Young men who have sex with men (YMSM) are substantially more likely to use illicit drugs and other substances compared to their heterosexual peers, including higher prevalence of cigarette smoking (Corliss et al., 2013; Garofalo et al., 1998; Marshal et al., 2009), alcohol use and binge-drinking (Garofalo et al., 1998; Hatzenbuehler et al., 2008; Marshal et al., 2009), and illicit drug use (Corliss et al., 2010; Garofalo et al., 1998; Kelly et al., 2006; Newcomb et al., 2014; Tucker et al., 2008). Substance use during adolescence has critical implications for long-term physical and mental health (NIDA, 2009; SAMHSA, 2012; WHO, 2010), including potentially severe impairments in neurocognitive functioning (Squeglia et al., 2009; Zeigler et al., 2005).

Several notable studies have documented substance use prevalence in community samples of YMSM and probability-based samples of U.S. high school students. However, the current literature is limited in many ways. First, studies have often focused on prevalence and/or frequency of use of a single substance (Garofalo et al., 2007; Wong et al., 2008), class of drugs (Clatts et al., 2005), or composite measure (Newcomb et al., 2011; Traube et al., 2013; Wong et al., 2010), which limits the ability to compare prevalence of use across multiple substances. Knowledge of demographic differences in substance use among YMSM is limited. While several studies have reported demographic differences in use of specific substance types among YMSM (Clatts et al., 2005; Garofalo et al., 2007; Kipke et al., 2007; Newcomb et al., 2011; Traube et al., 2013; Wong et al., 2008, 2010), few have done so across multiple substances, which limits our understanding of patterns of subgroup differences. Finally, studies have rarely (if ever) reported age of initiation of substance use among YMSM. This information would help identify the developmental periods that are most important to target for substance use prevention.

Certain subgroups of YMSM are likely at even higher risk for substance use than others. Evidence suggests that bisexual youth report the highest prevalence of substance use compared to heterosexual and gay youth (Austin et al., 2004; Marshal et al., 2009; McCabe et al., 2004; Newcomb et al., 2014; Russell et al., 2002); but see Newcomb and colleagues (Newcomb et al., 2013, 2012) for contradictory findings. Evidence also suggests that Black YMSM (and to a lesser degree Hispanic/Latino YMSM) report lower prevalence and frequency of substance use compared to White YMSM (Clatts et al., 2005; Kipke et al., 2007; Newcomb et al., 2011; Traube et al., 2013; Wong et al., 2008, 2010), which is consistent with research in the general population (NIDA, 2009; SAMHSA, 2012; Wallace et al., 2003).

Some recent investigations have utilized latent class analysis (LCA) in general samples (Agrawal et al., 2007; Monga et al., 2007; Ramo et al., 2010; Shin et al., 2010; Smith et al.,

2011) to examine patterns of substance use by empirically deriving groups of individuals who tend to use similar substances. This approach can identify patterns of polysubstance use, as well as demographic differences in these empirically derived groups. To our knowledge this approach has not been used in a sample of YMSM, which would help to inform prevention strategies by more precisely identifying low- and high-risk groups of YMSM.

The goal of the current study was to describe prevalence of substance use across multiple substances in a community sample of ethnically-diverse YMSM, and to investigate demographic differences in prevalence and patterns of use. We aimed to: 1) describe lifetime use, recent use (e.g., past 6 month), and age of onset of multiple substances, 2) identify demographic differences in substance use within YMSM, including age, race, and sexual orientation differences, and 3) use LCA to examine patterns of polysubstance use, and demographic differences in likelihood of belonging to these empirically-derived groups. We hypothesized that bisexual and White YMSM would endorse the highest prevalence of substance use across all substances. Given the dearth of research on patterns of substance use within YMSM using LCA, we made no specific hypotheses with regard to this aim.

2. METHODS

2.1. Participants and Procedures

Data were taken from the baseline interview for Crew 450, an ongoing longitudinal study designed to analyze the prevalence, course, and predictors of a syndemic of psychosocial health issues linked to HIV among YMSM. Inclusion criteria were: 1) between 16–20 years of age at baseline; 2) birth sex male; 3) spoke English; 4) had a previous sexual encounter with a man or identified as gay or bisexual; and 5) were available for 2 year follow-up. A modified form of respondent driven sampling (RDS; Heckathorn, 1997) was used to recruit participants. The initial convenience sample (i.e., “seeds”; *N*=172; 38.2%) was recruited from the community through targeted in-person and school outreach, geo-social network applications (i.e., Grindr and Jackd) and flyers posted in community settings frequented by YMSM.

A total of 450 participants were recruited between December, 2009 and February, 2013. The baseline assessment consisted of two visits scheduled approximately one week apart. Participants were paid $70. All data were collected using computer-assisted self-interview (CASI) technology with audio instructions. The protocol was approved by the Institutional Review Boards (IRBs) with a waiver of parental permission under 45 CFR 46, 408(c) (Mustanski, 2011). Participants provided written informed consent/assent, and mechanisms to protect participant confidentiality were utilized (i.e., a federal certificate of confidentiality).

2.2. Measures

2.2.1. Demographic characteristics—The demographic interview assessed participant age, race/ethnicity, sexual orientation, self-reported HIV status (confirmed with OraQuick HIV antibody test), living situation, and educational attainment. Participants self-reported

sexual orientation as: “only gay/homosexual”, “mostly gay/homosexual”, “bisexual”, “mostly heterosexual”, “only heterosexual”, or “other”.

2.2.2. Cigarette Smoking (CDC, 2009)—Lifetime and past 30 day prevalence of cigarette smoking were assessed with the following items, respectively: “Have you ever smoked a whole cigarette?”, and “During the past 30 days, on how many days did you smoke cigarettes?” Responses for past 30 day smoking were presented on a 7-point ordinal scale. Prevalent smoking was defined as at least one day of smoking in the past 30 days.

2.2.3. Alcohol Use and Binge Drinking (CDC, 2009)—Lifetime and past 6 month prevalence of alcohol use were assessed by participants’ positive endorsement of the following items, respectively: “Have you ever had a drink of alcohol (beer, wine, or liquor) other than a few sips?” (yes/no), and “Have you had a drink of alcohol during the past 6 months?” (yes/no). Prevalence of past 6 month binge-drinking was assessed with the following item: “During the past 6 months, how often did you have 5 or more drinks containing alcohol within a two-hour period?” Responses for this item were presented on a 10-point ordinal scale. Prevalent binge-drinking was defined as at least one day of binge-drinking in the past 6 months.

2.2.4. Illicit Drugs (CDC, 2009; NIAAA, 2003)—Lifetime and past 6 month prevalence of illicit drug use were assessed with the following items, respectively: “Have you ever used [drug name]?”, and “During the past 6 months, how many times did you use [drug name]?” Responses were presented on a 7-point ordinal scale. Prevalent drug use was defined as at least one day of use in the past 6 months. Illicit drugs included: marijuana, cocaine, methamphetamines, prescription stimulants, prescription depressants, heroin, other opiates (e.g., morphine, codeine, Demerol), MDMA (ecstasy), psychedelics (e.g., PCP, LSD, mescaline, mushrooms), gamma hydroxbutyrate (GHB), ketamine, poppers, other inhalants (e.g., glues, spray paint, cleaning fluids), Viagra, and anabolic steroids.

2.2.5. Age of Onset (CDC, 2009)—Age of onset of substance use was assessed with the following question: “How old were you when you [smoked a whole cigarette for the first time/had your first drink of alcohol other than a few sips/used {drug type} for the first time]?” Response options were on a 7 point ordinal scale: “I have never [smoked a whole cigarette/had a drink of alcohol other than a few sips/used {drug type}]”, “8 years old or younger”, “9 or 10 years old”, “11 or 12 years old”, “13 or 14 years old”, “15 or 16 years old”, and “17 years old or older”.

2.3. Analyses

We calculated prevalence rates of lifetime and recent cigarette smoking, alcohol use, and illicit drug use in the entire sample. Next, logistic regression was performed to estimate the odds ratios for group differences in prevalence of recent substance use (i.e., age, race and sexual orientation). In addition, LCA was conducted using Mplus software (Muthen and Muthen, 1998) to identify groups with comparable response patterns of past 6 month alcohol, marijuana, stimulant, club drug, and inhalant use. We evaluated relative model fit using adjusted Bayesian information criterion (BIC) with lower values indicating greater

model fit. In addition, the Lo, Mendell, and Rubin likelihood ratio test (LMR-LRT), the bootstrap likelihood ratio test (BLRT) and the entropy value were used to determine the appropriate number of latent classes. A significant *p*-value for both the LMR-LRT and BLRT tests indicates improvement in model fit when comparing a *k* and *k* – 1 class model. Entropy values range from zero to one with higher values indicating greater certainty in model classification (Jung and Wickrama, 2008). After the appropriate number of classes was determined, LCA with covariates was conducted in order to evaluate the predictive effect demographic characteristics had on latent class assignment. This statistical technique concurrently estimates latent class assignment and regresses this latent variable on a predefined set of covariates using multinomial logistic regression. To evaluate the predictive effect each covariate had on latent class assignment, an initial bivariate multinomial logistic regression was performed and only demographic characteristics that were found to be significant predictors ($p<0.05$) were included in the final multivariate model.

3. RESULTS

Table 1 presents the full demographic characteristics of the sample. Mean age of the sample was 18.9 years (*SD*=1.3), and 25.8% was under age 18. Eighty-two percent were racial/ethnic minorities, which is higher than the 69% estimated by the US Census Bureau (http://factfinder.census.gov) in the city of Chicago, but not substantially different from estimates for areas neighboring the primary sites of data collection. In terms of sexual orientation, 50.2% identified as only gay/homosexual, 22.9% as mostly gay/homosexual, 21.3% as bisexual, 2.4% as mostly heterosexual, 0.7% as only heterosexual, and 2.4% as “other”.

Table 1 presents unadjusted frequency estimates of lifetime and recent substance use. We also report unadjusted frequency estimates of lifetime and recent polysubstance use, including alcohol, marijuana, and other illicit substance use (cigarette smoking was excluded). A majority reported polysubstance use, both lifetime (64.4%) and past 6 months (53.0%). A minority reported never having used any substances in their lifetime (12.9%) or past 6 months (17.6%).

Table 2 reports age of onset of use for each substance. Among YMSM who indicated lifetime use, age of onset varied by substance type. Approximately a quarter to a third had initiated cigarette, alcohol and marijuana use in early adolescence (before age 15), whereas the vast majority initiated stimulant and club drug use in later adolescence. Table 3 reports results of logistic regression models testing demographic differences in recent substance use. Logistic regressions were run for the most frequently used substances (i.e., cigarette smoking, alcohol, binge-drinking, marijuana and inhalants), and we collapsed lower frequency substances into drug classes based on National Institute on Drug Abuse guidelines: stimulants (cocaine and methamphetamines) and club drugs (MDMA and GHB) (NIDA, 2011).

Compared to White YMSM, Black YMSM reported significantly lower prevalence of recent use of all substances except marijuana: cigarettes (OR=0.39), alcohol (OR=0.24), binge-drinking (OR=0.27), stimulants (OR=0.07), club drugs (OR=0.19), and inhalants (OR=0.25). Hispanic/Latino YMSM were significantly less likely than White YMSM to

have used alcohol (OR=0.34), marijuana (OR=0.49), and club drugs (OR=0.26), but they did not significantly differ in their use of cigarettes, binge-drinking, stimulants, or inhalants. Other race and White YMSM did not differ in their recent use of any substances.

To assess sexual orientation differences in substance use, we created the following groups of YMSM: gay/mostly gay, bisexual, and mostly heterosexual/heterosexual/other. Groups were combined in this manner due to low numbers of individuals endorsing the latter sexual orientation items. Compared to gay/mostly gay YMSM, bisexual YMSM were significantly more likely to have recently used stimulants (OR=3.07). Bisexual YMSM did not significantly differ from gay/mostly gay YMSM in use of all other substances, though they had higher (but non-significant) odds of recent cigarette and club drug use. Heterosexual/other YMSM had significant higher odds of recent club drug use compared to gay/mostly gay YMSM (OR=4.31), but they had higher (non-significant) odds of recent stimulant and inhalant use. Recent binge-drinking (OR=1.20) and club drug use (OR=1.78) increased significantly with age. There were no age differences in use of cigarettes, alcohol, marijuana, stimulants or inhalants.

Next, LCA was performed on past 6 month substance use to identify groups with comparable response patterns, using the same substance types and categories utilized in logistic regressions. Smoking was excluded because it was measured on a different scale (past 30 days), and unlike other substances, the majority of participants were legally able to smoke which made it conceptually different from the other substances. Binge-drinking was also excluded due to overlap with the alcohol use variable. A one, two, three and four class solution was calculated with model fit statistics shown in Table 4. A three class solution was chosen because: 1) the adjusted BIC was lowest, 2) the LMR-LRT and BLRT statistics indicated significant improvement compared to two classes, but no improvement compared to four classes, and 3) the entropy value was highest. A three class solution also resulted in the highest average probability for each participant's membership in the assigned latent class (89.0%, 97.9%, and 100.0%, respectively). Latent classes will be referred to as "polysubstance users" (moderate to high endorsement of all substances), "alcohol and marijuana users" (high alcohol and marijuana use but low endorsement of other substances), and "low marijuana users" (low to moderate marijuana use and negligible endorsement of all other substances) (see Figure 1).

Finally, covariates were included in the LCA and multinomial logistic regression was conducted to estimate the effect demographic characteristics had on latent class membership. Only demographic covariates that were found to show significant ($p<0.05$) bivariate associations with latent class assignment (i.e., age and race) were included as predictors in the final multivariate model, thus sexual orientation was excluded. Of all participants, 4.9% ($N=22$) were assigned to polysubstance users, 70.4% ($N=317$) to alcohol and marijuana users, and 24.7%($N=111$) to low marijuana users. Multinomial regression analysis indicated that members of the polysubstance users class were significantly older (OR=1.85, 95% CI=1.02, 3.37) and less likely to be a racial minority (Black: OR=0.12, 95% CI=0.00, 0.12; Latino: OR=0.14, 95% CI=0.03, 0.70; Other: OR=0.69, 95% CI=0.01, 0.73) than members assigned to the low marijuana users class. Members of the alcohol and marijuana users class were also significantly less likely to be a racial minority (Black:

OR=0.27, 95% CI=0.12, 0.61; Latino: OR=0.38, 95% CI=0.15, 0.98) compared to the low marijuana users class; however, unlike the polysubstance user class, no significant age differences were found.

4. DISCUSSION

The current analyses present prevalence estimates of lifetime and recent use of multiple substances in a community sample YMSM, including cigarette smoking, alcohol use and binge-drinking, and illicit drug use. Prevalence of substance use, including polysubstance use, was high in this sample of majority racial minority YMSM in mid- to late-adolescence. There were substantial racial differences in substance use. Black YMSM (and to a lesser degree Latino YMSM) had lower prevalence compared to White YMSM. Relative to gay/mostly gay YMSM, bisexual and heterosexual/other YMSM each had higher prevalence of use of some substances but not others. Finally, LCA found that YMSM in this sample fell into three general categories of substance users: polysubstance users, alcohol and marijuana users, and low marijuana users.

In interpreting substance use prevalence in this community sample of YMSM, it can be informative to make comparisons with other studies in demographically similar populations. CDC's Youth Risk Behavior Survey (YRBS) measures health-related risk behaviors in representative samples of students in grades 9–12 and is conducted every other year in 47 states and more than 20 territorial, tribal, and local regions (Brener et al., 2004). Compared to male students in the 12th grade in 2011 YRBS study data (Eaton et al., 2012), our sample reported substantially higher prevalence of lifetime marijuana use (14.5% higher). Similar prevalence (10% difference or less) of use was reported for tobacco, alcohol, cocaine, inhalants, MDMA/ecstasy, methamphetamines, heroin, and hallucinogens. The Healthy Young Men's Study (HYM) recruited a similar sample to the present study in terms of urbanicity and racial diversity that was somewhat older on average (Kipke et al., 2007). Compared to HYM, our sample reported similar lifetime prevalence (10% or less) of alcohol, marijuana, heroin, and hallucinogen use. Our sample sample reported substantially lower lifetime prevalence of tobacco (21.1% lower), methamphetamine (18.9%), and MDMA/ecstasy (11% lower) use.

Direct comparisons of prevalence must be made with caution due to differences in study methodologies. However, the YMSM in our study reported higher prevalence of marijuana use than 12th grade males in the 2011 YRBS and similar prevalence of all other substances. Of note, our sample contained a substantially higher proportion of racial minorities than the 2011 YRBS sample. Racial minorities, and in particular Black individuals, tend to use substances less frequently than White individuals (NIDA, 2009; SAMHSA, 2012); were the racial composition of the current study to match that of the YRBS, prevalence rates in the current study would likely be higher. Additionally, our participants reported similar or lower prevalence of substance use compared to the somewhat older HYM sample, which was an urban sample of predominantly racial minority YMSM. As our sample ages, we may observe prevalence rates similar to those in HYM. However, patterns of substance use may differ over time and across regions. For example, the HYM study was recruited in the Los Angeles area in the mid-2000s. The Western United States exhibited substantially higher

rates of methamphetamine use than other regions of thecountry during that time (SAMHSA, 2006), which may account for the higher prevalence of methamphetamine use in the HYM sample.

The current study also supports previous findings that Black YMSM have lower prevalence of drug use than White YMSM, and this finding is consistent with drug use patterns in the general population (NIDA, 2009; SAMHSA, 2012). Few studies have examined these racial differences across multiple substances simultaneously, and the present study found that Black YMSM had consistently lower prevalence of recent substance use for all substances except marijuana. Latino YMSM were also less likely to have recently smoked cigarettes and used marijuana and club drugs, which is consistent with national trends. Research suggests that Black youth, in particular, have certain family-based resources that help protect them against substance misuse (e.g., tight-knit family structures; Catalano et al., 1992; Gillmore et al., 1990). However, a recent study using a population-based sample found that these racial differences in substance use were less pronounced in sexual minority youth relative to heterosexuals (Newcomb et al., 2014), suggesting that the protective effects of families against substance use may be less beneficial for sexual minority youth. Without a heterosexual comparison group, it remains unclear whether the racial differences observed in this study are more or less pronounced than those observed in the general population.

Previous research has indicated that bisexual young men report higher prevalence of substance use compared to both gay and heterosexual young men (Austin et al., 2004; Marshal et al., 2009; McCabe et al., 2004; Newcomb et al., 2014; Russell et al., 2002). Our study found that bisexual YMSM reported higher prevalence of recent stimulant, cigarette, and club drug use compared to gay/mostly gay YMSM (though the latter two effects were not statistically significant) but similar prevalence of alcohol use and binge-drinking, marijuana use, and inhalant use. Furthermore, YMSM who identified as mostly heterosexual, heterosexual or other (all grouped together) reported higher prevalence of recent club drug, stimulant, and inhalant use compared to gay/mostly gay YMSM (again, the latter two effects were not statistically significant).

It has been suggested that elevated risk of substance use among bisexuals is the result of experiencing discrimination and stigma from both heterosexuals and gay/lesbians (Busseri et al., 2008; Eliason, 1997), but much less is known about the unique experiences of YMSM who do not identify as gay or bisexual. At the same time, non-gay-identified YMSM are often less connected to the gay community than gay YMSM and therefore have less access to gay-related venues that facilitate the use of alcohol and other substances (Grov et al., 2009). As such, some less connected non-gay-identified YMSM may be buffered against the use of certain substances. It is important to note that this community sample of YMSM had relatively low numbers of non-gay YMSM, making these nuanced differences more difficult to detect. Longitudinal designs would help to identify how changes in sexual orientation identities affect changes in substance use and would help to establish causal relationships.

Our novel use of LCA to empirically derive patterns of polysubstance users may help to shed light on the groups of YMSM that are at highest risk for substance use. This analysis produced a three class solution (polysubstance users, alcohol and marijuana users, and low

marijuana users), which is similar to those derived in a demographically comparable general sample of adolescents who had experienced childhood sexual abuse (Shin et al., 2010). Additionally, racial differences in class membership largely replicated findings from logistic regressions; White YMSM were more likely to belong to the polysubstance users and alcohol and marijuana users groups compared to both Black and Latino YMSM. Furthermore, YMSM in the polysubstance users group were older than those in the other groups, indicating that polysubstance use may increase with age in this critical developmental period of late adolescence and early adulthood. Continued observation of this longitudinal cohort will allow for the understanding of how these patterns of substance use develop over time.

Several limitations should be noted in interpreting findings. We used a convenience sample that is predominantly urban and racial minorities. As such, this sample is not generalizable to the YMSM population as a whole. This community sample had relatively low numbers of non-gay-identified YMSM, which limited our ability to understand sexual orientation differences in substance use prevalence and patterns. We also did not make comparisons with heterosexual males, which precluded the ability know whether differences in drug use patterns were a result of differences between heterosexuals and sexual minorities. Future research should address whether findings are consistent with general adolescent samples by including heterosexual comparison groups. Furthermore, we did not include sexual minority women in this sample, so we cannot assess whether these patterns are similar in young women. Finally, these cross-sectional analyses only examined prevalence and patterns of substance use. Future analyses of this longitudinal sample should examine predictors and consequence of use, and the cooccurrence of substance use with other health-related outcomes (e.g., mental health, HIV risk) in this population.

Despite these limitations, the current study provides important information on group differences in prevalence and patterns of substance use in a community sample of racially-diverse YMSM. Few studies have examined substance use in this population with as comprehensive a profile of substances, and we were able to examine lifetime and recent use of cigarettes, alcohol and binge drinking, and various illicit drugs. On average, lifetime prevalence of substance use was not substantially higher than the 12th grade males in the 2011 YRBS sample and was comparable to or lower than a previous study of older YMSM. Furthermore, we provide novel information on patterns of substance use, and we identified three main groups of substance users (polysubstance users, alcohol and marijuana users, and low marijuana users) that differ in terms of age and racial composition. With these findings in mind, future research should strive to identify the unique factors that predict substance use among racially diverse YMSM, as well as the negative sequelae of these various patterns of use.

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REFERENCES

Agrawal A, Lynskey MT, Madden PA, Bucholz KK, Heath AC. A latent class analysis of illicit drug abuse/dependence: results from the National Epidemiological Survey on Alcohol and Related Conditions. Addiction. 2007; 102:94–104. [PubMed: 17207127]

Austin SB, Ziyadeh N, Fisher LB, Kahn JA, Colditz GA, Frazier AL. Sexual orientation and tobacco use in a cohort study of US adolescent girls and boys. Arch. Pediatr. Adolesc. Med. 2004; 158:317–322. [PubMed: 15066869]

Brener ND, Kann L, Kinchen S, Grunbaum JA, Whalen L, Eaton DK, Hawkins J, Ross JG. Methodology of the Youth Risk Behavior Surveillance System. MMWR. 2004; 53:1–13. [PubMed: 15385915]

Busseri MA, Willoughby T, Chalmers H, Bogaert AF. On the association between sexual attraction and adolescent risk behavior involvement: examining mediation and moderation. Dev. Psychol. 2008; 44:69–80. [PubMed: 18194006]

Catalano RF, Morrison DM, Wells EA, Gillmore MR, Iritani B, Hawkins JD. Ethnic differences in family factors related to early drug initiation. J. Stud. Alcohol. 1992; 53:208–217. [PubMed: 1285743]

Centers for Disease Control and Prevention. 2009 National YRBS Data Users Manual. Atlanta, GA: CDC; 2009.

Clatts MC, Goldsamt LA, Yi H. Club drug use among young men who have sex with men in NYC: a preliminary epidemiological profile. Subst. Use Misuse. 2005; 40:1317–1330. [PubMed: 16048819]

Corliss HL, Rosario M, Wypij D, Wylie SA, Frazier AL, Austin SB. Sexual orientation and drug use in a longitudinal cohort study of U.S. adolescents. Addict. Behav. 2010; 35:517–521. [PubMed: 20061091]

Corliss HL, Wadler BM, Jun HJ, Rosario M, Wypij D, Frazier AL, Austin SB. Sexual-orientation disparities in cigarette smoking in a longitudinal cohort study of adolescents. Nicotine Tob. Res. 2013; 15:213–222. [PubMed: 22581940]

Eliason MJ. The prevalence and nature of biphobia in heterosexual undergraduate students. Arch. Sex. Behav. 1997; 26:317–326. [PubMed: 9146816]

Garofalo R, Mustanski BS, McKirnan DJ, Herrick A, Donenberg GR. Methamphetamine and young men who have sex with men: understanding patterns and correlates of use and the association with HIV-related sexual risk. Arch. Pediatr. Adolesc. Med. 2007; 161:591–596. [PubMed: 17548765]

Garofalo R, Wolf RC, Kessel S, Palfrey SJ, DuRant RH. The association between health risk behaviors and sexual orientation among a school-based sample of adolescents. Pediatrics. 1998; 101:895–902. [PubMed: 9565422]

Gillmore MR, Catalano RF, Morrison DM, Wells EA, Iritani B, Hawkins JD. Racial differences in acceptability and availability of drugs and early initiation of substance use. Am. J. Drug Alcohol Abuse. 1990; 16:185–206. [PubMed: 2288320]

Hatzenbuehler ML, Corbin WR, Fromme K. Trajectories and determinants of alcohol use among LGB young adults and their heterosexual peers: results from a prospective study. Dev. Psychol. 2008; 44:81–90. [PubMed: 18194007]

Heckathorn DD. Respondent-driven sampling: a new approach to the study of hidden populations. Soc. Probl. 1997; 44:174–200.

Jung T, Wickrama KAS. An introduction to latent class growth analysis and growth mixture modeling. Soc. Personal Psychol. Compass. 2008; 2:302–317.

Kelly BC, Parsons JT, Wells BE. Prevalence and predictors of club drug use among club-going young adults in New York city. J. Urban Health. 2006; 83:884–895. [PubMed: 16937088]

Kipke MD, Weiss G, Ramirez M, Dorey F, Ritt-Olson A, Iverson E, Ford W. Club drug use in los angeles among young men who have sex with men. Subst. Use Misuse. 2007; 42:1723–1743. [PubMed: 17934992]

Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance use in lesbian, gay and bisexual youth and heterosexual youth. Addiction. 2009; 104:974–981. [PubMed: 19344440]

McCabe SE, Hughes TL, Boyd CJ. Substance use and misuse: are bisexual women at greater risk? J. Psychoactive Drugs. 2007; 36:217–225. [PubMed: 15369203]

Monga N, Rehm J, Fischer B, Brissette S, Bruneau J, El-Guebaly N, Noel L, Tyndall M, Wild C, Leri F, Fallu JS, Bahl S. Using latent class analysis (LCA) to analyze patterns of drug use in a population of illegal opioid users. Drug Alcohol Depend. 2007; 88:1–8. [PubMed: 17049753]

Mustanski B. Ethical and regulatory issues with conducting sexuality research with LGBT adolescents: a call to action for a scientifically informed approach. Arch. Sex. Behav. 2011; 40:673–686. [PubMed: 21528402]

Muthen, BO.; Muthen, L. The Comprehensive Modeling Program for Applied Researchers. Los Angeles, CA: User's guide. Muthen & Muthen; 1998. Mplus software.

Newcomb ME, Birkett M, Corliss HL, Mustanski B. Sexual orientation, gender, and racial differences in illicit drug use in a sample of US high school students. Am. J. Public Health. 2014; 104:304–310. [PubMed: 24328653]

Newcomb ME, Clerkin EM, Mustanski B. Sensation seeking moderates the effects of alcohol and drug use prior to sex on sexual risk in young men who have sex with men. AIDS Behav. 2011; 15:565–575. [PubMed: 20960048]

Newcomb ME, Heinz AJ, Birkett M, Mustanski B. A longitudinal examination of risk and protective factors for cigarette smoking among lesbian, gay, bisexual, and transgender youth. J. Adolesc. Health. 2013

Newcomb ME, Heinz AJ, Mustanski B. Examining risk and protective factors for alcohol use in lesbian, gay, bisexual, and transgender youth: a longitudinal multilevel analysis. J. Stud. Alcohol Drugs. 2012; 73:783–793. [PubMed: 22846242]

National Institute on Alcohol Abuse and Alcoholism. Recommended Alcohol Questions. Task Force on Recommended Alcohol Questions. National Institutes of Health, U.S. Department of Health and Human Services; 2003. http://www.niaaa.nih.gov/research/guidelines-and-resources/recommended-alcoholquestions

National Institute on Drug Abuse. Monitoring the Future National Results on Adolescent Drug Use: Overview of Key Findings. Bethesda, MD: 2009.

National Institute on Drug Abuse. Commonly Abused Drugs. National Insitutes of Health, U.S. Department of Health and Human Services; 2011. http://www.drugabuse.gov/sites/default/files/cadchart_2.pdf

Ramo DE, Grov C, Delucchi K, Kelly BC, Parsons JT. Typology of club drug use among young adults recruited using time-space sampling. Drug Alcohol Depend. 2010; 107:119–127. [PubMed: 19939585]

Russell ST, Driscoll AK, Truong N. Adolescent same-sex romantic attractions and relationships: implications for substance use and abuse. Am. J. Public Health. 2002; 92:198–202. [PubMed: 11818291]

Substance Abuse and Mental Health Services Administration. National Survey on Drug Use and Health: state estimates of past year methamphetamine use. 2006. Retrieved October 15, 2013, from http://www.samhsa.gov/data/2k6/stateMeth/stateMeth.htm

Substance Abuse and Mental Health Services Administration. Results from the 2011 National Survey on Drug Use and Health: summary of national findings. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2012.

Shin SH, Hong HG, Hazen AL. Childhood sexual abuse and adolescent substance use: a latent class analysis. Drug Alcohol Depend. 2010; 109:226–235. [PubMed: 20197217]

Smith GW, Farrell M, Bunting BP, Houston JE, Shevlin M. Patterns of polydrug use in Great Britain: findings from a national household population survey. Drug Alcohol Depend. 2011; 113:222–228. [PubMed: 20863629]

Squeglia LM, Jacobus J, Tapert SF. The influence of substance use on adolescent brain development. Clin. EEG Neurosci. 2009; 40:31–38. [PubMed: 19278130]

Traube DE, Schrager SM, Holloway IW, Weiss G, Kipke MD. Environmental risk, social cognition, and drug use among young men who have sex with men: longitudinal effects of minority status on health processes and outcomes. Drug Alcohol Depend. 2013; 127:1–7. [PubMed: 22749680]

Tucker JS, Ellickson PL, Klein DJ. Understanding differences in substance use among bisexual and heterosexual young women. Womens Health Iss. 2008; 18:387–398.

Wallace JM Jr, Bachman JG, O'Malley PM, Schulenberg JE, Cooper SM, Johnston LD. Gender and ethnic differences in smoking, drinking and illicit drug use among American 8th, 10th and 12th grade students, 1976–2000. Addiction. 2003; 98:225–234. [PubMed: 12534428]

World Health Organization. The World Health Report, 2010. Geneva, Switzerland: World Health Organization; 2010.

Wong CF, Kipke MD, Weiss G. Risk factors for alcohol use, frequent use, and binge drinking among young men who have sex with men. Addict. Behav. 2008; 33:1012–1020. [PubMed: 18495364]

Wong CF, Weiss G, Ayala G, Kipke MD. Harassment, discrimination, violence, and illicit drug use among young men who have sex with men. AIDS Educ. Prev. 2010; 22:286–298. [PubMed: 20707690]

Zeigler DW, Wang CC, Yoast RA, Dickinson BD, McCaffree MA, Robinowitz CB, Sterling ML. The neurocognitive effects of alcohol on adolescents and college students. Prev. Med. 2005; 40:23–32. [PubMed: 15530577]

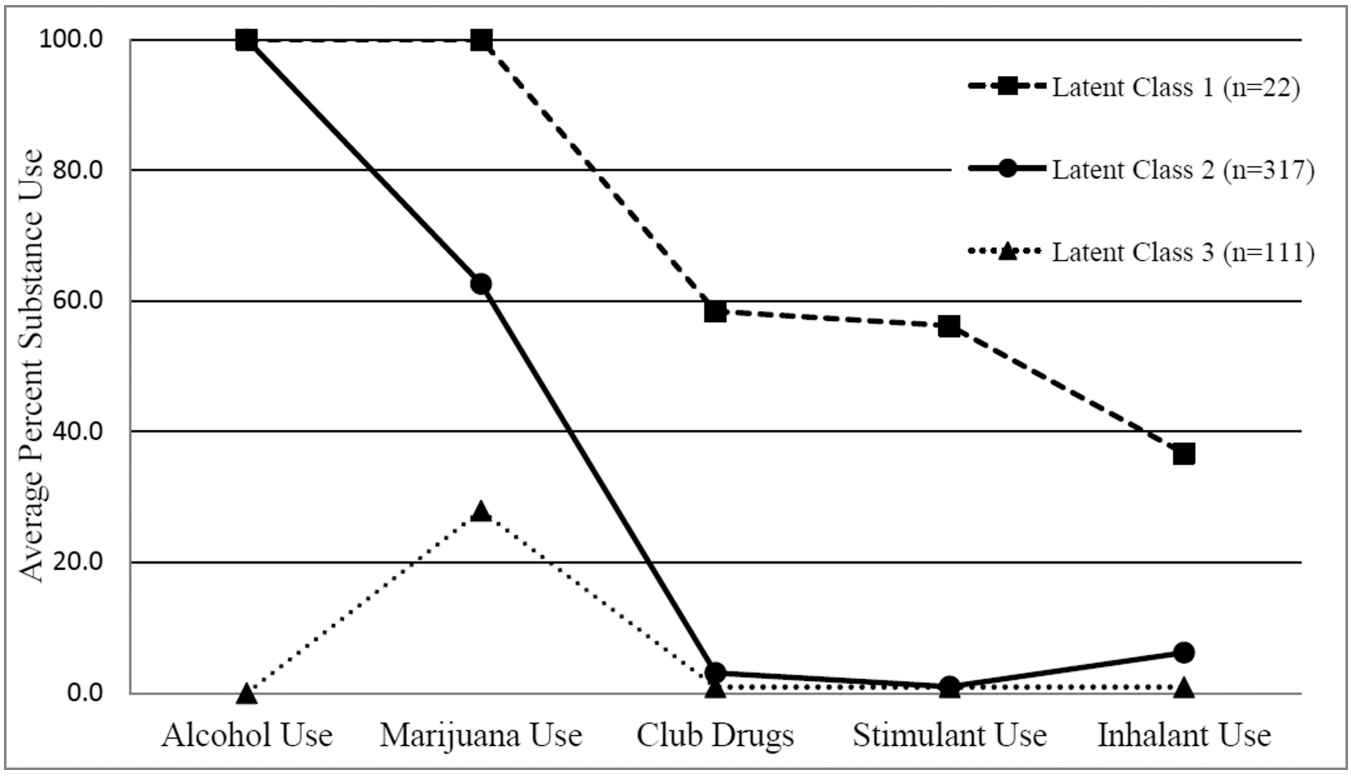

Figure 1.
Patterns of Past Six Month Substance Use in Young Men Who Have Sex with Men Across Three Latent Classes

Table 1

Demographic Description and Frequency of Lifetime and Recent Substance Use in Young Men Who Have Sex with Men Aged 16–20 Years, 2009–2013

Demographics	***N* (%)**
Age (*M* = 18.9, *SD* = 1.3)	
Less than 18	116 (25.8)
18 or older	334 (74.2)
Race/Ethnicity	
Black/African American	240 (53.3)
Hispanic/Latino	90 (20.0)
White	81 (18.0)
Other	39 (8.7)
Sexual Orientation	
Only Gay/Homosexual	226 (50.2)
Mostly Gay/Homosexual	103 (22.9)
Bisexual	96 (21.3)
Mostly Heterosexual	11 (2.4)
Only Heterosexual	3 (0.7)
Other	11 (2.4)
Living Situation	
Living with Parents	233 (51.8)
Other Stable Housing	188 (41.8)
Unstable Housing	29 (6.4)
Highest Education	
Less than High School	174 (38.7)
High School or GED	120 (26.7)
Greater than High School	156 (34.7)

Substance Use	Lifetime Use, % (SE)	Recent Use*, % (SE)
Cigarettes	44.9 (2.3)	37.3 (2.3)
Alcohol	82.4 (1.8)	75.3 (2.0)
Binge-drinking	--	50.0 (2.4)
Marijuana	65.3 (2.2)	56.2 (2.3)
Cocaine	6.2 (1.1)	3.3 (0.8)
Methamphetamine	1.1 (0.5)	0.7 (0.4)
Rx Stimulants	7.8 (1.3)	6.9 (1.2)
Rx Depressants	7.3 (1.2)	4.2 (0.9)
Heroin	0.7 (0.4)	0.4 (0.3)
Other Opiates	3.8 (0.9)	2.4 (0.7)
MDMA	9.1 (1.4)	5.8 (1.1)
Psychedelics	6.2 (1.1)	4.0 (0.9)

Demographics		***N* (%)**
GHB	0.4 (0.3)	0.2 (0.2)
Ketamine	1.3 (0.5)	1.1 (0.5)
Inhalants	5.1 (1.0)	2.4 (0.7)
Poppers	6.7 (1.2)	5.3 (1.1)
Viagra	1.1 (0.5)	0.7 (0.4)
Anabolic Steroids	0.4 (0.3)	0.2 (0.2)

Polysubstance Use	Lifetime Use, %	6 Month Use, %
No Substance Use	12.9	17.6
Alcohol only	18.7	22.7
Marijuana only	3.8	6.4
Other Illicit Drugs Only	0.2	0.2
Alcohol+Marijuana	40.4	35.1
Alcohol+Other Illicit Drugs	2.9	3.3
Marijuana+ Other Illicit Drugs	0.7	0.4
Alcohol+Marijuana+Other Illicit Drugs	20.4	14.2

NOTE: Rx = prescription.

*Recent substance use is defined as any use in the past 6 months for all drug categories except cigarettes, which defines recent use as any use in the past 30 days.

Table 2

Age of Onset of Substance Use in Young Men Who Have Sex with Men Aged 16–20 Years, 2009–2013

	< 13 years N (%)	13 – 14 years N (%)	15 – 16 years N (%)	> 16 years N (%)
Alcohol	57 (15.4)	72 (19.4)	125 (33.7)	117 (31.5)
Binge Drinking	-	-	-	-
Cigarette	26 (12.9)	33 (16.3)	72 (35.6)	71 (35.1)
Marijuana	24 (8.2)	56 (19.0)	108 (36.7)	106 (36.1)
Cocaine	2 (7.1)	1 (3.6)	7 (25.0)	18 (64.3)
Heroin	2 (66.7)	0 (0.0)	0 (0.0)	1 (33.3)
Methamphetamines	1 (20.0)	0 (0.0)	1 (20.0)	3 (60.0)
Opiates	1 (5.9)	0 (0.0)	2 (11.8)	14 (82.4)
Rx Depressants	2 (6.1)	3 (9.1)	11 (33.3)	17 (51.5)
Rx Stimulants	1 (2.9)	0 (0.0)	9 (25.7)	25 (71.4)
Psychedelics	1 (3.6)	1 (3.6)	3 (10.7)	23 (82.1)
MDMA	0 (0.0)	4 (9.8)	12 (29.3)	25 (61.0)
GHB	0 (0.0)	1 (50.0)	0 (0.0)	1 (50.0)
Ketamine	0 (0.0)	0 (0.0)	2 (33.3)	4 (66.7)
Inhalants	5 (21.7)	7 (30.4)	8 (34.8)	3 (13.0)
Anabolic Steroids	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)
Viagra	1 (20.0)	0 (0.0)	1 (20.0)	3 (60.0)
Poppers	1 (3.3)	0 (0.0)	7 (23.3)	22 (73.3)

NOTE: This table presents data on age of onset of multiple substances. Percentages were calculated as the percent of the total number of participants who reported ever using each substance. Participants who did not endorse using a substance are not included in the percentage. Rx = prescription

Table 3

Adjusted Odds Ratios (AORs) for Demographic Correlates of Substance Use in Young Men Who Have Sex with Men Aged 16–20 Years, 2009–2013

	Substance Use, Past 6 Months						
	Cigarette (Past 30 Days), AOR (95% CI)	**Alcohol, AOR (95% CI)**	**Binge-Drinking, AOR (95% CI)**	**Marijuana, AOR (95% CI)**	**Stimulants, AOR (95% CI)**	**Club Drugs, AOR (95% CI)**	**Inhalants, AOR (95% CI)**
Race (White ref)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Black/AA	0.39 (0.23,0.66)*	0.24 (0.11,0.53)*	0.27 (0.16,0.48)*	0.61 (0.36,1.05)	0.07 (0.02,0.27)*	0.19 (0.07,0.49)*	0.25 (0.08,0.78)*
Hispanic/Latino	1.01 (0.55,1.86)	0.34 (0.14,0.84)*	0.57 (0.30,1.08)	0.49 (0.26,0.92)*	0.44 (0.15,1.30)	0.26 (0.08,0.92)*	2.13 (0.82,5.52)
Other	0.90 (0.42,1.95)	0.39 (0.13,1.16)	0.49 (0.22,1.08)	0.72 (0.33,1.60)	0.24 (0.04,1.35)	0.33 (0.08,1.43)	1.31 (0.38,4.54)
Sexual Orientation (Gay/Mostly Gay ref)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bisexual	1.64 (0.99,2.68)	0.81 (0.48,1.37)	0.93 (0.58,1.51)	1.09 (0.68,1.75)	3.07 (1.02,9.24)*	2.24 (0.80,6.24)	0.96 (0.33,2.81)
Hetero/Other	0.93 (0.38,2.27)	0.61 (0.25,1.51)	0.91 (0.39,2.14)	0.80 (0.35,1.83)	1.66 (0.27,10.22)	4.31 (1.27,14.59)*	1.69 (0.40,7.18)
Age	1.13 (0.97,1.32)	1.14 (0.96,1.35)	1.20 (1.03,1.39)*	1.07 (0.93,1.24)	1.20 (0.83,1.74)	1.78 (1.21,2.62)*	1.25 (0.92,1.70)

NOTE: AOR = adjusted odds ratio. ref = reference. AA = African American.

*$p<.05$.

Table 4

Latent Class Model Fit Statistics

			LMR-LRT			BLRT		
	BIC-adjusted	**Entropy**	**2x LL Diff.**	**df**	***p*-value**	**2x LL Diff.**	**df**	***p*-value**
1 Class	1710.9	-	-	-	-	-	-	-
2 Class	1636.1	0.49	92.47	6	<.001	92.47	6	<.001
3 Class	1621.5	0.92	32.13	6	<.001	32.13	6	<.001
4 Class	1634.9	0.83	4.27	6	0.14	4.27	6	1.00