# Individual trajectories of substance use in lesbian, gay and bisexual youth and heterosexual youth

## Michael P. Marshal[1,2,3], Mark S. Friedman[2,3], Ron Stall[2,3] & Amanda L. Thompson[4]

Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA,[1] Department of Behavioral and Community Health Sciences, Graduate School of Public Health,[2] University of Pittsburgh, Pittsburgh, PA, USA, Center for Research on Health and Sexual Orientation, University of Pittsburgh Graduate School of Public Health, Pittsburgh PA, USA[3] and Nationwide Children's Hospital, Columbus, OH, USA[4]

## ABSTRACT

**Aims**   Several decades of research have shown that lesbian, gay and bisexual (LGB) adults are at high risk for substance use and substance use disorders, and a recent meta-analysis shows that these disparities most probably begin in adolescence; however, no studies to date have examined longitudinal growth in substance use in LGB youth and heterosexual youth to determine if they follow different trajectories into young adulthood. The primary aims of this paper were to estimate individual trajectories of substance use in youth and examine differences between self-identified LGB and heterosexual subsamples. **Method**   A school-based, longitudinal study of health-related behaviors of adolescents and their outcomes in young adulthood was used to test our hypotheses (The National Longitudinal Study of Adolescent Health). Participants were included if they were interviewed at all three waves and were not missing information regarding self-identified sexual orientation ($n = 10\,670$). **Results**   Latent curve models (LCMs) showed that LGB identity was associated significantly with individual variability in substance use intercepts and slopes, above and beyond age, race and gender. Self-identified LGB youth reported higher initial rates of substance use and on average their substance use increased over time more rapidly than did substance use by heterosexual youth. Two other indicators of sexual orientation (same-sex romantic attraction and same-sex sexual behavior) were also associated with substance use trajectories, and differential results were found for youth who identified as 'mostly heterosexual' and bisexual compared with youth who identified as completely heterosexual or homosexual. **Conclusions**   Sexual orientation is an important risk marker for growth in adolescent substance use, and the disparity between LGB and heterosexual adolescents increases as they transition into young adulthood. More research is needed in order to examine: causal mechanisms, protective factors, important age-related trends (using a cohort-sequential design), the influence of gay-related developmental milestones, curvilinear effects over time and long-term health outcomes.

**Keywords**   Bisexual, gay, lesbian, longitudinal, substance use, youth.

## INTRODUCTION

Several decades of research have shown that lesbian, gay and bisexual (LGB) adults are at higher risk for substance use and abuse [1–3], and minority stress theory suggests that disparities exist due to experiences with discrimination, victimization and oppression that are prevalent due to a pervasive homophobic culture [4]. A recent meta-analysis of 18 studies showed that sexual minority youth were anywhere from two to five times more likely to use drugs and alcohol than heterosexual youth [5]. Despite these relatively robust findings, this review also showed that the literature is characterized by multiple methodological limitations, including a dearth of longitudinal studies that examine change in substance use over time during this critical, high-risk period of adolescent development. To our knowledge there are virtually no studies that compare longitudinal trajectories of substance use between LGB and heterosexual adolescents. This was the primary goal of this study.

Examining substance use trajectories between LBG and heterosexual youth can be an important first step in

demonstrating that for many LGB adults, substance use disparities did indeed begin in adolescence. Most studies of LGB adults and youth are cross-sectional, which provide good developmental 'snapshots', but provide no evidence of a bridge linking adolescent substance use to young adult substance use and beyond. Researchers and clinicians can only infer that youth who are using substances continue to use at higher rates and thus are at higher risk for developing substance use disorders and comorbid psychopathology in adulthood. This inference is important to test, because the current cross-sectional literature may be a reflection of developmentally limited 'bursts' in substance use behaviors due to psychosocial, contextual or cultural factors. For example, substance use in LGB teenagers may be a response to increased stress during the 'coming out' process (i.e. when sexual identity begins to solidify and youth decide to disclose their LGB sexual orientation with others).

The term 'syndemics' is defined by the Center for Disease Control's Syndemics Prevention Network as 'two or more afflictions, interacting synergistically, contributing to excess burden of disease in a population' [6]. Syndemic theory is one theoretical orientation that predicts that LGB stress events may begin early in life, when pressure to conform to heterosexual norms reaches its peak, and when any deviations from those norms are punished by teasing, bullying and perhaps other forms of victimization [7]. In young adulthood, however, significant disparities between LGB and heterosexual substance use may be explained by differential norms in social networking and community building. For example, LGB individuals may be more likely to frequent bars and clubs (that are often frequented by LGB patrons) as a means of seeking community affiliation and social support, thereby increasing their exposure to environments where drug and alcohol use behaviors are highly prevalent. By examining individual trajectories of substance use over time, we can examine whether or not these cross-sectional snapshots are reflective of time-limited events or an underlying developmental continuum of risk.

By examining individual change in substance use behaviors over time in LGB youth, we can corroborate and inform theoretical and empirical models of gay identity development and individual progression through important gay-related developmental milestones [8]. Such milestones might include awareness of one's attraction to the same sex, having sexual relations with a same-sex partner, deciding that one is gay and disclosing one's gay identity to others. Indeed, when these milestones are combined and conceptualized in a developmental framework, research shows that they can be associated with long-term mental health, gay-related victimization and human immunodeficiency virus status [9], as well as sub-
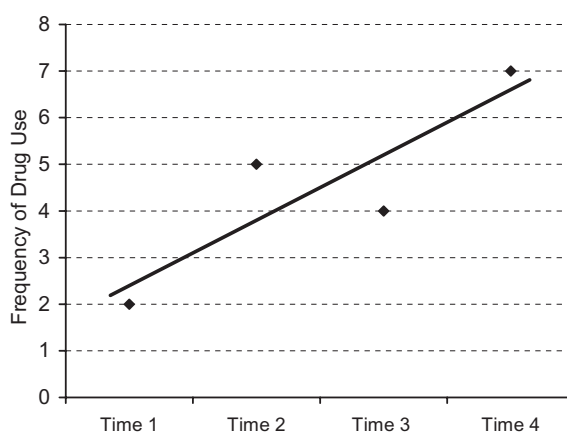


**Figure 1** Illustration of one subject's hypothetical trajectory of substance use over time using individual trajectory modeling

stance use in young adulthood. Thus, the most effective way to understand how gay-related development impacts the development of risk behaviors over time might be to understand first whether or not there are developmental differences in risk. Longitudinally examining growth in risky behavior such as such as substance use over time in LGB youth populations is an important first step in this process.

Finally, compared with traditional longitudinal data analysis methods that examine mean score differences across time, longitudinal trajectory modeling is a more intuitive approach to examining individual change over time and more appropriate for modeling developmental processes, by mapping more directly onto theoretical paradigms that are often person-centered accounts of longitudinal pathways [10,11]. This is accomplished by analyzing longitudinal data with three or more waves of data, estimating a best-fitting line through each individual's data points (see Fig. 1), and using the characteristics of these lines (e.g. intercepts and slopes) to describe what risk and protective factors are correlated with behavior at a specific time-point (intercepts) and an individual's change in behavior over time (e.g. correlations between exogenous variables and the slope value of a person's best-fitting line). Although there are no studies that examine growth in substance use in LGB youth in this way, two important longitudinal papers serve as precursors to the current study. First, Russell *et al.* (2002) found that same-sex attraction predicted increases in some adolescent substance use behaviors across waves I and II of the Add Health study [12]. Secondly, only one other study to our knowledge has examined trajectories of alcohol use in LGB populations, showing that trajectories of alcohol use in young college men who have sex with men (MSM) increased more sharply during their first year than for heterosexual men [13]. Thanks to the seminal contributions of these studies and others that

have investigated LGB youth development over the past 20 years [14–20], the LGB research literature has reached a point where much can be learned from examining developmental processes in LGB youth using longitudinal statistical analysis approaches such as latent curve modeling (LCM).

There were three primary goals of this study: (i) to estimate trajectories of substance use (alcohol, cigarettes, marijuana) and examine the overall mean trajectories to determine the average initial level of use (the average intercept) and whether or not, on average, there was significant change over time in use (average slope); (ii) to examine whether or not there were significant individual differences (variability across individuals) in the intercepts and slopes; and (iii) to test whether or not self-identified sexual orientation was associated with substance use intercepts and slopes. These are recommended first steps when characterizing and understanding developmental processes using the longitudinal LCM framework [21] and therefore are an appropriate starting point when examining trajectories in a high-risk (LGB) sample for the first time. We hypothesized that LGB youth would report higher initial rates of use and sharper increases in use over time.

We had two secondary research goals. First, a small but growing set of studies has examined substance use differences between lesbian/gay, bisexual and a 'mostly heterosexual' youth compared with completely heterosexual youth. Results from our recent meta-analysis [5] supported a growing trend in the literature showing that the average effect size for bisexual youth is significantly larger than the average effect size found for youth who identify exclusively as lesbian or gay. Another recent line of research has shown that youth who identify as 'mostly heterosexual'—those who endorse being attracted to opposite sex partners but also 'somewhat' attracted to same-sex partners—are also at significant risk for substance use and other mental health disparities [14,22]. Thus, our first exploratory goal was to estimate and compare trajectories of substance use for each of these self-identified subgroups: lesbian/gay, bisexual, mostly heterosexual and completely heterosexual.

Secondly, in the gay studies literature, sexual orientation has been defined and operationalized in three primary ways: (i) self-identification, which refers to choosing to label oneself as lesbian, gay or bisexual; (ii) same-sex attraction, which refers to experiencing and endorsing same-sex romantic or sexual attractions; and (iii) same-sex behavior, which refers to engaging in and reporting sexual activity with a member of the same sex. Only recently have researchers begun to study these different dimensions systematically [23–25], and results from our recent meta-analysis of cross-sectional studies showed that the association between sexual orientation

and adolescent substance use was strongest when studies operationalized sexual orientation using self-identification methods [5]. Thus, for the purposes of this paper, we hypothesized that self-identification would be associated with substance use trajectories in youth. However, we also conducted two additional sets of exploratory analyses to examine the association between same-sex attraction and behavior with substance use trajectories.

## METHOD

### Study design

The National Longitudinal Study of Adolescent Health (Add Health) is a school-based, longitudinal study of the health-related behaviors of adolescents and their outcomes in young adulthood [26,27]. A sample of 80 high schools and 52 middle schools from the United States was selected with unequal probability of selection. Incorporating systematic sampling methods and implicit stratification into the Add Health study design ensured that this sample is representative of US schools with respect to region of country, urbanicity, school size, school type and ethnicity. Beginning with an in-school questionnaire administered to students in grades 7–12, the study follows-up with a series of in-home interviews of students approximately 1, 2 and 6 years later. Participants used for the current analyses ($n = 10\ 670$) include those who participated in all three in-home interviews and did not having missing data on the sexual orientation item administered in wave III (described below). Descriptive statistics are reported in Table 1.

### Measures

#### Demographic characteristics

Adolescent participants at wave 1 reported their age (in years), gender (0 = female, 1 = male), ethnicity (0 = Hispanic, 1 = non-Hispanic) and race, such that racial minorities (black/African American, American Indian/Native American, Asian/Pacific Islander and 'other') were coded '0', and white was coded '1'.

#### Sexual orientation

Three measures of sexual orientation were examined. Self-identified sexual orientation was measured at wave III, with a single item which asked respondents to 'Please choose the description that best fits how you think about yourself'. Response options were '100% heterosexual (straight)', 'mostly heterosexual (straight) but somewhat attracted to people of your own sex', 'bisexual—that is, attracted to men and women equally', 'mostly homosexual (gay), but somewhat attracted to people of the

**Table 1** Descriptive statistics for demographic and sexual orientation variables.

| *Self-identified sexual orientation (wave III)* | *Heterosexual* (n = 9616) | *Mostly heterosexual* (n = 716) | *Bisexual* (n = 177) | *Mostly gay or completely gay* (n = 161) | *Total* (n = 10 670) |
|---|---|---|---|---|---|
| Wave 1 age (years; SD) | 15.8 (1.6) | 15.7 (1.6) | 15.5 (1.5) | 15.9 (1.6) | 15.8 (1.6) |
| Gender (% female) | 50.6 | 77.0 | 82.5 | 38.5 | 52.7 |
| Race (% non-white) | 40.6 | 33.0 | 35.0 | 42.5 | 40.0 |
| Ethnicity (% Hispanic) | 15.9 | 14.5 | 19.2 | 21.1 | 15.9 |
| Wave III same-sex attraction (%) | 2.7 | 54.9 | 93.8 | 99.4 | 9.2 |
| Any history of same-sex sexual behavior (%) | 0.9 | 4.2 | 29.9 | 73.9 | 2.7 |

Non-white race categories included 'Black or African American', 'American Indian or Native American', 'Asian or Pacific Islander' and 'Other'. SD: standard deviation.

opposite sex' and '100% homosexual (gay)'. This variable was used in two ways. First, it was dichotomized in order to compare youth who reported being 'completely heterosexual' to youth who reported any same-sex orientation (i.e. those ranging from 'mostly heterosexual' to 'completely gay'). Secondly, respondents were grouped into four categories in order to explore trajectories of substance use in each group: (i) completely heterosexual; (ii) mostly heterosexual; (iii) bisexual; (iv) mostly gay or completely gay. Same-sex romantic attraction was measured at wave III with one dichotomous variable for each gender: 'Have you ever had a romantic attraction to a [male/female]?'. Participants were assigned a 1 ('yes') if they reported any same-sex attraction and a 0 ('no') if they reported none. Same-sex sexual behavior was measured at wave III. This variable was constructed using several items from the 'Romantic Relationships Roster', which assessed the life-time history of: (i) number of romantic partners; (ii) the sex of each of those partners; and (iii) whether or not they engaged in sexual relations with each partner (yes/no) which was operationalized for the respondents as: 'vaginal intercourse (a man inserts his penis into a woman's vagina), oral sex (a person puts his or her mouth on another person's sex organs) or anal sex (a man inserts his penis in to his partner's anus or asshole)'. Thus, participants were assigned a 1 ('yes') if they had ever had a same-sex romantic partner with whom they had sexual relations and 0 ('no') if they had never had a same-sex romantic partner with whom they had sexual relations.

*Substance use*

Three substance use items (one at each wave) were used as indicator variables in five separate latent curve models, one for each variable of interest (frequency of alcohol use, binge drinking, drunkenness, cigarette use and marijuana use). Indicator variables were chosen if the wording in each item and response scales was identical across waves I–III. Some drugs were not used as outcome variables because there was not enough variability in the responses (e.g. cocaine, injection drugs). Frequency of alcohol use was operationalized as: 'During the past 12 months, on how many days did you drink alcohol?'. Binge drinking was operationalized as: 'Over the past 12 months, on how many days did you drink five or more drinks in a row?'. Drunkenness was operationalized as: 'Over the past 12 months, on how many days have you gotten drunk or "very, very high" on alcohol?'. The seven-point Likert response scale for alcohol items ranged from '0' (never) to '7' (every day to almost every day). Drug use items included frequency of cigarette use ('In the past 30 days, on how many days did you smoke cigarettes?') and marijuana use ('In the past 30 days, how many times did you smoke cigarettes?'). The response scale for these items ranged from 0 to 300. A small handful of respondents reported smoking marijuana more than 300 times in 30 days, which seemed excessive, therefore we recoded these few cases (<10) at waves II and III to be 300.

The data analysis proceeded in several steps. First, descriptive statistics of the demographic and same-sex attraction and behavior variables were conducted for each of the self-identified sexual orientation groups. Secondly, using LCM we estimated and described individual trajectories for all participants and tested whether or not the overall mean intercepts and slopes were significantly different from zero. Thirdly, we tested whether or not there was significant variability (i.e. random effects) in the intercepts and slopes across participants. Fourthly, we tested the association between self-identified sexual orientation and the intercepts and slopes, above and beyond wave I covariates including age, race, ethnicity and gender. Finally, we conducted three additional sets of analyses in order to explore the association between substance use trajectories and: (i) gay, bisexual and mostly heterosexual subgroups; (ii) same-sex attraction; and (iii) same-sex behavior.

## RESULTS

LCM models were estimated using Mplus software [28]. We estimated basic LCM models which amounted to a two-factor, three-indicator confirmatory factor analyses using the study wave as the metric of time where all the intercept factor loadings were fixed to 1, and the slope factors for waves I–III were fixed to 0, 1 and 6 (corresponding to the number of years distant from the first wave). Due to having only three time-points, only linear trajectories were estimated. Adopting a cohort sequential design [21,29], such that age was used as the metric of time, proved to be prohibitive due to the 5-year gap between waves II and III which introduced data sparseness in the intermediate years. We accounted for missing data on the indicator variables by using maximum-likelihood model estimation assuming ignorable missingness at random (missing data ranged from 0.1% to 2.5% across the 15 indicator variables and missingness was largely uncorrelated with the key sexual orientation variables). To handle skewness in the data more accurately, we used the maximum-likelihood with robust standard errors [multiple linear regression (MLR)] estimator for all models. We adjusted for the complex sampling design and interdependence of the data using procedures described by Stapleton (2005) [30].

Unconditional LCMs were estimated (prior to entering the sexual orientation variable and covariates) in order to accomplish the first two goals of the study. These results showed that the average intercept and slope for all four substance use outcome variables were significantly different from zero (all $Ps < 0.0001$), suggesting that on average at wave I participants reported at least some substance use, and on average their substance use increased over time. There was significant variability (individual differences) around the average intercepts and slopes (all $Ps < 0.0001$), suggesting that there are significant interindividual differences in trajectories over time, and that a random-effects method is appropriate for conceptualizing and modeling the proposed longitudinal processes.

The next step was to estimate conditional LCMs to examine the association between self-identified sexual orientation and trajectories of substance use above and beyond the covariates (see Fig. 2). These models showed that self-identified sexual orientation was associated significantly with higher initial rates of substance use on all substance use variables except marijuana use and drunkenness, and it was associated with steeper slopes on all substance use outcome variables except binge drinking (see Table 2).

We had two secondary goals. First, we compared different self-identified subgroups of sexual minority youth (completely/mostly gay, bisexual, mostly heterosexual) with completely heterosexual youth. Results revealed a
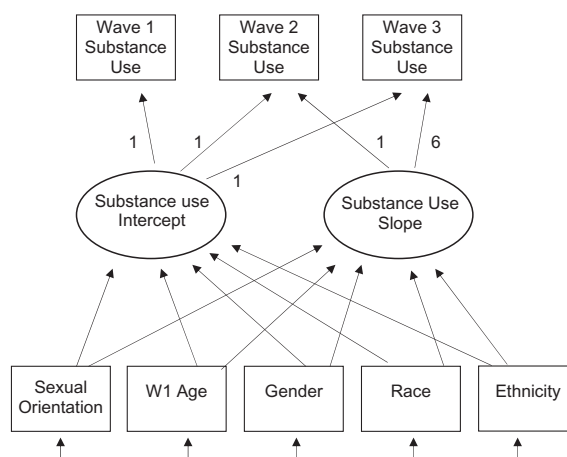


**Figure 2** Multivariate latent curve models (LCMs) testing the association between sexual orientation and substance use trajectories above and beyond covariates
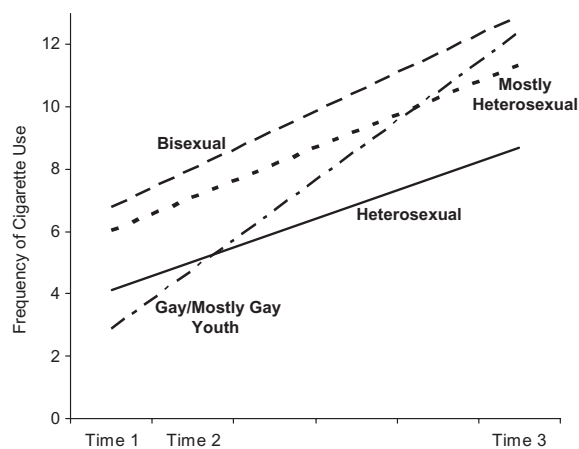


**Figure 3** Average cigarette use trajectories for lesbian, gay and bisexual (LGB) youth and heterosexual youth

fairly consistent pattern of effects across outcome variables such that the mostly heterosexual group and the bisexual group reported higher initial rates of use (intercepts) which stayed consistently higher over time than the heterosexual group (see Table 2, Model 2). The mostly/completely gay subgroup reported having similar initial rates of use but accelerated rates of growth in use compared with the heterosexual group (see Fig. 3). Secondly, we examined the association between a history of same-sex attraction and same-sex sexual behavior with substance use trajectories (Table 2, Models 3 and 4). Two notable patterns emerged. Results showed that all three sexual orientation variables were associated with sharper growth in cigarette and marijuana use. Also, same-sex sexual behavior was associated significantly with growth in substance use over time (slopes) on all outcome variables but not with initial rates of use (intercepts).

**Table 2** Multivariate latent curve models (LCMs) testing the association between three different sexual orientation measures and drug use trajectories controlling for covariates (*n* = 10 670).

| | Alcohol use | | Binge drinking | | Drunkenness | | Cigarette use | | Marijuana use | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Intercept | Slope | Intercept | Slope | Intercept | Slope | Intercept | Slope | Intercept | Slope |
| Model 1 | | | | | | | | | | |
| Self-identified sexual orientation | 0.19*** | 0.05*** | 0.12** | 0.03 | 0.04 | 0.38*** | 1.33** | 0.29** | 0.58 | 0.49*** |
| Model 2 | | | | | | | | | | |
| Mostly heterosexual[a] | 0.22** | 0.04 | 0.17** | 0.02 | 0.18** | 0.03 | 1.67** | 0.17 | 0.99 | 0.48*** |
| Bisexual | 0.32* | 0.03 | 0.23* | 0.04 | 0.28** | 0.03 | 2.44** | 0.30 | 0.77 | 0.65** |
| Mostly/completely gay | −0.09 | 0.12*** | −0.17 | 0.08* | −0.24** | 0.13*** | −1.31 | 0.80** | −0.132 | 0.36 |
| Model 3 | | | | | | | | | | |
| Same-sex romantic attraction | 0.21*** | 0.03 | 0.15** | 0.02 | 0.06** | 0.03 | 1.43** | 0.47*** | 0.79 | 0.43** |
| Model 4 | | | | | | | | | | |
| Same-sex sexual behavior | 0.08 | 0.08** | −0.10 | 0.07** | −0.03 | 0.08** | −0.06 | 0.55* | −0.68 | 0.67* |

[a]Completely heterosexual youth was used as the reference group. Model fit was assessed using suggested guidelines proposed by Hu & Bentler 1999 [32]. All models met their suggested criteria for comparative fit index (>0.95), Tucker–Lewis Index (>0.95), root mean square error of approximation (<0.05) and standardized root mean residual (<0.05). Coefficients for the covariates gender, race, ethnicity, and wave I age not shown. *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

## DISCUSSION

This study showed that LGB youth reported higher rates of substance use in adolescence, as well as rates of use that increased faster over time than rates reported by heterosexual youth. These results provide evidence to suggest that substance use disparities in LGB youth reported by previous cross-sectional studies [5] were most probably not due to temporary 'bursts' or increases in substance use that might be explained (spuriously) by time-limited developmental stages unique to LGB youth (e.g. associated with the coming-out process). Indeed, these results suggest that early in life a significant proportion of LGB youth are on a high-risk substance use trajectory that extends well into young adulthood and is different from the trajectories of heterosexual youth. Questions remain, therefore, about the underlying mechanism that may be responsible for these growing disparities. A recent theory of syndemic production focused on the development of health problems in LGB adults suggests that for many LGB individuals gay-related stressors such as harassment and discrimination begin very early in life and continue throughout the life course [6]. Whether it be teasing or bullying by peers in school, daring to attend the gay prom, legal discrimination by prospective employers or government-sponsored discrimination against same-sex marriages, sexual minority individuals face significant personal and social barriers at seemingly every developmental stage of life. Thus, it may be that persistent psychosocial stress associated with this discrimination and inequality is a significant underlying causal mechanism of life-long health disparities (including substance use) that many LGB individuals face.

Results of the present study also suggest that prevention efforts aimed at reducing risk for substance use and other mental health problems in LGB youth could have long-lasting effects that extend into young adulthood. Although designing a successful intervention program for substance use in LGB youth would be challenging due to the dearth of empirically identified mediators and moderators of risk, a body of evidence is growing. For example, one study found that the association between sexual orientation and substance use was stronger for those youth who had been victimized (teased and bullied) by peers [19]. Furthermore, a few studies have found support for mediators of mental health outcomes in LGB-only samples [20,31]. The results of this study suggest that successful interventions in youth that managed to curb early substance use behavior might serve to reduce its long-term deleterious effects.

The results from our exploratory goals add some clarity to the literature regarding how sexual orientation should be operationalized and which subgroups of sexual minority youth are at risk. For example, all three measures of sexual orientation (identity, attraction, behavior) were associated with accelerated growth in rates of cigarette and marijuana use over time, suggesting that any or all of the three measures may be employed by clinicians and researchers who are interested in identifying at-risk youth. Secondly, there are differential patterns of use across time when examining trajectories among different subgroups of sexual minority youth. One notable pattern that is consistent with a growing literature on youth who identify as 'mostly heterosexual' [14,22] is that these youth reported patterns of substance use over time that were similar to bisexual youth, and significantly higher than heterosexual youth.

There are several limitations of the current study that should be taken into account when interpreting the findings. First, there was a large gap in time between the second and third time-points which made it impossible to examine how trajectories changed during that time. Because risk for substance use increases dramatically during this period of adolescent development (between ages 16–20 years), future studies that help to elucidate patterns of change over time during this age range will be valuable. On a related note, while this study makes a valuable contribution to the literature because of its ability to compare trajectories of LGB youth and heterosexual youth over time, it is limited by only three time-points, which prevented us from examining curvilinear effects. It may be that, during this critical time-period between the second and third time-points, substance use in LGB youth escalates at an exponential rate, and a sharper curve or acceleration in substance use during this time-period is what is driving the increased disparities over time. Thus, with more time-points future studies can examine more refined questions about the timing of risk and perhaps identify critical developmental milestones that are associated with accelerated (curvilinear) risk patterns.

Finally, LGB identification was measured only at the third time-point, and same-sex sexual behavior was measured inconsistently across waves, requiring that we use wave III reports of all three variables in order to promote consistency among the three sets of analyses. These limitations prevented us from examining: (i) the prospective relationship between self-identified sexual orientation and trajectories of substance use over time; and, importantly, (ii) how change over time in critical gay-related developmental milestones (same-sex attraction, same-sex behavior, consolidation of an LGB identity) were associated with changes in substance use over time. By conceptualizing gay-related development, adolescent health behaviors and associated risk and protective factors within a developmental framework and examining changes over time in each of these domains using statistical methodology such as LCM, future researchers studying adolescent LGB health and wellness can make more confident statements about individual change and growth over time, and can create targeted prevention and intervention programs that aim to curb long-term health problems.

## Declarations of interest

None.

## Acknowledgments

## References

1. Stall R., Paul J., Greenwood G., Pollack L., Bein E., Crosby G. *et al.* Alcohol use, drug use and alcohol-related problems among men who have sex with men: the urban men's health study. *Addiction* 2001; **96**: 1589–601.

2. Cochran S. D., Ackerman D., Mays V. M., Ross M. W. Prevalence of non-medical drug use and dependence among homosexually active men and women in the US population. *Addiction* 2004; **99**: 989–98.

3. Beatty R. L., Madl R., Bostwick W. LGBT substance use. In: Shankle M. D., editor. *Handbook of LGBT Public Health*. Binghamton, NY: Haworth Press; 2006, p. 201–20.

4. Meyer I. H. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol Bull* 2003; **129**: 674–97.

5. Marshal M. P., Friedman M. S., Stall R., King K. M., Miles J., Gold M. A. *et al.* Sexual orientation and adolescent substance use: a meta-analysis and methodological review. *Addiction* 2008; **103**: 546–56.

6. *Centers for Disease Control*. Available at: http://www.cdc. gov/syndemics/definition.htm (accessed 20 November 2008).

7. Stall R., Friedman M. S., Catania J. Interacting epidemics and gay men's health: a theory of syndemic production among urban gay men. In: Wolitski R. J., Stall R., Valdiserri R. O., editors. *Unequal Opportunities: Health Disparities among Gay and Bisexual Men in the United States*. New York, NY: Oxford University Press; 2008, p. 251–74.

8. Rotheram-Borus M. J., Langabeer K. A. Developmental trajectories of gay, lesbian, and bisexual youths. In: D'Augelli A. R., Patterson C. J., editors. *Lesbian, Gay, and Bisexual Identities and Youth: Psychological Perspectives*. New York, NY: Oxford University Press; 2001, p. 97–128.

9. Friedman M. S., Marshal M. P., Wright E. R., Stall R. Early gay-related development, adolescence victimization and adult health outcomes among gay and bisexual males. *AIDS Behav* 2007; **12**: 891–902.

10. Curran P. J., Hussong A. M. The use of latent trajectory models in psychopathology research. *J Abnorm Psychol* 2003; **112**: 526–44.

11. Curran P. J., Willoughby M. J. Reconciling theoretical and statistical models of developmental processes. *Dev Psychopathol* 2003; **15**: 581–612.

12. Russell S. T., Truong N. L., Driscoll A. K. Adolescent same-sex romantic attractions and relationships: implications for substance use and abuse. *Am J Public Health* 2002; **92**: 198–202.

13. Hatzenbuehler M. L., Corbin W. R., 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.

14. Austin S. B., Ziyadeh N., Fisher L. B., Kahn J. A., Colditz G. A., Frazier A. L. Sexual orientation and tobacco use in a cohort study of US adolescent girls and boys. *Arch Pediatr Adolesc Med* 2004; **158**: 317–22.

15. Bontempo D. E., D'Augelli A. R. Effects of at-school victimization and sexual orientation on lesbian, gay, or bisexual youths' health risk behavior. *J Adolesc Health* 2002; **30**: 364–74.

16. Lampinen T. M., McGhee D., Martin I. M. Increased risk of 'club' drug use among gay and bisexual high school students in British Columbia. *J Adolesc Health* 2006; **38**: 458–61.

17. Robin L., Brener N. D., Donahue S. F., Hack T., Hale K., Goodenow C. Associations between health risk behaviors and opposite-, same-, and both-sex sexual partners in representative samples of Vermont and Massachusetts high school students. *Arch Pediatr Adolesc Med* 2004; **156**: 349–55.

18. Garofalo R., Wolf R. C., Kessel S., Palfrey S. J., DuRant R. H. The association between health risk behaviors and sexual orientation among a school-based sample of adolescents. *Pediatrics* 1998; **101**: 895–902.

19. Reis E., Saewyc E. *83,000 Youth: Select Findings of Eight Population-based Studies as They Pertain to Anti-gay Harassment and the Safety and Well-being of Sexual Minority Students*. Seattle, WA: Safe Schools Coalition of Washington; 1999.

20. Garofalo R., Wolf R. C., Wissow L. S., Woods E. R., Goodman E. Sexual orientation and risk of suicide attempts among a representative sample of youth. *Arch Pediatr Adolesc Med* 1999; **153**: 487–93.

21. Bollen K. A., Curran P. J. *Latent Curve Models: A Structural Equation Approach*. Hoboken, NJ: Wiley Series in Probability and Mathematical Statistics; 2006.

22. Ziyadeh N. J., Prokop L. A., Fisher L. B., Rosario M., Field A. E., Camargo C. A. *et al.* Sexual orientation, gender, and alcohol use in a cohort study of U.S. adolescent girls and boys. *Drug Alcohol Depend* 2007; **87**: 119–30.

23. Saewyc E. M., Bauer G. R., Skay C. L., Bearinger L. H., Resnick M. D., Reis E. *et al.* Measuring sexual orientation in adolescent health surveys: evaluation of eight school-based surveys. *J Adolesc Health* 2004; **35**: 345.e1–15.

24. Savin-Williams R. C. Who's gay? Does it matter? *Curr Dir Psychol Sci* 2006; **15**: 40–4.

25. Savin-Williams R. C., Ream G. L. Prevalence and stability of sexual orientation components during adolescence and young adulthood. *Arch Sex Behav* 2007; **36**: 385–94.

26. Stanton C. A., Papandonatos G., Lloyd-Richardson E. E., Niaura R. Consistency of self-reported smoking over a 6-year interval from adolescence to young adulthood. *Addiction* 2007; **102**: 1831–9.

27. Jackson K. M., Sher K. J., Cooper M. L., Wood PK. Adolescent alcohol and tobacco use: onset, persistence, and trajectories of use across two samples. *Addiction* 2002; **97**: 517–31.

28. Muthen L. K., Muthen B. O. *Mplus User's Guide*. Los Angeles, CA: Authors; 2002.

29. Mehta P. D., West S. G. Putting the individual back into individual growth curves. *Psychol Methods* 2000; **5**: 23–43.

30. Stapleton L. M. An assessment of practical solutions for structural equation modeling with complex sample data. *Struct Equat Mod* 2005; **13**: 28–58.

31. Hershberger S. L., D'Augelli A. R. The impact of victimization on the mental health and suicidality of lesbian, gay, and bisexual youths. *Dev Psychol* 1995; **31**: 65–74.

32. Hu L., Bentler P. M. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equat Mod* 1999; **6**: 1–55.