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# Romantic attraction and adolescent smoking trajectories

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ABSTRACT

Research on sexual orientation and substance use has established that lesbian, gay, and bisexual (LGB) individuals are more likely to smoke than heterosexuals. This analysis furthers the examination of smoking behaviors across sexual orientation groups by describing how same- and opposite-sex romantic attraction, and changes in romantic attraction, are associated with distinct six-year developmental trajectories of smoking. The National Longitudinal Study of Adolescent Health dataset is used to test our hypotheses. Multinomial logistic regressions predicting smoking trajectory membership as a function of romantic attraction were separately estimated for men and women. Romantic attraction effects were found only for women. The change from self-reported heterosexual attraction to lesbian or bisexual attraction was more predictive of higher smoking trajectories than was a consistent lesbian or bisexual attraction, with potentially important differences between the smoking patterns of these two groups.

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## 1. Introduction

### 1.1. Sexual orientation and substance use in adolescence

Decades of research on sexual orientation and substance use has established that lesbian, gay, and bisexual (LGB) adolescents and young adults are more likely to smoke, drink alcohol, and use other substances than heterosexual youth (D'Augelli, 2004; DuRant, Krowchuk, & Sinal, 1998; Garofalo, Wold, Kessel, Palfrey, & DuRant, 1998; Stall et al., 2001). Reviews of the literature on sexual orientation and substance use conclude that sexual minority youth, especially bisexuals, are 2–5 times more likely to use drugs, alcohol, and cigarettes than heterosexuals (Marshal et al., 2008; Ryan, Wortley, Easton, Pederson, & Greenwood, 2001). However, with a few notable exceptions, most earlier work was cross-sectional and based on convenience samples (Rosario, Hunter, & Gwadz, 1997; Rotheram-Borus et al., 1994) or area-based samples (DuRant et al., 1998; Faulkner & Cranston, 1998; Garofalo et al., 1998).

Much of the literature addressing the reasons for higher substance use among LGB youth focuses on the stresses associated with stigmatized identities (Bux, 1996; Hatzenbuehler, 2009). According to minority stress theory (Meyer, 2003), disparities in substance use may be due to LGB youth being more likely to experience depression, loneliness, discrimination, and victimization (Gonsiorek, 1988; Savin-Williams, 1994). Developmental models such as the "overload model" additionally suggest that risk behaviors can result from experiencing several developmental transitions in short succession (Schulenberg & Maggs, 2002). In addition to normative developmental tasks during the transition to adulthood, acknowledging and integrating a marginalized identity may contribute to further stress for LGB youth, for which substance use may serve as a coping strategy (Savin-Williams & Diamond, 2001; Schulenberg & Maggs, 2002). Minority stress theory and the overload model are neither mutually exclusive nor exhaustive, but both predict higher substance use among LGB youth as a coping mechanism. Higher use among LGB youth is also predicted by socialization-based explanations that posit greater use as a consequence of more frequent socializing in contexts supporting substance use (e.g., clubs, parties), and accompanying stronger use norms in LGB communities, rather than as a result of coping with stress (Heffernan, 1998; McKirnan & Peterson, 1989; Remafedi, 2007).

### 1.2. Developmental trajectories

Only five longitudinal studies have been published that consider developmental smoking patterns among LGB adolescents. Tucker, Ellickson, and Klein (2008) examined a West Coast cohort of heterosexual and bisexual women over a ten year period (ages 14–23), with sexual orientation assessed once at age 23. Women who reported being bisexual were already more likely to be smokers at age 14 than heterosexual women, and while the smoking rate did not change over time for heterosexuals, it increased a further 50% among bisexuals. Talley, Sher and Littlefield (2010) used four years of data drawn from a public university in Missouri (n = 2854) to model latent trajectories of cigarette use. The measure of cigarette use was an 8-point scale measuring frequency of use over the past three months (0 = never/not in the past three months; 7 = more than 40 times). Results

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indicated that sexual minority self-identification (anything other than exclusively heterosexual) predicted greater initial and sustained use of cigarettes compared to their sexual majority counterparts, as did reports of same-sex attraction and same-sex sexual behavior. In contrast to much of the prior literature, Talley, Sher and Littlefield did not find evidence of different effects by gender. They also included longitudinal measures of sexual orientation, but did not identify an association between the timing of developing of a minority sexual identity and subsequent smoking behavior.

The other three studies used data from the National Longitudinal Study of Adolescent Health (Add Health), the first nationally representative study to include information about both sexual orientation and substance use. Each of these studies relies on measures of romantic attraction to assess sexual orientation. Russell, Driscoll, and Truong (2002) examined change in the quantity of past month smoking over a one-year period, finding that bisexual women were more likely to increase their smoking over time compared with lesbian women, but changes in smoking did not differ as a function of sexual orientation for men. Easton, Jackson, Mowery, Comeau, and Sell (2008) examined whether smoking initiation over a one-year period varied according to sexual orientation, finding that adolescents with both-sex attractions or relationships were significantly more likely to initiate smoking one year later compared to those with opposite or same-sex attractions or relationships. Differences by sexual orientation were more pronounced for girls than boys. Marshal, Friedman, Stall, and Thompson (2009) used latent growth curve models and all three measures of sexual orientation (attraction, behavior, and self-definition) to examine the growth in frequency of substance use (including smoking) among LGB youth compared to heterosexual youth over a six-year period. Somewhat surprising in light of previous research, smoking escalated over time at a faster pace for homosexual youth, but not bisexual youth, compared to heterosexuals. Results were consistent across the three measures of sexual orientation.

The studies by Talley et al. (2010) and Marshal et al. (2009) are the most sophisticated longitudinal examinations of LGB smoking to date, but there are methodological or conceptual limitations to each, some of which also hamper comparability with much of the prior literature. First, both studies considered gender as a covariate rather than examining gender differences in the association of sexual orientation with smoking. Several studies show that sexual orientation is more strongly associated with substance use for women than men (Easton et al., 2008; Hatzenbuehler, Corbin, & Fromme, 2008), and that sexual identity is more fluid among adolescent girls than adolescent boys (Diamond 2003; Savin-Williams & Ream, 2007). Second, smoking was assessed in terms of frequency (days smoked, either actual number or an ordinal scale response), rather than using a more common measure that includes both the quantity *and* frequency of smoking. Third, the studies focused on smoking trajectories based on the overall mean smoking frequency for each sexual orientation group, ignoring the considerable heterogeneity in smoking patterns that exists within each of these groups. Marshal et al. (2009) modeled linear trajectories because only three waves of data were available, whereas Talley et al. (2010) were able to estimate non-linear trajectories. Finally, Marshal et al.'s (2009) sexual orientation measures were based on data from the six-year follow-up only and thus were insensitive to the development of sexual identity. The most prevalent model of sexual orientation posits that individuals possess an early predisposition to experience attractions, and sexual identity is the eventual culmination of acknowledging and accepting these attractions (Diamond, 2000; Savin-Williams, 1988) It may be that *change* in attraction and sexual orientation during adolescence is itself associated with patterns of substance use. Talley et al. (2010) is the only study to include longitudinal measures of sexual orientation but it did not identify a timing effect on days smoked (although they did note timing effects on frequency of binge drinking and cannabis use in the same study, with higher consumption patterns observed among individuals who endorsed a minority sexual identity earlier).

### 1.3. The present study

The present analysis addresses each of these limitations and furthers the examination of smoking behaviors across a key component of sexual orientation – types of romantic attraction – in several respects. First, we describe how heterosexual and same-sex/bi-sexual attractions are associated with distinct developmental trajectories of smoking rather than variations around a single trajectory. Second, we examine how changes in romantic attraction over time (e.g., transition from heterosexual attraction to LGB attraction) are linked to these trajectories. Third, we use a measure of smoking that is based on both the quantity and frequency. Finally, we examine these associations separately for men and women. Although preliminary analyses did not find gender differences in the overall number and type of smoking trajectories, we investigate whether the associations between romantic attraction (and changes in attraction) and smoking trajectory membership differ by gender.

We tested several hypotheses based on applying the theories of sexual orientation and substance use just reviewed specifically to romantic attraction. Premised on the idea that if smoking is a mechanism for coping with stress, then changes in stress levels should be followed by changes in smoking levels over time. While the various theories lead to an array of hypotheses, the primary aim here is not to test one theory against the other, but rather to guide description of differences between romantic attraction groups. First, consistent with prior literature we hypothesize that differences by romantic attraction will be more pronounced for women than men (H1). Second, based on the pervasive stress posited by minority stress theory, we hypothesize that consistently LGB-attracted youth (H2a) or youth who transition to LGB attraction (H2b) will be more likely to belong to any smoking trajectory group compared with consistently heterosexually-attracted youth. Third, the overload model suggests that as youth transition to adulthood, consistently LGB-attracted individuals will accumulate greater stress and will be more likely to increase their smoking over time. Thus, we hypothesize that LGB-attracted youth will be more likely than consistently heterosexually-attracted youth to belong to a trajectory group exhibiting either an early increase (H3a) or a delayed increase (H3b) in smoking. Finally, youth that transition to an LGB attraction face additional acute stress associated with the transition period itself, making them even more likely to belong to one of the increasing use trajectory groups (either early [H4a] or delayed [H4b]) than the consistently alternative orientation youth who have already transitioned prior to observation. It should be generally noted that while early heavy smoking may be an indicator of coping with stress, delayed escalation may be more indicative of socialization.

## 2. Method

### 2.1. Data

The analyses are based on data drawn from Waves I through III of the National Longitudinal Study of Adolescent Health. Add Health is a nationally representative study of adolescents in grades 7 through 12 (roughly ages 12–18) in the United States in 1995 who have been followed with multiple interview waves into young adulthood. The sampling frame included all high schools in the United States. Over 90,000 participants from 145 schools were given a basic interview at school. Data from this interview were used to generate a baseline sample of 20,745 adolescents aged 12–19 to complete a follow-up interview at home between April and December 1995 (Wave I), between April and August 1996 (Wave II), and again between August 2001 and April 2002 (Wave III). Over 15,000 Add Health respondents

were re-interviewed at Wave III (76.0% response rate among eligible Wave I respondents). The overall sample is representative of United States schools with respect to region of the country, urbanicity, school type, ethnicity, and school size. See Harris et al. (2009) for more details on the Add Health design and longitudinal data. Regression analyses are corrected for complex sample design effects using strata, cluster, and weight variables (Chantala & Tabor, 1999).

The present analysis links information about sexual orientation to a previously defined set of six discrete smoking trajectories in the same Add Health sample using multinomial logit models predicting trajectory group membership (Pollard, Tucker, Green, Kennedy, & Go, 2010). For all analyses we focus on a sample of students who were in grades 9 through 11 at Wave I and had valid smoking information, and follow them across all three waves (N = 6696). At Wave I, these individuals range in age from 14 to 18 (94% were ages 15–17). Respondents in grade 12 at baseline were not interviewed at Wave II, and thus they are excluded from the analysis. We exclude respondents who were missing information on romantic attraction at Wave I or III (5%) and those missing information on age, race/ethnicity, gender, or number of smoking friends at Wave I (less than 2%), for a final sample size of 6203.

### 2.2. Key measures

#### 2.2.1. Smoking behavior

The outcome measure in our analysis is the estimated smoking trajectory class to which an individual belongs.

We use PROC TRAJ in SAS 9.1.3 to perform latent class growth analysis (Nagin, 1999) identifying discrete developmental trajectories of cigarette consumption based on the average number of cigarettes smoked per day during the past 30 days. The latent class growth analysis method relies on a multinomial modeling strategy (estimating the parameters of finite mixture models by maximum likelihood), permitting cross-group differences in the level and shape of trajectories in a fashion that is flexible with only three data points (Jones, Nagin, and Roeder, 2001; Nagin and Tremblay, 2001). This procedure is commonly used to model developmental trajectories (e.g., Halpern-Manners, Warren, & Brand, 2009; Kozyrskyj, Kendall, Jacoby, Sly, & Zubick, 2010; Marti, Stice, & Springer, 2010; Petts, 2009) and has previously been applied to the Add Health data to examine trajectories of depression (Costello, Swendsen, Rose, and Dierker, 2008), delinquency (Aalsma and Tong, 2008), and smoking (Pollard et al., 2010). We incorporate sample weights in all analyses. See Jones, Nagin and Roeder (2001) for a detailed discussion of the likelihood function and estimation of these models.

Six discrete smoking trajectories were previously identified for the same analytic sample, using the average number of cigarettes smoked per day during the past 30 days (calculated as [the number of days smoked] × [the number of cigarettes per day]/30) at each of the three waves (Pollard et al., 2010). The trajectories are displayed in Fig. 1. Steady Highs (4.2% of sample; 4.2% males, 4.2% females) smoked close to an average of 18 cigarettes a day (nearly a pack a day) across all three waves. Early Increasers (8.3% total; 8.7% males, 7.9% females) smoked an average of five cigarettes per day at Wave I, quickly doubled that by Wave II, and eventually tripled their initial consumption by Wave III. Decreasers (2.9% total; 3.2% males, 2.7% females) initially smoked slightly more than a half a pack a day at Wave I, but decreased to an average of less than one cigarette per day by Wave III. Delayed Increasers (6.8% total; 8.2% males, 5.4% females) started with very low (close to zero) consumption at Waves I and II, but increased to the same 15 cigarette per day average consumed by the Early Increasers by Wave III. Steady Lows (22.6% total; 22.6% males, 22.7% females) remained close to two cigarettes per day for the entire period, whereas Never Smokers (55.3% total; 53.5% males, 57.1% females) abstained from smoking at all waves. Complete details about the estimation method for these trajectories are available elsewhere (Pollard et al., 2010).

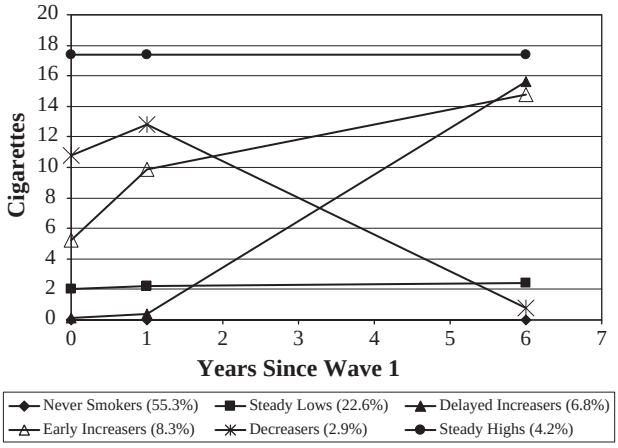


**Fig. 1.** Trajectories of average cigarettes per day: grades 9–11 at Wave I (weighted).

#### 2.2.2. Romantic attraction

The primary independent variable here is romantic attraction. Research typically relies on three ways to define sexual orientation: sexual/romantic attraction, sexual behavior, and sexual identity (Savin-Williams, 2006, 2009). Research typically finds that the prevalence of LGB sexual orientation is greatest when measured as sexual or romantic attraction, followed by sexual behavior, and then by sexual identity, which produces the lowest prevalence rates. As this pattern suggests, the three standard measures of sexual orientation do not yield consistent categorizations within individuals.

Currently there are no recommended standard items for assessing sexual orientation (Sell & Becker, 2001), but when limited to a single item, attraction has been suggested as the best choice for adolescents (Frankowski, & American Academy of Pediatrics, Committee on Adolescence, 2004; Saewyc et al., 2004). Sexual orientation develops during adolescence, but not all aspects of orientation change at the same pace. Beginning with experiences of attractions to persons of one or both sexes, individuals organize their self-concept around these experiences into sexual identity (Diamond, 2000). Individuals may develop a sexual identity without ever being sexually active (behavior).

An additional complicating factor is the instability of sexual orientation over time. Self-reported sexual identity sometimes changes. A number of studies show that a substantial minority of youth report shifts in self-identified sexual orientation and romantic attractions over adolescence and young adulthood (Diamond, 2000; Rosario, Schrimshaw, Joyce, & Lisa, 2006; Udry & Chantala, 2005). This "sexual fluidity" is a challenge for researchers attempting to investigate sexual orientation and substance use.

The primary independent variables in the analyses, romantic attraction, are based on responses to separate questions at Waves I and III asking whether adolescents had a romantic attraction to a male and to a female. Specifically, at Wave I and again at Wave III respondents were asked both "Have you ever had a romantic attraction to a female?" and "Have you ever had a romantic attraction to a male?" Romantic attraction categories are defined as follows: "consistent heterosexual attraction" is defined as having only opposite-sex attractions at Wave I and Wave III; "consistent LGB attraction" is defined as having same- and/or both-sex attractions at both waves; "transition to LGB attraction" is defined as having only opposite-sex attractions at Wave I, but same- or both-sex attractions at Wave III; and "transition to heterosexual attraction" is defined as having same- or both-sex attractions at Wave I, but only opposite-sex attractions at Wave III. Using measures of romantic attraction also has

the advantage of consistent longitudinal measurement across Add Health Waves I and III. Note that a self-identified measure of sexual identity (heterosexual, lesbian/gay, bisexual) is available at Wave III, but not earlier waves.

Sensitive portions of the Add Health interview, including the sections on romantic attraction, were conducted via computer-aided self-interview methods; respondents listened through earphones while recording their responses on a laptop computer. This method has been demonstrated to improve the validity of self-reported sensitive data among adolescents (Supple, Aquilino, & Wright, 1999; Turner et al., 1998).

#### 2.2.3. Control variables

All analyses controlled for age, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other) and perceived peer smoking (how many of three best friends smoked daily at Wave I).

### 2.3. Predicted trajectory group membership using romantic attraction

Following the literature that links various measures of sexual orientation more strongly to the substance use behaviors of women than those of men (Cochran, Keenan, Schober, & Mays, 2000; Eisenberg & Wechsler, 2003; McCabe, Boyd, Hughes, & d'Arcy, 2003; McCabe, Hughes, Bostwick, & Boyd, 2005; McCabe, Hughes, Bostwick, West, & Boyd, 2009), we stratify the analyses of romantic attraction associations with smoking by sex and present results first for women, then for men.

Multinomial logistic regressions predicting smoking trajectory membership as a function of romantic attraction are separately estimated for males and females, controlling for race/ethnicity, age, and the number of best friends who smoke daily. The "never smoke" group serves as the reference category in the table, although additional comparisons were also made between consistently LGB-attracted and transition to LGB attraction in order to examine H1c, H3a and H3b. Specifically, the summarized odds ratios may be interpreted as the odds that one romantic attraction group (e.g., consistently LGB-attracted) belongs to a particular trajectory group versus being a Never Smoker, relative to the odds of consistent heterosexually-attracted individuals belonging to that trajectory group versus being a Never Smoker.

## 3. Results

### 3.1. Romantic attraction by gender

Table 1 presents the unweighted sample frequencies for each romantic attraction group, by gender, in the final study sample. The table also provides detail on the specific types of attraction transitions that comprise each final category. Ninety percent of males and 86% of females reported a consistent romantic attraction type, with nearly all of these cases (97%) reporting consistently heterosexual attraction. Of the 300 males and 469 females whose responses indicated a transition in romantic attraction type from Wave I to Wave III, 40% of these males and 78% of these females transitioned to an LGB attraction. Consistent with research on sexual orientation among adolescents and young adults, females expressed greater LGB attractions (Mosher, Chandra, & Jones, 2005; Savin-Williams & Ream, 2007). Sample size necessitated combining same-sex and bisexual attraction individuals into a single group, although it should be noted that this group primarily consists of those with bisexual attraction.

**Table 1**
Detailed romantic attraction type sample sizes, by gender.

| | Sample size (unweighted) | |
|---|---|---|
| | Male | Female |
| Consistent lesbian/gay/bisexual (LGB) attraction | 43 | 65 |
| Consistent lesbian/gay | 3 | 3 |
| Consistent bisexual | 21 | 48 |
| Lesbian/gay to bisexual | 8 | 11 |
| Bisexual to lesbian/gay | 11 | 3 |
| Transition to LGB attraction | 121 | 365 |
| Heterosexual to lesbian/gay | 22 | 18 |
| Heterosexual to bisexual | 99 | 347 |
| Transition to heterosexual attraction | 179 | 104 |
| Lesbian/gay to heterosexual | 24 | 28 |
| Bisexual to heterosexual | 155 | 76 |
| Consistently heterosexual attraction | 2571 | 2755 |
| Total | 2914 | 3289 |

### 3.2. Initial test of overall differences by gender

A model interacting sex with all other variables was estimated (not shown). Results confirmed that differences by gender were significant overall, with greater romantic attraction effects for women, supporting H1 (difference in AIC between constrained model and interactive model = 28.8). Models are subsequently estimated separately for females and males.

#### 3.3.1. Predicted trajectory group membership using romantic attraction — Females

Panel A of Table 2 presents the results for women. Those who reported a consistently lesbian/bisexual attraction were about four times more likely than consistently heterosexual women to belong to the Delayed Increaser group (OR = 4.27) or Decreaser group (OR = 3.85) versus being a Never Smoker (consistent with both minority stress and overload models, H2a and H3a). However, there were no differences between consistently heterosexually attracted and consistently lesbian/bisexually attracted women in the likelihood of belonging to any of the other trajectory groups, which were also predicted by H2a and H3a, providing mixed support overall.

Women who transitioned to a lesbian/bisexual attraction by Wave III, however, were significantly more likely than consistently heterosexually attracted women to be in any of the smoking trajectory groups (with the exception of the Decreaser group) versus being a Never Smoker (fully supporting H2b and H3b). For example, a woman who transitioned to a lesbian/bisexual attraction was nearly three times as likely as a consistently heterosexually attracted woman of being in the Steady High (OR = 2.90) or Delayed Increaser (OR = 3.00) trajectory group versus being a Never Smoker.

Contrasts between women with consistently lesbian/bisexual attraction and those that transitioned to lesbian/bisexual attraction were estimated (not shown), indicating that those who transitioned to lesbian/bisexual attraction were more likely to be in the Early Increaser trajectory group than consistently lesbian/bisexual women (OR = 1.44; supporting H4a), but were not more likely to be in the Delayed Increaser group (OR = 0.70; failure to support H4b), again providing mixed support.

#### 3.3.2. Predicted trajectory group membership using romantic attraction — Males

Panel B presents the results for males, showing that there is virtually no significant difference by romantic attraction type in the likelihood of belonging to any particular smoking trajectory group versus being a Never Smoker.

## 4. Discussion

Longitudinal descriptions of LGB smoking trajectories are important complements to literature showing that LGB individuals are at high risk of smoking. Although prior research has demonstrated this point, it is unclear whether higher levels of adolescent LGB smoking persist over time, or represent a relatively temporary or exploratory

**Table 2**
Estimated odds ratios[a] for multinomial logistic regression models predicting trajectory membership, by gender.

| | Steady Lows | Delayed Increasers | Early Increasers | Decreasers | Steady Highs | Never Smokers (reference) |
|---|---|---|---|---|---|---|
| *Panel A* | | | | | | |
| Women | [n = 475] | [n = 161] | [n = 221] | [n = 72] | [n = 86] | [n = 2274] |
| Consistent lesbian/bisexual attraction | 1.764 | 4.271* | 1.884 | 3.851* | 0.322 | |
| | (0.837, 3.719) | (1.379, 13.225) | (0.553, 6.419) | (1.140, 13.011) | (0.042, 2.448) | |
| Transition to lesbian/bisexual | 2.107*** | 2.995*** | 2.716** | 0.692 | 2.896** | |
| | (1.399, 3.173) | (1.790, 5.010) | (1.449, 5.092) | (0.257, 1.863) | (1.361, 6.161) | |
| Transition to heterosexual attraction | 1.526 | 0.872 | 1.933 | 1.505 | 1.746 | |
| | (0.843, 2.763) | (0.201, 3.783) | (0.576, 6.487) | (0.349, 6.489) | (0.480, 6.358) | |
| Consistent heterosexual attraction (reference) | | | | | | |
| *Panel B* | | | | | | |
| Men | [n = 440] | [n = 224] | [n = 229] | [n = 60] | [n = 94] | [n = 1867] |
| Consistent gay/bisexual attraction | 1.322 | 1.444 | 0.202 | 0.926 | 0.218 | |
| | (0.371, 4.715) | (0.347, 6.009) | (0.022, 1.866) | (0.145, 5.900) | (0.016, 3.010) | |
| Transition to gay/bisexual attraction | 1.737 | 1.700 | 0.224† | 2.836 | 0.354 | |
| | (0.749, 4.030) | (0.838, 3.451) | (0.045, 1.110) | (0.705, 11.403) | (0.049, 2.567) | |
| Transition to heterosexual attraction | 1.224 | 1.300 | 1.142 | 2.295 | 0.833 | |
| | (0.716, 2.094) | (0.623, 2.713) | (0.612, 2.133) | (0.606, 8.693) | (0.323, 2.151) | |
| Consistent heterosexual attraction (reference) | | | | | | |

[a] Models also control for number of smoking best friends, race/ethnicity and age. 95% confidence interval shown in parentheses.
†$p<.10$, *$p<.05$, **$p<.01$, ***$p<.001$.

period during the transition to adulthood. Latent class growth analysis also illustrates that there are a variety of distinct developmental smoking trajectories individuals may take (Pollard et al., 2010); analyses that simply compare sexual orientation groups on a single mean trajectory of smoking over time cannot illuminate potentially important group differences in specific patterns of smoking (i.e., delayed increasing vs. steady high vs. decreasing). Such analyses overlook that women with consistent lesbian or bisexual romantic attractions are more likely than women with heterosexual attractions to belong to two nearly opposite types of smoking patterns — either showing a delayed increase in smoking or decreasing smoking. Neglecting to examine men and women separately would similarly obscure the finding that smoking patterns vary significantly with romantic orientation for women, but not for men.

Further, this study not only demonstrates how romantic attraction type is linked to smoking over time, but also how *the transition* to LGB attraction status is linked to smoking, while the transition to heterosexual status is not. Indeed, it appears that the transition to LGB attraction is more predictive of higher smoking trajectories than is a consistent LGB attraction. Thus, studies that assess sexual orientation at a single point in time (using any measure) are limited both because sexual orientation is known to be unstable during adolescence and young adulthood, particularly for females (Savin-Williams & Ream, 2007), and because smoking risk for certain LGB subgroups will be underestimated.

Few studies examining differences in the substance use of LGB males and females, and none of the developmental trajectory research, formally test interactions between sexual orientation and gender in predicting substance use outcomes. As a result, previous conclusions about the role of gender as a risk factor for smoking among LGB youth are largely based on the assumption that observed differences in rates are statistically significant (Marshal et al., 2008). Our results confirm those of most other studies on attraction and sexual orientation and smoking; non-heterosexually attracted women are at significantly greater risk than heterosexual women of higher developmental smoking trajectories, but the same is not true for men. Studies with adult women suggest higher smoking rates among lesbian/bisexual attracted women than among heterosexual women (Aaron et al., 2001; Valanis et al., 2000). Our results indicate that the origins of these elevated adult rates appear to stem from adolescence.

Questions remain about why same- or bi-sexually attracted young women are at greater risk of these developmental smoking patterns. At face, these results are consistent with the dominant explanation posited in the literature – that smoking serves as a coping mechanism for the additional stresses faced by LGB youth – but no studies directly test this. The present findings indicate that transitioning to LGB attraction is more consistently associated with smoking trajectory membership than having stable LGB romantic attraction. In order to be coded as "stable LGB attraction," this type of romantic attraction must have been established by a relatively young age (at Wave I over 70% of individuals were under the age of 17); it is possible that much of the stress associated with developing or acknowledging a non-heterosexual romantic orientation may have been experienced at an age before smoking was a widely available option. The timing of such stressors may be crucial in terms of the adoption of smoking; if the stressors occur at an age where smoking is not a realistically potential activity, other coping strategies may be developed instead.

However, these results suggest that socialization may also be an important factor in LGB smoking patterns. Although women with consistently lesbian or bisexual attractions are at greater risk of belonging to the Decreaser trajectory group (characterized by early heavy smoking) and the Delayed Increaser group compared to women with heterosexual romantic attractions, they are not also at greater risk of belonging to the Steady Low group, or the Steady High and Early Increase groups that one would expect if smoking were simply a coping strategy. Instead, women who transition to a lesbian/bisexual romantic orientation are the ones who experience greater risk of belonging to any of these trajectory groups, suggesting that mechanisms other than stress are also involved. For example, if smoking is more normative among lesbian or bisexual women and if socializing occurs in settings that are more accepting of substance use, individuals may smoke as a means of identifying with or developing an additional sense of belonging to this group. Possibly exacerbating this process is research by Austin et al. (2004) that identified that non-heterosexual girls, but not boys, were more likely to say that they were willing to use merchandise branded with cigarette logos than heterosexuals.

This research has several limitations that should be kept in mind when interpreting the results. Due to sample sizes, individuals with bisexual and lesbian/gay romantic orientations were combined to a single LGB attraction group. This group is mostly composed of those

with bisexual attraction and, as suggested by cross-sectional comparisons (Eisenberg & Wechsler, 2003; Russell et al., 2002), they may be driving the LGB results. Additionally, romantic attraction does not address whether the individual is engaging in same-sex relationships or has self-identified as LGB. While all three measures of sexual orientation have been associated with smoking behaviors (Marshal et al., 2009), the three measures are not entirely redundant (McCabe et al., 2009) and it may be useful to compare developmental patterns across the different measures when such data become available. Sensitivity analyses were conducted using Wave III self-identified orientation instead of Wave III romantic attraction to determine whether we would get the same results using this other measure of sexual orientation; results were generally similar though statistical significance was more frequently identified using the consistent attraction-based measure. This study is unable to directly address the reasons why women with a consistent lesbian/bisexual attraction, or who transition to lesbian/bisexual attraction, differ from consistently heterosexually oriented women in their smoking patterns. Finally, as noted earlier, Add Health used data collection methods that have been shown to improve the validity of self-reported sensitive data; however, it is possible that some respondents still failed to disclose LGB romantic attractions, which would lead to underestimates of non-heterosexual romantic attraction. Comparing LGB prevalence across the various dimensions of sexual orientation in Add Health to other data sources such as the National Survey of Family Growth (Mosher et al., 2005) and National Health and Social Life Survey (Black, Gates, Sanders, & Taylor, 2000) indicates that estimates are comparable, if not greater, mitigating this concern somewhat.

The results point to two mechanisms – coping and socialization – that may explain why LGB populations are at greater risk for tobacco use compared to their heterosexual peers. Future work would benefit from disentangling these mechanisms. Though these mechanisms ultimately lead to similar outcomes, they may require significantly different interventions to prevent and reduce smoking. Smoking as a means of coping with stress suggests the need for broad support and counseling resources, whereas socialization mechanisms suggest more targeted awareness building programs concerning the choice of social venues and friends' behaviors. Given the relative high rates of smoking among LGB youth, research to better understand and intervene on these mechanisms should be a public health priority.

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**Contributors**

Dr. Pollard was primarily responsible for the design of the study, conducted the data analysis, and wrote the first draft of the manuscript. Dr. Tucker assisted with the design of the study and literature review, and provided feedback on drafts of the manuscript. Drs. Green, Kennedy, and Go assisted with the design of the study and provided feedback on drafts of the manuscript.

**Conflict of interest**

All authors declare that they have no conflicts of interest.

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