Sexual Orientation and Trajectories of Adolescent Smoking

Michael S. Pollard*
Joan S. Tucker*
Harold D. Green*
David Kennedy*
Myong-Hyun Go*

(* RAND, Santa Monica, CA)

Paper prepared for the Population Association of America Annual Meetings, April 14-17, 2010, Dallas, Texas.

Corresponding Author: Michael S. Pollard, RAND Corporation, 1776 Main Street, Santa Monica, CA 90407-2138. Phone 310-393-0411 x7627; Fax 310-260-8160;
E-mail: mpollard@rand.org

ABSTRACT

Aims Research on sexual orientation and substance use has established that lesbian, gay, and bisexual (LGB) adolescents and young adults are more likely to smoke than heterosexual youth. This analysis furthers the examination of smoking behaviors across sexual orientation groups by describing how sexual orientation, and changes in sexual orientation, are associated with distinct six-year developmental trajectories of smoking.

Method A nationally representative longitudinal survey (the National Longitudinal Study of Adolescent Health) was used to test our hypotheses. Individuals in grades 9-11 at Wave I were included if they were not missing information on smoking information at any of the three waves, and if they reported sexual orientation at Waves I and III (N = 6,203).

Results Multinomial logistic regressions predicting smoking trajectory membership as a function of sexual orientation were separately estimated for men and women, controlling for race/ethnicity, age, and the number of best friends who smoke daily. Sexual orientation effects were found only for women. The transition to LGB orientation was more predictive of higher smoking trajectories than was a consistent LGB orientation, with potentially important differences between the smoking patterns of these two groups.

Conclusions Sexual orientation and, particularly, the transition to LGB are associated with women's developmental smoking patterns. Results point to coping and socialization as two mechanisms that may explain the association, but further research is needed to disentangle them. Though these mechanisms ultimately lead to similar outcomes, they may require significantly different interventions to prevent and reduce smoking.

Keywords: Adolescent, bisexual, gay, lesbian, longitudinal, smoking

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INTRODUCTION

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 [1-4]. 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 [5, 6]. However, most earlier work was cross-sectional and based on self-identified nonrandom samples [7, 8] or area-based samples [2, 3, 9].

Much of the literature addressing the reasons for higher substance use among LGB youth focuses on the stresses associated with stigmatized identities [10, 11]. According to minority stress theory [12], disparities in substance use may be due to LGB youth being more likely to experience depression, loneliness, discrimination, and victimization [13, 14]. Developmental models such as the "overload model" additionally suggest that risk behaviors can result from experiencing several developmental transitions in short succession. 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 [15, 16]. 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 [17-19].

Only four longitudinal studies have been published that consider developmental smoking patterns among LGB adolescents. Tucker, Ellickson and Klein [20] examined a West Coast cohort of heterosexual and bisexual women over a ten year period (ages 14-23), with sexual orientation assessed at age 23. At age 14, bisexual women were already more likely to be smokers than heterosexual women, and while the smoking rate did not change over time for heterosexuals, it increased a further 50% among bisexuals. 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. Russell, Driscoll and Truong [21] 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 et al. [22] 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 et al. [23] used latent growth curve models 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 three measures of sexual orientation (i.e., attraction, behavior, and self-definition).

Although the Marshal et al. [23] study is the most sophisticated longitudinal examination of LGB smoking to date, it has four methodological or conceptual limitations, some of which also hamper comparability with much of the prior literature. First, gender was considered 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 [22, 24]. Second, sexual orientation measures were based on data from the six-year follow-up only and thus were insensitive to the development of sexual identity. It may be that *change* in sexual orientation during adolescence (e.g., "coming out") is itself associated with patterns of substance use. Third, smoking was assessed in terms of days smoked, rather than using a more standard measure capturing both the quantity and frequency of smoking. Finally, the study focused on linear 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.

The present analysis furthers the examination of smoking behaviors across sexual orientation groups by describing how heterosexual and LGB orientations are associated with distinct developmental trajectories of smoking, as well as how changes in sexual orientation over time (e.g., transition from a heterosexual identity to LGB) are linked to these trajectories. Although preliminary analyses did not find gender differences in the overall number and type of smoking trajectories, men and women are examined separately to explore whether the association between sexual orientation and smoking trajectory membership differs by gender. Smoking trajectories are based on the amount of past month cigarette smoking, in keeping with the majority of prior work.

We tested several hypotheses based on the theories of sexual orientation and substance use just reviewed, 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. The pervasive stress posited by minority stress theory suggests consistently LGB youth will be more likely than consistently heterosexual youth to belong to a trajectory group characterized by either steady low (H1a) or steady high (H1b) levels of smoking. Similarly, youth that transition to LGB status are expected to be more likely than consistently heterosexual youth to belong to the steady low (H1c) and steady high smoking trajectory groups (H1d). The overload model suggests that as youth transition to adulthood, consistently LGB individuals will accumulate greater stress and will be more likely to increase their smoking over time. Thus, we hypothesized that LGB youth will be more likely than consistently heterosexual youth to belong to a trajectory group exhibiting either an early increase (H2a) and delayed increase (H2b) in smoking. Youth that transition to an alternative orientation 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 [H3a] or delayed [H3b]) than the consistently alternative orientation youth who have already transitioned prior to observation. According to minority stress theory, youth that transition to a heterosexual orientation may ultimately face lower levels of stress than those who remain consistently

alternative and may be more likely to decrease smoking over time (H4); however the stress of the transition itself may negate this possibility. It should be noted that while early heavy smoking may particularly be an indicator of coping with stress, delayed escalation may be more indicative of socialization. Consistent with prior literature, we anticipate that differences by sexual orientation will be more pronounced for women than men (H5).

METHOD

Study Design

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 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. Of the initial 90,000 respondents, a baseline sample of 20,745 adolescents aged 12-19 was interviewed at home between April and December 1995, between April and August 1996, and again between August 2001 and April 2002. Over 15,000 Add Health respondents were re-interviewed at Wave III. 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. [25] for more details on the Add Health design and longitudinal data.

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 [26]. 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=6,696). At Wave I, these individuals range in age from 14-18 (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 the 7% of the previous sample who were either missing information on sexual orientation at Waves I or III, or who reported having no orientation at either Wave, as well as those missing information on other key variables at Wave I, for a final sample size of 6,203.

Measures

Smoking Behavior. The outcome measure in our analysis is the estimated smoking trajectory class to which an individual belongs. 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 at each of the three Waves [26]. The trajectories are displayed in Figure 1. Steady Highs (4.2% of sample) smoked close to an average of 18 cigarettes a day (nearly a pack a day) across all three waves. Early Increasers (8.3%) 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%) 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%) 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%) remained close to two cigarettes per day for the entire period, whereas Never Smokers (55.3%) abstained from smoking at all Waves. Complete details about the estimation method for these trajectories are available elsewhere [26].

[Figure 1 About Here]

Sexual Orientation. The primary independent variables in the analyses, sexual orientation, are based on responses to separate questions at Wave I and III asking whether they had a romantic attraction to a male and to a female. The timeframe was "ever" at Wave I and "since the last interview" at Wave III. The sexual orientation categories are defined as follows: "consistently heterosexual orientation" is defined as having only opposite-sex attractions at Wave I and Wave III; "consistently alternative orientation" is defined as having same- and/or both-sex attractions at both waves; "transition to alternative orientation" is defined as having only opposite-sex attractions at Wave I, but same- or both-sex attractions at Wave III; and "transition to heterosexual orientation" is defined as having same- or both-sex attractions at Wave I, but only opposite-sex attractions at Wave III. Note that a self-identified measure of sexual orientation is also available at Wave III, but we relied on the romantic attraction measure to ensure consistent measurement of sexual orientation across waves.

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).

RESULTS

Table 1 presents the unweighted sample frequencies for each sexual orientation group, by gender, in the final study sample. The table also provides detail on the specific types of sexual orientation transitions that comprise each final category. 90% of males and 86% of females reported a consistent sexual orientation, with nearly all of these cases (97%) being consistently heterosexual. Of the 300 males and 469 females whose responses indicated a transition in sexual orientation from Wave I to Wave III, 40% of these males and 78% of these females transitioned to an alternative orientation. Sample size necessitated combining lesbian/gay and bisexual individuals into a single group, although it should be noted that this group primarily consists of bisexuals.

[Table 1 About Here]

Multinomial logistic regressions predicting smoking trajectory membership as a function of sexual orientation are separately estimated for males and females, controlling for race/ethnicity, age, and the number of best friends who smoke daily (see Table 2). The "never smoke" group serves as the reference category in the Table, although additional comparisons were also made between consistently LGB and transition to LGB in order to examine H3a and H3b. Specifically, the summarized odds ratios may be interpreted as the odds that one sexual orientation group (e.g., consistently alternative) belongs to a particular trajectory group versus being a Never Smoker, relative to the odds

of consistent heterosexuals belonging to that trajectory group versus being a Never Smoker.

Nested models were also estimated that excluded the number of smoking best friends; the magnitude and significance levels of the sexual orientation measures were virtually unchanged, despite strong and significant positive association of smoking friends with smoking trajectory group membership in the final model (not shown).

[Table 2 About Here]

Panel A presents the results for women. Those who reported a consistently alternative orientation were about four times more likely than consistently heterosexual women to belong to the Delayed Increaser group (OR=4.27; consistent with H2b) or Decreaser group (OR=3.85) versus being a Never Smoker. However, consistently alternative and consistently heterosexual females did not differ in their likelihood of being in any of the other trajectory groups (failure to support H1a, H1b, and H2a).

Women who transitioned to an alternative orientation by Wave III, however, were significantly more likely than consistently heterosexual women to be in any of the smoking trajectory groups (with the exception of the Decreaser group) versus being a Never Smoker (supporting H1c, H1d, and H2b). For example, a woman who transitioned to an alternative orientation was nearly three times as likely as a consistently heterosexual women 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 a consistently alternative orientation and those that transitioned to an alternative orientation were estimated, indicating that those who transitioned to an alternative orientation were more likely to be in the Early Increaser trajectory group than consistently alternative women (OR=1.44 $p< 0.05$; supporting H3a), but were not more likely to be in the Delayed Increaser group (OR=0.70 p=0.54; failure to support H3b).

Women who transitioned to a heterosexual orientation did not differ from consistently heterosexual women in their odds of being in any of the trajectory groups compared to being a Never Smoker (failure to support H4).

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

Finally, a fully interactive (by sex) model was estimated that included both males and females (not shown). Results confirmed that differences by gender were significant overall (supporting H5; interactive model AIC=1.92, constrained model AIC=1.94).

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 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 [26]; analyses based on a single trajectory for each comparison group (i.e., LGB vs. heterosexual) are silent on the heterogeneity within groups. Such analyses overlook that women with consistently alternative orientations are more likely than heterosexual women 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 sexual orientation for women, but not for men.

Further, this study not only demonstrates how sexual orientation is linked to smoking over time, but also how *the transition* to LGB status is linked to smoking, while the transition to heterosexual status is not. Indeed, it appears that the transition to an alternative orientation is more predictive of higher smoking trajectories than is a consistent alternative orientation. Thus, studies that assess sexual orientation at a single point in time are limited both because sexual orientation is known to be unstable during adolescence and young adulthood, particularly for females [27], and because smoking risk of certain LGB subgroups will be underestimated.

Finally, this is the first longitudinal LGB study to account for the potential influence of smoking friends. To the extent that friendship networks are homophilous in terms of sexual orientation, LGB individuals are likely exposed to greater peer smoking which could partly account for associations between LGB status and smoking risk. Add Health data indicate that youth who are consistently LGB or transition to LGB have significantly more smoking best friends than heterosexuals (results not shown). However, while the number of smoking best friends was strongly associated with being in a higher smoking trajectory group, it did little to attenuate the association between LGB status and smoking. Greater exposure to smoking is thus not a solely viable explanation for elevated LGB smoking, directing attention towards stress or cultural norm explanations. Indeed, prior work has noted that bisexual women are more likely than heterosexual women to engage in solitary smoking at younger ages [20], with this form of smoking behavior in turn being linked to holding more positive attitudes about the affect-regulating consequences of smoking (such as alleviating depression or anxiety) [28, 29].

Smoking as a stress coping strategy is also suggested by the finding that transitioning to LGB is more consistently associated with smoking trajectory membership than having a stable LGB orientation. Because "stable alternative orientations" 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 "coming out" or developing an alternative orientation may have been experienced 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 before smoking is a viable activity, other coping strategies may be developed instead.

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. These results suggest socialization may also be an important factor in LGB smoking patterns. Although women with consistently alternative orientations are at greater risk of belonging to the Decreaser trajectory group (characterized by early heavy smoking) and the Delayed Increaser group compared to heterosexual women, 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 an alternative orientation are the ones who experience greater risk of belonging to any of these trajectory groups, suggesting 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 during the process of "coming out."

This research has several limitations that should be kept in mind when interpreting the results. Due to sample sizes, bisexuals and lesbian/gay individuals were combined to a single alternative orientation/LGB group. This group is mostly comprised of bisexuals and, as suggested by cross-sectional comparisons [21, 30], they may be driving the LGB results. Additionally, sexual orientation is assessed in terms of romantic attraction, which does not address whether the individual is engaging in same-sex relationships or has self-identified as LGB. While all three measures of orientation have been associated with smoking behaviors [23], the three measures are not entirely redundant [31] 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 attractions; results were generally similar though statistical significance was more frequently identified using the consistent attraction-based measure. Finally, this study is unable to directly address the reasons why women with a consistent alternative orientation, or who transition to an alternative orientation, differ from consistently heterosexual women in their smoking patterns.

The results point to two mechanisms – coping and socialization. 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.

Acknowledgements

This research was supported by funds from the California Tobacco-Related Disease Research Program of the University of California, Grant Number 16RT-0169. This research uses data from Add Health, a program project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a grant P01-HD31921 from the National Institute of Child Health and Human Development, with Cooperative funding from 17 other agencies. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from Add Health should contact Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill, NC 27516-2524 (addhealth@unc.edu)

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Table 1. Detailed Sexual Orientation Sample Sizes, By Gender

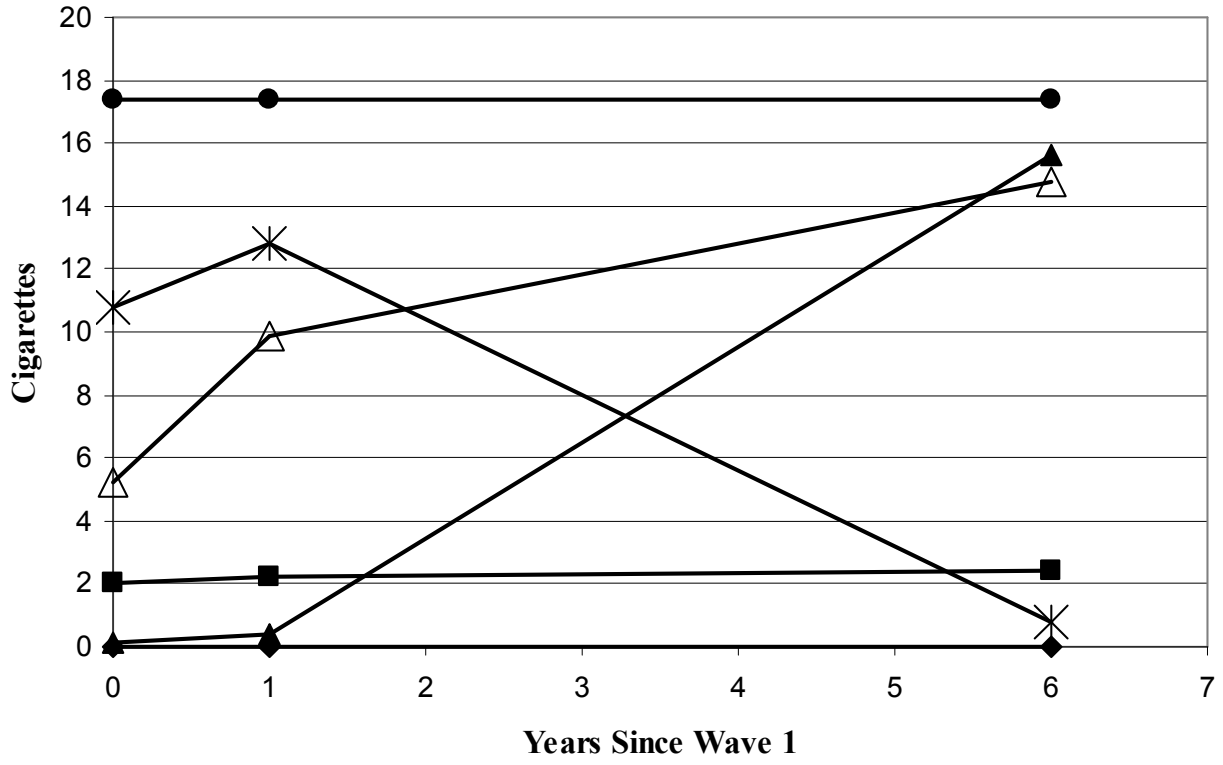
	Sample Size (unweighted)	
	Male	**Female**
Consistently Alternative Orientation	**43**	**65**
Consistently Lesbian/Gay	3	3
Consistently Bisexual	21	48
Lesbian/Gay to Bisexual	8	11
Bisexual to Lesbian/Gay	11	3
Transition to Alternative Orientation	**121**	**365**
Heterosexual to Lesbian/Gay	22	18
Heterosexual to Bisexual	99	347
Transition to Heterosexual Orientation	**179**	**104**
Lesbian/Gay to Heterosexual	24	28
Bisexual to Heterosexual	155	76
Consistently Heterosexual Orientation	**2,571**	**2,755**
Total	**2,914**	**3,289**

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 = 2,274)
Consistently Alternative Orientation	1.764	4.271 *	1.884	3.851 *	0.322	
Transition to Alternative Orientation	2.107 ***	2.995 ***	2.716 **	0.692	2.896 **	
Transtion to Heterosexual Orientation	1.526	0.872	1.933	1.505	1.746	
Consistently Heterosexual Orientation (Reference)						
Panel B						
Men	(n = 440)	(n = 224)	(n = 229)	(n = 60)	(n = 94)	(n = 1,867)
Consistently Alternative Orientation	1.322	1.444	0.202	0.926	0.218	
Transition to Alternative Orientation	1.737	1.700	0.224 †	2.836	0.354	
Transtion to Heterosexual Orientation	1.224	1.300	1.142	2.295	0.833	
Consistently Heterosexual Orientation (Reference)						

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

Figure 1. Trajectories of Average Cigarettes per Day: Grades 9-11 at Wave 1



Never Smokers (55.3%) Steady Lows (22.6%) Delayed Increasers (6.8%)
Early Increasers (8.3%) Decreasers (2.9%) Steady Highs (4.2%)