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Association of Coming Out as Lesbian, Gay, and Bisexual+ and Risk of Cigarette Smoking in a Nationally Representative Sample of Youth and Young Adults

Alyssa F. Harlow, MPH; Dielle Lundberg, MPH; Julia R. Raifman, ScD, SM; Andy S. L. Tan, PhD, MPH, MBA, MBBS; Carl G. Streed Jr, MD, MPH; Emelia J. Benjamin, MD, ScM; Andrew C. Stokes, PhD

➕ **Supplemental content**

IMPORTANCE Coming out as lesbian, gay, bisexual, or other identities besides heterosexual (LGB+) may represent a susceptible period for cigarette smoking initiation in youth and young adults.

OBJECTIVE To assess whether young people who change their sexual identity have higher risk of cigarette smoking initiation and current smoking compared with those with consistent sexual identities.

DESIGN, SETTING, AND PARTICIPANTS This cohort study used data from the nationally representative Population Assessment of Tobacco and Health study (wave 1, 2013-2014; wave 2, 2014-2015; wave 3, 2015-2016; wave 4, 2016-2018). Youth and young adults aged 14 to 29 years who were never smokers at wave 1 were included in this study. Analysis began October 2018 and ended June 2020.

EXPOSURES Consistent sexual identity (consistently heterosexual, consistently LGB+) vs changing sexual identity (coming out as LGB+, other LGB+ patterns) based on 4 waves of sexual identity data. Identities were further classified by distinguishing between bisexual and lesbian, gay, and other nonheterosexual identities.

MAIN OUTCOMES AND MEASURES Smoking initiation and current cigarette smoking at wave 4.

RESULTS Among 7843 individuals who never smoked at wave 1, 6991 (90.7%) reported a consistent sexual identity, and 852 (9.3%) changed sexual identity across waves. The mean (SE) baseline age of participants who reported consistent heterosexuality was 20.1 (0.8) years; consistently LGB+, 20.0 (3.7) years; coming out as LGB+, 18.0 (2.9) years, and other LGB+ pattern, 20.3 (3.8) years. A total of 14.1% (weighted) initiated smoking, and 6.3% were current smokers at wave 4. Compared with consistently heterosexual identities, coming out as LGB+ (23% vs 13%; odds ratio [OR], 1.72; 95% CI, 1.34-2.20), consistently LGB+ identities (17% vs 13%; OR, 1.45; 95% CI, 1.03-2.04), and other LGB+ patterns (17% vs 13%; OR, 1.47; 95% CI, 1.04-2.08) were positively associated with smoking initiation by wave 4. Compared with consistently heterosexual identities, ORs for smoking initiation were 2.24 (28% vs 13%; 95% CI, 1.72-2.92) for coming out as bisexual, 1.99 (23% vs 13%; 95% CI, 1.20-3.29) for consistently LGB+ with change to/from bisexual, and 2.20 (23% vs 13%; 95% CI, 1.40-3.46) for other LGB+ patterns with change to/from bisexual identity. Current smoking estimates were similar to those for smoking initiation.

CONCLUSIONS AND RELEVANCE Compared with consistently heterosexual identities, changing sexual identity over follow-up was associated with smoking initiation and current smoking. The risk associated with changing sexual identities was concentrated among participants coming out as bisexual or reporting other changes in their identity to/from being bisexual. More research is needed on mechanisms underlying the association between changing sexual identity and smoking initiation to inform tailored prevention programs and tobacco regulations.

Author Affiliations: Department of Epidemiology, Boston University School of Public Health, Boston, Massachusetts (Harlow, Benjamin); Department of Global Health, Boston University School of Public Health, Boston, Massachusetts (Lundberg, Stokes); Department of Health Law, Policy and Management, Boston University School of Public Health, Boston, Massachusetts (Raifman); Annenberg School for Communication, University of Pennsylvania, Philadelphia (Tan); Section of General Internal Medicine, Department of Medicine, Boston University School of Medicine, Boston, Massachusetts (Streed); Department of Medicine, Boston University School of Medicine, Boston, Massachusetts (Benjamin).

Corresponding Author: Andrew C. Stokes, PhD, Boston University School of Public Health, 801 Massachusetts Ave, Boston, MA 02118 (acstokes@bu.edu).

S ignificant disparities in tobacco use exist for lesbian, gay, bisexual, and other nonheterosexual identity (LGB+) cisgender populations compared with heterosexual populations.[1,2] LGB+ young people have higher rates of cigarette smoking, smoking cigarettes at earlier ages, and smoking with more intensity than heterosexual youth.[3-7] The prevalence of smoking among LGB+ populations is approximately 22%, compared with 14% among heterosexual populations.[8] Within LGB+ groups, bisexual populations have the highest prevalence of current smoking, at more than 30%.[8] Cigarette smoking is associated with 2 to 4 times the risk of coronary heart disease and stroke,[9] with 25 times the risk of lung cancer,[9] and with a myriad of other health consequences,[9] putting LGB+ youth at increased risk of smoking-related disease. Addressing LGB+ disparities in cigarette smoking is a public health priority.[10,11]

Most research on LGB+ smoking disparities considers sexual identity a static phenomenon.[12] However, establishing one's sexual identity, often referred to as *coming out*, is a multistage developmental process.[13] Sexual identity development can differ from person to person,[14] sexual identity can change over time among individuals, and the stage or timing of one's sexual identity development may play an important role in risk behaviors.[15-19] LGB+ young people just beginning a coming out process may be more at risk of cigarette smoking than those who have consistently identified as LGB+ for some time. Establishing a new identity may result in more internalized and externalized stress as a result of discrimination, social exclusion, experiences of identity rejection, or internalized homophobia, leading to smoking as a coping mechanism.[20] Young people with a new LGB+ identity also may be exposed to new social environments with more positive tobacco-related social norms[21,22] or encounter LGB+-targeted tobacco marketing.[23] Sexual identity is complex, and different stressors exist among individuals coming out to or from different identities. For example, the tobacco risk of a heterosexual person coming out as bisexual may differ from someone coming out as gay or lesbian and may also differ from a gay or lesbian person coming out as bisexual.[1]

Previous research has been limited in its ability to explore nuances of sexual identity changes in relation to smoking behaviors because of a lack of longitudinal data that measure sexual identity. The Population Assessment of Tobacco and Health (PATH) study provides an opportunity to examine changes in sexual identity and cigarette smoking on a national level, as the nationally representative survey asks youth about sexual identity and smoking behaviors over multiple waves of data collection. The present study aimed to determine whether youth and young adults who report a change in sexual identity have higher risk of cigarette smoking than young people with consistent sexual identities over follow-up using 4 waves of data from the PATH study (2013-2018). We hypothesize that youth and young adults who come out as LGB+ or report other changes in sexual identity during the follow-up period have higher risk of initiating cigarette smoking and current smoking than those with consistent heterosexual identities. Because prior studies reported that bisexual populations have higher rates of smoking compared with other

lesbian, gay, and other nonheterosexual (LG+) populations,[24,25] we also hypothesize that the risk of smoking initiation and current smoking is greater for young people who come out as bisexual than for those who come out as LG+.

Key Points

Question Is changing sexual identity associated with increased risk of cigarette smoking initiation and current smoking?

Findings In this nationally representative cohort study of 7843 youth and young adults, those who changed their sexual identity from heterosexual to bisexual were more likely than those with consistent heterosexual identities to initiate smoking and be current smokers during 3 years of follow-up. There was no increased risk for youth and young adults changing from heterosexual to lesbian, gay, or other nonheterosexual identities.

Meaning In this study, coming out as bisexual was associated with increased risk of initiating cigarette smoking and current smoking in youth and young adults.

Methods

Study Sample

We used 4 waves of data from the PATH study, established in 2013 by the National Institutes of Health and the US Food and Drug Administration to study tobacco product use and health. PATH sampled more than 49 000 youth and adults in the United States using a 4-stage stratified area probability sample design.[26] Participants completed 4 waves of data approximately 12 months apart. We used deidentified data from the adult and youth restricted use files from wave 1 (September 2013-December 2014), wave 2 (October 2014-October 2015), wave 3 (October 2015-October 2016), and wave 4 (December 2016-January 2018). Output of unweighted frequencies were not allowed from the restricted use files. We restricted our analysis to participants aged 14 to 29 years who were never cigarette smokers at wave 1 and did not identify as transgender by wave 4 (eFigure in the Supplement). This study relies on deidentified data and was deemed exempt by the Boston University Medical Center Institutional Review Board.

Outcome: Cigarette Smoking Initiation

Our primary outcome was cigarette smoking initiation, defined as ever smoking a cigarette by wave 4 and measured with the question, "Have you ever smoked a cigarette, even 1 or 2 puffs?" We also examined current smoking at wave 4, defined as past 30-day use and measured with the question, "In the past 30-days, have you smoked a cigarette, even 1 or 2 puffs?" Past 30-day smoking is a standard measure for current smoking among youth and is associated with smoking in adulthood.[27,28]

Sexual Identity Categories

We distinguished between consistent sexual identities and changing identities over the 3-year follow-up. At each wave,

Table 1. Eight-Level Sexual Identity Categories Over 4 Waves of the Population Assessment of Tobacco and Health Study, 2013-2018

Sexual identity category	Individuals, No. (%)	Derived from original identity category[a]	Description
Consistently heterosexual	6707 (85.5)	Consistently Heterosexual	Participants who do not identify as lesbian, gay, bisexual, or other nonheterosexual identities over the entire 3-y follow-up
Consistently LG+	100 (12.8)	Consistently LGB+	Participants who consistently identify as lesbian, gay, or other nonheterosexual identities over the 3-y follow-up; excluding bisexual identity
Consistently bisexual	85 (1.1)	Consistently LGB+	Participants who identify as bisexual over the entire 3-y follow-up
Consistently LGB+ with change to/from bisexual	99 (1.3)	Consistently LGB+	Participants who identify as lesbian, gay, bisexual, or other nonheterosexual identities over the 3-y follow-up but change between a lesbian/gay/other nonheterosexual identity and a bisexual identity; these include participants who change from bisexual to lesbian/gay/other identities and vice versa
Coming out bisexual	339 (4.3)	Coming out LGB+	Participants who identify as heterosexual at wave 1 and change to a bisexual identity over follow-up; this may also include participants who identify as lesbian/gay/other nonheterosexual identity in addition to bisexual over follow-up
Coming out LG+	163 (2.1)	Coming out LGB+	Participants who identify as heterosexual at wave 1 and change to a lesbian, gay, or other non-heterosexual identity over follow-up. These participants do not identify as bisexual at any point.
Other LGB+ patterns with change to/from bisexual	189 (2.4)	Other LGB+ patterns	Participants who change between a bisexual and heterosexual identity over follow-up and do not meet the definition for coming out bisexual; this may also include participants who identify as lesbian/gay/other nonheterosexual identity in addition to bisexual and heterosexual over follow-up
Other LG+ patterns	161 (2.1)	Other LGB+ patterns	Participants who change between a lesbian/gay/other nonheterosexual identity and heterosexual identity over follow-up and do not meet the definition for coming out LG+; these participants do not identify as bisexual at any point

Abbreviations: LG+, lesbian, gay, and other nonheterosexual identities; LGB+, lesbian, gay, bisexual, and other nonheterosexual identities.

[a] Eight-level bisexual identities were derived from the 4-level identity variable. Consistently heterosexual participants identified as heterosexual at all 4 waves; consistently LGB+ participants identified as LGB+ at all 4 waves; coming out LGB+ identified as heterosexual at wave 1 and LGB+ by wave 4; Participants with other LGB+ patterns changed sexual identity over follow-up but did not meet the definition of coming out LGB+.

participants were asked the following question on sexual identity: "Do you consider yourself to be…(1) straight, (2) lesbian or gay, (3) bisexual, (4) something else?" We dichotomously classified participants as either heterosexual or LGB+ at each wave. LGB+ identities included lesbian/gay, bisexual, or something else (other than heterosexual). The something else category may include other identities such as queer/asexual, etc, or those who do not use labels or are questioning their identity.[26] We then further categorized participants by whether they had a consistent identity across waves or if they came out during follow-up. We defined coming out as changing one's reported sexual identity from heterosexual to LGB+ over follow-up. Consistent identities included participants who were consistently heterosexual or consistently LGB+ at all 4 waves. Coming out identities included participants who identified as heterosexual at wave 1 and identified as LGB+ by wave 4. Approximately 4% of the sample reported other identity patterns (eg, changed from LGB+ to heterosexual). Our primary independent variable was a 4-category mutually exclusive sexual identity variable: (1) consistently heterosexual, (2) consistently LGB+, (3) coming out LGB+, and (4) other LGB+ patterns.

As prior studies indicate high smoking prevalence among bisexual youth,[24,25] we classified participants by whether they identified as bisexual at any point over follow-up for an additional independent variable (Table 1). We divided our original 4-level variable into an 8-level variable accounting for bisexual identity: (1) consistently heterosexual, (2) consis-

tently LG+, (3) consistently bisexual, (4) consistently LGB+ with change to/from bisexual, (5) coming out bisexual, (6) coming out LG+, (7) other LGB+ patterns with change to/from bisexual, and (8) other LG+ patterns. Table 1 provides definitions for the 8 identity categories.

Assessment of Covariates

At wave 1, participants reported their age (continuous), sex (male, female), race/ethnicity (non-Hispanic Black, non-Hispanic White, non-Hispanic Asian or other race, Hispanic), urban residence (urban, nonurban), and census region (Northeast, South, Midwest, West). Education was measured for participants 18 years and older, and parental education was measured for participants younger than 18 years (<high school or GED, high school graduate, >high school). Parental education was the only measure of socioeconomic status in the wave 1 youth survey.

Statistical Analysis

We compared wave 1 characteristics across each sexual identity category and tested the association between sexual identities and our 2 outcomes (smoking initiation and current smoking at wave 4) using multivariable logistic regression. We separately modeled each outcome as a function of identity categories, with consistently heterosexual as the reference, adjusting for covariates associated with cigarette smoking and sexual identity, and temporally preceding sexual identity changes. We did not adjust for potential mediators, including

Table 2. Descriptive Baseline Characteristics Stratified by 4-Level Sexual Identity Categories Among 7843 Individuals Who Never Smoked Cigarettes From the Population Assessment of Tobacco and Health Study, 2013-2018

Wave 1 characteristic[a]	Consistently heterosexual[b]	Consistently LGB+[b]	Coming out LGB+[b]	Other LGB+ pattern[b]
Total individuals, No. (%)	6707 (87.1)	284 (3.6)	502 (5.0)	350 (4.4)
Age, mean (SE), y	20.1 (0.8)	20.0 (3.7)	18.0 (2.9)	20.3 (3.8)
Female, %	50.7	64.4	62.6	63.5
Race/ethnicity, %				
Non-Hispanic White	52.9	53.4	53.4	39.1
Non-Hispanic Black	14.9	16.6	13.3	19.6
Hispanic	20.3	16.1	18.2	30.5
Asian or other race[c]	11.8	13.8	15.0	10.8
Education, %[d]				
<High school	11.0	12.6	12.3	25.5
Graduated high school	24.6	22.3	24.6	25.2
>High school	64.5	65.1	63.1	49.3
US census region, %				
Northeast	17.8	17.1	12.4	18.2
Midwest	21.1	23.8	29.0	21.1
South	36.2	33.5	34.8	38.3
West	24.9	25.5	23.8	22.4
Urban residing, %	95.5	96.7	95.5	97.3

Abbreviation: LGB+, lesbian, gay, bisexual, and other nonheterosexual identities.

[a] Descriptive statistics calculated using sample-weighted percentages and sample-weighted means.

[b] Consistently heterosexual participants identified as heterosexual at all 4 waves; consistently LBG+ participants identified as LGB+ at all 4 waves; and coming out LGB+ identified as heterosexual at wave 1 and LGB+ by wave 4. Participants with other LGB+ patterns changed sexual identity over follow-up but did not meet the definition of coming out LGB+.

[c] Other races included individuals reporting more than 1 race, American Indian/Alaska Native, and Native Hawaiian/Pacific Islander.

[d] For participants younger than 18 years, parental education is reported.

other substance use or mental health disorders. Final models adjusted for age, sex, race/ethnicity, education, urban residence, and census region. We calculated adjusted predicted probabilities of wave 4 cigarette smoking assuming the mean value of model covariates.[29] We repeated the analysis using the 8-level identity measure accounting for bisexual identity.

We stratified our primary analysis by sex and age at baseline (<18 vs ≥18 years) and included interaction terms between sexual identity and sex as well as sexual identity and age. We compared attrition between wave 1 LGB+ and heterosexual participants and compared baseline characteristics of those retained vs lost to follow-up. Missing data on exposure, outcome, and covariates (n = 462) were assumed to be missing at random and imputed using multiple imputation with 5 data sets. For all estimates, we used population weights and replicate weights using the balanced repeated replication method with the Fay adjustment (ρ = 0.3) for inferences generalizable to the US population.[26] Analyses were conducted using SAS version 9.4 (SAS Institute). Analysis began October 2018 and ended June 2020.

Results

Our study included 7843 participants aged 14 to 29 years who were never cigarette smokers at wave 1. **Table 2** and eTable 1 in the Supplement present baseline characteristics stratified by our 4-level and 8-level identity categories, respectively. Most participants (6707 [87.1%]) reported a consistently heterosexual identity across waves, 284 (3.6%) reported a consistently LGB+ identity, 502 (5.0%) came out as LGB+ over follow-up, and 350 (4.4%) reported other LGB+ patterns (Table 2). Among other LGB+ patterns, 62% (weighted) changed from

LGB+ at wave 1 to heterosexual over follow-up (eTable 2 in the Supplement). The mean (SE) baseline age of participants who reported consistent heterosexuality was 20.1 (0.8) years; consistently LGB+, 20.0 (3.7) years; coming out as LGB+, 18.0 (2.9) years; and other LGB+ pattern, 20.3 (3.8) years. Attrition was similar for wave 1 LGB+ and heterosexual participants (31.1% vs 30.5%). There were no substantive differences in baseline characteristics between those retained and lost to follow-up (eTable 3 in the Supplement).

Smoking Initiation by Wave 4

By wave 4, 14.1% of participants reported ever cigarette smoking. Adjusted predicted probabilities of ever smoking were 23.8% (95% CI, 19.3%-28.2%) for coming out LGB+, 21.1% (95% CI, 15.3%-26.9%) for other LGB+ patterns, 20.9% (95% CI, 15.3%-26.5%) for consistently LGB+, and 15.4% (95% CI, 13.8%-16.9%) for consistently heterosexual participants. Coming out as LGB+ was associated with 72% greater adjusted odds of smoking initiation compared with consistently heterosexual identities (odds ratio [OR], 1.72; 95% CI, 1.34-2.20) (**Table 3**). Participants who reported other LGB+ patterns were 1.47 (95% CI, 1.04-2.08) times more likely and consistently LGB+ participants were 1.45 (95% CI, 1.03-2.04) times more likely than consistently heterosexual participants to report smoking initiation.

Participants who came out as bisexual had 2.24 (95% CI, 1.72-2.92) times the adjusted odds of smoking initiation by wave 4 compared with consistently heterosexual young people (**Table 4**). Participants with other LGB+ patterns that included change to/from bisexuality had an adjusted OR of 2.20 (95% CI, 1.40-3.46). Participants with consistently LGB+ identities that included change to/from bisexuality had an adjusted OR of 1.99 (95% CI, 1.20-3.29). There was no associa-

Table 3. Cigarette Smoking at Wave 4 by 4-Level Sexual Identity Categories Among 7843 Individuals Who Never Smoked Cigarettes at Wave 1 From the Population Assessment of Tobacco and Health Study, 2013-2018

Sexual identity category	Cigarette use, %[a]	Odds ratio (95% CI)	Adjusted odds ratio (95% CI)[b]	Predicted probabilities (95% CI)[b,c]
Smoking initiation by wave 4[d]				
Total	14.1	NA	NA	NA
Consistently heterosexual	13.3	1 [Reference]	1 [Reference]	0.154 (0.138-0.169)
Consistently LGB+	16.9	1.33 (0.94-1.88)	1.45 (1.03-2.04)	0.209 (0.153-0.265)
Coming out LGB+	23.0	1.98 (1.51-2.60)	1.72 (1.34-2.20)	0.234 (0.193-0.282)
Other LGB+ patterns	17.3	1.39 (0.97-2.01)	1.47 (1.04-2.08)	0.211 (0.153-0.269)
Current smoker at wave 4[e]				
Total	6.3	NA	NA	NA
Consistently heterosexual	5.8	1 [Reference]	1 [Reference]	0.069 (0.060-0.077)
Consistently LGB+	8.3	1.49 (0.90-2.45)	1.63 (1.00-2.66)	0.107 (0.060-0.154)
Coming out LGB+	11.5	2.12 (1.55-2.89)	1.78 (1.33-2.39)	0.116 (0.085-0.147)
Other LGB+ patterns	8.5	1.54 (0.98-2.44)	1.63 (1.03-2.56)	0.107 (0.063-0.151)

Abbreviations: LGB+, lesbian, gay, bisexual, and other nonheterosexual identities; NA, not applicable.

[a] Sample-weighted percentages.

[b] Regression models and predicted probabilities were sample weighted and adjusted for urban residence, sex, race/ethnicity, education, and census region.

[c] Predicted probabilities calculated at the mean of model covariates.

[d] Reported ever smoking by wave 4.

[e] Defined as past 30-day smoking at wave 4.

Table 4. Cigarette Smoking at Wave 4 by 8-Level Identity Categories Among 7843 Individuals Who Never Smoked Cigarettes at Wave 1 From the Population Assessment of Tobacco and Health Study, 2013-2018

Sexual identity category	Cigarette use, %[a]	Odds ratio (95% CI)	Adjusted odds ratio (95% CI)[b]	Predicted probabilities (95% CI)[b,c]
Smoking initiation by wave 4[d]				
Total	14.1	NA	NA	NA
Consistently heterosexual	13.3	1 [Reference]	1 [Reference]	0.153 (0.138-0.169)
Consistently LGB+ identities				
Consistently LG+	11.5	0.80 (0.38-1.67)	0.90 (0.43-1.87)	0.141 (0.054-0.228)
Consistently bisexual	17.1	1.36 (0.72-2.58)	1.60 (0.89-2.88)	0.225 (0.123-0.327)
Consistently LGB+ with change to/from bisexual	22.6	2.02 (1.16-3.53)	1.99 (1.20-3.29)	0.264 (0.164-0.365)
Coming out LGB+ identities				
Coming out bisexual	28.3	2.59 (1.94-3.47)	2.24 (1.72-2.92)	0.289 (0.235-0.342)
Coming out LG+	13.5	1.03 (0.58-1.84)	0.91 (0.52-1.60)	0.141 (0.073-0.210)
Other LGB+ patterns				
Other LGB+ patterns with change to/from bisexual	23.4	2.12 (1.30-3.46)	2.20 (1.40-3.46)	0.285 (0.194-0.377)
Other LG+ patterns	11.5	0.85 (0.50-1.45)	0.91 (0.55-1.49)	0.141 (0.079-0.202)
Current smoker at wave 4[e]				
Total	6.3	NA	NA	NA
Consistently heterosexual	5.8	1 [Reference]	1 [Reference]	0.068 (0.060-0.077)
Consistently LGB+ identities				
Consistently LG+	3.8	0.60 (0.20-1.82)	0.69 (0.22-2.14)	0.048 (0.00-0.100)
Consistently bisexual	8.2	1.47 (0.62-3.46)	1.77 (0.76-4.10)	0.115 (0.031-0.199)
Consistently LGB+ with change to/from bisexual	13.2	2.64 (1.34-5.20)	2.58 (1.36-4.89)	0.159 (0.071-0.248)
Coming out LGB+ identities				
Coming out bisexual	14.2	2.73 (1.96-3.80)	2.28 (1.64-3.15)	0.143 (0.103-0.183)
Coming out LG+	6.4	1.07 (0.57-2.00)	0.93 (0.51-1.69)	0.064 (0.027-0.100)
Other LGB+ patterns				
Other LGB+ patterns with change to/from Bisexual	10.6	2.04 (1.09-3.83)	2.07 (1.11-3.88)	0.132 (0.063-0.201)
Other LG+ patterns	6.5	1.13 (0.58-2.19)	1.23 (0.65-2.32)	0.083 (0.032-0.135)

Abbreviations: LG+, lesbian, gay, and other nonheterosexual identities; LGB+, lesbian, gay, bisexual, and something else besides heterosexual; NA, not applicable.

[a] Sample-weighted percentages.

[b] Regression models and predicted probabilities were sample weighted and adjusted for urban residence, sex, race/ethnicity, education, census region.

[c] Predicted probabilities calculated at the mean of model covariates.

[d] Reported ever smoking by wave 4.

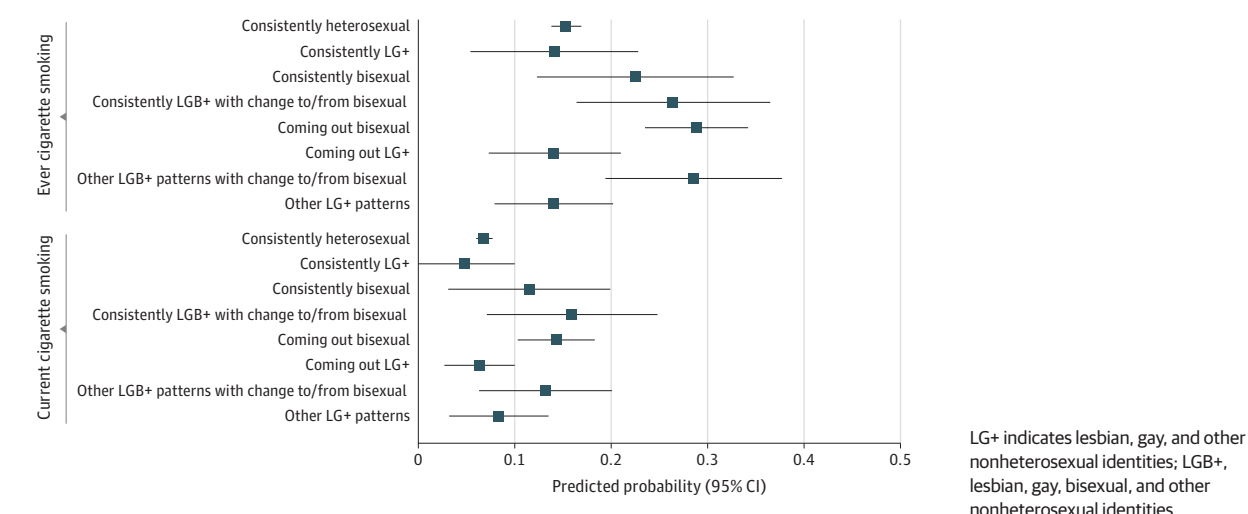[e] Defined as past 30-day smoking at wave 4.

tion for participants who came out as LG+ (OR, 0.91; 95% CI, 0.52-1.60), those with consistently LG+ identities (OR, 0.90; 95% CI, 0.43-1.87) or those with other LG+ patterns (OR, 0.91; 95% CI, 0.55-1.49). Estimates for consistently bisexual participants were imprecise but indicated an association with elevated risk (OR, 1.60; 95% CI, 0.89-2.88). The **Figure** presents predicted probabilities by the 8-level sexual identity categories.

Current Smoking at Wave 4

By wave 4, 6.3% of participants reported current smoking (Table 3). Adjusted ORs for current smoking were 1.78 (95% CI,

Figure. Adjusted Predicted Probability of Cigarette Smoking at Wave 4 by Sexual Identity Transitions
From the Population Assessment of Tobacco and Health, 2013-2018

LG+ indicates lesbian, gay, and other
nonheterosexual identities; LGB+,
lesbian, gay, bisexual, and other
nonheterosexual identities.

1.33-2.39) for coming out LGB+, 1.63 (95% CI, 1.03-2.56) for other LGB+ patterns, and 1.63 (95% CI, 1.00-2.66) for consistently LGB+ compared with consistently heterosexual participants (Table 3). When accounting for bisexual identity, all identities with change to or from bisexuality had approximately twice the odds of current smoking compared with consistently heterosexual identity (Table 4). Odds ratios for coming out LG+ and other LG+ patterns showed no association. Estimates for consistently LG+ identities indicated a reduced risk, but confidence intervals were wide and included no association.

Sensitivity Analyses

Stratified estimates were less precise than primary models, but we identified some differences in smoking initiation by sex. Among male individuals, consistent LGB+ identities and other LGB+ patterns were not associated with increased risk of smoking initiation, although a positive association remained for coming out LGB+ (eTable 4 in the Supplement). There were no substantive differences by age (eTable 5 in the Supplement).

Discussion

In this longitudinal nationally representative study, we found that participants who came out as bisexual or reported changes in their identity to/from being bisexual were twice as likely to initiate smoking and to be current smokers compared with consistently heterosexual participants. Participants who came out as LG+ did not have increased risk of smoking initiation or current smoking compared with consistently heterosexual participants.

Our findings provide evidence that changing sexual identities may be an important mechanism behind the LGB+ smoking disparity, particularly for bisexual young people. Results align with previous research on sexual identity fluidity and substance use risk[30] and provide evidence that the association between coming out and smoking is present in a nationally rep-

resentative sample. Our data are also supported by prior studies showing life event transitions (eg, losing a job, change in romantic partners, entering college) increase risk of smoking[31,32] and other substance use.[33,34] Our work demonstrates the timing and type of sexual identity development matters with regard to smoking behaviors in young people. Public health professionals should recognize the nuances of sexual identity and its effect on health behaviors,[35] rather than homogenizing young people into binary and static sexual identities.[36] This is particularly important given that in our nationally representative sample of youth and young adults, a majority of LGB+ participants reported a change in sexual identity over the 3-year follow-up.

Importantly, our results indicate that the smoking risk associated with changing sexual identities was entirely attributed to coming out as bisexual or reporting other changes in identity to/from being bisexual, rather than coming out as LG+. The elevated smoking risk was present for those changing between heterosexual and bisexual identities and for those changing between LG+ and bisexual identities. In addition, after accounting for bisexual identity, the association for consistently LG+ participants completely attenuated, while consistently bisexual participants had elevated smoking risk. Previous research shows bisexual young people have higher prevalence of smoking[8,25] and other substance use[24] compared with other LG+ groups. Prior data and our own findings highlight the importance of differentiating between bisexual and other LG+ identities in health research. Results also reveal the importance of studying changes between LGB+ identities in addition to changes between heterosexual and LGB+ identities. Categorizing participants into 1 homogenous sexual minority status group can obscure important disparities within the LGB+ population.

Young people changing sexual identities may develop smoking habits as a form of integration with new social environments.[21,22,24,37] Smoking may be used to establish oneself in a new community or to reduce social anxiety associ-

ated with new social groups.[24,38] One longitudinal study found initial increased involvement in LGB+-related activities was associated with increased alcohol and marijuana use among LGB+ youth, but substance use eventually decreased over time.[37] Therefore, once settled in their sexual identities, LGB+ youth may feel less compelled to socially smoke.

It is also possible that youth and young adults smoke as a coping mechanism for the stress associated with coming out.[20] Psychological distress, discrimination, and mental health disorders are consistently found to be correlated with cigarette smoking in the literature.[39-42] LGB+ young people exhibit greater incidence of poor mental health and stress,[20] and nationally representative data show bisexual populations have higher prevalence of severe psychological distress than other LG+ populations.[43] Publicly identifying as LGB+ makes individuals vulnerable to social stressors in the form of stigma, prejudice, and discrimination, a phenomenon called *minority stress*.[20] Recently out LGB+ individuals may smoke as a reaction to newly experienced discrimination.[38,44] A study by Newcomb et al[4] found psychological distress and LGB+ violence and discrimination predicted cigarette smoking and higher rates of smoking among LGB+ youth.[4] However, other research suggests individuals who privately but not publicly identify as LGB+ can experience stress caused by internalized homonegativity[12,45]; in this case, coming out may actually alleviate internalized stress. More research is needed to better understand the role of minority stress and LGB+ mental health on risk of smoking.

Limitations

There are limitations of our study. First, we do not know participants' sexual identity before entering and after leaving the study. Second, participants' reported sexual identity may not align with their public sexual identity. It is possible some participants privately identified as LGB+ during data collection but publicly identified as heterosexual. Further, sexual orientation is comprised of 3 domains (identity, attraction, behavior), and we only address identity in this analysis. It is difficult to make conclusions on mechanisms without more data on environmental and interpersonal contexts. Third, although we group together participants with the same identity patterns, the LGB+ community is diverse, and individuals within the same identity group may differ on factors related to smoking risk, including familial support and social environments. Participants across groups may also differ on unmeasured confounders, and we cannot rule out residual confounding. Fourth, some identity categories had small sample sizes, leading to imprecise estimates with wide confidence intervals. Larger samples are needed to explore granularities in sexual identity and smoking, including risks associated with gender identity transitions for transgender and nonbinary youth and intersectional identities (eg, combinations of sexual identity, race/ethnicity, gender, etc). Fifth, our assumption of data being missing at random for multiple imputation may not be met if there are unmeasured variables associated with missing data.

Conclusions

Our study represents one of the first analyses to explore the nuances of sexual identity development and timing associated with cigarette smoking initiation on a national scale, to our knowledge. Our findings stress the importance of recognizing that LGB+ young people in different stages of identity development and with different LGB+ identities have different risks of smoking. Those who have recently changed identities may be more at risk of smoking initiation than those who have identified as LGB+ consistently for some time. Our data suggest young people who change to or from a bisexual identity are particularly susceptible. Future research should address mechanisms underlying the association between changes in sexual identity and cigarette smoking to inform tailored smoking prevention programs and tobacco regulations.

REFERENCES

1. Hoffman L, Delahanty J, Johnson SE, Zhao X. Sexual and gender minority cigarette smoking disparities: an analysis of 2016 Behavioral Risk Factor Surveillance System data. *Prev Med*. 2018; 113:109-115. doi:10.1016/j.ypmed.2018.05.014

2. Johnson SE, Holder-Hayes E, Tessman GK, King BA, Alexander T, Zhao X. Tobacco product use among sexual minority adults: findings from the 2012-2013 National Adult Tobacco Survey. *Am J Prev Med*. 2016;50(4):e91-e100. doi:10.1016/j.amepre.2015.07.041

3. Watson RJ, Lewis NM, Fish JN, Goodenow C. Sexual minority youth continue to smoke cigarettes earlier and more often than heterosexuals: findings

from population-based data. *Drug Alcohol Depend*. 2018;184:64-70. doi:10.1016/j.drugalcdep.2017.11.025

4. Newcomb ME, Heinz AJ, Birkett M, Mustanski B. A longitudinal examination of risk and protective factors for cigarette smoking among lesbian, gay, bisexual, and transgender youth. *J Adolesc Health*. 2014;54(5):558-564. doi:10.1016/j.jadohealth.2013.10.208

5. Corliss HL, Wadler BM, Jun H-J, et al. Sexual-orientation disparities in cigarette smoking in a longitudinal cohort study of adolescents. *Nicotine Tob Res*. 2013;15(1):213-222. doi:10.1093/ntr/nts114

6. Wheldon CW, Kaufman AR, Kasza KA, Moser RP. Tobacco use among adults by sexual orientation: findings from the Population Assessment of Tobacco and Health study. *LGBT Health*. 2018;5(1):33-44. doi:10.1089/lgbt.2017.0175

7. Fish JN, Turner B, Phillips G II, Russell ST. Cigarette smoking disparities between sexual minority and heterosexual youth. *Pediatrics*. 2019;143(4):e20181671. doi:10.1542/peds.2018-1671

8. Drope J, Liber AC, Cahn Z, et al. Who's still smoking? disparities in adult cigarette smoking prevalence in the United States. *CA Cancer J Clin*. 2018;68(2):106-115. doi:10.3322/caac.21444

9. U.S. Department of Health and Human Services. The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General. Updated January 2014. Accessed September 17, 2020. https://www.ncbi.nlm.nih.gov/books/NBK179276/pdf/Bookshelf_NBK179276.pdf

10. Perez-Stable EJ. Director's message: sexual and gender minorities formally designated as a health disparity population for research purposes. National Institute on Minority Health and Health Disparities. Published October 2016. Accessed June 21, 2019. https://www.nimhd.nih.gov/about/directors-corner/messages/message_10-06-16.html

11. Alexander R, Parker K, Schwetz T. Sexual and gender minority health research at the National Institutes of Health. *LGBT Health*. 2016;3(1):7-10. doi:10.1089/lgbt.2015.0107

12. Blosnich J, Lee JGL, Horn K. A systematic review of the aetiology of tobacco disparities for sexual minorities. *Tob Control*. 2013;22(2):66-73. doi:10.1136/tobaccocontrol-2011-050181

13. Kaestle CE. Sexual orientation trajectories based on sexual attractions, partners, and identity: a longitudinal investigation From adolescence through young adulthood using a U.S. representative sample. *J Sex Res*. 2019;56(7):811-826. doi:10.1080/00224499.2019.1577351

14. Frost DM, Hammack PL, Wilson BDM, Russell ST, Lightfoot M, Meyer IH. The qualitative interview in psychology and the study of social change: sexual identity development, minority stress, and health in the generations study. *Qual Psychol*. Published online October 9, 2020. doi:10.1037/qup0000148

15. Rosario M, Schrimshaw EW, Hunter J. Different patterns of sexual identity development over time: implications for the psychological adjustment of lesbian, gay, and bisexual youths. *J Sex Res*. 2011;48(1):3-15. doi:10.1080/00224490903331067

16. Cass VC. Homosexual identity formation: a theoretical model. *J Homosex*. 1979;4(3):219-235. doi:10.1300/J082v04n03_01

17. Erikson EH. *Identity and the Life Cycle*. WW Norton & Co; 1994.

18. Rosario M, Schrimshaw EW, Hunter J. Predicting different patterns of sexual identity development over time among lesbian, gay, and bisexual youths: a cluster analytic approach. *Am J Community Psychol*. 2008;42(3-4):266-282. doi:10.1007/s10464-008-9207-7

19. Ott MQ, Corliss HL, Wypij D, Rosario M, Austin SB. Stability and change in self-reported sexual orientation identity in young people: application of mobility metrics. *Arch Sex Behav*. 2011;40(3):519-532. doi:10.1007/s10508-010-9691-3

20. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol Bull*. 2003;129(5):674-697. doi:10.1037/0033-2909.129.5.674

21. Cochran SD, Grella CE, Mays VM. Do substance use norms and perceived drug availability mediate sexual orientation differences in patterns of substance use? results from the California Quality of Life Survey II. *J Stud Alcohol Drugs*. 2012;73(4):675-685. doi:10.15288/jsad.2012.73.675

22. Mereish EH, Goldbach JT, Burgess C, DiBello AM. Sexual orientation, minority stress, social norms, and substance use among racially diverse adolescents. *Drug Alcohol Depend*. 2017;178:49-56. doi:10.1016/j.drugalcdep.2017.04.013

23. Tan ASL, Hanby EP, Sanders-Jackson A, Lee S, Viswanath K, Potter J. Inequities in tobacco advertising exposure among young adult sexual, racial and ethnic minorities: examining intersectionality of sexual orientation with race and ethnicity. *Tob Control*. Published online December 19, 2019. doi:10.1136/tobaccocontrol-2019-055313

24. Green KE, Feinstein BA. Substance use in lesbian, gay, and bisexual populations: an update on empirical research and implications for treatment. *Psychol Addict Behav*. 2012;26(2):265-278. doi:10.1037/a0025424

25. McQuoid J, Thrul J, Ozer E, Ramo D, Ling PM. Tobacco use in the sexual borderlands: the smoking contexts and practices of bisexual young adults. *Health Place*. 2019;58:102069. doi:10.1016/j.healthplace.2018.12.010

26. National Addiction & HIV Data Archive Program. Population Assessment of Tobacco and Health (PATH) Study [United States] Restricted-Use Files (ICPSR 36231). Updated June 24, 2020. Accessed September 17, 2020. https://www.icpsr.umich.edu/icpsrweb/NAHDAP/studies/36231

27. Sargent JD, Gabrielli J, Budney A, Soneji S, Wills TA. Adolescent smoking experimentation as a predictor of daily cigarette smoking. *Drug Alcohol Depend*. 2017;175:55-59. doi:10.1016/j.drugalcdep.2017.01.038

28. Saddleson ML, Kozlowski LT, Giovino GA, Homish GG, Mahoney MC, Goniewicz ML. Assessing 30-day quantity-frequency of U.S. adolescent cigarette smoking as a predictor of adult smoking 14 years later. *Drug Alcohol Depend*. 2016;162:92-98. doi:10.1016/j.drugalcdep.2016.02.043

29. Muller CJ, MacLehose RF. Estimating predicted probabilities from logistic regression: different methods correspond to different target populations. *Int J Epidemiol*. 2014;43(3):962-970. doi:10.1093/ije/dyu029

30. Ott MQ, Wypij D, Corliss HL, et al. Repeated changes in reported sexual orientation identity linked to substance use behaviors in youth. *J Adolesc Health*. 2013;52(4):465-472. doi:10.1016/j.jadohealth.2012.08.004

31. Allem J-P, Soto DW, Baezconde-Garbanati L, Unger JB. Role transitions in emerging adulthood are associated with smoking among Hispanics in Southern California. *Nicotine Tob Res*. 2013;15(11):1948-1951. doi:10.1093/ntr/ntt080

32. Huh J, Huang Z, Liao Y, Pentz M, Chou C-P. Transitional life events and trajectories of cigarette and alcohol use during emerging adulthood: latent class analysis and growth mixture modeling. *J Stud Alcohol Drugs*. 2013;74(5):727-735. doi:10.15288/jsad.2013.74.727

33. Allem JP, Lisha NE, Soto DW, Baezconde-Garbanati L, Unger JB. Emerging adulthood themes, role transitions and substance use among Hispanics in Southern California. *Addict Behav*. 2013;38(12):2797-2800. doi:10.1016/j.addbeh.2013.08.001

34. Low NCP, Dugas E, O'Loughlin E, et al. Common stressful life events and difficulties are associated with mental health symptoms and substance use in young adolescents. *BMC Psychiatry*. 2012;12(1):116. doi:10.1186/1471-244X-12-116

35. Streed CG, Davis JA. Improving clinical education and training on sexual and gender minority health. *Curr Sex Health Rep*. 2018;10(4):273-280. doi:10.1007/s11930-018-0185-y

36. Eliason MJ, Streed CG Jr. Choosing "something else" as a sexual identity: evaluating response options on the National Health Interview Survey. *LGBT Health*. 2017;4(5):376-379. doi:10.1089/lgbt.2016.0206

37. Rosario M, Schrimshaw EW, Hunter J. Predictors of substance use over time among gay, lesbian, and bisexual youths: an examination of three hypotheses. *Addict Behav*. 2004;29(8):1623-1631. doi:10.1016/j.addbeh.2004.02.032

38. Remafedi G. Lesbian, gay, bisexual, and transgender youths: who smokes, and why? *Nicotine Tob Res*. 2007;9(1)(suppl 1):S65-S71. doi:10.1080/14622200601083491

39. Purnell JQ, Peppone LJ, Alcaraz K, et al. Perceived discrimination, psychological distress, and current smoking status: results from the Behavioral Risk Factor Surveillance System Reactions to Race module, 2004-2008. *Am J Public Health*. 2012;102(5):844-851. doi:10.2105/AJPH.2012.300694

40. Kassel JD, Stroud LR, Paronis CA. Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. *Psychol Bull*. 2003;129(2):270-304. doi:10.1037/0033-2909.129.2.270

41. Chaiton MO, Cohen JE, O'Loughlin J, Rehm J. A systematic review of longitudinal studies on the association between depression and smoking in adolescents. *BMC Public Health*. 2009;9(1):356. doi:10.1186/1471-2458-9-356

42. O'Cleirigh C, Dale SK, Elsesser S, et al. Sexual minority specific and related traumatic experiences are associated with increased risk for smoking among gay and bisexual men. *J Psychosom Res*. 2015;78(5):472-477. doi:10.1016/j.jpsychores.2015.02.004

43. Gonzales G, Przedworski J, Henning-Smith C. Comparison of health and health risk factors between lesbian, gay, and bisexual adults and heterosexual adults in the United States: results from the national health interview survey. *JAMA Intern Med*. 2016;176(9):1344-1351. doi:10.1001/jamainternmed.2016.3432

44. Rosario M, Schrimshaw EW, Hunter J. Predictors of substance use over time among gay, lesbian, and bisexual youths: an examination of three hypotheses. *Addict Behav*. 2004;29(8):1623-1631. doi:10.1016/j.addbeh.2004.02.032

45. Solomon D, McAbee J, Åsberg K, McGee A. Coming out and the potential for growth in sexual minorities: the role of social reactions and internalized homonegativity. *J Homosex*. 2015;62(11):1512-1538. doi:10.1080/00918369.2015.1073032