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REGULAR ARTICLE

Sexual orientation and smoking history: results from a community-based sample of youth in Shanghai, China

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Abstract
Objective Cigarette smoking has been found to be more prevalent among adults and youths with a minority sexual orientation (lesbian, gay, bisexual, LGB) than among the general population, while less is known about smoking among LGB youth in low- and middle-income countries. The goal of the study was to examine cigarette smoking in relation to sexual orientation in a community-based sample of youth in Shanghai, China.
Methods A multi-center cross-sectional survey of 17,016 youth aged 15–24 years was conducted in rural and urban areas of Hanoi, Vietnam; Taipei, Taiwan; and Shanghai, China in 2006. In this article, analysis was restricted to the 6,299 respondents in Shanghai. Assessments included ever smoking, age at first smoking, frequency of smoking, and number of cigarettes smoked daily. Logistic regression was used to estimate the association between sexual orientation and cigarette smoking.
Results Nine percent (594/6,299) of eligible participants considered themselves as LGB youths; 34.2 % ever smoked, 14.81 % initiated smoking before age 13, 15.9 % smoked in the past 30 days, and 14.1 % were moderate or heavy smokers. LGB identity predicted moderate or heavy smoking (OR 2.2, 95 % CI 1.3, 3.9). Male LGB youth smoked more cigarettes daily (OR 2.2, 95 % CI 1.3, 3.9) whilst female LGB youth reported less any prior cigarette use (OR 0.7, 95 % CI 0.5, 1.0).
Conclusions Few meaningful disparities in cigarette smoking were related to sexual orientation, except male LGB youth consumed more cigarettes daily. Prevention and cessation should target this population, especially male LGB youth.

Keywords Sexual orientation · LGB · Smoking · Youth · China

Background

Globally, cigarette smoking represents a major public health concern that continues to be the leading preventable cause of death, disease, and disability [1, 2]. Locally, China is the world's leading producer and consumer of tobacco [3–5]. Smoking among youths with minority sexual orientations (i.e., lesbian, gay or bisexual, LGB) is of particular concern in the policies and programs of fighting against tobacco use, considering the higher risk of smoking rate among this group.

Accumulating evidence has established that LGB youths are more likely than heterosexual peers to smoke cigarettes [6, 7] and tobacco use might be a gateway to other substance abuse that could lead to negative health effects [8, 9]. Most studies examining the relationship between sexual orientation and cigarette smoking were based on cross-sectional data. In the 1995 Massachusetts Youth Risk Behavior Surveys (YRBS), LGB and unsure students were significantly more likely than their peers to initiate cigarette use before 13 years (47.9 vs. 23.4 %), smoke cigarettes (59.3 vs. 35.2 %) and smoke at school (37.4 vs. 18.4 %) [10]. The findings of 1995

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Massachusetts and Vermont YRBS showed that LGB students were more likely than their peers to smoke more than half a pack per day (25.5 vs. 5.8 % among female students, and 22.5 vs. 8.2 % among male students) [11]. Conversely, a study undertaken in a community-based sample revealed very high smoking levels but no difference between LGBT and heterosexual participants and few differences in overall tobacco use [12].

Longitudinal survey designs have the capability to investigate differences over time. In one study, using data from the first two waves of the school-based National Longitudinal Study of Adolescent Health, bisexual youths were more likely to be current smokers and were at greater risk of initiating smoking within the 1-year of follow-up than their heterosexual counterparts [13]. In another study, using data from four waves of community-based Growing Up Today Study, youths of all minority sexual orientations were more likely to initiate cigarette use at younger ages than heterosexuals [14]. Findings from a longitudinal study of college students showed that heterosexual and sexual-minority participants shared similar patterns of changes in smoking over time, but minority sexual orientation was associated with higher frequency of cigarette smoking at the beginning of the study [15].

Thus, the findings of relationship between sexual orientation and cigarette smoking are inconsistent [12]. Besides that, exiting studies adopted different methods of recruiting respondents and definitions of sexual orientation and cigarette smoking. Data from low- and middle-income countries (LMIC) are limited.

Given the aforementioned researches and gaps in the literatures, the current study, which aimed to better understand the relationship between sexual orientation and cigarette smoking, was undertaken in a community-based sample of youth aged 15–24 years in Shanghai, China. The objectives of this study are as follows: (1) determine the proportion of sexual minorities among youth in Shanghai, China; (2) estimate sexual orientation differences in cigarette smoking; (3) examine the association between sexual orientation and cigarette smoking by gender.

Materials and methods

Setting

The dataset used in this study was part of a multi-center cross-sectional study, conducted in Hanoi, Vietnam; Taipei, Taiwan; and Shanghai, China by a team of researchers from the Johns Hopkins Bloomberg School of Public Health, the Hanoi Institute for Family and Gender Studies, the Population and Health Research Center in Taiwan's Bureau of Health Promotion, and the Shanghai Institute of Planned Parenthood Research. In Shanghai, data were collected in 2006 from youth aged 15–24.

Study population

The sampling methodology has been described in detail in "Levels of Change in Adolescents' and Young Adults' Sexual Behavior in Three Asian Cities" [16]. Multistage sampling methods were used to ensure representativeness. In Shanghai, listings were prepared of all the dwelling units known to have at least one resident aged 15–24 and all the youth aged 15–24 were recruited if the unit was selected. Totally, 6,433 youth were invited and 6,299 finished interviews, the response rate was 97.92 %. Both private residences (4,800 youth, 76.20 %) and group living facilities (1,499 youth, 23.80 %) were sampled. The survey was developed by the research team, translated, back-translated, and pilot tested in each site. Interviewers received extensive training. Most of the interview was conducted face-to-face, except that computer-assisted self-interview was used for sensitive questions. All aspects of this study received approval from the Committee on Human Research at the Johns Hopkins University as well as the collaborating local organizations [17].

Measures

Social demographic characteristics

The questionnaire included a wide variety of demographic characteristics including age, gender, Hukou (registered permanent residence), highest education level attained (primary or lower, junior secondary, senior secondary, college/graduate school), marital status, type of work, family structure (live with parents, relatives/others, friends, alone).

Smoking outcomes

Four cigarette smoking behavior items adapted from the Youth Risk Behavior Surveillance System [18] were used to categorize smoking behavior. Participants were asked, (1) "Have you ever tried smoking, even only one or two puffs?", (2) "At what age did you first try smoking a cigarette?", (3) "On how many days did you smoke in the past 30 days (within a month)?", (4) "In the past month, what was the average number of cigarettes you smoked on a typical smoking day (cigarettes per day, CPD)?" Current smoking was defined as smoking in the past 30 days. The fourth item was dichotomized as: (a) any smoking in the past month versus no smoking and (b) smoking $\leq$10 CPD (light smoking) versus smoking >10 CPD (moderate or heavy smoking) [12].

Sexual orientation

Sexual orientation was gathered through the question: "Which of the following best describes your feelings? (Here we are talking about attraction, not having sex)". (1) 100 % heterosexual (attracted to persons of the opposite sex), (2) mostly heterosexual (mostly attracted to people of the opposite sex), (3) bisexual (equally attracted to men and women), (4) mostly homosexual (mostly attracted to people of my same sex), (5) 100 % homosexual (attracted to persons of my same sex) [12]. The "mostly homosexual" responses and "100 % homosexual" responses were collapsed into lesbian/gay category, because the sample sizes in these categories were too small.

Statistical analysis

Data analyses, completed in 2014, were performed with Stata/SE 12 (StataCorp, College Station, TX, USA) [19]. Contingency tables were used to describe the relationship between smoking and demographics, the differences between non-LGB and combined LGB youth were tested by Pearson Chi-square, all tests are two-sided by default. In the interest of statistical power and ease of interpretation, all variables with multiple response options were dichotomized for multivariate analysis. Of special note, sexual orientation was introduced into the logistic regression equation as dummy variable.

Odds ratios and 95 % confidence intervals (CIs) for the association between sexual orientation and cigarette smoking were estimated using logistic regression models with adjustment for potential confounding by age, education level, Hukou and living condition. Completely heterosexuals served as the reference. Statistical significance was set at the $p < 0.05$ by default.

Results

Nine percent (594/6,299) of eligible participants considered themselves as LGB youth. Among males ($n = 3{,}060$), based on the self-report of sexual orientation, 91.3 % were heterosexual, 6.8 % were bisexual, and 1.9 % were gay. Among females ($n = 3{,}239$), 89.9 % were heterosexual, 7.4 % were bisexual, and 2.7 % were lesbian.

The demographic characteristics of participants are showed by category in Table 1. The mean age was 19.3 years (SD = 2.63, range = 15–24 years). There are 71.1 % (4,480/6,299) youth who were 18 years or older, 48.6 % (3,060/6,299) males, 81.2 % (5,117/6,299) Shanghainese, 10.4 % (653/6,299) youth who graduated from college and 55.6 % (3,502/6,299) shared rooms with others. The proportion of younger youth in LGB youth (41.58 %) is significantly higher than in heterosexual youth (27.55 %). The proportion of higher education lever in LGB youth is also significantly lower than in heterosexual youth (6.73 vs. 10.74 %).

The association between cigarette smoking characteristics and sexual orientation (based on non-gender-stratified model) is illustrated in Table 2. There were significant differences in ever smoked cigarettes, with 29.1 % of LGB youths reported any prior cigarette use, compared to 34.7 % of heterosexual youths, whilst conversely more LGB youths smoked more cigarettes daily, with 24.1 % of LGB youths identified themselves as moderate or heavy smokers, compared to 13.2 % of heterosexual youths.

The association between sexual orientation and cigarette smoking, based on non-gender-stratified model and gender-stratified model separately, is illustrated in Table 3. According to non-gender-stratified model, after controlling confounders, LGB youth and homosexual youth smoked more cigarettes daily. After stratified by gender, male LGB youth and gays were more likely to be moderate or heavy smokers (OR 2.2; 95 % CI 1.3, 3.9), while female LGB youth was less likely to trying to smoke ever (OR 0.7; 95 % CI 0.5, 1.0). Yet, bisexual males and females shared similar smoking patterns with heterosexuals, respectively.

Discussion

This study provides valuable findings, as little is known about smoking among sexual minorities in LMIC. The findings reveal lower smoking level of overall cigarette smoking than the results from United States [3, 10, 11]. LGB youth was more likely than non-LGB youth to smoke more than 10 cigarettes per day. Contrary to prior studies [10, 11, 13–15, 20], the prevalence of whoever experienced prior cigarettes smoking, initiated smoking earlier and have smoked in the 30 days prior to the survey are similar with non-LGB youth.

LGB youth, in our study, had lower levels of education and were younger than heterosexuals.

Younger and less educated youth was more likely to initiate smoke in earlier stage. One possible reason is that younger youth has less developed coping skills than older youth, so they are more vulnerable to adopt unhealthy coping methods, including smoking, to response the stressors in their lives. Another reason is low levels of education might be an indicator of lower socioeconomic status, and lower socioeconomic status might were interrelated with higher stressful life and lacking of support that are closer predictors of smoking.

Gender differences emerged in our data. Male LGB youth was more likely to smoke more cigarettes daily, whist female LGB youth was less likely to ever experience

Table 1 Demographic characteristics of the study population, by sexual orientation

Demographic characteristics	Non-LGB (n = 5,705)	LGB (n = 594)		
	Heterosexual n (%)	Bisexual n (%)	Homosexual n (%)	Combined n (%)
Ages(years)				
<18	1,572 (27.55)	183 (40.85)***	64 (43.84)***	247 (41.58)***
≥18	4,133 (72.45)	265 (59.15)	82 (56.16)	347 (58.42)
Gender				
Male	2,793 (48.96)	208 (46.43)	59 (40.41)*	267 (44.95)
Female	2,912 (51.04)	240 (53.57)	87 (59.59)	327 (55.05)
Hukou[a]				
Shanghai	4,673 (81.91)	332 (74.11)*	112 (76.71)	444 (74.75)***
Non-Shanghai	1,032 (18.09)	116 (25.89)	34 (23.29)	150 (25.25)
Education				
≤12 grade	5,092 (89.26)	420 (93.75)**	134 (91.78)	554 (93.27)**
>12 grade	613 (10.74)	28 (6.25)	12 (8.22)	40 (6.73)
Currently housing situation				
Share room with others	3,157 (55.34)	266 (59.38)	79 (54.11)	345 (58.08)
Alone	2,548 (44.66)	182 (40.63)	67 (45.89)	249 (41.92)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

[a] Hukou, is a record in the system of household registration, which officially identifies a person as a resident of an area and includes identifying information such as name, parents, spouse, and date of birth, required by law in the People's Republic of China (mainland China)

Table 2 Cigarette smoking characteristics of the study population, by sexual orientation

Cigarette smoking characteristics	Non-LGB (n = 5,705)	LGB (n = 594)		
	Heterosexual n (%)	Bisexual n (%)	Homosexual n (%)	Combined n (%)
Ever smoked cigarette				
No	3,724 (65.28)	311 (69.42)	110 (75.34)	421 (70.88)**
Yes	1,981 (34.72)	137 (30.58)	36 (24.66)	173 (29.12)
Years when first smoked				
Aged <13	1,497 (85.15)	100 (84.03)	31 (91.18)	131 (85.62)*
Aged ≥13	261 (14.85)	19 (15.97)	3 (8.82)	22 (14.38)
Current smoking				
No	4,789 (83.94)	381 (85.04)	130 (89.04)	511 (86.03)
Yes	916 (16.06)	67 (14.96)	16 (10.96)	83 (13.97)
Smoking CPD				
Light smoking (CPD ≤ 10)	795 (86.79)	53 (79.10)	10 (62.50)	63 (75.90)**
Moderate or heavy smoking(CPD > 10)	121 (13.21)	14 (20.90)	6 (37.50)	20 (24.10)

CPD the number of cigarettes smoked per day

** $p < 0.01$

cigarette smoking. The reason for this gender difference is not immediately clear. While sexual minorities with both genders are all at risk of higher stress due to their stigmatized sexual orientation, it is possible that females may attempt to cope with it in different ways than males [14, 21]. Compared to female LGB youth, Male LGB youth may be more involved in LGB community, which was associated with higher risk for cigarette use.

Sexual minority subgroup differences should also attract attention. The importance of heterogeneity may be masked when researchers collapse all subgroups of sexual minorities into one group for statistical power or easy interpretability [12, 14]. In our study, after controlling covariates (Table 3), there was a heightened risk of ever smoking cigarettes and smoking more cigarettes daily among homosexual youth; however, bisexual youth

Table 3 Association between sexual orientation (LGB versus non-LGB) and cigarette smoking in Shanghai

Smoking variables	LGB		
	Bisexual	Homosexual	Combined
Whole sample			
Ever smoked cigarette, OR(95 % CI)	0.90 (0.72, 1.11)	0.67 (0.45, 0.98)*	0.84 (0.69, 1.01)
Age <13 Years when first smoked, OR(95 % CI)	1.00 (0.60, 1.68)	0.60 (0.18, 2.00)	0.91 (0.57, 1.48)
Current smoking, OR(95 % CI)	0.98 (0.75, 1.30)	0.69 (0.41, 1.18)	0.91 (0.71, 1.17)
Moderate or heavy smoking, OR(95 % CI)	1.83 (0.98, 3.43)	4.41 (1.54, 12.60)**	2.23 (1.29, 3.85)**
Male			
Ever smoked cigarette, OR(95 % CI)	1.03 (0.77, 1.38)	0.88 (0.51, 1.52)	1.00 (0.77, 1.30)
Age <13 Years when first smoked, OR(95 % CI)	0.76 (0.38, 1.51)	0.94 (0.27, 3.19)	0.80 (0.43, 1.47)
Current smoking, OR(95 % CI)	1.08 (0.76, 1.49)	0.85 (0.45, 1.58)	1.02 (0.76, 1.37)
Moderate or heavy smoking, OR(95 % CI)	1.85 (0.98, 3.48)	4.26 (1.47, 12.39)**	2.23 (1.28, 3.88)**
Female			
Ever smoked cigarette, OR(95 % CI)	0.74 (0.51, 1.10)	0.52 (0.25, 1.08)	0.69 (0.49, 0.97)*
Age < 13 Years when first smoked, OR(95 % CI)	1.68 (0.72, 3.94)	–	1.23 (0.55, 2.76)
Current smoking, OR(95 % CI)	0.85 (0.37, 1.98)	0.39 (0.05, 2.87)	0.73 (0.33, 1.60)
Moderate or heavy smoking, OR(95 % CI)	–	–	–

Covariates: age (<18 years, ≥18 years); education (≤12 grade, >12 grade); Hukou (Shanghai, others); live station (alone, with others). Referent group is heterosexual (non-LGB) group

CI confidence interval, *OR* odds ratio

* $p < 0.05$; ** $p < 0.01$

shared the same patterns of cigarette use with heterosexual youth, which indicate that homosexual youth may be more involved in the LGB community with higher risk for smoking exposure (e.g. pride events) than heterosexual and bisexual peers [14]. Other studies conducted in western countries found that bisexual (compared to heterosexual) identity is associated with smoking [22, 23],which may suggest that bisexual youth in China may be less likely than those in western countries to take "bar culture" as a primary means of socialization and cope with the stress resulting from homophobia by smoking [24].

Several studies have found that cigarette smoking may be adopted by sexual minorities, especially younger adolescents, to cope with negatively feelings related to having a sexual orientation that is socially stigmatized [25, 26]. Positive support from family and friends could reduce the magnitude of the association between smoking and distress [14].

Strengths of this article include the breadth of smoking issues examined, the large size of the community-based sample, and the ability to stratify analysis by sexual orientation. The study is one of the few community-based studies to document elevated rates of cigarette smoking among sexual minority youth in China.

Major limitations include the cross-sectional nature of the study and the use of self-reported measures. The cross-sectional nature of the study does not allow us to determine directionality of the relationship documented, and cross-sectional analyses are vulnerable to bias because of uncontrolled confounding. We controlled for age, gender, educational attainment, Hukou and living station, but not for employment, income, legal marital status, copying strategies and positive support that may be affected by sexual orientation and thus may be on the causal pathway between sexual orientation and cigarette smoking [27]. The validity of self-reported measures is likely limited, if accuracy of reporting smoking is related to sexual orientation, and then estimates may be biased [14]. Issues related to response bias, sexual orientation subgroup sample size, and external validity also merits further discussion. Despite these limitations, these findings are important as a basis for future researches in LMIC. More research is needed to help better understanding of respective factors that promote sexual minority youth to initiate and sustain cigarette smoking; prospective and qualitative research may be helpful [12]. Attention should also be paid to the differences of sexual minority subgroup, which provide a more detailed understanding of the spectrum of sexual orientation [14].

Sexual minority youth is a population at risk for smoking and should be a focus of sensitive and appropriate prevention and cessation efforts in state and local tobacco control programs. The findings highlight that smoking cessation efforts should target male LGB youth especially.

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