Smoking Susceptibility and its Predictors among Adolescents in China: Evidence from Ningbo City

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Abstract

Susceptibility to smoking is a risk factor of actual adolescent smoking behaviors. This study aimed to estimate the rate of smoking susceptibility and its predictors in China with a sample of 4,695 junior high school students in Ningbo, China. Core questions from the Global Youth Tobacco Survey (GYTS) were adapted to the China context and administered to these students. The rate of smoking susceptibility, measured by “Do you foresee yourself taking up smoking in the next 12 months”, is 6.1%. Results from logistic regression suggested that among boys, adolescents’ health knowledge that smoking can cause lung cancer (OR=2.73), the belief that smoking can help people relax (OR=2.32), and self-report of never having seen anti-smoking information on campus (OR=1.80) predicted increased susceptibility to smoking. Conversely, the belief that boys who smoke are less attractive (OR=0.64), that parents will see a firm commitment to not smoking (OR=0.50), having no friends or classmates who smoke (OR=0.22), and not seeing teachers smoke in the previous week (OR=0.61) predicted decreased susceptibility to smoking. Findings for girls were similar. This study suggested the need for comprehensive programs aiming to improve family, peer, and school environments to decrease smoking susceptibility among adolescents.

Keywords: Smoking susceptibility; Adolescent; Peer effect; Social learning; China

Introduction

Smoking has become an emerging public health problem among youth, with initiation occurring at younger ages [1,2]. The Global Youth Tobacco Survey (GYTS), a school-based survey of students aged 13-15 years old in 131 countries suggested that 8.9% of students were current smokers, and one in five never smokers reported that they were susceptible to smoking in the next year [3]. Ample evidence suggests that adolescents are usually susceptible to smoking when they do not show a firm commitment to not smoking [4], and that there is a strong correlation between smoking susceptibility and actual adolescent smoking behavior [4-7].

Existing studies have identified a series of psychosocial factors relating to smoking susceptibility among adolescents [8-10]. For example, susceptibility to smoking is positively associated with smoking behaviors of friends and family members [9,10]. School environment also matters [8,9]. Exposure to and perceived usefulness of school prevention programs are negatively associated with susceptibility to smoking. These effects are not gender blind. For example, for girls only, billboard tobacco advertising increases the risk of susceptibility and classroom prevention decreases risk; but for boys only, attendance at schools with higher prevalence of tobacco use increases the risk of susceptibility and anti-smoking media messages decrease the risk [8]. Most of these studies were conducted in the US or Canada, and very little evidence came from low-income countries [8].

The purpose of the current study was two-fold: first, we examined the influence of knowledge, attitudes around smoking behavior, peers, family, and school environments on smoking susceptibility among adolescents in China- the biggest producer and consumer of tobacco worldwide. Second, we tested whether these effects are gender-specific.
final sample consisted of 4,695 students: 2,440 boys and 2,255 girls—completing the survey. The students’ ages ranged from 10 to 18 years old, with 97.8% of the students were 12-14 years old.

The survey questions were adapted from the core questions of the Global Youth Tobacco Survey (GYTS), including introduction, tobacco-related knowledge, attitudes and behaviors, policies and regulations, and smoking status. These questions were adapted to China’s context, translated into Chinese, and pilot-tested. The survey was approved by the Institutional Review Board of Ningbo Centers for Disease Control and Prevention (CDC). Enumerators from the Ningbo CDC received training prior to survey administration and adhered to strict procedures. The survey was anonymous and informed consent was obtained from participants. Teachers were not present when the students were taking the survey, and each returned questionnaire was checked for completeness by the enumerators.

### Measures

**Smoking susceptibility:** We measured susceptibility to smoking, the outcome variable of this study, with a single question: “Do you foresee yourself taking up smoking in the next 12 months?” Those responding positively were coded as susceptible to smoking. Potential risk factors for smoking susceptibility were also measured, including smoking-related knowledge, attitudes towards smoking, peer dynamics, family characteristics, and school environment.

**Knowledge:** Specifically, we measured students’ knowledge of harm caused by smoking by asking “Do you think smoking can cause the following diseases: bronchitis, hypertension, lung cancer, heart attack, and stroke?” Responses for each type of disease were given a binary code of “no” vs. “yes”.

**Attitudes and social norms:** We measured attitudes towards smoking and perceived social norms regarding smoking with three questions: “Do you think smoking can help people relax?”, “Do you think boys who smoke are more attractive?”, and “Do you think girls who smoke are more attractive?”

**Peer dynamics and family characteristics:** We measured peer dynamics with the question: “Based on your knowledge, do any of your friends or classmates smoke?” For family characteristics, respondents were asked, “Do you think your parents will not mind you smoking after you grow up?” and “In a typical week, how many days do people smoke in your presence at home?”

**School environment:** School environment was measured with questions including the following: “In the past week, did you see your teachers smoking?”, “During the past semester, did your school distribute any tobacco control materials to you?”, “In the past semester, did you watch any videos or TV programs on tobacco control on campus?”, “In the past semester, did anyone at your school teach you that smokers would eventually have yellow teeth, wrinkles, and bad smell”, “In the past semester, did anyone at your school teach you skills on how to refuse smoking”, and “Do you often see anti-smoking information on campus?”

### Analytic strategy

Logistic regression analysis was used to estimate the crude associations between smoking acceptability and each of the five types of risk factors, including knowledge, attitudes, peer influences, family influences, and school environment in separate models (Model 1-5), controlling for grade and location of schools. We also assessed the independent effect of each cluster of risk factors when other clusters were included (Model 6). Because gender differences have been observed in the effects of predictive factors, separate models were estimated for boys and girls. We also adjusted standard errors to accommodate clustering effects at the class level, because students from the same class presumably shared similar experiences in the school environment. All analyses were conducted using SAS 9.0, and we reported odds ratios (ORs) with their 95% confidence intervals (CI).

### Results

Table 1 presents characteristics of students by susceptibility to smoking in our sample. Of the 4,695 students, 6.1% were susceptible to smoking. That is, they lacked a firm commitment to not smoking in the following 12 months. The characteristics of students who were susceptible to smoking were significantly different from those who were not susceptible, except for the health knowledge that smoking can cause problems such as heart attack, lung cancer, and stroke.

| Characteristics                  | No (n=4,410) | Yes (n=285) | P-value |
|----------------------------------|-------------|------------|---------|
| Area of residence                |             |            |         |
| Urban                            | 63.9%       | 56.5%      | 0.0245  |
| Suburban                         | 24.0%       | 27.0%      |         |
| Rural                            | 12.1%       | 16.5%      |         |
| Grade                            |             |            |         |
| 7th                              | 49.9%       | 35.1%      | <0.0001 |
| 8th                              | 50.1%       | 64.9%      |         |
| Do you think smoking can cause bronchitis? |             |            |         |
| No                               | 13.3%       | 23.5%      | <0.0001 |
| Yes                              | 86.7%       | 76.5%      |         |
| Do you think smoking can cause hypertension? |             |            |         |
| No                               | 63.1%       | 62.8%      | 0.912   |
| Yes                              | 36.9%       | 37.2%      |         |
| Do you think smoking can cause lung cancer? |             |            |         |
| No                               | 3.6%        | 13.0%      | <0.0001 |
| Yes                              | 96.4%       | 87.0%      |         |
| Do you think smoking can cause heart attack? |             |            |         |
| No                               | 63.6%       | 66.0%      | 0.4179  |
| Yes                              | 36.4%       | 34.0%      |         |
| Do you think smoking can cause stroke? |             |            |         |
| No                               | 69.3%       | 68.8%      | 0.8504  |
| Yes                              | 30.7%       | 31.2%      |         |
| Do you think smoking can help people relax? |             |            |         |
| No                               | 11.4%       | 36.1%      | <0.0001 |
| Yes                              | 88.6%       | 63.9%      |         |
| Do you think smoking boys are more attractive? |             |            |         |
| More                             | 3.4%        | 14.8%      | <0.0001 |
| Less                             | 63.9%       | 37.0%      |         |
| No difference                    | 32.7%       | 48.2%      |         |
| Do you think smoking girls are more attractive? |             |            |         |
| More                             | 4.6%        | 19.3%      | <0.0001 |
| Less                             | 72.1%       | 51.2%      |         |
| No difference                    | 23.3%       | 29.5%      |         |
| As far as you know, does any of your friends or classmates smoke? |             |            |         |
| None                             | 80.7%       | 47.7%      | <0.0001 |
| Some                             | 18.0%       | 3.2%       |         |
| Most or all                      | 1.2%        | 9.1%       |         |
| Do you think your parents would not mind your smoking after you grow up? |             |            |         |
| No                               | 7.4%        | 14.7%      | <0.0001 |
| Yes                              | 92.7%       | 85.3%      |         |

In a typical week, how many days do people smoke in your presence at home

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hypertension, heart attack, and stroke. For example, higher percentages of susceptible students held pro-smoking beliefs, such as the belief that smoking can help people relax (36.1% vs. 11.4%), and that boys who smoke (14.8% vs. 3.4%) and girls who smoke (19.3% vs. 4.6%) are more attractive.

Table 2 presents results from the logistic regressions for boys. Model 1 examined the multivariate association between smoking-related knowledge and smoking susceptibility, controlling for residential area and grade in school. Compared with students from rural areas, urban students had a reduced risk of being susceptible to smoking in the next 12 months (OR=0.61; 95% CI: 0.41-0.91). And among seventh grade boys, the risk was 41% lower compared with their eighth grade counterparts (OR=0.59; 95% CI: 0.44-0.80). Boys who did not believe that smoking can cause lung cancer had an almost two-fold higher risk of being susceptible to smoking (OR=2.73; 95% CI: 1.59-4.70).

Students who believed that smoking could help people relax had over one-fold higher risk of smoking susceptibility (OR=2.32; 95% CI: 1.62-3.31). On the other hand, school boys who thought that boys who smoked were less attractive had a 36% lower risk of being susceptible to smoking (OR=0.64; 95% CI: 0.43-0.96). Whether girls who smoked were determined to be more attractive or less attractive had no impact on boys’ smoking susceptibility (Model 2).

Compared with having friends who were all or almost all smokers, having no smoking friends reduced a boy’s risk of smoking susceptibility by 78% (OR=0.22; 95% CI: 0.11-0.45), and having only some smoking friends reduced the risk by 52% (OR=0.48; 95% CI: 0.24-0.96) among boys (Model 3). Believing that their parents would mind their smoking when they grew up cut the boys’ risk of smoking susceptibility by half (OR=0.50; 95% CI: 0.34-0.75; Model 4).

Model 5 examined the influence of school environment on smoking susceptibility among boys. Compared with those who had seen teachers smoking in the past week, boys who had not seen teachers smoking had a 39% lower risk of smoking susceptibility (OR=0.61; 95% CI: 0.45-0.84). Moreover, boys who had not seen any anti-smoking information on campus had an almost a one-fold higher risk of being susceptible to smoking compared with those who had seen such information (OR=1.80; 95% CI: 1.16-2.79).

When all factors were included in the logistic regression (Model 6), the belief that smoking could help people relax predicted increased susceptibility to smoking (OR=1.89; 95% CI: 1.28-2.80), and having no classmates who were smokers greatly reduced the risk of susceptibility compared with having most of or all classmates who were smokers (OR=0.38; 95% CI: 0.18-0.79).

Table 3 presents results of the logistic regression for girls. The findings were similar to those for boys, in particular from analysis in which all types of risk factors were included simultaneously (Model 6). A significant difference between girls and boys in terms of associations between risk factors and susceptibility resulted from the question, “Do you think that girls who smoke are more attractive?”, which predicted smoking susceptibility for girls (OR=0.41; 95% CI: 0.22-0.77 in Model 6), but not for boys.

Discussion

This study aims to understand the risk factors of susceptibility to smoking among adolescents in the context of a developing country. Many findings of this study are consistent with evidence from developed countries. For example, previous studies found that beliefs about negative consequences for social desirability among adolescents dissuade young adults from smoking [12-14], while perceived positive reactions to smoking and normative beliefs about smoking among peers were found to increase adolescents’ risk of smoking susceptibility or initiation [10,15,16]. Similarly, we found that both boys and girls who believed that cigarettes’ had a relaxing effect were more susceptible to smoking (OR=1.89; 95% CI: 1.28-2.80 for boys; OR=2.37; 95% CI: 1.24-4.53 for girls). In addition, boys and girls differed on the subjective norms governing smokers’ image. Both groups appeared more concerned with images of their own gender than the opposite sex, which may suggest an emphasis on self-image. Boys perceiving that boys who smoked were less attractive had a 36% lower risk of being susceptible to smoking (OR=0.64; 95% CI: 0.43-0.96) in Model 2, although in the overall model (Model 6), this association was no longer significant at the .05 level. On the other hand, girls who believed that girls who smoked were more attractive had an over two-fold higher risk of smoking susceptibility, even after other factors had been controlled (OR=3.69; 95% CI: 1.33-10.25; Model 6). This finding suggested that girls appear more vulnerable to the stereotype of “coolness” around smoking [12,13].

Familial environments have been argued to play an important role in adolescent smoking initiation. Parents’ attitudes, perceptions, and expectations towards smoking (teaching), as well as parents’ own smoking behavior (modeling) have been found to influence adolescents’ smoking involvement [8,15,17-21]. The association, however, was sometimes found to be weak or inconsistent, whereas stronger evidence emerged on the influences of peers and older siblings [22-24], which was echoed by our findings. For example, we found that having no smokers as friends and classmates cut the risk of smoking
Table 2: Estimated Odds Ratio (95% confidence interval) of smoking susceptibility among boys.

| Characteristics                                              | Model 1-Knowledge | Model 2-Attitude | Model 3-Peer | Model 4-Family | Model 5-School | Model 6-Overall |
|--------------------------------------------------------------|-------------------|------------------|--------------|----------------|----------------|----------------|
| Area (Rural)                                                 |                   |                  |              |                |                |                |
| Urban                                                        | 0.61 (0.41-0.91)  | 0.52 (0.35-0.73) | 0.84 (0.54-1.30) | 0.58 (0.39-0.86) | 0.67 (0.44-1.03) | 0.88 (0.54-1.44) |
| Sub-urban                                                    | 0.78 (0.50-1.22)  | 0.69 (0.44-1.08) | 0.97 (0.60-1.57) | 0.74 (0.48-1.15) | 0.75 (0.47-1.18) | 0.96 (0.57-1.63) |
| Grade (8th)                                                  |                   |                  |              |                |                |                |
| 7th                                                          | 0.59 (0.44-0.80)  | 0.68 (0.50-0.92) | 0.83 (0.60-1.15) | 0.64 (0.48-0.86) | 0.67 (0.49-0.91) | 0.82 (0.58-1.16) |

Do you think smoking can cause the following diseases:

- **Bronchitis (Yes)**
  - No: 1.49 (0.99-2.23)
  - Yes: 0.85 (0.58-1.25)

- **Hypertension (Yes)**
  - No: 2.73 (1.59-4.70)
  - Yes: 0.78 (0.50-1.22)

- **Lung cancer (Yes)**
  - No: 0.88 (0.50-1.56)
  - Yes: 0.75 (0.47-1.18)

- **Heart attack (Yes)**
  - No: 1.22 (0.82-1.61)
  - Yes: 0.51 (0.30-0.86)

- **Stroke (Yes)**
  - No: 0.91 (0.62-1.33)
  - Yes: 0.87 (0.58-1.32)

Do you think smoking can help people relax? (No)

- No: 2.32 (1.62-3.31)
- Yes: 1.89 (1.28-2.80)

Do you think smoking boys are more attractive? (No difference)

- More attractive: 1.43 (0.95-2.16)
- Less attractive: 0.94 (0.60-1.47)

Do you think smoking girls are more attractive? (No difference)

- More attractive: 1.61 (0.89-2.90)
- Less attractive: 0.75 (0.48-1.19)

As far as you know, does any of your friends or classmates smoke? (Most of or all)

- None: 0.22 (0.11-0.45)
- Some: 0.48 (0.24-0.96)
- All: 0.78 (0.58-1.07)

Do you think your parent would not mind your smoking after you grow up? (Yes)

- No: 2.32 (1.62-3.31)
- Yes: 1.89 (1.28-2.80)

In a typical week, how many days do people smoke in your presence at home? (1-7 days)

- None: 0.22 (0.11-0.45)
- Some: 0.48 (0.24-0.96)
- All: 0.78 (0.58-1.07)

In the past week, did you see your teachers smoking? (Yes)

- No: 0.61 (0.45-0.84)
- Yes: 0.70 (0.48-1.01)

In the past semester, did the school distribute any tobacco control material to you? (Yes)

- No: 0.82 (0.55-1.23)
- Yes: 0.90 (0.58-1.41)

In the past semester, did you watch any video or TV program on tobacco control on campus? (Yes)

- No: 0.65 (0.41-1.03)
- Yes: 0.61 (0.36-1.03)

In the past semester, did anyone in your school teach you that smokers would have yellow teeth, wrinkles, or bad smell? (Yes)

- No: 0.99 (0.67-1.46)
- Yes: 1.05 (0.69-1.62)

In the past semester, did anyone in your school teach you skills on how to refuse smoking? (Yes)

- No: 1.09 (0.72-1.65)
- Yes: 1.12 (0.70-1.79)

Do you often see anti-smoking information on campus? (very often)

- None: 1.80 (1.16-2.79)
- Some times: 1.43 (0.95-2.16)

Table 2: Estimated Odds Ratio (95% confidence interval) of smoking susceptibility among boys.
### Table 3: Estimated Odds Ratio (95% confidence interval) of smoking susceptibility among girls.

| Characteristics | Model 1-Knowledge | Model 2-Attitude | Model 3-Peer | Model 4-Family | Model 5-School | Model 6-Overall |
|-----------------|-------------------|------------------|--------------|---------------|---------------|----------------|
| **Area (Rural)**|                   |                  |              |               |               |                |
| Urban           | 1.20 (0.55-2.61)  | 1.07 (0.49-2.33) | 1.29 (0.58-2.89) | 1.26 (0.58-2.70) | 1.29 (0.58-2.88) | 1.27 (0.52-3.13) |
| Sub-urban       | 1.33 (0.57-3.14)  | 1.27 (0.54-3.03) | 1.56 (0.64-3.75) | 1.34 (0.58-3.11) | 1.34 (0.57-3.17) | 1.38 (0.52-3.66) |
| **Grade (8th)** |                   |                  |              |               |               |                |
| 7th             | 0.31 (0.18-0.53)  | 0.35 (0.20-0.60) | 0.47 (0.27-0.82) | 0.34 (0.20-0.58) | 0.32 (0.19-0.54) | 0.41 (0.22-0.77) |

Do you think smoking can cause the following diseases:

- **Bronchitis (Yes)**
  - No: 1.39 (0.69-2.78)
  - Yes: 3.29 (1.88-5.78)

- **Hypertension (Yes)**
  - No: 0.64 (0.36-1.13)
  - Yes: 0.51 (0.16-1.57)

- **Lung cancer (Yes)**
  - No: 3.73 (1.69-8.24)
  - Yes: 0.49 (0.25-0.97)

- **Heart attack (Yes)**
  - No: 1.23 (0.67-2.26)
  - Yes: 1.06 (0.49-2.26)

Do you think smoking can help people relax? (No)

- Yes: 3.29 (1.88-5.78)

Do you think smoking boys are more attractive? (No difference)

- More attractive: 0.51 (0.16-1.57)
- Less attractive: 0.49 (0.25-0.97)

Do you think smoking girls are more attractive? (No difference)

- More attractive: 5.30 (2.13-13.16)
- Less attractive: 1.06 (0.49-2.26)

As far as you know, does any of your friends or classmates smoke? (Most of or all)

- None: 0.33 (0.11-0.97)
- Some: 0.33 (0.11-0.97)

Do you think your parents would not mind your smoking after you grow up? (Yes)

- No: 0.33 (0.11-0.97)
- Yes: 0.51 (0.24-1.09)

In a typical week, how many days do people smoke in your presence at home? (1-7 days)

- None: 0.33 (0.11-0.97)
- Some: 0.51 (0.30-0.86)

Do you see your teachers smoking? (Yes)

- No: 0.77 (0.41-1.46)
- Yes: 0.51 (0.30-0.86)

In the past semester, did the school distribute any tobacco control material to you? (Yes)

- No: 0.77 (0.41-1.46)
- Yes: 0.51 (0.30-0.86)

Do you often see anti-smoking information on campus? (very often)

- None: 0.77 (0.41-1.44)
- Some times: 0.77 (0.41-1.44)

Findings from our study also suggested that school interventions were largely ineffective at preventing student susceptibility to smoking, which is consistent with some existing literature. For example, a meta-analysis on smoking prevention programs revealed that programs focused on delivering knowledge about smoking stopped being effective one year post program, although those oriented towards behavioral change remained in effect over a period of three years [25]. Similarly, a review of adolescent smoking prevention programs in South Korea reported that the effectiveness of knowledge-based smoking prevention programs were lower than expected [26]. We are aware that most of the survey questions in our study referred to programs and campaigns that had taken place within the previous semester. A systematic review of school-based smoking prevention programs found that brevity is one of the main reasons of program failure and that for programs to have long-term practical effects, they must be carried out in at least fifteen sessions over several years, also continuing into high school [27].

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Caution should be exercised with these findings. First, the susceptibility to smoking was self-reported, and may be subjected to students’ reluctance to disclose their future intention of smoking [28], despite the appropriate methods, such as anonymity of questionnaires and absence of teachers from the classroom when the surveys were administered. Second, as a cross-sectional study, the findings from this study should not be considered causal. For example, the positive association between peer smoking behaviors and susceptibility to smoking of the respondent may not be due to peer effect, but rather to peer selection, being that youth who have not made a firm commitment not to smoke are more likely to have friends who are smokers.

Despite these limitations, the evidence from this case study suggested that susceptibility to smoking may be shaped by a complicated process, in which the interplay of many factors, including social norms, peer, family, and school, may play a role [1,29]. It may therefore be recommended that interventions aimed at curbing youth smoking initiation should be grounded in a comprehensive and long-lasting model, which may effectively change the psychological motivations underlying adolescent smoking intentions and behaviors [30,31], and build communication and decision-making skills, as well as assertiveness training to resist the negative influences of peers, family, and the community [1,11,29].

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