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Effectiveness of Smoke-Free Policy among Elementary Students in Nanjing, China

By

Joo Chang

Master of Public Health

Global Epidemiology

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Julie Gazmararian
Faculty Thesis Advisor

Effectiveness of Smoke-Free Policy among Elementary Students in Nanjing, China

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Bachelor of Arts
Emory University
2006

Faculty Thesis Advisor: Julie Gazmararian, MPH, PhD

An abstract of

A thesis submitted to the Faculty of the

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Abstract

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By Joo Chang

Research on smoking among elementary students is lacking, particularly in China where youth smoking is becoming a growing public health issue. One way to address youth smoking is implementing anti-smoking policies in schools, but the literature is inconsistent in their effectiveness. A randomized cluster design was utilized in the current study to better understand how implementing a smoke-free policy contributes to smoking experimentation among elementary students. Sixteen schools in Nanjing were selected into the intervention group where smoke-free policy was implemented and eight schools were selected into the control group where smoke-free policy was not implemented. Self-administered surveys were given to a random selection of students a year and a half after policy implementation, and a total of 3,023 students in grades five and six were included in the analysis. Gender, age, parental educational level, and both pro-smoking and anti-smoking influences in homes, schools, and the media were controlled for in the analysis. Results indicated that there was no difference in smoking experimentation between the intervention group and the control group. But when assessing by gender, there was a significant association between policy implementation and smoking among females but not among males. Additionally, predictors of smoking experimentation of both genders included exposures to smokers at home, exposures to smokers in schools, and not discussing harmful effects of smoking at home. The data suggests that smoke-free policy is generally an effective strategy for females, and is helpful for males only if policy was followed by stringent enforcement. Limiting visibility of smokers in schools and thereby sending consistent anti-smoking messages appear to be critical particularly among elementary school boys. Comprehensive implementation and enforcement of smoke-free policy in addition to multipronged anti-smoking interventions in the contexts of homes and schools are recommended to curb adolescent smoking in China.

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Background

Smoking in China among young people

According to the World Health Organization (WHO), cigarette smoking leads to 6 million deaths every year (1). About half of mortality due to smoking is from developing countries and it is expected that the number will continue to increase (2, 3). China, with a population of 1.3 billion, contributes substantially to such mortality rate (4). Producing and consuming the largest quantity of tobacco in the world, China has over 31% of adults smoking regularly according to the WHO (5). A national survey conducted in 2010 indicates an even higher prevalence: more than 60% of Chinese men are regular smokers and a significant proportion of nonsmokers are exposed to second-hand smoking (6). Smoking among the younger population in particular has become a rising public health concern since the majority of young smokers continue to smoke into adulthood (7). Tobacco dependency among adults can be traced back to initiation during younger stages (8). About 88% of people who smoke daily in the United States (US) reported that they were already smokers by the age of 18 (9). This signifies that if young people did not smoke by age 18, the majority would never have begun. In China, there has been an increase in the prevalence of smoking among younger population and a decrease in the age of smoking initiation (10). The WHO reports that about 5.5% of Chinese youths aged 13 to 15 years are current smokers (5).

With such increasing prevalence of smoking in China in the younger population, in 2005, the Chinese government implemented various tobacco control programs prompted by the ratification of the WHO Framework Convention on Tobacco Control (WHO FCTC). However, tobacco control efforts have been stagnant due to the political power of the tobacco industry with its economic revenue (11). Furthermore, the tobacco companies have targeted younger population by being involved in various philanthropic efforts, such as rebuilding schools after the devastating Sichuan earthquake in 2008. In fact, one school was named "Sichuan Tobacco Hope Primary School" to recognize the support from these companies. Though such development efforts are beneficial and

necessary, branding tobacco companies in a positive way can influence students' perceptions on smoking (12).

Defining young people

With such political background and social influences, smoking in China among young people has become an important issue to focus on and understand from a public health standpoint. There are various terms to describe the younger population, such as "children," "youths," and "adolescents." Societies and organizations across the world define young people with different terms and specific age cutoffs. The WHO and several entities from the United Nations (UN) define "youth" as those between 15 and 24 years old (13). They also specify adolescence as the period between 10 and 19 years old and "young people" as the period between 10 and 24 years old. The WHO definitions of these terms for younger population will be utilized throughout the paper. The specific age group of interest for the current study is the younger segment within the "young people" category: adolescents aged 10 to 13 and even preadolescents, those slightly younger than 10 years old.

School-based interventions

Majority of young people spend a significant time in schools, providing a stage where health interventions can be carried out with more ease and efficiency. Such attractive features of school-based interventions and the need to address risk behaviors of adolescents have led to greater interest and initiatives from public health professionals. In the context of adolescent smoking, intervention and prevention strategies in the forms of health education, policy implementations, designated smoke-free areas, and others have become commonly seen programs in schools (14).

The effectiveness of school-based interventions, however, has not been consistent in previous studies (15, 16). In China and in the US, there have been observed associations between student cigarette use and school interventions such as smoking curricula, designated tobacco-free school zones, and anti-smoking policies (17-19). Nevertheless, one systematic review observing studies in the US and Australia suggested a lack of significant long-term effectiveness of school interventions against smoking (16). A rigorous randomized trial of smoking intervention in schools in

Washington State also failed to find a significant effect of such efforts (20). To make sense of these inconsistencies, a review on anti-smoking programs asserted that school-based programs are complicated to assess due to different underlying theories with varying methods and depth of implementation. They also work with diverse students of various age groups and social contexts (21). For example, smoking programs targeting adolescent minorities may need to be tailored in a culturally appropriate way and they may yield results different from interventions targeting other adolescents (22). Thus, it is difficult to offer conclusive remarks on the effectiveness of school-based programs. Generally, however, findings indicate that long-term effects can be made if programs produce considerable short-term changes, focus on social influences, and expand to include several sessions as part of the intervention (21). The 2012 US Surgeon General report stated there is enough evidence to conclude that school-based programs yield at least short-term benefits and should remain a priority along with other strategies (9).

The majority of these studies exploring school-based interventions in relation to adolescent smoking have been conducted in the more developed, Western societies. In China and other Asian countries, there have been several studies that looked at the effectiveness of school-based interventions against smoking. A randomized controlled trial conducted in Guangzhou, China has found that multi-staged, multipronged interventions with school policy, curriculum, peer education, media advocacy, and community and home resources helped students from becoming heavy smokers but failed to deter students from initiating smoking (14). There was also increased knowledge in smoking among those in the intervention group but no difference in attitudes toward smoking. Huang et al. examined anti-smoking policies and curricula in Taiwan elementary schools and found that they were inversely related to smoking experimentation. The association was stronger among males, so the researchers recommended that schools have a specific target audience, such as males, for their anti-smoking campaigns (17). Another study with Chinese adolescents and a systematic review of smoking prevention programs in South Korea found little impact on adolescent smoking

(23, 24). Such diverse findings bring to question whether school-based programs work in countries like China.

School-based policies

School-based interventions discussed above can include prevention programs, cessation programs, curriculum that teaches dangers of smoking, smoke-free policies, designated smoking areas, and much more. Because school-based strategies to curb adolescent smoking can be diverse and complex, it may be beneficial to focus on a single intervention. One of these intervention strategies is smoke-free policy intervention, which is a top-down approach to create an environment where smoking is discouraged and health attitudes and beliefs toward smoking are fostered (25). Smoke-free policy sends the message to students that smoking is bad and not condoned in schools. It can raise awareness and impart knowledge to students. Understanding the effectiveness of school policy in deterring smoking-related behaviors among students is particularly important in China, where schools are being recognized as important platforms that can promote and enforce healthy behaviors through policies. Schools in China, furthermore, may play a different role compared to the Western countries where most previous studies have taken place. Many schools are beginning to implement similar policy and a nation-wide smoke-free campaign is also taking place in China. Thus, a need to better understand smoke-free policies exists.

Confounders: social contexts and individual risk factors

There have been many studies on adolescent smoking and its risk factors both on the individual and contextual level. These factors are important to note when considering the influence of one element such as smoking policy. Recent research emphasizes the importance of social contexts in which adolescents derive risky behaviors (26, 27). A health behavior may not be attributed to a single factor alone, though the two may be causally related. For example, even when policy protects adolescents from having access to cigarettes, the effect may be negated by peer influences. Policies may be more effective in schools where anti-smoking messages are well received by popular students, but ineffective in other schools (28). Negative family effects may be further

magnified in schools and among peers, encouraging earlier initiation of smoking (26). Thus, various social contexts, external influences, as well as individual risk factors will be discussed below and controlled for in the analysis.

Individual risk factors: gender, age, and ethnicity

Generally across the world, males are more likely than females to smoke (9, 29). In one study of Chinese adolescents, boys were twice as likely to have tried smoking as girls (30). As expected, older adolescents smoke at a higher rate than younger adolescents (31, 32). Differences in smoking prevalence across ethnic groups in China exist, with higher prevalence among minority groups (22, 33).

Social contexts and external influences: home, peer, school, and media

Perhaps the most extensively studied influences of smoking are parental and peer contexts. Because adolescence is a vulnerable time where social pressures add more weight to one's decisions, these contexts of family and friends are important considerations. Risky behaviors of adolescents have been associated with parents who also exhibit similar risky behaviors, including smoking (34). Adolescent smoking was also tied to parental monitoring and approval of smoking (32). The educational level of parents was another predictor of smoking experimentation among Chinese adolescents, suggesting that more educated parents can protect their children from smoking (31).

Peer networks contribute significantly to smoking initiation among adolescents (28, 35, 36). Those that have friends who smoke were more likely to smoke (9). According to a study that observed Chinese adolescents in Shanghai, adolescents whose friends smoked were 11 times more likely to smoke than those whose friends did not (31). Several studies conducted in elementary schools in Taiwan and China found that having a close friend who smoked strongly predicted smoking behaviors among elementary students (17, 35, 37). Fifth graders in the US who smoked were more likely to have best friends or siblings who smoked (38).

School environment also shapes adolescents' view on smoking. One study showed that third and fourth grade students attending schools with higher perceived prevalence of smoking were

associated with higher smoking behaviors than those attending lower perceived smoking prevalence schools, particularly among boys (37). Teachers who often serve as role models to elementary students can shape students' decisions as well. Research shows that Chinese students who see teachers smoke were more likely to experiment with smoking (35).

More young people are exposed to media messages than ever before. In the US, tobacco companies in the past have utilized marketing techniques to get young people to smoke and such cigarette marketing was effective (9). Even with more stringent regulations against smoking advertisements, there have been other ways such messages were given to youths. A study among US adolescents aged 10 to 14 years observed that smoking initiation was associated with seeing actors smoke in movies (39). There is sufficient evidence to conclude that across the world, tobacco promotion and advertisement cause tobacco initiation among young people (9, 40-42). A qualitative study done in China found that middle school students understood smoking as a sign of authority or power, a coping strategy, and an opportunity to maintain social ties. Such portrayal of smokers was based on what the students viewed in the media (43). Conversely, anti-smoking campaigns have been largely successful in curbing youth smoking in the US (9). The success suggests the potential effectiveness of anti-smoking media messages in Chinese adolescents.

These individual and contextual factors of gender, age, home, school, and media can all shape an adolescent's decision to smoke. The directed acyclic graph, seen in figure 1, depicts the relationships between these factors. Not many research have taken into account such risk factors and social contexts while evaluating anti-smoking policies (15). Other studies on tobacco control policies have typically considered demographic variables of age and sex as well as family, peer, or school influences but these are studies of middle or high school students in the Western countries (18, 19, 44). There have been several studies in German and Taiwanese elementary schools that assessed school policies in the context of family, peer, and school variables but not media influences (15, 17, 37). Inference from these studies cannot be made to Chinese adolescents. To date, there have not

been any studies evaluating the effectiveness of smoke-free policies among Chinese elementary students while adjusting for individual and contextual factors.

Study goal and objectives

Based on such gaps in the literature, the current study attempts to measure the effectiveness of smoke-free policies in Chinese elementary schools. The following question is of interest: are Chinese elementary school students exposed to smoke-free policies in schools less likely to experiment with smoking than those who are not exposed?

There are four specific objectives. First, the study will test the hypothesis that elementary students in Chinese schools with smoke-free policies are less likely to smoke than students that attend schools without such policies after adjusting for other risk factors. Second, the effects of the policy will be seen by gender to see if there are any differences. Third, the study will assess which of the risk factors best predict smoking among Chinese elementary students. Fourth, the study will offer suggestions on reducing youth smoking in China based on the results.

The inconsistent findings of school policies on youth smoking as well as a limited number of studies done in China warrant the current study. Studies on elementary students on smoking experimentation are also lacking even though there is a natural progression of experimenters to become smokers (32). Furthermore, research has shown that people start smoking between 10 and 15 years of age in China, but there have been relatively few studies focusing on the younger segments (10, 36). The need to broaden the scope of research to include those younger than 13 years old is apparent. Finally, Chinese health authorities are investing resources on anti-smoking campaigns such as smoke-free policy in schools so ensuring its effectiveness will be valuable.

The current study is a secondary analysis of data that have already been collected.

Methods

Setting

The study was conducted in schools in Nanjing, China. Nanjing has a population of 3.6 million people and was one of the 17 cities that have been participating in the Tobacco-Free Cities program implemented by the Emory Global Health Institute—China Tobacco Control Partnership funded by the Bill & Melinda Gates Foundation (45). The goal of the Partnership was to decrease burdens caused by tobacco use in China with initiatives such as the Tobacco-Free Cities program. This program was created in 2009 to fund and support city-wide tobacco control initiatives of smoking prevention, cessation, and protection against second-hand smoking (46). Many of the participating cities have implemented interventions targeting different populations such as students, hospital workers, government employees, and pregnant women to create a smoke-free environment (35). In Nanjing, the smoke-free policy interventions were carried out in participating elementary and junior high schools, public places, and the Youth Olympic Games that will be held in the summer of 2014 (47).

Sampling design

A three-stage cluster design was utilized for the study. Districts were the primary sampling units; schools were secondary units; and classes were tertiary units. From the eight districts of Nanjing that were selected, schools were randomly chosen to be in the intervention group or the control group. Within each district, three elementary schools were randomly selected from the list of schools provided by the board of education. Two schools were selected to be in the intervention group, leading to a total of 16 intervention schools, and one school was placed in the control group for a total of eight schools. Some districts had more schools that actively pursued to be part of the tobacco control efforts and they were allowed to participate. It was the intention of the Nanjing Center for Disease Control (CDC) to allow all schools that wished to participate to do so in order to promote tobacco-control campaigns for the younger population. The schools that have decided to

participate in the intervention were not included in the analysis. In the intervention group, a third grade class and a fourth grade class from each elementary school were randomly selected and were followed for a year and a half. In the control group, all third and fourth grade classes were selected to participate in the surveys.

The intervention group implemented the smoke-free policy and the control group did not. Having a smoke-free policy meant that schools would not allow any person, including teachers and staffs, to smoke on school grounds. The smoke-free policy was implemented in 2011, which was followed by a baseline survey in the schools. A follow-up survey was conducted a year and a half later when the students were two grades higher. Six of the eight schools in the control group and two of the 16 schools in the intervention group were unable to complete the baseline survey. Thus, only the follow-up survey was used for the current study due to the high volume of non-response. Figure 2 shows the sampling procedure.

Surveys were self-administered and anonymity was ensured. Each school in the intervention group had a team of staffs and leaders that carried out the smoke-free policy intervention in collaboration with district authorities and the Nanjing CDC. After receiving training and support, designated school staffs administered surveys and all procedures were followed accordingly.

There were 3,532 elementary students that completed the follow-up survey, with grades ranging from three to six. Students that were part of the schools that opted to be in the intervention were excluded from the study. Students aged eight years or younger were also excluded in addition to those who were not in grades five and six, leading to a total of 3,023 students for analysis (refer to Figure 2).

Measures

The survey administered to the students was based on the Global Youth Tobacco Survey (GYTS), a feasible and inexpensive tool for youth tobacco surveillance (48). Public health officials in Nanjing further adapted the survey to be more relevant to Chinese young people. The questionnaire was divided into five sections of tobacco use, knowledge and attitudes, media and school

environment, family environment, and participant characteristics. Table 1 describes the relevant variables and how they are measured in the survey.

Outcome (dependent) variable: Smoking experimentation

The dependent variable was based on the question, "Have you ever tried or experimented with cigarette smoking, even one or two puffs?" Students who answered "yes" to this question were considered to be experimenters or ever-smokers. These students may be different from current-smokers who are addicted to tobacco and smoke consistently. Although there is a distinction between smokers and experimenters, both terms will be used throughout the paper to describe these students that have answered "yes" to the above question.

Covariates

To accurately assess the relationship between smoke-free policy and smoking experimentation, the survey included questions measuring demographics and influences that promote and limit smoking. Demographic variables of interest were gender, parental education, and age (refer to Table 1).

Influences that promote smoking behaviors such as parental smoking and exposures to people smoking at home, school and in the media were also measured (31, 34, 37, 39). These influences would herein be referred to as pro-smoking factors. Pro-smoking factors were measured by the following four questions: "Do your parents smoke?" [None; both smokes; only father smokes; only mother smokes] "During the past 7 days, on how many days have people smoked in your presence, in your home?" [None; 1-2 days; 3-4 days; 5-6 days; 7 days] "During the past 30 days, on how many days have people smoked in your presence in your school?" [None; 1-7 days; 8-15 days; 15-20 days; 20 days or more] "When you watch TV, videos, or movies, how often do you see actors smoking?" [I never watch media; often, sometimes; never]

Anti-smoking influences include learning about smoking in the homes and schools as well as anti-smoking advertisements in the media (9, 17, 32). They were measured by the following three questions: "Has anyone in your family discussed the harmful effects of smoking with you?" [Yes; no]

"In school, were you taught in any of your classes about the dangers of smoking?" [Yes; no; don't remember] "During the past 30 days, how many anti-smoking media messages (e.g. television, radio, billboards, posters, newspapers, magazines, movies) have you seen or heard?" [A lot; sometimes; never]

Some of these variables were re-categorized due to the inherent order of the answer options (Table 1). These re-categorized variables were used in the analysis when estimating crude and adjusted associations. For example, parental smoking was re-categorized into "both parents smoke," "one parent smoke," and "none," combining the "mother smokes" and "father smokes" categories. Exposures to smoking at home and schools were also re-categorized by combining the middle answer options (such as "3-4 days" and "5-6 days" to "3-6 days") due to relatively few responses in these categories. It might have been difficult for respondents to recall and choose these middle options, particularly if there were multiple selections.

Analysis

The analysis in the current study was carried in the following order. Firstly, descriptive statistics were calculated by examining the frequencies of relevant variables, stratified by gender and by smoke-free policy that differentiated the intervention group from the control group. The Rao-Scott chi-square test that takes into account the design effect was used to analyze whether the predictors and outcome differed by gender and by policy implementation. Secondly, crude associations between smoking experimentation and both the main exposure and covariates were assessed by the Rao-Scott chi-square test for variables of two categories and Wald chi-square test for variables with more than two categories. Odds ratios (ORs) and 95% confidence intervals (CIs) were also estimated. Lastly, a multivariate logistic model with all predictors and their interaction terms was utilized in order to estimate adjusted effect measures, using a methodology outlined by Kleinbaum and Klein (49). The analysis was conducted separately by males and females.

Prior to building the multivariate logistic model, multi-collinearity was assessed using a condition index of 30 as a cutoff point and detecting high variance decomposition proportions

(VDP). The full model included all predictor variables and interaction terms between policy and variables of gender, age, grade, and school environments (exposure to smokers in school and learning about smoking). Necessary adjustments were made if multi-collinearity became an issue. Afterwards, the interaction terms were assessed for significance to see if the effects of policy differed by these factors. The maximum likelihood values (-2 ln) of the models with and without the interaction terms were calculated. The difference between these values, or the likelihood ratio statistic, would approximate a chi square distribution with the number of interaction terms as the degrees of freedom. If the likelihood ratio statistic was significant, the interaction terms would be included in the model.

Weighting was used based on the probability of selection for each observation. The appropriate weighting values were obtained from publicly available information on the number of schools within each district and an average number of classes within each grade in Nanjing, which were four classes per grade. Clustering effects were addressed using the survey procedure in the Statistical Analysis Software (SAS) that would adjust the variance estimation by specifying the primary sampling unit (district). All statistical analysis was done using SAS 9.3, with a significance level of 0.05.

The current study was reviewed by the Emory Institutional Review Board and received expedited approval (IRB00069450).

Results

Descriptive statistics by gender and by policy

More than 75% of the students were 11 or 12 years of age, with half of the students in fifth grade and the other half in sixth grade (Table 2). Only 3% of students were not of the Han origin. The most common educational level attained by both parents was completing middle or high school, which was close to 40%, followed by completing college or university. More fathers completed higher education such as college or graduate school than mothers. Parents' education levels and ethnicity differed by gender ($p<0.05$).

About 51% of students reported their fathers smoked, with close to 47% reporting that none of the parents smoked. A little over 60% of students were not exposed to smoking at home and slightly less than a tenth were exposed to people smoking at home for all seven days out of the week. Generally, more boys were exposed to people smoking in their presence at school than girls, with 4% of boys and 2% of girls observing people smoke in schools 20 days or more and 72% of boys and 75% of girls not having any exposure to smokers in schools. Frequency of actors smoking in the media also differed by gender, with more boys exposed to pro-smoking influences in the media than girls ($p<0.0001$).

Anti-smoking exposures in homes and in the media, but not in schools, differed by gender ($p<0.0005$). Close to 85% of boys and 89% of girls said they discussed harmful effects of smoking at home. In school, 79% of students reported that they were taught about the dangers of smoking. More than half of the students said they saw anti-smoking messages in the media "sometimes" and a third of them reported they saw anti-smoking messages in the media "a lot." Close to 17% of boys never saw such messages, compared to 14% of girls.

There were 1,159 students in the intervention group, or 38% of the sampled students. The control group had 1,864 students or 62%. Reported smoking experimentation constituted 4% of all students, or 132 students. The outcome variable of smoking experimentation differed significantly

between males and females, with 6% of boys experimenting with smoking compared to 3% of girls ($p=0.0183$).

Among the smokers (n=132), half reported that they started experimenting with smoking at the age of six or less. Close to 30% started smoking at the age between seven to eight years, and 21% after nine years. About 71% of experimenters did not try to buy cigarettes and a tenth were unable to buys cigarettes due to age. Nearly a fifth of them were still able to buys cigarettes despite their age. Boys were more likely to attempt to buy cigarettes and were more successful in doing so than girls ($p<0.05$).

Table 3 shows the participant characteristics stratified by the policy implementation status, which differentiated intervention group from the control group. Age, grade, gender and ethnicity differed by the policy variable ($p<0.05$). The largest age group was 12 years in the control group (45%) and 11 years in the intervention group (37%), indicating that the average age of the control group was slightly older. The fifth and sixth grade distribution also reflected such age difference: about 57% of the students in the intervention group were fifth graders and 55% in the control group were sixth graders. Education of both parents did not differ between intervention and control group.

Other covariates were similar between the intervention and control groups, except for learning about dangers of smoking and anti-smoking media messages ($p<0.05$). About 88% of the intervention group, compared to 74% in the control group, said they were taught the dangers of smoking. Anti-smoking messages also differed by the policy variable, with more students in the intervention group (38%) reporting that they saw anti-smoking media messages "a lot" compared to the control group (27%). Such differences would be taken into account in the multivariate logistic model.

Crude associations

Table 4 shows the frequencies and proportions of the variables stratified by smoking status, with crude odds ratio (cOR) and 95% confidence intervals (CI). More than 70% of experimenters were from the control group where smoke-free policy was not implemented, compared to 61% of

non-smokers, yielding a cOR of 1.5 (CI: 0.9-2.4). However, the crude association between smoke-free policy and smoking experimentation was not significant.

Age, grade, ethnicity, and parental education were not associated with smoking status. Gender was a significant predictor of smoking experimentation: the odds of smoking for boys were twice the odds for girls (CI: 1.0-4.2). Parental smoking was associated with smoking experimentation ($p<0.005$). There was an increase in the odds of smoking as the number of days per week exposed to smokers at home increased ($p<0.0001$). A similar pattern was also shown in schools, depicting an association between smoking and all levels of exposure to smokers in schools ($p<0.005$). There was no difference in smoking between those who were not exposed to actors smoking in the media and those who saw them "sometimes" or "often."

Anti-smoking exposures were all significantly associated with smoking experimentation, with one exception. Discussing harmful effects of smoking at home and being taught the dangers of smoking were associated with smoking ($p<0.005$). There was no difference between those who saw anti-smoking messages "a lot" compared to "sometimes." However, there was a significant difference in smoking between those who never saw anti-smoking messages and those who were exposed to them "a lot" ($p=0.0003$).

Multivariate logistic model

Multi-collinearity was assessed before building the multivariate logistic model. The full model yielded a condition index of 64.6336. The highest variance decomposition proportions (VDP) was 0.7215 from the policy*grade variable. After dropping the interaction term, the condition index became 47.5483 with the highest VDP after the intercept coming from the grade variable (VDP=0.6462). After grade was dropped, the condition index was 34.3721. The intercept and ethnicity (VDP=0.8327) had the highest VDP, so ethnicity was dropped. The condition index at this point was 17.8659, satisfying the cut-off point of 30. The four interaction terms remained and were assessed for significance. The model with all interaction terms yielded a -2 ln of 943.368 and the model without the interaction terms had a -2 ln of 946.972. The difference between the two

estimates was not statistically significant. The interaction terms were dropped in the final multivariate model.

The adjusted odds ratios (aOR), confidence intervals, and p-values from the resulting model are shown in table 5, as well as estimates after stratifying by gender. Policy was not significantly associated with smoking experimentation but the effect increased slightly after adjusting for all other covariates ($p=0.0711$). The aOR was 1.6 (CI: 1.0-2.7).

Age and education levels of both parents remained non-significant. Gender was no longer significantly associated with smoking experimentation after adjustment. Among the pro-smoking covariates, having one or both parents who smoked compared to none was no longer significantly associated with smoking experimentation. Having people smoke in the homes were associated with smoking at all degrees of exposure ($p<0.05$). All ordinal categories of being exposed to smokers at school were significantly associated with smoking experimentation ($p<0.005$). Seeing actors smoke in the media had no association with smoking experimentation after adjusting for other covariates.

All anti-smoking variables were not significantly associated with smoking experimentation in the multivariate logistic regression model, except for anti-smoking exposure in the homes. Those who did not discuss the harmful effects of smoking at home had an aOR of 1.8 compared to those who did (CI: 1.0-3.3). Being taught dangers of smoking in schools and seeing anti-smoking messages "sometimes" or "never" (compared to "a lot") did not yield significant associations with smoking experimentation.

When stratifying by gender, the aOR of smoke-free policy on smoking was significant among females ($p=0.0282$). The odds of smoking for girls in the control group were 2.1 times the odds for girls in the intervention group (CI: 1.1-4.3). Policy was not a significant predictor among males after adjusting for covariates. There were only modest changes in the aOR estimates and significance for most of the other variables between the non-stratified model and the models stratified by gender.

Discussion

The results indicate that there is no overall difference in smoking experimentation between intervention and control groups, suggesting that smoke-free policy itself is not effective. However, implementation of such policy seems to be effective among girls in Chinese elementary schools. Among the risk factors studied, the following three influences predicted smoking among young people in China: being exposed to smokers at home, being exposed to smokers in schools, and discussing harmful effects at home. Focusing on multifaceted efforts with emphasis on home and school contexts is encouraged for Chinese health officials in curbing youth smoking.

Smoke-free policy and school environment

Elementary students in Chinese schools with smoke-free policy experimented with smoking at similar rates than students that attended schools without such policy. This is consistent with several studies that did not find a policy effect (25, 38). The studies that did find significant impacts have looked at smoke-free policies that were combined with other school interventions such as anti-smoking curricula, cessation programs, and sessions on refusal techniques (17, 50-52). This suggests that smoke-free policy itself is not a strong enough influence to deter students from smoking but combining various types of intervention is effective.

School policies are often implemented because it directly impacts the environment that can influence a student's decision to smoke. School environment has been shown to be an important context where certain behaviors are learned. Observing teachers smoke, perceiving high prevalence of smoking in schools and receiving consequences for smoking can promote or deter smoking behaviors (28, 34, 53). School environment and policies are thus directly related but they have been intentionally separated because policy does not automatically translate into practice. Smoke-free policy does not necessarily mean less people smoke in school or less visibility of smokers. The current data reveals there was no significant difference between intervention and control groups in respect to exposures to smokers on school grounds. The lack of enforcement may be the reason

behind the lack of policy effect in the current study. Such discrepancy between policy and practice can undermine the health message behind anti-smoking policies, leading to very little change in students' perceptions on smoking (18, 32, 54). Students may receive mixed messages when seeing school personnel or peers smoke, which ignores and challenges the smoke-free policy. Similar implications are seen in middle and high schools where perceptions of policy enforcement rather the policy itself predicted smoking prevalence (25, 55).

As seen in another study as well as the current study, the lack of association between smoking and learning about the dangers of smoking in schools implies that knowledge is also not sufficient (14). But significant association between smoking and varying degrees of exposures to smokers in schools suggest that what elementary students observe is more influential than policy or knowledge. Although smoke-free policy in elementary schools can shift the environment to discourage potential smokers to have opportunities to smoke, it will be a futile cause without enforcement or regulation of such policy. Consistent and comprehensive policy implementation and enforcement will likely determine the effectiveness of a policy (19, 25).

Differential effect of smoke-free policy by gender

Stratified analysis revealed that smoke-free policy was associated with lower prevalence of smoking experimentation among females and not among males. The policy effect on female elementary students is unexpected. Several studies conducted in Taiwan observed gender differences in the effects of anti-smoking programs in elementary schools and found that school interventions were more effective among boys (17, 37). However, these studies also showed that boys who perceived many people smoking in schools were more likely to smoke than those who did not; but perception of school smoking rates did not matter to girls. Boys perceiving higher smoking rates may choose to smoke regardless of whether a smoke-free policy exists. For girls, on the other hand, seeing many people smoke in schools may not matter as much as observing a policy that is in place. Policy itself can be a protective factor for younger girls but can be counterproductive for boys if they observe that people are ignoring the policy.

Another reason for the observed effect may be that girls have less opportunities to observe teachers or peers smoke than boys in schools, as indicated by the gender difference in exposure to smokers in schools. With less chance of receiving mixed messages resulting from inconsistent enforcement, smoke-free policy itself can be a message that is sufficient to deter elementary school girls from smoking. A study on smoking among girls 12 years or younger has observed that protective factors of smoking included viewing schools as a positive learning environment (56). Elementary school girls may be more willing to follow rules than boys particularly if they see schools as a positive place. Due to a limited number of studies on smoking among elementary school girls, the result warrants further study on the type of audience a smoke-free policy might be the most effective.

Predictors of smoking among elementary students

There were three predictors of smoking after adjusting for other factors: high exposure to smokers at home, high exposure to smokers in schools, and not discussing harmful effects of smoking at home. Parental smoking was no longer associated with smoking experimentation after adjustment whereas exposure to smokers at home stayed significant. This suggests that parents who smoke but limit smoking in front of their children may still be protecting them from imitating the smoking parents. It also implies that even if parents do not smoke, having other people smoke in the students' presence at home can be harmful. Studies in China have shown a robust association between parental smoking and risk behaviors such as smoking, but the results suggest that the underlying influence is exposure to anyone smoking in their presence, regardless of who the smoker is (32, 34). The consequence is a learned behavior, even if parents are not directly involved. This may explain why a national study in China did not find any association between parental smoking and student smoking (57).

As indicated previously, exposure to smokers in schools is significantly associated with smoking. Confirming previous research, the current data shows that exposure to smokers in schools is an important risk factor for elementary students (35, 37, 55). Discussing harmful effects of home is

also protective against smoking, giving credence to family-based health education that have been encouraged by previous studies (33, 58).

China and youth smoking

As indicated by the US Surgeon Report in 2012, the most effective and encouraged anti-smoking methods for students are multi-modal in nature that combine various sectors and spheres of influence (9). Such multipronged approach acknowledges that individuals are nested in different social contexts and addressing all contextual and individual influences will provide the most benefit in reducing youth smoking. Particularly in China, priorities should be given to schools and homes as seen by the predictors of youth smoking discussed above.

Although Chinese law prohibits those under 18 to purchase cigarettes, there are still underage adolescents that are able to buy them (11, 32). About 30% of students in the current study attempted to buy cigarettes and about two thirds of those who attempted were successful. Despite such challenges of the lack of tobacco control regulations, there are many indicators that China is going the right direction. The relatively high percentage of people exposed to anti-smoking media messages and education in schools and homes in Nanjing indicate synonymous efforts by city, district, and school level stakeholders. Nearly nine out of ten students have discussed harmful effects of smoking at home, even though more than half had parents that smoked. This shows that parents are aware of and have talked about health risks of smoking even if they themselves smoke. Furthermore, as of January of 2014, the Chinese government banned smoking in kindergartens, elementary, middle schools, and vocational schools with limits on smoking advertisement and cigarette sales in school stores (59). With such a shift on a national scale, enforcement of these bans and laws will remain critical in effectively reducing youth smoking in China.

Strengths

There are several strengths in the current study that contributes to literature. Firstly, it is unique in assessing the effectiveness of smoke-free policy in Chinese elementary schools while simultaneously controlling for other individual and contextual factors of home, school, and the

media. There have not been any studies to date focusing on this specific population while adjusting for such risk factors. With growing prevalence of youth smoking in China and an increase in school-based anti-smoking policies in response, there has been a need to understand the effectiveness of school policies (7, 59). The current study begins to address such need and provides insights to health authorities implementing similar policies. Secondly, the study sheds light on the influences behind smoking experimentation among elementary students, which have been lacking in the literature. Effects are also seen by gender, which is vital since males and females have differential mechanisms of smoking. Thirdly, adjustment for the clustering effect and weighting based on probability of selection allows better representation and a more robust inference across the city of Nanjing. Lastly, ordinal categories have been used for several variables so that degrees of exposure can be seen in relation to the outcome variable. This can offer clearer insights in assessing relationships between different factors.

Limitations

Despite the strengths and contributions of the study, there are several limitations. Firstly, the current study is based on self-reported survey results. The actual smoking prevalence among the participating schools are likely to be higher as students, especially girls, can misreport their smoking behaviors (60). Secondly, because this is a cross-sectional design, causality cannot be determined and the directions of the observed associations are speculative. Thirdly, because the study was a secondary analysis, there were limitations on the variables of interest. Peer networks, for example, were not studied and it may have offered further insights if peer factors were included in the analysis. However, considering that the number of students experimenting with smoking is small, having friends who smoke may also be limited and may not have offered significant contribution to the conclusions. Fourthly, inference is limited to the city of Nanjing and similar cities in China or in other middle-income countries. Lastly, the small number of elementary students that have experimented with smoking may not have sufficiently measured the effectiveness of smoke-free policy. Utilizing another outcome variable, such as the likelihood of smoking in the future or views

on smoking, could have offered a new understanding of young people who smoke or are at risk for smoking.

Future directions

The current study suggests that smoke-free policy implementation is not sufficient in preventing elementary students from smoking and that more emphasis should be placed on enforcement and controlling visibility of smokers on school grounds. Future studies assessing the effectiveness of smoke-free policy should understand the gap that might exist between policy and practice. Regulation and enforcement of policies should also be taken into account when planning a policy intervention. Studies comparing the types and levels of enforcement and their effects on smoking among elementary students will be insightful.

Data also shows that there are significant differences by gender in individual and contextual risk factors. Because the etiology and the rate of initiation and addiction differ by gender, it is important to acknowledge such differences and use gender-specific tactics. More research on young female smokers is needed as there is an increase in smoking rate for females and a narrowing gender gap (9, 61). The current study reveals that almost 60% of female smokers said they started smoking before the age of six or earlier, which is a higher percentage than the male smokers in this sample (46%). There may be other mechanisms that are at work for girls that initiate smoking in China. Furthermore, future studies should be aware that the types of audience will determine the most suitable anti-smoking intervention. Clayton et al has suggested that the question surrounding school-based anti-smoking programs be shifted from "what works" to "what works, for whom, under what conditions, how, and why" (62). Understanding the individual, social, and contextual factors of the target population will be critical in planning interventions and future studies.

Conclusion

Smoke-free policy itself is not effective in protecting elementary school boys from smoking, but with enforcement it offers to be a promising intervention method. Among girls, smoke-free policy may be a sufficient influence to deter them from smoking. It is essential to have a

comprehensive implementation and enforcement of smoke-free policy. Bringing schools, families, and district level authorities together for a broad, multipronged intervention is encouraged to prevent youths from smoking in China.

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Tables

Table 1. Measurement variables and answer choices of adapted Global Youth Tobacco Survey used in elementary schools, Nanjing, 2012.

Variables	Survey questions	Answer options	Re-categorized answers*
Outcome: smoking experimentation	Have you ever tried smoking, even one or two puffs?	1- Yes 0- No	
Exposure: smoke-free policy in school	N/A	1- Intervention 0- Control	
Covariates:			
Demographics			
Gender	Gender:	1- Male 0- Female	
Age	What is your age?	1- 8 years or younger 2- 9 years 3- 10 years 4- 11 years 5- 12 years 6- 13 years or older	0- 9-11 years 1- 12-13 year or older
Father's education	Father's education	1- Elementary school or less 2- Middle/ high school 3- College/ university 4- Graduate school or higher	
Mother's education	Mother's education		
Pro-smoking influences			
Parents' smoking	Do your parents smoke?	1- Both do not smoke 2- Both smokes 3- Only father smokes 4- Only mother smokes	0- Both do not smoke 1- one parent smokes 2- Both parents smoke
Exposure to smoking at home	During the past 7 days, how many days have people smoked in your presence, in your home?	0- None 1- 1-2 days 2- 3-4 days 3- 5-6 days 4- 7 days	0- None 1- 1-2 days 2.5- 3-6 days 4- 7 days
Exposure to smoking in school	During the past 30 days, on how many days have people smoked in your presence in your school?	0- None 1- 1-7 days 2- 8-15 days 3- 15-20 days 4- 20 days or more	0- None 1- 1-7 days 2.5- 8-20 days 4- 20 days or more
Exposure to smoking in the media	When you watch TV, videos, or movies, how often do you see actors smoking?	1- I never watch media 2- Often 3- Sometimes 4- Never	0- I never watch media/ never 1- Sometimes 2- Often

Variables	Survey questions	Answer options	Re-categorized answers*
Anti-smoking influences			
Harmful effects of smoking discussed at home	Has anyone in your family discussed the harmful effects of smoking with you?	1- Yes 0- No	
Taught dangers of smoking in school	In school, were you taught in any of your classes about the dangers of smoking?	1- Yes 2- No 3- Don't remember	1- Yes 0- No/don't remember
Exposure to anti-smoking media messages	During the past 30 days, how many anti-smoking media messages (e.g. television, radio, billboards, posters, newspapers, magazines, movies) have you seen or heard?	1- A lot 2- Sometimes 3- Never	

* Used for crude and adjusted associations

Table 2. Demographics and relevant survey responses of elementary school participants by gender, Nanjing, 2012.

Variables	Total (n=3,023)		Male (n=1,616)		Female (n=1,407)		p value
	N	%	N	%	N	%	
Age							0.1253
9 years	7	0.2%	1	0.1%	6	0.4%	
10 years	495	16.4%	259	16.0%	236	16.8%	
11 years	1,085	35.9%	561	34.7%	524	37.2%	
12 years	1,216	40.2%	657	40.7%	559	39.7%	
13 years or older	220	7.3%	138	8.5%	82	5.8%	
Grade							0.2282
5th	1,495	49.4%	812	50.3%	683	48.5%	
6th	1,528	50.6%	804	49.8%	724	51.5%	
Ethnicity							0.0003
Han	2,932	97.0%	1,572	97.3%	1,360	96.7%	
Other	91	3.0%	44	2.7%	47	3.3%	
Father's education							0.0214
Elementary school or less	622	20.6%	388	24.0%	234	16.6%	
Middle/High School	1,205	39.9%	620	38.4%	585	41.6%	
College/University	934	30.9%	457	28.3%	477	33.9%	
Graduate school or higher	262	8.7%	151	9.3%	111	7.9%	
Mother's education							0.0264
Elementary school or less	811	26.8%	493	30.5%	318	22.6%	
Middle/High School	1,192	39.4%	606	37.5%	586	41.7%	
College/University	845	28.0%	414	25.6%	431	30.6%	
Graduate school or higher	175	5.8%	103	6.4%	72	5.1%	
Pro-smoking exposures							
Home: Parents smoke							0.6442
No	1,410	46.6%	755	46.7%	655	46.6%	
Father only	1,540	50.9%	821	50.8%	719	51.1%	
Mother only	10	0.3%	6	0.4%	4	0.3%	
Both	63	2.1%	34	2.1%	29	2.1%	
Home: days/week smoked in presence							0.3575
None	1,821	60.2%	967	59.8%	854	60.7%	
1-2 days	664	22.0%	351	21.7%	313	22.3%	
3-4 days	211	7.0%	107	6.6%	104	7.4%	
5-6 days	71	2.4%	43	2.7%	28	2.0%	
7 days	256	8.5%	148	9.2%	108	7.7%	
School: days/month smoked in presence							0.0075
None	2,224	73.6%	1,169	72.3%	1,055	75.0%	
1-7 days	591	19.5%	316	19.6%	275	19.6%	
8-15 days	82	2.7%	51	3.2%	31	2.2%	
15-20 days	28	0.9%	15	0.9%	13	0.9%	
20 days or more	98	3.2%	65	4.0%	33	2.4%	

Variables	Total (n=3,023)		Male (n=1,616)		Female (n=1,407)		p value
	N	%	N	%	N	%	
Media: Frequency of actors smoking							<0.0001
I never watch media	86	2.8%	51	3.2%	35	2.5%	
Never	291	9.6%	129	8.0%	162	11.5%	
Sometimes	1,867	61.8%	938	58.0%	929	66.0%	
Often	779	25.8%	498	30.8%	281	20.0%	
Anti-smoking exposures							
Home: Harmful effects of smoking discussed							0.0003
Yes	2,619	86.6%	1,372	84.9%	1,247	88.6%	
No	404	13.4%	244	15.1%	160	11.4%	
School: Taught dangers of smoking							0.0792
Yes	2,393	79.1%	1,266	78.3%	1,127	80.1%	
No	197	6.5%	119	7.4%	78	5.5%	
Don't remember	433	14.3%	231	14.3%	202	14.4%	
Media: Frequency of anti-smoking messages							0.0002
A lot	951	31.5%	518	32.1%	433	30.8%	
Sometimes	1,603	53.0%	827	51.2%	776	55.2%	
Never	469	15.5%	271	16.8%	198	14.1%	
TF policy							0.4119
Implemented	1,159	38.3%	599	37.1%	560	39.8%	
Not implemented	1,864	61.7%	1,017	62.9%	847	60.2%	
Smoking experimentation							0.0183
Yes	132	4.4%	93	5.8%	39	2.8%	
No	2,891	95.6%	1,523	94.3%	1,368	97.2%	
Age of smoking onset*							0.7740
6 years or less	66	50.0%	43	46.2%	23	59.0%	
7 -8 years	39	29.6%	29	31.2%	10	25.6%	
9 years or older	27	20.5%	21	22.6%	6	15.4%	
Unable to buy cigarettes due to age*							0.0355
Did not try to buy	93	70.5%	65	69.9%	28	71.8%	
Yes	13	9.9%	8	8.6%	5	12.8%	
No	26	19.7%	20	21.5%	6	15.4%	

*Among smokers only: n=132

Table 3. Demographics and relevant survey responses of elementary school participants by smoke-free (SF) policy, Nanjing, 2012.

Variables	Intervention: SF policy (n=1,159)		Control: No SF policy (n=1,864)		p value
	N	%	N	%	
Age					0.0031
9 years	1	0.1%	6	0.3%	
10 years	259	22.4%	236	12.7%	
11 years	430	37.1%	655	35.1%	
12 years	386	33.3%	830	44.5%	
13 years or older	83	7.2%	137	7.4%	
Grade					0.0269
5th	662	57.1%	833	44.7%	
6th	497	42.9%	1,031	55.3%	
Gender					0.0001
Male	599	51.7%	1,017	54.6%	
Female	560	48.3%	847	45.4%	
Ethnicity					0.0152
Han	1,116	96.3%	1,816	97.4%	
Other	43	3.7%	48	2.6%	
Father's education					0.7990
Elementary school or less	216	18.6%	406	21.8%	
Middle/High School	417	36.0%	788	42.3%	
College/University	397	34.3%	537	28.8%	
Graduate school or higher	129	11.1%	133	7.1%	
Mother's education					0.6669
Elementary school or less	278	24.0%	533	28.6%	
Middle/High School	414	35.7%	778	41.7%	
College/University	371	32.0%	474	25.4%	
Graduate school or higher	96	8.3%	79	4.2%	
Pro-smoking exposures					
Home: Parents smoke					0.6755
No	537	46.3%	873	46.8%	
Father only	593	51.2%	947	50.8%	
Mother only	4	0.4%	6	0.3%	
Both	25	2.2%	38	2.0%	
Home: days/week smoked in presence					0.9224
None	710	61.3%	1,111	59.6%	
1-2 days	252	21.7%	412	22.1%	
3-4 days	74	6.4%	137	7.4%	
5-6 days	24	2.1%	47	2.5%	
7 days	99	8.5%	157	8.4%	
School: days/month smoked in presence					0.7773
None	882	76.1%	1,342	72.0%	
1-7 days	200	17.3%	391	21.0%	
8-15 days	37	3.2%	45	2.4%	
15-20 days	9	0.8%	19	1.0%	
20 days or more	31	2.7%	67	3.6%	

Variables	Intervention: SF policy (n=1,159)		Control: No SF policy (n=1,864)		p value
	N	%	N	%	
Media: Frequency of actors smoking					0.6152
I never watch media	35	3.0%	51	2.7%	
Never	126	10.9%	165	8.9%	
Sometimes	701	60.5%	1,166	62.6%	
Often	297	25.6%	482	25.9%	
Anti-smoking exposures					
Home: Harmful effects of smoking discussed					0.1207
Yes	988	85.3%	1,631	87.5%	
No	171	14.8%	233	12.5%	
School: Taught dangers of smoking					0.0002
Yes	1,021	88.1%	1,372	73.6%	
No	42	3.6%	155	8.3%	
Don't remember	96	8.3%	337	18.1%	
Media: Frequency of anti-smoking messages					0.0167
A lot	445	38.4%	506	27.2%	
Sometimes	573	49.4%	1,030	55.3%	
Never	141	12.2%	328	17.6%	
Smoking experimentation					0.1226
Yes	39	3.4%	93	5.0%	
No	1,120	96.6%	1,771	95.0%	
Age of smoking onset*					0.8903
6 years or less	21	53.9%	45	48.4%	
7 -8 years	10	25.6%	29	31.2%	
9 years or older	8	20.5%	19	20.4%	
Unable to buy cigarettes due to age*					0.7502
Did not try to buy	27	69.2%	66	71.0%	
Yes	3	7.7%	10	10.8%	
No	9	23.1%	17	18.3%	

*Among smokers only: n=132

Table 4. Crude associations between predictor variables and smoking experimentation of elementary students, Nanjing, 2012.

Variables	Experimenters (n=132)		Non-smokers (n=2,891)		cOR	95% CI	p value
	N	%	N	%			
TF policy							
Implemented	39	29.6%	1,120	38.7%	ref		
Not implemented	93	70.5%	1,771	61.3%	1.5	(0.8, 2.7)	0.1226
Age							
9-11 years	61	46.2%	1,526	52.8%	ref		
12-13 years or older	71	53.4%	1,365	47.2%	1.3	(0.8, 2.2)	0.2305
Grade							
5th	67	50.8%	1,423	49.4%	ref		
6th	65	49.2%	1,463	50.6%	0.9	(0.5, 1.9)	0.8454
Gender							
Female	39	29.6%	1,368	47.3%	ref		
Male	93	70.5%	1,523	52.7%	2.0	(1.0, 4.2)	0.0183
Ethnicity							
Han	129	97.7%	2,803	97.0%	ref		
Other	3	2.3%	88	3.0%	0.7	(0.2, 12.4)	0.6971
Father's education							
Graduate school or higher	10	7.6%	252	8.7%	ref		
College/University	24	18.2%	910	31.5%	0.7	(0.3, 1.9)	0.4839
Middle/High School	55	41.7%	1,150	39.8%	1.0	(0.4, 2.4)	0.9476
Elementary school or less	43	35.3%	579	20.0%	1.3	(0.6, 2.9)	0.4662
Mother's education							
Graduate school or higher	6	4.6%	169	5.9%	ref		
College/University	24	18.2%	821	28.4%	0.7	(0.3, 1.5)	0.3356
Middle/High School	50	37.9%	1,142	39.5%	0.9	(0.5, 1.6)	0.6339
Elementary school or less	52	39.4%	759	26.3%	1.0	(0.5, 2.0)	0.9573

Variables	Experimenters (n=132)		Non-smokers (n=2,891)		cOR	95% CI	p value
	N	%	N	%			
Pro-smoking exposures							
Home: Parents smoke							
None smokes	40	30.3%	1,370	47.4%	ref		
One parent smokes	82	62.1%	1,468	50.8%	3.2	(2.1, 4.8)	<0.0001
Both smoke	10	7.6%	53	1.8%	4.2	(1.6, 11.0)	0.0029
Home: days/week smoked in presence							
None	43	32.6%	1,778	61.5%	ref		
1-2 days	30	22.7%	634	21.9%	2.7	(1.9, 3.8)	<0.0001
3-6 days	19	14.4%	263	9.1%	3.5	(2.0, 5.8)	<0.0001
7 days	40	30.3%	216	7.5%	9.5	(6.5, 13.8)	<0.0001
School: days/month smoked in presence							
None	59	44.7%	2,165	74.9%	ref		
1-7 days	44	33.3%	547	18.9%	3.3	(1.8, 6.4)	0.0002
8-20 days	14	10.6%	96	3.3%	6.2	(2.0, 19.2)	0.0014
20 days or more	15	11.4%	83	2.9%	13.8	(7.1, 26.9)	<0.0001
Media: Frequency of actors smoking							
Never/Don't watch media	12	9.1%	365	12.6%	ref		
Sometimes	65	49.2%	1,802	62.3%	1.0	(0.5, 2.1)	0.9545
Often	55	41.7%	724	25.0%	2.0	(0.9, 4.4)	0.0907
Anti-smoking exposures							
Home: Harmful effects of smoking discussed							
Yes	93	70.5%	2,526	87.4%	ref		
No	39	29.6%	365	12.6%	3.3	(1.7, 6.3)	<0.0001
School: Taught dangers of smoking							
Yes	87	65.9%	2,306	79.8%	ref		
No/ Don't remember	45	34.1%	585	20.2%	2.3	(1.1, 4.7)	0.0027
Media: Frequency of anti-smoking messages							
A lot	30	22.7%	921	31.9%	ref		
Sometimes	63	47.7%	1,540	53.3%	1.5	(0.7, 3.0)	0.3259
Never	39	29.6%	430	14.9%	3.3	(1.7, 6.4)	0.0003

Table 5. Adjusted associations between predictor variables and smoking experimentation of elementary students based on a multivariate logistic model, stratified by gender, Nanjing, 2012.

Variables	All n=3,023 (smokers: n=132)			Males n=1,616 (smokers: n=93)			Females n=1,407 (smokers: n=39)		
	aOR	CI	p-value	aOR	CI	p-value	aOR	CI	p-value
TF policy (ref: implemented)									
Implemented	ref			ref			ref		
Not implemented	1.6	(1.0, 2.7)	0.0711	1.4	(0.9, 2.4)	0.1794	2.1	(1.1, 4.3)	0.0282
Age									
9-11 years	ref			ref					
12-13 years or older	1.1	(0.7, 1.6)	0.7683	1.4	(1.0, 2.1)	0.0746	0.6	(0.3, 1.0)	0.0588
Gender									
Female	ref								
Male	1.7	(0.8, 3.3)	0.1610						
Father's education									
Graduate school or higher	ref			ref			ref		
College/University	1.0	(0.4, 2.8)	0.9871	0.8	(0.2, 2.7)	0.7361	1.2	(0.3, 4.8)	0.8100
Middle/High School	1.5	(0.6, 3.7)	0.3859	1.2	(0.4, 3.6)	0.7684	3.0	(0.9, 10.4)	0.0811
Elementary school or less	1.6	(0.7, 3.9)	0.3050	1.4	(0.5, 4.6)	0.5310	2.5	(0.3, 19.0)	0.3710
Mother's education									
Graduate school or higher	ref			ref			ref		
College/University	0.6	(0.3, 1.2)	0.1368	0.7	(0.2, 2.0)	0.4932	0.3	(0.5, 2.1)	0.2387
Middle/High School	0.5	(0.2, 1.3)	0.1608	0.8	(0.2, 3.1)	0.6918	0.1	(0.0, 0.4)	0.0006
Elementary school or less	0.4	(0.1, 1.1)	0.0671	0.6	(0.1, 2.4)	0.4644	0.1	(0.0, 1.7)	0.1260
Pro-smoking exposures									
Home: Parents smoke									
None smokes	ref			ref			ref		
One parent smokes	1.5	(0.9, 2.5)	0.1131	1.1	(0.6, 2.2)	0.6645	2.7	(0.7, 10.2)	0.1483
Both smoke	2.0	(0.6, 6.4)	0.2288	1.7	(0.4, 7.4)	0.5091	3.2	(0.8, 13.2)	0.1140

Variables	All n=3,023 (smokers: n=132)			Males n=1,616 (smokers: n=93)			Females n=1,407 (smokers: n=39)		
	aOR	CI	p-value	aOR	CI	p-value	aOR	CI	p-value
Home: days/week smoked in presence									
None	ref			ref			ref		
1-2 days	2.0	(1.2, 3.2)	0.0091	2.2	(1.0, 5.0)	0.0605	1.4	(0.2, 11.9)	0.7406
3-6 days	2.2	(1.1, 4.1)	0.0212	1.9	(0.9, 3.8)	0.0846	2.6	(0.5, 13.2)	0.2582
7 days	4.8	(2.9, 7.8)	<0.0001	4.4	(2.2, 8.7)	<0.0001	6.2	(3.2, 12.1)	<0.0001
School: days/month smoked in presence									
None	ref			ref			ref		
1-7 days	2.4	(1.1, 5.3)	0.0273	2.3	(0.8, 6.9)	0.1457	2.9	(1.9, 4.4)	<0.0001
8-20 days	3.4	(1.3, 9.2)	0.0148	4.6	(1.3, 16.0)	0.0175	0.8	(0.1, 5.4)	0.7772
20 days or more	5.2	(2.7, 10.2)	<0.0001	2.5	(1.0, 6.5)	0.0542	16.7	(4.1, 67.7)	<0.0001
Media: Frequency of actors smoking									
Never/Don't watch media	ref			ref			ref		
Sometimes	0.7	(0.4, 1.5)	0.3617	0.6	(0.3, 1.2)	0.1423	1.9	(0.4, 9.8)	0.4652
Often	0.9	(0.5, 1.9)	0.8561	0.6	(0.3, 1.5)	0.3074	2.9	(0.6, 14.2)	0.1976
Anti-smoking exposures									
Home: Harmful effects of smoking discussed									
Yes	ref			ref			ref		
No	1.8	(1.0, 3.3)	0.0461	2.1	(1.1, 4.1)	0.0226	1.8	(1.2, 2.6)	0.0071
School: Taught dangers of smoking									
Yes	ref			ref			ref		
No/ Don't remember	1.4	(0.7, 2.6)	0.3304	1.3	(0.9, 1.9)	0.2178	1.8	(0.4, 8.8)	0.4429
Media: Frequency of anti-smoking messages									
A lot	ref			ref			ref		
Sometimes	1.2	(0.6, 2.5)	0.5655	1.2	(0.6, 2.5)	0.6004	1.2	(0.3, 5.1)	0.8043
Never	1.9	(0.5, 4.5)	0.1251	1.9	(1.0, 3.8)	0.0586	1.9	(0.5, 7.1)	0.3424

Figure

Figure 1. Directed acyclic graph (DAG) of smoke-free policy, smoking experimentation, and covariates of adolescent smoking, Nanjing, 2012.

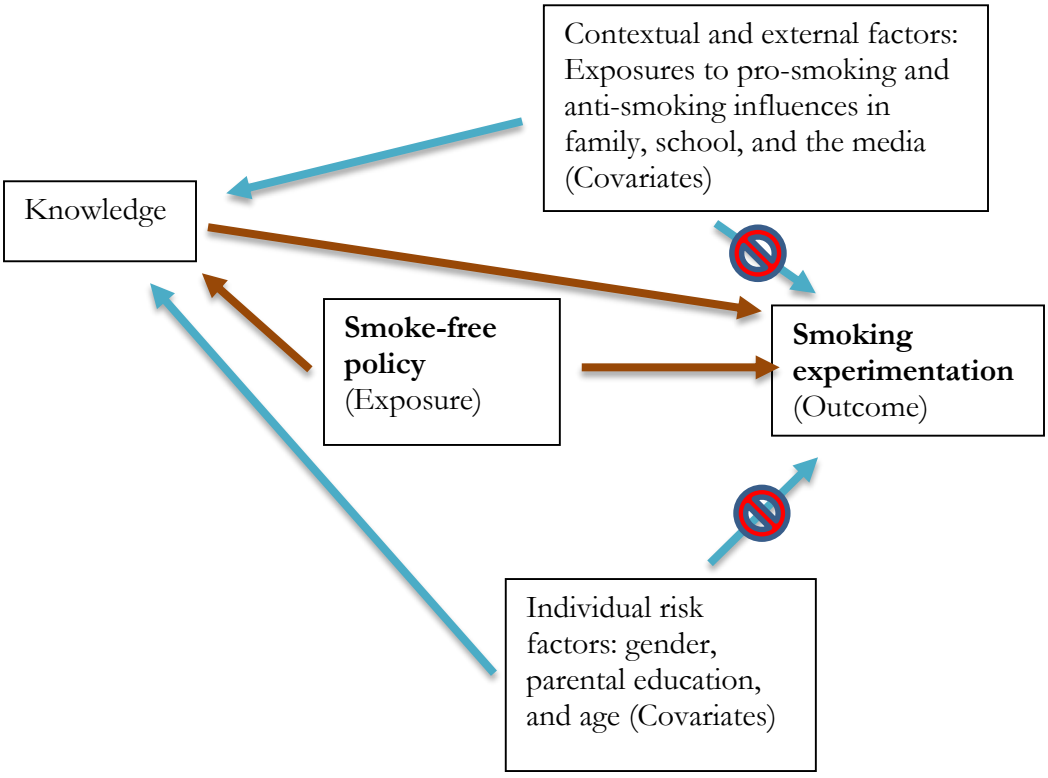

Figure 2. Sampling procedure of smoke-free policy study, Nanjing, 2012.