A TPB-Based Smoking Intervention among Chinese High School Students

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ABSTRACT

Objectives: China is the world’s largest tobacco consumer and its adolescent smoking rate is increasing. Smoking interventions among high school students are limited. The aim of this study was to deliver and evaluate a brief theory-based smoking intervention in China, with a focus on anti-smoking cognitions.

Methods: The intervention was based on the constructs of an extended theory of planned behavior and life skills training. Using class-level randomization sampling, 106 tenth graders from two high schools in Kunming, China received a four-session intervention; 101 students were assigned as control group members. Surveys were conducted at three time-points (1 week before the intervention, 1 week post-intervention, and 6 months post-intervention). MANOVA and latent class analysis were used to test the intervention’s effectiveness and personal change trajectories over time.

Results: The intervention failed to change smoking behavior, intention or willingness, but improved anti-smoking attitudes and perceived control over smoking. Skills showed a general enhancement, consistent with participants’ qualitative feedback. Trajectories of smoking behavior, intention, and willingness all assumed two distinct but constant latent classes independent of the intervention.

Conclusions: This study suggests that addressing attitudinal and control beliefs among adolescents and building on assertiveness via additional strategies in life skills such as appropriate refusal skills may be beneficial. The absence of a successful change in subjective norm should be a focus for future anti-smoking programs in China.

KEYWORDS

Smoking intervention; Chinese adolescents; theory of planned behavior; prototype willingness model; attitudes; perceived behavioral control; life skills; trajectories; LCGA

Introduction

Background

China has over 300 million current smokers, mostly male. According to a recent meta-analysis, Chinese adolescent smoking rates are constantly high among males and increasing among females; current smoking rates of males and females were estimated to be 17.4 and 3.26%, respectively (Han & Chen, 2015). This trend is alarming because smoking in mid- and late-teenage years leads to heavier smoking in adulthood (Chassin, Presson, Rose, & Sherman, 1996; Chinese Center for Disease Control and Prevention, 2011; Morrell, Song, & Halpern-Felsher, 2011).

China’s smoking interventions are in their infancy. School-based smoking interventions previously undertaken in China had methodological shortcomings and rarely reduced or prevented smoking at 6-month follow-up (Chen et al., 2014; Wen & Chen, 2005; Wen et al., 2010). Although most programs have targeted junior secondary school students, national surveys indicate an upsurge in smoking rates from late-teenage years to early adulthood, signifying that tobacco control in this transitional period is crucial (Chinese Center for Disease Control and Prevention, 2011).

In order to alter smoking cognitions and behaviors, three theoretical frameworks have been used in developing this smoking intervention; namely, the theory of planned behavior (TPB), the prototype willingness model (PWM), and life skills training.

Theoretical frameworks

The TPB (Ajzen, 1991) is a suitable framework for examining smoking in this age group. In the TPB, behavior is determined by intention (one’s readiness to perform a behavior) and perceived behavioral control (PBC; perceptions of control over behavioral performance); intention is influenced by attitudes (one’s overall evaluations of performing a behavior), subject-
ive norm (perceived social pressure from others to perform a behavior), and PBC (Ajzen, 1991), all with respective underlying beliefs. By changing underlying beliefs, the TPB constructs (attitudes, subjective norm, and PBC) can be modified; intention and behavior will be subsequently altered (Ajzen, 2011).

Developed based on the TPB, the PWM (Gibbons & Gerrard, 1997; Gibbons, Houlihan, & Gerrard, 2009) posits that, in addition to a reasoned path of decision making as per the TPB, there is a social reaction path where prototypes (social images) predict people’s willingness to perform a behavior given supportive circumstances. The PWM has successfully predicted adolescent risk behaviors including smoking (Hukkelberg & Dykstra, 2009; van den Eijnden, Spijkerman, & Engels, 2006). Given the salience of smoker images (for example, male smokers are regarded as cool and fashionable) elicited from Chinese adolescents (Zhao, White, Young, & Obst, 2018), constructs such as prototypes in the PWM should be considered as a target in the development of smoking interventions.

In addition to meta-analytic evidence for TPB interventions including among adolescents (Steinmetz, Knappstein, Ajzen, Schmidt, & Kabst, 2016), the TPB is able to encapsulate relevant psychological factors associated with smoking among Chinese high school students (Davey, McClenahan, & Zhao, 2014; Zhao, White, et al., 2018) but its ability to inform an effective intervention in this setting remains unknown. Previous studies among Chinese adolescents highlighted that academic stress and social influences are important triggers for adolescent smoking (Davey et al., 2014; Davey & Zhao, 2012; Zhao, White, et al., 2018). Life skills training, a well-established anti-substance use program, posits that, by enhancing personal and social competence and substance resistance skills/cognitions (using strategies such as stress coping, decision making, refusal skills, and critical thinking training), adolescents will be more confident to resist substance influences psychologically and then behaviorally (Botvin, 1980; Botvin & Griffin, 2015). Based on a previous belief elicitation study (Zhao, White, et al., 2018), we designed a TPB-based smoking intervention including life skills training (for details, see the Intervention section).

**Research aims**

The primary aim of this study was to evaluate the effectiveness of a brief theory-based intervention, especially on anti-smoking cognitions. As the majority of high school students are nonsmokers, we hypothesized that participants in the intervention group, compared to control group participants, would show a larger increase over time (in 4 weeks) in their anti-smoking cognitions (outcome variables: attitudes, subjective norm, PBC, prototypes) as well as their life skills (outcome variables: stress coping, decision making, assertiveness, pragmatics, and dispositions toward critical thinking); also, the smoking incidence (outcome variable: smoking behavior in the previous month) in the intervention group was hypothesized to be lower at follow-up than in the control group. To better capture the effectiveness of the intervention at an individual level, we also undertook a person-centered approach to examine the trajectories of smoking behavior and two proximal cognitions (intention and willingness) among all participants across time. We hypothesized that, with a successful intervention, a subgroup with a decreasing trend which could be predicted by the intervention condition would be identified. Qualitative materials from the intervention were also utilized to probe the mechanisms of the outcome (Thomas, McLellan, & Perera, 2015).

**Methods**

**Design**

The study was a prospective randomized controlled trial conducted in Kunming, Yunnan Province, China. Two secondary schools (one public, one private) were invited to participate using convenience sampling. Four classes were randomly selected out of 19 classes in 10th grade and allocated randomly to the intervention or control group. The study was approved by the University Human Ethics Committee and principals of participating schools provided their consent for the study to be undertaken in their schools. Consent for students to partake in the study was provided, as per school protocol, by the form teachers of the participating classes.

**Participants**

As shown in the Figure 1, 207 students (all boarding students) were invited to participate. Classes were randomly allocated to intervention ($n = 106$ students) and wait-listed control ($n = 101$) groups. To balance any school effects, each school had a class as a control group and a class as the intervention group. Attrition occurred at Time 2 (3.9%) and Time 3 (21.6%).

Considerations of sample size were fivefold: (1) based on prior contacts with principals in participating schools, one intervention class (usually 40 students per class) from each school was feasible for school
operations; (2) as an initial intervention, 30 participants in each condition is recommended (Browne, 1995; Lancaster, Dodd, & Williamson, 2004); (3) since changes in smoking-associated cognitions were the main focus of this trial, IBM SPSS MANOVA procedure was used to calculate the required sample size (60 participants in total could obtain a power of 0.76, with a mean standard deviation of 1.33 and an estimated correlation between all variables of 0.3), which could detect significant changes between the intervention and control groups (D’Amico, Neilands, & Zambarano, 2001); (4) repeated measures of smoking behavior were assessed using Cochran’s Q; 16 is suggested as the minimum sample size for this test (Myers, DiCecco, White, & Borden, 1982); (5) to detect a medium effect size from latent growth curve modeling, 75 cases are suggested (Fan & Fan, 2005).

Based on these considerations, the number of participants at Time 1 (N = 207) allowed for an attrition rate of up to 63.8%.

**Intervention**

The intervention was designed based on formative research comprising a qualitative study among Chinese middle school students (Zhao, White, et al., 2018). The decision for the number of intervention sessions was based on both previous research and practicalities. Brief programs have shown promise to reduce smoking among high school students and adults in China (Chen, Fang, Li, Stanton, & Lin, 2006; Zheng et al., 2007). Time constraints exist for school-based interventions; thus, the number of sessions (four sessions delivered on a weekly basis) was chosen.
based on the practicalities of Chinese high schools where students typically have little class time allocated to health education. Similar to a previous intervention targeting illicit drug use (Guo, Lee, Liao, & Huang, 2015), our intervention (facilitated by the first author) targeted extended TPB psychological constructs and life skills (for the theoretical framework, see Appendix A). Each session (40 min) included one main construct and one life skill (for practical strategies, see Table 1). Prototypes, part of the PWM struct and one life skill (for practical strategies, see Appendix B). The program comprised activities designed to foster or strengthen anti-smoking beliefs (debates, discussions) and skills training (role-play, advertisement analysis).

Three surveys were conducted throughout the intervention: baseline (Time 1; 1-week pre-intervention), post-intervention (Time 2; 1 week post-intervention), and follow-up (Time 3; 6 months post-intervention). After each session, anonymous feedback surveys were completed. To triangulate the effect of the intervention in a qualitative approach, focus groups among participants and individual interviews of form teachers of participating classes were conducted six months after the intervention.

**Measures**

The measures comprised outcome variables and control variables (for definitions of each variable, see Appendix B).

**Outcome variable**

**Smoking behavior.** Participants’ smoking behavior in the past 4 weeks was assessed with a binary answer (yes/no).

**TPB variables.** Following the standard TPB framework, attitude, subjective norm, and PBC were assessed using a 7-point Likert scale. As suggested by

### Table 2. Baseline characteristics of treatment groups.

| Variable | Control | Intervention | p<sup>b</sup> |
|----------|---------|--------------|--------------|
| Male<sup>a</sup> | 61.3% | 56.3% | .521 |
| Han Ethnicity<sup>a,c</sup> | 69.3% | 81.3% | .085 |
| Private school student<sup>a</sup> | 41.3% | 45.7% | .584 |
| Smoking status | | | .003 |
| Never smoked<sup>d</sup> | 58 | 46 | |
| Ever smoked<sup>d</sup> | 10 | 12 | |
| Quitter<sup>d</sup> | 4 | 2 | |
| Current smoker<sup>d</sup> | 3 | 19 | |
| Smoker father<sup>e</sup> | 64.0% | 60.8% | .678 |
| Smoker mother<sup>e</sup> | 1.3% | 3.8% | .337 |
| Friends’ smoking status | | | .044 |
| None<sup>d</sup> | 3 | 5 | |
| Few<sup>d</sup> | 23 | 23 | |
| Some<sup>d</sup> | 38 | 26 | |
| Majority<sup>d</sup> | 11 | 25 | |
| Intention | 1.60 | 2.07 | .027 |
| Willingness | 1.84 | 2.19 | .062 |
| Attitude | 1.97 | 2.46 | .043 |
| Subjective norm | 2.06 | 1.98 | .651 |
| PBC: Controllability | 5.75 | 5.23 | .049 |
| PBC: Self-efficacy | 3.37 | 3.45 | .774 |
| Prototype | 2.51 | 2.70 | .390 |
| Stress coping | 5.51 | 5.41 | .638 |
| Decision making | 5.57 | 5.45 | .453 |
| Assertiveness | 3.33 | 3.36 | .736 |
| Pragmatics | 3.73 | 3.69 | .737 |
| Dispositions toward critical thinking | 4.57 | 4.56 | .962 |

<sup>a</sup>Different statistic values are shown for variables: <sup>a</sup>represents frequency, <sup>b</sup>represents percentage, and the rest are means. <sup>c</sup>p: p value. Differences of variables resulted from χ<sup>2</sup> test (the part above the horizontal line) and t-test (the part below the horizontal line). <sup>d</sup>Besides Han Ethnicity, there were 13 Yi People, 11 Hui People, 7 Bai People, 3 Naxi People, 1 Dai People, 1 Ha’ni People, 1 Yao People, 1 Zhuang People. Since non-Han populations are officially termed as minority ethnicities, we grouped participants as Han and non-Han for analyses. PBC: perceived behavioral control. Smoking intention refers to one’s intention to smoke. Smoking willingness refers to one’s openness to smoking. p Values ≤.05 are highlighted in bold. Propensity score matching with kernel logit function was used in order to balance the baseline differences (regressors including sex, ethnicity, school type, smoking status, parents’ smoking status, friends’ smoking status, intention, willingness, attitude, subjective norm, controllability, self-efficacy, and prototype) between intervention and control groups.

### Table 1. Overview of sessions of the school-based smoking intervention: Achieving my healthy future.

| Session<sup>a</sup> | Construct/skill | Activity | Aims of the TPB-based activities |
|---------------------|-----------------|----------|---------------------------------|
| 1                   | Attitude        | Debate: What is the impact of smoking for people of your age and for your future life? Coping training: Deep breathing techniques | Linking smoking to participants’ current and future health and success in order to create their new beliefs against smoking. |
|                     | Stress coping   |          |                                 |
| 2                   | Subjective norm | Discussion of approvers and disprovers of smoking Decision-making steps | By linking Confucian teachings on friendship and filial piety, the session highlighted that smoking may kill people who are important to participants and that participants can influence smoking of their friends or relatives. |
|                     | Decision making |          |                                 |
| 3                   | Perceived behav- | Group discussion Training and role play: culturally appropriate refusal skills | With situational examples elicited from our previous qualitative study, this discussion focused on goal setting, and strategies to overcome barriers. |
|                     | 10-oral control |          |                                 |
|                     | Assertiveness   |          |                                 |
|                     | pragmatics      |          |                                 |
| 4                   | Prototypes      | Smoker image discussion Critical thinking over tobacco packaging | Deconstructing social images of smokers (such as “cool boys”) among participants. |
|                     | Critical thinking |          |                                 |
|                     | dispositions    |          |                                 |

<sup>a</sup>Session 4 of the intervention at the private school was delayed 1 week due to the school’s scheduling.<br>
<sup>b</sup>The duration of each session was 40 min. A 5-min-feedback survey was conducted at the end of each session.
Table 3. Fit indices for latent class growth analysis.

|          | SSABIC | Entropy | Adj. LMR – LRT (p) |
|----------|--------|---------|---------------------|
|          | Smoking behavior |        |                     |
| 2 classes | 295.03  | 0.96    | 141.83 (<.001)      |
| 3 classes | 299.09  | 0.89    | 4.22 (.108)         |
| 4 classes | 304.75  | 0.92    | <0.01 (.514)        |
|          | Smoking intention |      |                     |
| 2 classes | 1350.19 | 0.99    | 232.42 (.001)       |
| 3 classes | 1287.80 | 0.98    | 63.63 (.126)        |
| 4 classes | 1260.54 | 0.95    | 30.77 (.831)        |

SSABIC: sample size adjusted Bayesian information criteria; adj. LMR-LRT: adjusted Lo-Mendell-Rubin likelihood ratio test; p: p value.

When selecting the optimal number of latent classes, we considered multiple fit indices following three steps (Wickrama et al., 2016). First, models whose smallest class included fewer than 5% of the total sample size were excluded. Second, SSABIC statistics were compared and the model with the smallest SSABIC was considered best. Third, entropy and likelihood ratio were evaluated: higher entropy suggests better separation between classes, significant results from the likelihood ratio test indicate the k-class model has a better fit than the k-1-class model. Both the Bootstrapped Likelihood Ratio Test (BLRT) and the LMR-LRT were undertaken but the more robust LMR-LRT was applied as the local solution was reported in most of the BLRTs (Nylund, Asparouhov, & Muthén, 2007). Accordingly, for the behavior trajectories, the smallest group sizes for the 3-class and 4-class models suggested these models are problematic. For the intention and willingness trajectories, the same pattern emerged with the decrease of entropies when the class number increased from 2 to 4, as well as the non-significance of the adjusted LMR – LRT outcomes in the 3- and 4-class models, indicating that adding the class number from the 2-class model assumed no statistical meaning.

Figure 2. Latent class memberships: estimated trajectories of smoking behavior, intention and willingness from baseline (Time 1) to post-intervention (Time 2) to follow-up six months after the intervention (Time 3). Smoking intention refers to one’s intention to smoke. Smoking willingness refers to one’s openness to smoking. We modeled linear, rather than nonlinear, growth for 3 LCGAs as there were only 3 time points; variance and covariance values for the growth factors within each latent class were constrained to zero as per the guidelines of LCGA (Muthén & Muthén, 2000; Muthén & Muthén, 1998–2015).

For smoking behavior in the past month (a), the first latent class comprised 17.3% of the sample (n = 27). The characteristics of this trajectory are its constant high smoking likelihood with an increasing but non-significant tendency (intercept mean = 5.15; slope mean = 0.24, p = .349). We named this class as “likely smokers.” In contrast, another class (n = 129; 82.7%) had a low start (intercept mean < 0.01) with a slightly declining trend (slope mean = −0.05, p = .686). We labeled this class “unlikely smokers.” For smoking intention trajectories (b), the smaller class (n = 21; 13.9%) was named “high intenders” as this trajectory started with a high smoking intention (intercept mean = 4.49) and slightly increased (slope mean = 0.01, p = .766). The other class (n = 130; 86.1%), with a comparatively low starting score (intercept mean = 1.40) and a small increasing trend (slope mean = 0.02, p = .139), was labeled “low intenders.”

For smoking willingness trajectories (c), 24.5% of the participants (n = 37) showed a medium but increasing (not significantly) level across time (intercept mean = 3.86; slope mean = 0.07, p = .063). We labeled this class “more willing endorsers” in contrast to the other class “less willing endorsers.” The “low willing endorsers” comprised 114 participants (75.5%), and showed a slowly increasing tendency (intercept mean = 1.50; slope mean = 0.01, p = .337).

PWM variables. Willingness and prototype were assessed using a 7-point Likert scale. Higher scores indicated a stronger willingness to smoke and more favorability toward smoker images. All questions were asked with a timeframe (in the following 7 d).

Latent class memberships of smoking and proximal cognitions. We applied latent class growth analysis (LCGA) to generate the latent subgroups in the longitudinal changes of smoking and its proximal variables (intention and willingness) at an individual level. Results suggested that the 2-class model was optimal for the smoking behavior, intention, and willingness LCGAs (for details, see Table 3 and Figure 2).

Life skills. Five life skills were tested. Stress coping, decision making, and pragmatics items were created by the authors to fit the study context. Assertiveness

Ajzen (2002), separate measures of controllability and self-efficacy were used instead of a global PBC scale. Higher scores indicated a stronger intention to smoke, more pro-smoking attitudes, more perceived approval from others to smoke, as well as more control over one’s own smoking behavior. All questions were asked with a specific timeframe (in the following 7 d).
and dispositions toward critical thinking were based on established measures (Wills, Baker, & Botvin, 1989; Yeh, 1999). Higher scores indicate a higher level of life skills/abilities.

The TPB and PWM variables showed sound reliability (Cronbach’s $\alpha \geq 0.74$ or significant correlation). All scales of life skills showed acceptable or close to acceptable reliability. Averaged scores were used for these constructs. All questions were developed in English and were later translated into Chinese.

Control variables
Demographic variables were used (see Table 2); including age, gender, and ethnicity. Smoking status, smoking behavior in the past 4 weeks, parents’ smoking status, and friends’ smoking status were assessed with single items.

Intervention evaluation
To evaluate the intervention program, we used quantitative responses including ratings of overall satisfaction of each session (see Appendix B) and asked open-ended questions for feedback on the intervention.

Data analytic plan
Statistical significance was defined as $p \leq .05$ and the confidence interval (CI) was 95%. To examine the baseline status, t-tests and $\chi^2$ tests were undertaken to compare baseline variables between groups. Due to the randomization being class-based, several baseline differences between groups were identified. With PSMATCH2 available in Stata version 14.2 (StataCorp, College Station, TX), propensity score matching with kernel logit function was used in order to balance baseline differences between intervention and control groups, thereby generating a more accurate trial evaluation (Katz, 2010; Leuven & Sianesi, 2017; Strong, Juon, & Ensminger, 2016; Timberlake, Huh, & Lakon, 2009). Consistent with the research aim and theoretical framework, contextual factors, TPB variables, and PWM variables were balanced between groups using a propensity score as they showed significant differences. The propensity score weights generated from this step was consistently used in the following analyses.

Intervention effects were examined through changes on self-reported smoking behavior and both TPB and PWM variables. As smoking behavior in the past 4 weeks is a repeated measured dichotomous scale, we used Cochran’s Q test (Katz, 2010). We used repeated measures MANOVA to examine the changes over time between groups on related variables: proximal set (intention, willingness), cognition set (attitudes, subjective norm, controllability, self-efficacy, and prototype), and skills set (coping, decision making, assertiveness, pragmatics, and critical thinking).

As MANOVA operates at the group-mean level, changes at an individual level are not the focus of this analysis (Hancock, Harring, & Lawrence, 2013; Jung & Wickrama, 2008). However, methodologically, using population-centered variables such as smoking rates might obscure the results of an intervention. Thus, to better capture the effectiveness of the intervention, changes across time were examined with LCGA, analyzing the smoking behavior, intention, and willingness across time in a person-centred perspective (Jung & Wickrama, 2008; Muthén & Muthén, 1998–2015; Wickrama, Lee, O’Neal, & Lorenz, 2016). As opposed to smoking rates, which are traditionally used to compare behavioral changes, LCGA allows research to trace the smoking behavioral changes at an individual level. Three sets of dummy codes were generated from the LCGAs (for details, see Figure 2 and Table 3). To assess whether the intervention has a person-centered level effect, propensity score weighted binary logistic regression was used to identify the relationship between the condition (intervention vs. control) and latent classes in three trajectory sets.

For the quantitative intervention evaluation, descriptive analyses were used to identify the general feedback. Emerging themes from qualitative materials were summarized using content analysis.

Results
Baseline status comparison
As shown in Table 2, the proportion of current smokers in the intervention group (24.1%) was higher than in the control group (4.0%), $\chi^2(3) = 13.78$, $p = .003$. Furthermore, more participants in the intervention than control group reported that the majority of their friends were smokers ($\chi^2(3) = 8.10$, $p = .044$). Finally, the intervention group had stronger intentions ($t(133.21) = -2.24$, $p = .027$) and more positive attitudes ($t(149.75) = -2.04$, $p = .043$), as well as lower controllability related to smoking behavior ($t(146.88) = 1.99$, $p = .049$). Given these discrepancies between the groups, the following analyses were conducted with the weighted propensity scores.

Effect of the intervention
The descriptive results for the outcome variables are displayed in Table 4. Smoking behavior and
Table 4. Means (standard deviation) for smoking behavior, psychological variables, life skills at baseline (Time 1), post-intervention (Time 2), and follow-up six months after intervention (Time 3).

| Construct          | Condition | Time 1       | Time 2       | Time 3       |
|--------------------|-----------|--------------|--------------|--------------|
| Smoking behavior   | Control   | 0.06 (0.24)  | 0.09 (0.29)  | 0.06 (0.24)  |
|                    | Intervention | 0.41 (0.49)  | 0.43 (0.50)  | 0.47 (0.50)  |
| Intention          | Control   | 1.56 (0.97)  | 1.50 (0.89)  | 1.58 (1.17)  |
|                    | Intervention | 2.28 (1.46)  | 2.36 (1.47)  | 2.08 (1.50)  |
| Attitude           | Control   | 1.93 (1.31)  | 1.93 (1.05)  | 1.92 (1.47)  |
|                    | Intervention | 2.80 (1.67)  | 3.10 (1.58)  | 2.49 (1.25)  |
| Subjective norm    | Control   | 2.01 (0.96)  | 2.07 (0.78)  | 2.23 (1.00)  |
|                    | Intervention | 2.18 (1.04)  | 2.47 (0.96)  | 2.49 (1.19)  |
| PBC: Controllability | Control | 5.72 (1.37)  | 5.96 (1.19)  | 6.20 (0.87)  |
|                    | Intervention | 5.46 (2.01)  | 6.15 (1.21)  | 5.69 (1.24)  |
| PBC: Self-efficacy | Control   | 3.44 (1.66)  | 3.57 (1.51)  | 3.52 (1.44)  |
|                    | Intervention | 4.45 (2.18)  | 4.69 (1.80)  | 3.94 (1.23)  |
| Willingness        | Control   | 1.70 (1.06)  | 1.92 (1.14)  | 1.92 (1.23)  |
|                    | Intervention | 2.56 (1.49)  | 2.74 (1.44)  | 2.77 (1.55)  |
| Prototype          | Control   | 2.50 (1.35)  | 2.53 (1.31)  | 2.57 (1.20)  |
|                    | Intervention | 3.00 (1.36)  | 3.01 (1.20)  | 3.39 (1.42)  |
| Stress coping      | Control   | 5.64 (1.21)  | 5.84 (0.91)  | 5.73 (0.92)  |
|                    | Intervention | 5.08 (1.27)  | 5.65 (1.08)  | 5.27 (1.20)  |
| Decision making    | Control   | 5.59 (0.88)  | 5.54 (0.92)  | 5.61 (0.84)  |
|                    | Intervention | 5.25 (0.98)  | 5.17 (0.94)  | 5.57 (1.01)  |
| Assertiveness      | Control   | 3.35 (0.47)  | 3.35 (0.45)  | 3.37 (0.46)  |
|                    | Intervention | 3.27 (0.52)  | 3.41 (0.46)  | 3.43 (0.50)  |
| Pragmatics         | Control   | 3.71 (0.77)  | 3.67 (0.78)  | 3.69 (0.75)  |
|                    | Intervention | 3.63 (0.83)  | 3.82 (0.70)  | 3.72 (0.72)  |
| Dispositions toward critical thinking | Control | 4.57 (0.58)  | 4.54 (0.54)  | 4.51 (0.59)  |
|                    | Intervention | 4.59 (0.69)  | 4.59 (0.60)  | 4.72 (0.63)  |

Scores in the table are weighted propensity score values. PBC = Perceived behavioral control. 

*Smoking behavior was measured using a binary scale (1 = yes, 0 = no). Other variables were assessed with Likert scales; higher scores suggest higher intention and willingness to smoke, as well as more pro-smoking attitudes.

willingness both showed a gradual increase in the intervention group, whereas smoking intention increased from Time 1 to Time 2 followed by a decrease at Time 3. Participants in the intervention group showed an increase in most TPB and PWM variables from Time 1 to Time 2, suggesting they had more pro-smoking attitudes, more perceived social pressure to smoking (subjective norm), and higher control over their smoking after the intervention. In contrast, participants’ pro-smoking attitudes and control over their smoking both reduced at Time 3, while subjective norm remained at similar levels to Time 2. As for prototypes, although intervention participants showed a similar level to baseline after the program, they appeared to have higher favorability and similarity toward smoker images at Time 3. Intervention group members’ life skills generally showed an increasing trend on the mean scores across time.

**Variable-centered approach**

Across three time points, both intervention (Cochran’s Q = 4.31, p = .116) and control group (Cochran’s Q = 1.00, p = .607) participants showed homogeneous patterns on their smoking behavior in the past month, reflecting no significant changes due to the intervention.

Using a series of repeated measures MANOVAs among all participants, there were no intervention effects across time on the proximal set. However, both the cognition set (F(10,158) = 4.25, p < .001, partial \( \eta^2 = 0.21 \)) and skills set (F(10,157) = 1.93, p = .045, partial \( \eta^2 = 0.11 \)) showed significant combined effects in condition by time multivariate tests. These multivariate effects are large (Cohen, 1988). For the cognition set, significant univariate time by intervention interaction effects included attitude (F(1.90, 317.53) = 12.55, p < .001, partial \( \eta^2 = 0.01 \)), controllability (F(1.74, 290.56) = 3.81, p = .029, partial \( \eta^2 = 0.02 \)), and self-efficacy (F(1.89, 316.39) = 4.75, p = .010, partial \( \eta^2 = 0.03 \)). Results suggest that the intervention had significantly reduced students’ pro-smoking attitude and increased their perceived control over smoking. As for the skills set, although the intervention group showed several increasing trends for different skills, only assertiveness had a near-significant univariate effect, F(1.72,284.84) = 2.86, p = .067, partial \( \eta^2 = 0.02 \). Compared to the multivariate results, the univariate effects are deemed as much smaller (Cohen, 1988).

**Person-centered approach**

For the person-centered level approach, the intervention condition was not a significant predictor for behavioral, intentional, or willingness trajectories in the propensity score weighted logistic regression analyses.

**Intervention feedback**

Participants were highly satisfied with their participation in the intervention (M = 4.22, SD = 0.59; aggregated scores of five questions).

Participants qualitatively evaluated the intervention in a positive manner. Outcomes regarding smoking and life skills were both reported. The form teachers of participating classes also reported improvements of participating classes also reported improvements for life skills among the students.

I was quite immature… and tried to smoke due to curiosity… I viewed smoking as something to be proud of. As I am becoming more mature, I corrected those inaccurate thoughts. After these sessions, I have strengthened the belief that I will not smoke. [Female, previously smoked]
[The intervention] informed me with many methods to deal with problems in my life. I am using the methods you taught us when I need to make choices. [Female student, never smoked]

I rarely reflected on my actions, but now I even quit alcohol. [Male student, current smoker]

I have practised [stress coping skill]. When I attended a competition at school, my classmate and I were very nervous and we tried to cope with it by the deep breathing method you taught us, and we felt we got better. When we performed, we were not that nervous. [Male student, intervention group]

The intervention may not have changed their smoking but it taught them a lot about life skills. They studied it carefully because I found that some students wrote things they learnt from the intervention in their ‘Weekly Logs’ [a system that form teachers use in order to gather information from each student whereby students are asked to report on their life or reflections of their life in the past week]. Students said that they got insights and lessons from your programme … I feel there are some changes in terms of their life skills. [Form teacher]

Although some sessions could be easily recalled 6 months after the program (e.g. the tobacco packaging discussion), it was generally suggested that the program should include more sessions. A few students reported that they could not reduce their smoking due to offers of cigarettes from friends or classmates, stress, and dealing with negative emotions.

I remember you gave us some colourful pictures of different tobacco packaging where we discussed how packaging was designed. That activity impressed me a lot. I think those tobacco companies manipulate consumers' minds for better sales. [Male student, intervention group]

I can reduce smoking by not buying cigarettes myself and only smoking cigarettes offered by classmates … some classmates encouraging me to smoke and negative emotions are barriers for me to stop smoking. [Male student, intervention group]

Limited changes for smoking behavior were reported, although the program seemed to establish an anti-smoking consensus within classes where non-smokers could express their dislike of passive smoking more freely. However, the intervention may have normalized the social image of smokers.

After the intervention, I reckon it is easier to stop classmates smoking in my presence … Now, classmates who smoke do it away from us … after the intervention, classmates all know that people do not like them smoking around us. I do not know how to say it, but I can feel it is easier to stop their smoking now as opposed to before. [Female student]

I used to think smokers are very bad and I did not make friends with people if I saw them smoke. Now, I know people smoke for some reasons and I can evaluate their behaviour in a rational way. [Male student, intervention group]

Discussion

Our study aimed to alter Chinese adolescents’ smoking behavior and cognitions and enhance life skills using a brief intervention based on the TPB, PWM, and life skills training. This study is, to the authors’ knowledge, the first TPB-based smoking intervention in China. With qualitative triangulation, this study was able to unpack the quantitative findings. Although not changing reported smoking behavior, the program significantly improved students’ anti-smoking attitudes, controllability, and self-efficacy over smoking. The intervention has generally enhanced group members’ life skills. Participants reported high satisfaction with the intervention. Findings from this study provide important implications for smoking intentions in China.

Generally, this intervention showed minimal effects in improving participants’ anti-smoking behavior or its proximal cognitions (i.e. intention and willingness). Consistent with previous school-based anti-smoking interventions conducted in China (Chen et al., 2014; Chou et al., 2006; Wen et al., 2010), smoking behavior remained unchanged at both variable-centered and person-centered levels. By contrast, successful outcomes were demonstrated on attitudes and PBC given that the program significantly reduced students’ pro-smoking attitudes and enhanced their perceptions of control over smoking. Notably, both constructs showed a reduction at Time 3 (the follow-up time-point). In terms of life skills, although the condition by time effect was significant in the multivariate test, evidence of skill improvements in specific skills was not identified. Apart from assertiveness, which showed a near-significant condition by time effect ($p = .067$), other skills showed a gradual increase across time or a reduction at Time 3.

As suggested by Ajzen (2011), the results of a TPB-based intervention can provide underlying reasons to explain its effectiveness. Controlling for the background factors with sampling weights (propensity score matching), the general improvement of life skills is in agreement with the changes in attitudes and PBC. Consistent with a similar design (Guo et al., 2015), the results suggest that life skills enhancement can facilitate the change in psychological constructs of tobacco use. Unexpectedly, although successful changes were demonstrated in attitude and PBC, the
behavior and its proximal cognitions (i.e. intention and willingness) did not improve. As identified by Davey et al. (2014), the subjective norm-intention link is the strongest association compared to attitude-intention and PBC-intention. Due to the strong influence of subjective norm, it is likely that the inability to change subjective norm may have contributed to the absence of significant changes in smoking behavior, intention, and willingness.

Our study offers practical implications given its successful effects on some of the psychological constructs as well as generally positive intervention feedback. Especially important is assertiveness, which not only showed a near-significant increase across time, but also assisted the participating classes to form anti-smoking group dynamics as the qualitative feedback suggested. Current anti-smoking curricula in Chinese schools still focus on information of smoking’s harm (Zhao, Shen, & Davey, 2017; Zhao, Young, & White, 2018). Based on the positive outcomes of life skills and specific intervention activities (e.g. the tobacco packaging discussion), future anti-smoking curricula may benefit from incorporating skill training. Furthermore, the decrease in attitude and PBC from Time 2 to Time 3 may indicate that participants’ anti-smoking attitudes took a period of time to form rather than immediately after the program; however, PBC’s immediate effect appeared to diminish after six months. Thus, including more sessions (also suggested from participants’ feedback) or booster sessions might be beneficial to provide participants with more chances to practice and comprehend the skill and content (Guo et al., 2015).

It is worth noting that the intervention group members’ social image (prototype) of smokers showed a non-significant albeit increasing trend from Time 2 to 3, suggesting participants in the intervention group perceived more favorability and similarity to smoker images. Some positive smoker images (e.g. wealthy businessmen) discussed in the program might have inadvertently contributed to this trend. The smoker images in adulthood are frequently reported by Chinese adolescents and some students are attracted to smoking due to the positive values associated with them (e.g. better interpersonal relationships associated with the image of successful businessmen who smoke) (Davey & Zhao, 2012; Zhao, White, et al., 2018; Zhao, Young, et al., 2018). In order to establish a wider anti-smoking norm, future anti-smoking programs may benefit if the targets extend to positive smoker images beyond the school environment setting (e.g. negative smoker images in the broader Chinese community should be addressed).

**Study limitations**

Study limitations include the issue that intervention participants comprised both smokers and nonsmokers, possibly affecting the results (Thomas, McLellan, & Perera, 2013); that more sessions (or booster sessions) may be needed as stated by participants, and that three time points might miss information about participant trajectories (e.g. changes beyond 6 months) (Orlando, Tucker, Ellickson, & Klein, 2004); that both the intervention and control groups were from the same boarding schools, which might result in contamination; and that biochemical measures to confirm smoking status were not utilized. Future smoking interventions targeting specific smoking experiences (e.g. daily smokers, social smokers, and nonsmokers) using more sessions and biochemical validators are needed to improve the design of this intervention.

**Conclusions**

This research highlights the need for further examination of tobacco control strategies in high schools in China. Smoking at this age appears to be a stable behavior which creates challenges for smoking interventions. Based on the encouraging outcomes on attitudes, PBC and life skills, future programs with a stronger emphasis on assertiveness and sessions targeting attitudes and controllability may assist in efforts to curb students’ tobacco use. The results from our intervention also suggest that future interventions should address detrimental influences (e.g. positive smoker images) in wider society.

**Declaration of interest**

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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**Reference**

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T
Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32*(4), 665–683. doi:10.1111/j.1559-1816.2002.tb00256.x

Ajzen, I. (2011). Behavioral interventions: Design and evaluation guided by the theory of planned behavior. In M. M. Mark, S. I. Donaldson, & B. Campbell (Eds.), *Social psychology and evaluation* (pp. 74–100). New York, NY: Guilford Press.

Botvin, G. J. (1980). *Life skills training: Teacher’s manual*. New York, NY: Smithfield Press.

Botvin, G. J., & Griffin, K. W. (2015). Life skills training: A competence enhancement approach to tobacco, alcohol, and drug abuse prevention. In L. M. Scheier (Ed.), *Handbook of adolescent drug use prevention: Research, intervention strategies, and practice* (pp. 177–196). Washington DC: American Psychological Association.

Browne, R. H. (1995). On the use of a pilot sample for sample size determination. *Statistics in Medicine, 14*(17), 1933–1940. doi:10.1002/sim.4780141709

Chassin, L., Presson, C. C., Rose, J. S., & Sherman, S. J. (1996). The natural history of cigarette smoking from adolescence to adulthood: Demographic predictors of continuity and change. *Health Psychology, 15*(6), 478–484. doi:10.1037/0278-6133.15.6.478

Chen, L., Chen, Y., Hao, Y., Gu, J., Guo, Y., & Ling, W. (2016). Effectiveness of school-based smoking intervention in middle school students of Linzhi Tibetan and Guangzhou Han ethnicity in China. *Addictive Behaviors, 39*(1), 189–195. doi:10.1016/j.addbeh.2013.09.026

Chen, X., Fang, X., Li, X., Stanton, B., & Lin, D. (2006). Stay away from tobacco: A pilot trial of a school-based adolescent smoking prevention program in Beijing, China. *Nicotine & Tobacco Research, 8*(2), 227–237. doi:10.1080/14622200600576479

Chinese Center for Disease Control and Prevention. (2011). *Global adults tobacco survey (GATS) China 2010 country report*. Beijing, China: Sanxia Press [in Chinese].

Chou, C. P., Li, Y., Unger, J. B., Xia, J., Sun, P., Guo, Q., … Johnson, C. A. (2006). A randomized intervention of smoking for adolescents in urban Wuhan, China. *Preventive Medicine, 42*(4), 280–285. doi:10.1016/j.ypmed.2006.01.002

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences*. Hillsdale, NJ: Erlbaum.

D’Amico, E. J., Neilands, T. B., & Zambarano, R. (2001). Power analysis for multivariate and repeated measures designs: A flexible approach using the SPSS MANOVA procedure. *Behavior Research Methods, Instruments, & Computers, 33*(4), 479–484. doi:10.3758/bf03195405

Davy, G., McClenahan, C., & Zhao, X. (2014). Smoking intention among Chinese youth and implications for health interventions. *Asia Pacific Journal of Counselling and Psychotherapy, 5*(1), 71–86. doi:10.1080/21507686.2013.878368

Davy, G., & Zhao, X. (2012). ‘A real man smells of tobacco smoke’—Chinese youth’s interpretation of smoking imagery in film. *Social Science & Medicine, 74*(10), 1552–1559. doi:10.1016/j.socscimed.2012.01.024

Fan, X., & Fan, X. (2005). Power of latent growth modeling for detecting linear growth: Number of measurements and comparison with other analytic approaches. *The Journal of Experimental Education, 73*(2), 121–139. doi:10.3200/JEXE.73.2.121-139

Gibbons, F. X., & Gerrard, M. (1997). Health images and their effects on health behavior. In B. P. Buunk & F. X. Gibbons (Eds.), *Health, coping, and well-being: Perspectives from social comparison theory* (pp. 63–94). Mahwah, NJ: Erlbaum.

Gibbons, F. X., Houlihan, A. E., & Gerrard, M. (2009). Reason and reaction: The utility of a dual-focus, dual-processing perspective on promotion and prevention of adolescent health risk behaviour. *British Journal of Health Psychology, 14*(2), 231–248. doi:10.1348/13590708X376640

Guo, J. L., Lee, T. C., Liao, J. Y., & Huang, C. M. (2015). Prevention of illicit drug use through a school-based program: Results of a longitudinal, cluster-randomized controlled trial. *Journal of Adolescent Health, 56*(3), 314–322. doi:10.1016/j.jadohealth.2014.12.003

Han, J., & Chen, X. (2015). A meta-analysis of cigarette smoking prevalence among adolescents in China: 1981–2010. *International Journal of Environmental Research and Public Health, 12*(5), 4617–4630. doi:10.3390/ijerph120504617

Hancock, G. R., Harring, J. R., & Lawrence, F. R. (2013). Using latent growth modeling to evaluate longitudinal change. In G. R. Hancock & R. O. Mueller (Eds.), *Structural equation modeling: A second course* (2nd ed., pp. 309–342). Charlotte, NC: Information Age Publishing, Inc.

Hukkelberg, S. S., & Dykstra, J. L. (2009). Using the prototype/willingness model to predict smoking behaviour among Norwegian adolescents. *Addictive Behaviors, 34*(3), 270–276. doi:10.1016/j.addbeh.2008.10.024

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass, 2*(1), 302–317. doi:10.1111/j.1751-9004.2007.00054.x

Katz, M. H. (2010). Evaluating clinical and public health interventions: A practical guide to study design and statistics. Cambridge, UK: Cambridge University Press.

Lancaster, G. A., Dodd, S., & Williamson, P. R. (2004). Design and analysis of pilot studies: Recommendations for good practice. *Journal of Evaluation in Clinical Practice, 10*(2), 307–312. doi:10.1111/j.1447-5958.2002.00840.x

Leuven, E., & Sianesi, B. (2017). *PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing*. Retrieved from http://EconPapers.repec.org/RePEc:boc:bocode:s432001

Morrell, H. R., Song, A., & Halpern-Felsher, B. (2011). Earlier age of smoking initiation may not predict heavier cigarette consumption in later adolescence. *Prevention Science, 12*(3), 247–254. doi:10.1007/s11121-011-0209-6

Muthén, B. O., & Muthén, L. K. (2000). Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research, 24*(6), 882–891. doi:10.1111/j.1530-0270.2000.tb02070.x

Muthén, L. K., & Muthén, B. O. (1998–2015). *Mplus user’s guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.

Myers, J. L., DiCecco, J. V., White, J. B., & Borden, V. M. (1982). Repeated measurements of dichotomous variables:
Appendix A

Figure A1. Theoretical framework of the intervention.
PBC: perceived behavioral control. As shown in the above figure, our intervention targeted the individual level of smoking psychology, following an extended Theory of Planned Behavior model. Besides the activities directly working on smoking cognitions (attitudes, subjective norm, prototype, and PBC), the five-pronged life skills training was also incorporated.
### Appendix B

#### Table B1. Scales used for the study.

| Variable (definition) | Item                                                                 | Scale                                                                 | Reliability (Cronbach’s α/ Spearman correlation) |
|-----------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------|
| Smoking behavior      | In the last 4 weeks, I smoked.                                       | 1 (yes) to 0 (no)                                                    | N/A                                              |
| Theory of planned behavior (TPB) variables | I intend to smoke./I plan to smoke./It is likely that I will smoke. | 1 (strongly disagree) to 7 (strongly agree)                         | 0.93                                             |
| Attitude (one’s overall evaluations of smoking) | Smoking cigarettes during the next week would be … | 1 (pleasant) to 7 (unpleasant) 1 (good) to 7 (bad) 1 (wise) to 7 (unwise) 1 (easy) to 7 (difficult) 1 (nice) to 7 (awful) 1 (positive) to 7 (negative) | 0.94                                             |
| Subjective norm (one’s perceived social pressure to smoke) | Those people who are important to me would want me to smoke./Most of my friends smoke./Most people who are important to me would approve of my smoking./My friends think that smoking is a good thing to do. | 1 (strongly disagree) to 7 (strongly agree)                         | 0.74                                             |
| PBC: controllability | I have complete control over whether I smoke./It is mostly up to me whether I smoke. | 1 (strongly disagree) to 7 (strongly agree)                         | 0.62**                                           |
| PBC: self-efficacy | If I wanted to, it would be easy for me to smoke./I am confident that I could smoke. | 1 (strongly disagree) to 7 (strongly agree)                         | 0.56**                                           |
| Willingness (one’s openness to smoke) | I am willing to smoke./Suppose I were with a group of classmates on campus where no school staff could find me and there were cigarettes that I could have if I wanted. I am willing to smoke in such a situation./Suppose I were at some entertainment place (e.g. karaoke room, mahjong house) with my friends and there were cigarettes that I could have if I wanted. I am willing to smoke in such a situation. | 1 (strongly disagree) to 7 (strongly agree)                         | 0.86                                             |
| Prototype (social image of smoking) | In general, how favorably do I view the typical smokers around my age?/In general, how similar am I to the smokers around my age? | 1 (very unfavorable) to 7 (very favorable) 1 (nothing similar) to 7 (very similar) | 0.43**                                           |
| Stress coping (one’s perceived ability to cope with stress from one’s study and life) | I am able to cope with stress./I am able to cope with stress from the study without smoking cigarettes./I am able to cope with stress from life, in general, without smoking cigarettes. | 1 (strongly disagree) to 7 (strongly agree)                         | 0.82                                             |
| Decision making (one’s perceived ability to make “thoughtful” decisions) | I am able to make good decisions./I consider more than one option when weighing up my decisions./I make decisions after finding out enough information to base my decisions on. | 1 (strongly disagree) to 7 (strongly agree)                         | 0.64                                             |
| Assertiveness* (how assertive one is to clearly state one’s opinions when refusing substance use, generally, as well as in common social scenarios) | [Substance assertiveness] Resist pressure to drink alcohol./Resist pressure to smoke cigarettes./Resist an unfair request from a friend. [General assertiveness] Express an opinion that differs from what the person I am talking to is saying./Tell people when I feel they have done something that is unfair./Ask for service when I am not getting it./Request that someone return borrowed things./Return items that I am not satisfied with./Ask a person annoying me to stop./Resist sales pressure from a salesman. [Social assertiveness] Tell someone I like them./Compliment a person I really appreciate./Ask whether I have offended someone./Start a conversation with a stranger. | 1 (never do this) to 5 (always do this)                         | 0.78                                             |
| Pragmatics (linguistic resources one has to refuse a request and cigarette offers) | Knowing the wording used to refuse a request./Knowing the wording used to refuse cigarette offers. | 1 (never do this) to 5 (always do this)                         | 0.36**                                           |
| Dispositions toward critical thinking* (one’s willingness to suspend judgments: intellectual curiosity, open-mindedness) | [Intellectual curiosity] Think about one question from different perspectives./Use new ideas or viewpoints./Further explore novel things and ideas. [Open-mindedness] Respect others’ views during | 1 (never) to 6 (always)                         | 0.93                                             |

*Continued*
| Variable (definition) | Item                                                                 | Scale | Reliability (Cronbach’s α/ Spearman correlation)* |
|-----------------------|----------------------------------------------------------------------|-------|--------------------------------------------------|
| open-minded, thinking holistically, reflectively, systematically and analytically | [Holistic & reflective] Consider situational factors when I make decisions./Test if my idea is convincing by challenging my own ideas./Find out the hidden hypotheses when one raises an argument./Predict the consequences of all the alternative plans before making decisions. | 1 (not at all) to 5 (completely) | 0.86 |
|                       | [Systematicity & analyticity] Remain a rational and logical thinking, even when I face complicated situations./Think if a piece of information is reliable before I use it./Examine the value and reliability of a new viewpoint./Clarify the question before I deal with it./Collect relevant information that is updated and holistic when I deal with a problem./Quickly understand others’ feelings and thoughts by discussions and observations./Immediately correct my own viewpoints when enough evidence shows my bias./Find out the causes of a problem when I start to handle it./Look for the histories of controversial issues that have recently happened. |       |       |

Evaluation of the intervention

| Overall evaluation | I am satisfied with the new facts, strategies and skills I have learned in the program./Overall, the activities were enjoyable./Overall, the activities helped me to learn new things./Overall, the program leader was easy to understand and I felt comfortable to ask questions when needed. | 1 (not at all) to 5 (completely) | 0.86 |

PBC: perceived behavioral control. Smoking intention refers to how one is motivated to perform smoking. Smoking intention refers to one’s intention to smoke. Smoking willingness refers to one’s openness to smoking.

*Scores have been reversed in order to keep consistent direction with other variables.

*PBC refers to one’s perceptions of the control over smoking. As suggested by Ajzen (2002), separate measures of controllability and self-efficacy were used instead of a global PBC scale. Note. Composites (mean scores) of each variable were used for the analyses.

*We deleted a question that was deemed unsuitable for Chinese middle school students due to the sensitivity of the topic (“resist pressure to use drugs”).

*For the scale originally in Chinese (Yeh, 1999), we also modified its wording for use in Mainland China.

*Results from Spearman correlations are underlined in order to differentiate them from Cronbach’s α.