Published in final edited form as:
Addict Behav. 2012 March ; 37(3): 273–279. doi:10.1016/j.addbeh.2011.11.002.

Do Cognitive Attributions for Smoking Predict Subsequent Smoking Development?

Qian Guo, Ph.D.[a,*], **Jennifer B. Unger, Ph.D.**[b], **Stanley P. Azen, Ph.D.**[b], **David P. MacKinnon, Ph.D.**[c], and **C. Anderson Johnson, Ph.D.**[d]

[a]Department of Public Health, County of Los Angeles

[b]Keck School of Medicine, University of Southern California

[c]Department of Psychology, Arizona State University

[d]School of Community and Global Health, Claremont Graduate University

Abstract

To develop more effective anti-smoking programs, it is important to understand the factors that influence people to smoke. Guided by attribution theory, a longitudinal study was conducted to investigate how individuals' cognitive attributions for smoking were associated with subsequent smoking development and through which pathways.

Middle and high school students in seven large cities in China (N=12,382; 48.5% boys and 51.5% girls) completed two annual surveys. Associations between cognitive attributions for smoking and subsequent smoking initiation and progression were tested with multilevel analysis, taking into account plausible moderation effects of gender and baseline smoking status. Mediation effects of susceptibility to smoking were investigated using statistical mediation analysis (MacKinnon, 2008).

Six out of eight tested themes of cognitive attributions were associated with subsequent smoking development. Curiosity (β=0.11, p<0.001) and autonomy (β=0.08, p=0.019) were associated with smoking initiation among baseline non-smokers. Coping (β=0.07, p<0.001) and social image (β=0.10, p=<.0001) were associated with smoking progression among baseline lifetime smokers. Social image (β=0.05, p=0.043), engagement (β=0.07, p=0.003), and mental enhancement (β=0.15, p<0.001) were associated with smoking progression among baseline past 30-day smokers. More attributions were associated with smoking development among males than among females. Susceptibility to smoking partially mediated most of the associations, with the proportion of mediated effects ranging from 4.3% to 30.8%.

This study identifies the roles that cognitive attributions for smoking play in subsequent smoking development. These attributions could be addressed in smoking prevention programs.

[*]Corresponding author: Los Angeles County Department of Public Health 5555 Ferguson Drive, Suite 210-02 Commerce, CA 90022 USA Phone: 1-(626) 377-5028 Fax: 1-(323) 869-6084 qguo8@yahoo.com .

Statement 2: Contributors Qian Guo was the Project Manager of China Seven Cities Study (CSCS). She conducted the present smoking attribution study and wrote the manuscript. Carl Anderson Johnson was the Principal Investigator of CSCS and Principal Investigator of TTAURC. He worked closely with Qian Guo on this study and provided instructive and mentor assistance throughout the process. Jennifer B. Unger, Stanley P. Azen, and David P. MacKinnon provided input on statistical analysis and interpretation. All authors contributed to and have approved the final manuscript.

Statement 3: Conflict of Interest All authors declare that they have no conflicts of interest.

Keywords

Attributions; Smoking; Attribution Theory; Adolescents; China

1. Introduction

Cigarette smoking has been a major public health problem worldwide. Empirical studies have identified numerous personal, social, and environmental determinants of smoking (Moolchan, Ernst, & Henningfield, 2000; Schepis & Rao, 2005; Turner, Mermelstein, & Flay, 2004; Tyas & Pederson, 1998). However, little is known about how smokers themselves perceive the causes of their smoking behaviors, and even less is known about how their perceptions influence their subsequent smoking behaviors.

Attribution theories describe how people explain the causes of their behaviors and the behaviors of others. Attribution theorists posit that people are motivated to explain the causes of personal behaviors to make the social environment seem more manageable (Heider, 1958; Jones & Davis, 1965; Kelley, 1967). People's explanations of behaviors, called "attributions", can be classified as either personal or situational. Personal attributions imply volitional intention on the part of the actor, whereas situational attributions imply that contextual or environmental factors influence the behavior. Attribution is a different concept from other personal attitude, belief, or outcome expectancy. For instance, a person might hold a belief or an expectancy that smoking can help calm down when feeling nervous. However, he or she might not *perceive* this belief or outcome expectancy as a reason why he or she smoked, although empirically it might be related to the smoking behavior. Similar to other cognitive perceptions, attributions can be inaccurate or biased. For example, people tend to attribute the behavior of others to personal factors and attribute their own behaviors to situational factors (Jones & Nisbett, 1971; Monson & Snyder, 1977). However, attribution theorists argue that the task is not to determine the true causes of events, but to discern people's perceptions of the causes, because those perceptions influence people's subsequent actions regardless of their accuracy. In other words, health communication messages can be more effective if they counter-argue the reasons why smokers *perceive* that they smoke, in addition to altering the personal, social, and environmental variables that are empirically associated with their smoking behaviors.

Several studies have identified cognitive attributions for adult smoking (Jenks, 1994a; Kleinke, Staneski, & Meeker, 1983; McKennell, 1970; Tomkins, 1966) and adolescent smoking (Allbutt, Amos, & Cunningham-Burley, 1995; Aloise-Young, Hennigan, & Graham, 1996; Barton, Chassin, Presson, & Sherman, 1982; Cronan, Conway, & Kaszas, 1991; Rugkasa et al., 2001; Sarason, Mankowski, Peterson, & Dinh, 1992; Stanton, Mahalski, McGee, & Silva, 1993; Treacy et al., 2007) by asking people directly why they and other people smoked. A few of these studies have assessed whether individuals' stated attributions for smoking were actually correlated with their smoking behaviors (Guo et al., 2010; Kleinke et al., 1983). However, it remains unclear whether and how cognitive attributions can influence *subsequent* smoking behaviors. To design more effective smoking prevention and cessation program, it is better to not only understand cognitive attributions and their associations with current smoking behaviors, but also understand their influences on subsequent smoking behaviors and the underlying mechanisms of those influences, so that relevant issues can be addressed in health communication curricula.

Most previous attribution studies have been conducted in western countries(Berlin et al., 2003; Eiser, Sutton, & Wober, 1977; Jenks, 1994b; Kleinke et al., 1983; Sarason et al., 1992). Few have been conducted in China, where smoking has caused more than 600

million people, 72% of the total population including 60% of female non-smokers of childbearing age, to be either directly or indirectly exposed to cigarette smoke(Yang et al., 1999). Adolescence is a critical period when smoking may initiate, so an understanding of why so many Chinese adolescents smoke is essential.

Most previous studies have treated a certain smoking status as an outcome (for example, former smokers or current smokers; past 30-day smokers or daily smokers; etc). As a matter of fact, any smoking status may result from initiation of smoking, progression of smoking from an early stage to a more advanced stage, maintenance of smoking at the same stage, or regression of smoking from an advanced stage to an earlier stage. Of all above-mentioned conditions, those individuals whose smoking behaviors initiate or progress are at higher risk of becoming habitual smokers and suffering from smoking related diseases. Therefore, these high-risk individuals should be the focus of smoking prevention and cessation programs.

While knowing *which* cognitive attributions for smoking influence subsequent smoking behaviors is important for the design of effective health communication messages, knowing *how* these attributions influence subsequent smoking behaviors is equally important. Previous studies have found that peer smoking (Gritz et al., 2003; Presson et al., 1984; Straub, Hills, Thompson, & Moscicki, 2003), family smoking (Presson et al., 1984), and psychological problems (Booker, Gallaher, Unger, Ritt-Olson, & Johnson, 2004; Hampson, Andrews, & Barckley, 2007; Straub et al., 2003) predicted susceptibility to adolescent smoking – the absence of a firm commitment *not* to smoke. The susceptibility to adolescent smoking in turn predicted smoking initiation (Jackson, 1998; Stanton, Barnett, & Silva, 2005). Gritz et al. (2003) proposed that susceptibility to smoking was not an independent risk factor, but rather a mediating variable for adolescent smoking. The mediating effects of behavioral intentions, which are similar to susceptibility, have been posited in the Theory of Reasoned Action (TRA) (I Ajzen & Fishbein, 1980) and the Theory of Planned Behavior (TPB) (I. Ajzen, 1985). TRA and TPB have also been applied to explain and predict smoking behaviors among adolescents (Hanson, 1999; Harakeh, Scholte, Vermulst, de Vries, & Engels, 2004; Maassen, Kremers, Mudde, & Joof, 2004; O'Callaghan, Callan, & Baglioni, 1999), including Chinese adolescents (Guo et al., 2007). Therefore, it is worthy to explore whether susceptibility to smoking is one of the mechanisms by which cognitive attributions for smoking influence subsequent smoking development.

To address all of the above-mentioned issues, the present study was conducted to investigate whether cognitive attributions for smoking were associated with subsequent smoking development among Chinese adolescents, and whether susceptibility to smoking mediates the associations, either partially or completely. By using smoking initiation and progression, rather than absolute smoking status, as the outcomes of interest, we hoped to obtain evidence for development of primary prevention programs aiming to prevent people from initiating smoking, and secondary prevention programs aiming to prevent people from progressing to more advanced stages of smoking.

2. Methods

Data for this study are derived from the China Seven Cities Study (CSCS), a large project in China to assess the effects of changing economic and social factors on health behaviors including tobacco use. The information has been used to develop community-based smoking and alcohol abuse prevention programs. The CSCS included seven cities in four regions of China: Northeastern (Harbin, Shenyang), central (Wuhan), southwestern (Chengdu, Kunming), and coastal (Hangzhou, Qingdao).

2.1. Participants

Participants were recruited from schools in each of the seven cities. All schools in the metropolitan area of each city were stratified by median income in the district (high, medium, low) and by school academic performance (high, medium, low), resulting in nine clusters of schools. One middle school and one high school were randomly selected from each of the nine clusters. One classroom in the 7^{th} and 8^{th} grades in the selected middle schools and one classroom from the 10^{th} and 11^{th} grades in the selected high schools were recruited. In addition, one professional high school was selected from each district, major courses of study within each professional school were randomly selected, and students in these majors were recruited from the 10^{th} and 11^{th} grades. As a result, 147 schools were selected across the seven cities, 15,516 students were invited, and 14,434 students (93.0% of those who were invited) participated in the study. One year later, 12,382 students (85.8% of those surveyed at baseline) completed a follow-up survey.

2.2. Procedures

Two waves of self-administered paper-and-pencil surveys were conducted in 2002 and 2003 respectively. The informed consent and data collection procedures were reviewed and approved by both the University of Southern California and Chinese Institutional Review Boards. More details about the methodology of this study were reported elsewhere(Johnson et al., 2006).

2.3. Measures

Demographic characteristics included age, gender, ethnicity, and geographic region. Susceptibility to smoking was assessed with one question: “At any time in the next 12 months, do you think you will smoke a cigarette?” Four response options were provided as: 1 (Yes, definitely), 2 (Maybe yes), 3 (Maybe no), and 4 (No, definitely not) (Pierce, Choi, Gilpin, Farkas, & Merritt, 1996). Based on the definition of susceptibility to smoking as “a lack of firm commitment against cigarette smoking” (Jackson, 1998), this variable was dichotomously re-coded as “0” if a student chose the response option of 4, and “1” if a student chose any of other 3 response options. Smoking behaviors were assessed at three levels: lifetime smoking, past 30-day smoking, and daily smoking.

Cognitive attributions for smoking consisted of eight themes generated by a previous study through exploratory factor analysis on a bunch of self-reported attribution items(Guo et al., 2010). They were curiosity about smoking (e.g., “I’m curious what it’s like”), coping (e.g., “It helps me deal with stress”), social image (e.g., “It makes me look good”), social belonging (e.g. “I don’t like to refuse when someone gives me a cigarette”), engagement (e.g., “It keeps me from being bored”), autonomy (e.g., “I feel like I’m making my own decisions”), mental enhancement (e.g., “It helps me concentrate”), and weight control (e.g., “It helps me keep my weight down”). The bunch of self-reported attribution items were response options for one question on the survey, “I smoke, (or might smoke), because: (circle all that apply)”, which was originally developed by qualitative and quantitative research, along with consultation with educational and medical experts in China, to assess meanings of smoking among Chinese American and Taiwanese American college students (Hsia & Spruijt-Metz, 2003), U.S. adolescents (Spruijt-Metz, Gallaher, Unger, & Johnson, 2005), and Chinese adolescents (Weiss, Spruijt-Metz, Palmer, Chou, & Johnson, 2006) (Cronback alpha=0.87). Since this question actually asked people to explain the reasons why they smoked or might smoke, it has been used to assess attributions for smoking as well(Guo et al., 2010).

2.4. Statistical Analyses

Demographic characteristics and smoking behaviors were summarized as frequency (percent) overall, and stratified by gender. Chi-square analyses were conducted to test for gender differences for each of the variables. In addition, chi-square analyses were conducted to contrast differences at baseline between students who had only baseline data vs. those who had both baseline and follow-up data.

Information on smoking status was coded as: 0 (never smoked), 1 (smoked, but not during the past 30 days), 2 (smoked during the past 30 days, but not daily), and 3 (smoked daily during the past 30 days). In addition, information on smoking progression status was obtained longitudinally and coded as: 1 (for students who progressed to a more advanced stage of smoking one year later), and 0 (for students who did not progress).

Associations between cognitive attributions and subsequent smoking progression were tested with multilevel analysis, taking into account the clustering of individuals within groups. Intraclass correlation coefficients (*ICC's*) were calculated at the city, school, and class levels to determine which level(s) of unit should be counted in multilevel analyses. Year-one smoking status, gender, age, geographic region, district economy rank, and school academic rank were covariates in the analysis. To test the potential moderation effects of gender and year-one smoking status, interaction terms for each cognitive attribution X gender and year-one smoking status were added into the model. If the interaction terms were significant at $p<0.05$, the sample was stratified by gender and/or year-one smoking status, and the models were retested. Otherwise, if the interaction terms were not significant at $p>0.05$, no further stratification analyses were performed.

The plausible mediation effects of susceptibility to smoking were examined using methods described in MacKinnon (2008) (MacKinnon, 2008). Multilevel analyses were performed for the steps, stratified by year-one smoking status and adjusting for gender, age, geographic region, district economy rank, and school academic rank. The significance of mediation effects was tested using confidence intervals based on the distribution of the product (MacKinnon, 2008). This method is more powerful than other commonly used mediation tests and has more accurate Type 1 error rates, because it computes asymmetric confidence limits based on the distribution of the product rather than based on the normal distribution (MacKinnon, Fritz, Williams, & Lockwood, 2007). The proportion of the total effect that was mediated was obtained by dividing the difference between the total and direct effect by the total effect.

3. Results

3.1. Demographic characteristics and smoking behavior

As shown in Table 1, the sample contained slightly more females (51.5%) than males (48.5%). The distribution of ethnicity ($p=0.48$) and geographic regions ($p=0.22$) were not significantly different between genders, but the distribution of age groups was significantly different ($p<.0001$). The prevalence of smoking was higher among males than among females at all stages of smoking ($p<.0001$). The percentage of adolescents who have either initiated smoking or progressed their smoking to higher stages one year later was also significantly higher among males than among females ($p<.0001$ for all).

3.2. Attrition analysis

While this study successfully followed 12,382 students from baseline to one year later, 2,052 students were lost during this period, accounting for 14.2% of the sample. There was no significant difference on gender between students followed and lost ($p=0.52$). However,

the students lost were about one year older on the average than those followed (mean age of 15.7 versus 14.8 years, $p<.0001$). The percentages of students lost to follow-up were significantly different among the seven cities, ranging from 6.9% to 24.5% ($p<.0001$). Students of non-Han (minority) ethnicities were more likely to be lost, compared with those of Han ethnicity (19.8% versus 13.9%, $p<.0001$). Lifetime smokers were more likely to be lost, compared to never-smokers (20.5% versus 11.1%, $p<.0001$); past 30-day smokers were more likely to be lost, compared with those who had not smoked in the past 30 days (31.7% versus 12.4%, $p<.0001$).

3.3. Associations between cognitive attributions and smoking initiation and progression

ICC's at the city, school and classroom levels for smoking progression outcome variable were 0.01, 0.02, and 0.02 respectively, indicating a lower level of clustering at the city level but a larger effect of clustering at the school and classroom levels. Since the *ICC*'s were identical at the school and classroom levels, school was used as the level 2 variable in the multilevel analyses.

As shown in Table 2, after adjusting for demographic characteristics and baseline smoking status, curiosity, coping, social image, and engagement were positively associated with smoking initiation and progression one year later ($p<0.05$ for all). After adding interaction terms into the models, moderation effects caused by gender and baseline smoking status were detected. Curiosity was more associated with progression from earlier stages of smoking ($\beta=-0.04$, $p=0.006$), and engagement was more associated with smoking progression among males ($\beta=0.10$, $p=0.010$). Therefore, the model was re-tested among males and females respectively and among adolescents at different stages of smoking.

Table 3 shows that the effects of attributions on smoking initiation and progression differed according to initial smoking status. Among adolescents who had never smoked, curiosity ($\beta=0.11$, $p<.0001$) and autonomy ($\beta=0.08$, $p=0.019$) were positively associated with initiation of smoking. Among adolescents who had tried smoking, coping ($\beta=0.07$, $p<.0001$) and social image ($\beta=0.10$, $p=<.0001$) were positively associated with smoking progression. Among adolescents who had already smoked during the past 30-days, social image ($\beta=0.05$, $p=0.043$), engagement ($\beta=0.07$, $p=0.003$), and mental enhancement ($\beta=0.15$, $p<.0001$) were positively associated with smoking progression. The significant cognitive attributions identified were not the same among males and females. More cognitive attributions were associated with smoking initiation and progression among males than among females.

3.4. Mediation effects

Table 4 shows that susceptibility to smoking partially mediated the associations between most of the significant cognitive attributions, including curiosity, autonomy, coping, engagement, and mental enhancement, and smoking initiation and progression. The proportion of mediated effects ranged from 4.3% to 30.8%. However, the effect of social image was not mediated through susceptibility to smoking.

4. Discussion

The percentages of students in this sample whose smoking progressed to more advanced stages were 18.6%, 16.8%, and 11.5% respectively among year-one never smokers, lifetime smokers, and past 30-day smokers. Apparently, adolescence is an important period for smoking initiation and progression in China. One of the few longitudinal attribution studies that we found reported that most of attributions given by adolescents as causes of their own smoking (for example, relaxation, friends' smoking, and image) did not significantly predict their smoking two years later (McGee & Stanton, 1993). However, the present study

demonstrates that six out of eight cognitive attributions given by Chinese adolescents as causes of their own smoking, including curiosity, autonomy, social image, coping, engagement, and mental enhancement, were influential to their subsequent smoking progression one year later.

4.1. Possible explanations about why Chinese adolescents initiate and progress smoking

Curiosity and autonomy were associated with subsequent smoking initiation in this study. Adolescents are in a maturation period – the transition from childhood to adulthood. They are curious about adult behaviors, including smoking behavior, and tend to imitate. They also want to show others that they are becoming mature and independent. Cigarette smoking, which has been widely used by adults, especially Chinese adults, might have become a tool for them to achieve the goal.

In western countries, some adolescents reported that smoking helped relieve stress (Allbutt et al., 1995). However, other adolescents felt that stress could not be a reason for their smoking because they did not expect to experience mental problems until they grew up (Rugkasa et al., 2001). Among Chinese adolescents, coping with anger, stress, and other problems was an important reason for smoking, almost the top reason for smoking across all stages (e.g., lifetime smoking, past 30-day smoking, and daily smoking) (Guo et al., 2010). The present study demonstrates that coping was also associated with subsequent smoking progression. That stress might be perceived as causal to smoking among Chinese but not American youth might be explained by some unique aspects of Chinese society. On one hand, the educational achievement is valued very highly in China. In order to obtain the higher education that is only available for a limited percentage of excellent students, adolescents are motivated to work very hard so as to excel academically. On the other hand, most families in China, especially in urban areas, comply with the only-child family planning policy enacted by the Chinese government. Parents who have high expectations about the children's future might impose extra pressure such that the only-children have to spend even more time and effort on study and other skill-building activities. Consequently, high family expectations may place a heavy daily burden making many adolescents feel depressed, stressed, and even angry. They may resort to cigarette smoking due to lack of awareness of other better ways to cope with these emotional problems. This phenomenon is consistent with a reformulated negative reinforcement model of drug addiction which proposes that the escape and avoidance of negative affect is the prepotent motive for addictive drug use(Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). Therefore, it is important for health communication messages to have components to teach students better ways to cope with negative emotions, such as taking deep breath, doing meditation, consulting parents, teachers, or close friends, listening music, and doing excise, so that they are less likely to use cigarettes to deal with these problems. Under high pressure to study hard, adolescents might also try smoking to increase their concentration.

It is not surprising that social image and engagement were associated with smoking progression. Adolescents tend to attach great importance on the image or impression of themselves that they convey to others and especially to their peers. To be ignored may be especially threatening, and cigarette smoking might be seen as utilitarian both for gaining recognition and influencing the impressions of others (Allbutt et al., 1995; Cronan et al., 1991; Rugkasa et al., 2001; Stanton et al., 1993; Treacy et al., 2007). However, social belonging, which has been widely reported as one of the most important reasons for adolescent smoking (Allbutt et al., 1995; Cronan et al., 1991; Rugkasa et al., 2001; Sarason et al., 1992; Stanton et al., 1993; Stanton & Silva, 1993; Treacy et al., 2007), including Chinese adolescent smoking(Guo et al., 2010), was not associated with smoking progression in this study. Explanations for this finding need to be explored further.

4.2. Variations in cognitive attributions for different stages in smoking development

Although six cognitive attributions were found to influence subsequent smoking progression, each influenced only one or two stages in the trajectory of smoking development. For example, curiosity and autonomy were positively associated with initiation of smoking, coping was positively associated with smoking progression from lifetime smoking to higher stages, engagement and mental enhancement were positively associated with smoking progression from past 30-day smoking to higher stages, and social image was positively associated with smoking progression from lifetime and past 30-day smoking to higher stages. These findings have profound implications for anti-smoking efforts. For discouraging adolescents from ever trying their first cigarette, it might be useful to focus on demystifying smoking and taking steps to counter the perception of smoking as a sign of maturity and independence. For discouraging adolescents from progressing to higher stages of smoking, useful messages may include those that counter the idea of using cigarettes to present positive social images and those that present more effective ways to cope with stress and negative emotions for adolescents in the early stages of smoking uptake, and include alternative strategies to deal with boredom and lack of concentration for adolescents in more advanced stages of smoking uptake.

4.3. Gender differences

Compared with female adolescents, many more male adolescents initiated smoking and progressed to higher stages of smoking. Some previous studies found that attributions for male smoking and female smoking were identical (Grube, Rokeach, & Getzlaf, 1990; Jenks, 1994b; Palmqvist & Martikainen, 2005; Stanton et al., 1993); however, other studies found inconsistent results (Anderson & Anderson, 1990; Sarason et al., 1992). Among Chinese adolescents, Guo et al (2010) found that more cognitive attributions were associated with male smoking; and for attributions that were associated with both male smoking and female smoking, the strength of associations was all stronger among males(Guo et al., 2010). The present study indicated that cognitive attributions that were associated with smoking progression were also different between genders, and more cognitive attributions were associated with smoking progression among males than among females. For example, while engagement and autonomy were positively associated with initiation of smoking among males, only curiosity about smoking was positively associated with initiation of smoking among females; while coping and social image were positively associated with smoking progression among year-one lifetime male smokers, no cognitive attributions was identified to be significantly associated with smoking progression among year-one lifetime female smokers; while mental enhancement, engagement, and social image were positively associated with smoking progression among year-one past 30-day male smokers, coping, social belonging, and weight control were associated with smoking progression among year-one past 30-day female smokers. These findings imply that, in a context like Chinese society where the gender differences in smoking behaviors and expectations about smoking are larger, even if adolescents are at the same smoking status, anti-smoking intervention components should not be the same among males and females.

4.4. Mediation effects

This study indicates that most cognitive attributions (e.g., coping, engagement, mental enhancement, autonomy, and curiosity) did not influence subsequent smoking development directly. Rather, they produced influence more or less through the effect of susceptibility to smoking. This implies an additional opportunity for smoking prevention endeavor. Health communication messages might be more effective if they incorporate components to prevent smoking intention, in addition to other components to counter-argue the cognitive attributions for smoking. This might be especially true for those attributions whose effects on subsequent smoking development were more mediated by susceptibility to smoking (e.g.,

coping and engagement). Any efforts that can cut off the meditational pathways may be able to prevent adolescents from initiating or progressing their smoking behaviors.

By utilizing longitudinal data, this study has obtained evidence for plausibly causal relationships between cognitive attributions and subsequent smoking progression. By identifying the mediation pathways, this study demonstrates clues about causal mechanisms.

4.5. Summary

Findings from this study support the general idea underlying attribution theory that people's perceptions of causes of behaviors influence their subsequent actions. By employing a longitudinal design, conducting investigations by initial smoking status and gender, and using smoking progression as the outcome of interest, this study discloses some important roles that cognitive attributions for smoking played in subsequent smoking initiation and progression among males and females who were at earlier or later stages of smoking. The findings are instructive for development of primary and secondary smoking prevention, especially targeting Chinese adolescents. An essential recommendation from this study is that smoking prevention programs should be purposive, stage-matched, and gender specific, because no single program can fit all audiences.

4.6. Limitations and future directions

The measures of cognitive attributions used in this study did not include the full range of possible attributions for smoking among Chinese adolescents. Further studies need to investigate broader cognitive attributions of smoking, as well as to ascertain the psychometric properties of the scale. Another limitation came from the attrition during follow-ups. While students lost were not significantly different from those followed on some demographic characteristics such as gender, they were about one year older than students followed, distributed differently across the seven cities, and more likely to be smokers. However, the influence is likely minimal, given the large sample size and relatively low attrition rate. Lastly, although susceptibility to smoking has been tested and proven to partially mediate the associations between some cognitive attributions for smoking and subsequent smoking development, more mediation pathways are worthy to be explored in the future. In addition, this study used data collected in 2002 and 2003. Similar studies can be conducted in the future to track down whether cognitive attributions for Chinese adolescent smoking would change over time.

Acknowledgments

Statement 1: Role of Funding Sources

This research was supported by the University of Southern California/Claremont Graduate University Transdisciplinary Tobacco and Alcohol Use Research Center (TTAURC), funded by the National Institutes of Health (grant #1 P50 CA84735-01) and the Sidney R. Garfield Endowment. The sponsoring organizations had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

Statement 4: Acknowledgements (optional)

The authors thank the co-investigators and staff at the University of Southern California and Claremont Graduate University for participation in the CSCS in study design, protocol development, and data collection. The authors thank the project directors and staff at the Centers for Disease Control and Prevention in the cities of Chengdu, Hangzhou, Harbin, Qingdao, Shenyang, and Wuhan and the Institute for Health Education in Kunming, China, for assistance with project coordination and data collection. We also thank the principals, physicians, and teachers in the participating schools for their cooperation. Finally, we express our gratitude to the national Chinese Center for Disease Control and Prevention, Peking University School of Public Health, and the municipal government, Health Bureau, and Education Committee in each participating city for their support.

References

Ajzen, I. From intentions to actions. In: Kuhl, J.; Beckman, J., editors. Action Control from Cognition to Behavior. Springer Verlag; New York: 1985. p. 11-39.

Ajzen, I.; Fishbein, M. Understanding attitudes and predicting social behavior. Prentice Hall; Inglewood Cliffs, NJ: 1980.

Allbutt H, Amos A, Cunningham-Burley S. The social image of smoking among young people in Scotland. Health Education Research. 1995; 10:443–454.

Aloise-Young PA, Hennigan KM, Graham JW. Role of the self-image and smoker stereotype in smoking onset during early adolescence: a longitudinal study. Health Psychology. 1996; 15(6):494–497. [PubMed: 8973931]

Anderson RC, Anderson KE. Success and failure attributions in smoking cessation among men and women. Journal of the American Association of Occupational Health Nurses. 1990; 38(4):180–185.

Baker TB, Piper ME, McCarthy DE, Majeskie MR, Fiore MC. Addiction motivation reformulated: an affective processing model of negative reinforcement. Psychological Review. 2004; 111(1):33–51. [PubMed: 14756584]

Barton J, Chassin L, Presson CC, Sherman SJ. Social image factors as motivators of smoking initiation in early and middle adolescence. Child Development. 1982; 53(6):1499–1511. [PubMed: 7172778]

Berlin I, Singleton EG, Pedarriosse AM, Lancrenon S, Rames A, Aubin HJ, et al. The Modified Reasons for Smoking Scale: factorial structure, gender effects and relationship with nicotine dependence and smoking cessation in French smokers. Addiction. 2003; 98(11):1575–1583. [PubMed: 14616184]

Booker CL, Gallaher P, Unger JB, Ritt-Olson A, Johnson CA. Stressful life events, smoking behavior, and intentions to smoke among and multiethnic sample of sixth graders. Ethnicity & Health. 2004; 9(4):369–397. [PubMed: 15570681]

Cronan TA, Conway TL, Kaszas SL. Starting to smoke in the Navy: when, where and why. Social Science and Medicine. 1991; 33(12):1349–1353. [PubMed: 1776048]

Eiser JR, Sutton SR, Wober M. Smokers, non-smokers and the attribution of addiction. British Journal of Social & Clinical Psychology. 1977; 16(4):329–336. [PubMed: 588888]

Gritz ER, Prokhorov AV, Hudmon KS, Jones M. Mullin, Rosenblum C, Chang CC, et al. Predictors of susceptibility to smoking and ever smoking: a longitudinal study in a triethnic sample of adolescents. Nicotine and Tobacco Research. 2003; 5(4):493–506. [PubMed: 12959787]

Grube JW, Rokeach M, Getzlaf SB. Adolescents' value images of smokers, ex-smokers, and nonsmokers. Addictive Behaviors. 1990; 15(1):81–88. [PubMed: 2316415]

Guo Q, Johnson CA, Unger JB, Lee L, Xie B, Chou CP, et al. Utility of the theory of reasoned action and theory of planned behavior for predicting Chinese adolescent smoking. Addictive Behaviors. 2007; 32(5):1066–1081. [PubMed: 16934414]

Guo Q, Unger JB, Azen PS, Li C, Spruijt-Metz D, Palmer PH, et al. Cognitive attributions for smoking among adolescents in China. Addictive Behaviors. 2010; 35(2):95–101. [PubMed: 19800741]

Hampson SE, Andrews JA, Barckley M. Predictors of the development of elementary-school children's intentions to smoke cigarettes: hostility, prototypes, and subjective norms. Nicotine and Tobacco Research. 2007; 9(7):751–760. [PubMed: 17577804]

Hanson MJ. Cross-cultural study of beliefs about smoking among teenaged females. Western Journal of Nursing Research. 1999; 21(5):635–647. discussion 647-651. [PubMed: 11512184]

Harakeh Z, Scholte RH, Vermulst AA, de Vries H, Engels RC. Parental factors and adolescents' smoking behavior: an extension of the theory of planned behavior. Preventive Medicine. 2004; 39(5):951–961. [PubMed: 15475029]

Heider, F. The psychology of interpersonal relations. Wiley; New York: 1958.

Hsia FN, Spruijt-Metz D. The meanings of smoking among Chinese American and Taiwanese American college students. Nicotine and Tobacco Research. 2003; 5(6):837–850. [PubMed: 14668068]

Jackson C. Cognitive susceptibility to smoking and initiation of smoking during childhood: a longitudinal study. Preventive Medicine. 1998; 27(1):129–134. [PubMed: 9465363]

Jenks RJ. Attitudes and perceptions toward smoking: smokers' views of themselves and other smokers. Journal of Social Psychology. 1994a; 134(3):355–361. [PubMed: 8057636]

Jenks RJ. Smoking and satisfaction and motivations: a comparison of men and women. Journal of Social Psychology. 1994b; 134(6):847–849. [PubMed: 7869709]

Johnson CA, Palmer PH, Chou CP, Pang Z, Zhou D, Dong L, et al. Tobacco use among youth and adults in Mainland China: the China Seven Cities Study. Public Health. 2006; 120(12):1156–1169. [PubMed: 17007895]

Jones EE, Davis KE. From acts to dispositions: the attribution process in person perception. Advances in Experimental Social Psychology. 1965; 2:219–266.

Jones, EE.; Nisbett, RE. The actor and the observer: divergent perceptions of the causes of behavior. General Learning Press; Morristown: New Jersey: 1971.

Kelley HH. Attribution theory in social psychology. Nebraska Symposium on Motivation. 1967; 15:192–238.

Kleinke CL, Staneski RA, Meeker FB. Attributions for smoking behavior: comparing smokers with nonsmokers and predicting smokers' cigarette consumption. Journal of Research in Personality. 1983; 17:242–255.

Maassen IT, Kremers SP, Mudde AN, Joof BM. Smoking initiation among Gambian adolescents: social cognitive influences and the effect of cigarette sampling. Health Education Research. 2004; 19(5):551–560. [PubMed: 15155587]

MacKinnon, DP. Introduction to statistical mediation analysis. Taylor & Francis; New York: 2008.

MacKinnon DP, Fritz MS, Williams J, Lockwood CM. Distribution of the product confidence limits for the indirect effect: program PRODCLIN. Behavior Research Methods. 2007; 39(3):384–389. [PubMed: 17958149]

McGee R, Stanton WR. A longitudinal study of reasons for smoking in adolescence. Addiction. 1993; 88(2):265–271. [PubMed: 8220064]

McKennell AC. Smoking motivation factos. British Journal of Social & Clinical Psychology. 1970; 9(1):8–22. [PubMed: 5488969]

Monson TC, Snyder M. Actors, observers, and the attribution process. Journal of Experimental Social Psychology. 1977; 13:89–111.

Moolchan ET, Ernst M, Henningfield JE. A review of tobacco smoking in adolescents: treatment implications. Journal of the American Academy of Child and Adolescence Psychiatry. 2000; 39(6):682–693.

O'Callaghan FV, Callan VJ, Baglioni A. Cigarette use by adolescents: attitude-behavior relationships. Substance Use and Misuse. 1999; 34(3):455–468. [PubMed: 10082067]

Palmqvist RA, Martikainen LK. Changes in reasons given for adolescent smoking, 1984-1999. Substance Use and Misuse. 2005; 40(5):645–656. [PubMed: 15887595]

Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Merritt RK. Validation of Susceptibility as a Predictor of Which Adolescents Take up Smoking in the United States. Health Psychology. 1996; 15(5):355–361. [PubMed: 8891714]

Presson CC, Chassin L, Sherman SJ, Olshavsky R, Bensenberg M, Corty E. Predictors of adolescents' intentions to smoke: age, sex, race, and regional differences. International Journal of the Addictions. 1984; 19(5):503–519. [PubMed: 6490231]

Rugkasa J, Knox B, Sittlington J, Kennedy O, Treacy MP, Abaunza PS. Anxious adults vs. cool children: children's views on smoking and addiction. Social Science & Medicine. 2001; 53(5): 593–602. [PubMed: 11478539]

Sarason IG, Mankowski ES, Peterson AV Jr. Dinh KT. Adolescents' reasons for smoking. Journal of School Health. 1992; 62(5):185–190. [PubMed: 1522700]

Schepis TS, Rao U. Epidemiology and etiology of adolescent smoking. Current Opinion in Pediatrics. 2005; 17(5):607–612. [PubMed: 16160535]

Spruijt-Metz D, Gallaher P, Unger JB, Johnson CA. Unique contributions of meanings of smoking and outcome expectancies to understanding smoking initiation in middle school. Annals of Behavioral Medicine. 2005; 30(2):104–111. [PubMed: 16173906]

Stanton WR, Barnett AG, Silva PA. Adolescents' intentions to smoke as a predictor of smoking. Preventive Medicine. 2005; 40(2):221–226. [PubMed: 15533533]

Stanton WR, Mahalski PA, McGee R, Silva PA. Reasons for smoking or not smoking in early adolescence. Addictive Behaviors. 1993; 18(3):321–329. [PubMed: 8342444]

Stanton WR, Silva PA. Consistency in children's recall of age of initiating smoking. International Journal of Epidemiology. 1993; 22(6):1064–1069. [PubMed: 8144287]

Straub DM, Hills NK, Thompson PJ, Moscicki AB. Effects of pro- and anti-tobacco advertising on nonsmoking adolescents' intentions to smoke. Journal of Adolescent Health. 2003; 32(1):36–43. [PubMed: 12507799]

Tomkins SS. Psychological model for smoking behavior. American Journal of Public Health and the Nation's Health. 1966; 56(12)(Suppl 56):17–20. [PubMed: 5951586]

Treacy MP, Hyde A, Boland J, Whitaker T, Abaunza PS, Stewart-Knox BJ. Children talking: emerging perspectives and experiences of cigarette smoking. Qualitative Health Research. 2007; 17(2):238–249. [PubMed: 17220394]

Turner L, Mermelstein R, Flay B. Individual and contextual influences on adolescent smoking. Annals of the New York Academy of Sciences. 2004; 1021:175–197. [PubMed: 15251888]

Tyas SL, Pederson LL. Psychosocial factors related to adolescent smoking: a critical review of the literature. Tobacco Control. 1998; 7(4):409–420. [PubMed: 10093176]

Weiss JW, Spruijt-Metz D, Palmer PH, Chou CP, Johnson CA. Smoking among adolescents in China: an analysis based upon the meanings of smoking theory. American Journal of Health Promotion. 2006; 20(3):171–178. [PubMed: 16422135]

Yang G, Fan L, Tan J, Qi G, Zhang Y, Samet JM, et al. Smoking in China: findings of the 1996 National Prevalence Survey. The Journal of the American Medicine Association. 1999; 282(13): 1247–1253.

Highlights

We test associations between smoking attributions and subsequent smoking behaviors.> 6 out of 8 smoking attributions were associated with subsequent smoking development.> The associations varied between genders and at various stages of smoking.> Most associations were partially mediated by susceptibility to smoking.>These findings should be considered in smoking prevention programs.

Table 1

Demographic Characteristics and Smoking Behaviors of the Sample (N=12,382)

	All *n* (%)	Male *n* (%)	Female *n* (%)	Gender Difference
		5988 (48.5)	6354 (51.5)	
Ethnicity				*p*=0.48
Han	11850 (96.1)	5731 (96.0)	6097 (96.2)	
Others	481 (3.9)	239 (4.0)	238 (3.8)	
Age				*p*<.0001
12 Years or Younger	1174 (9.5)	509 (8.5)	650 (10.2)	
13 years	2515 (20.3)	1239 (20.7)	1273 (20.0)	
14 years	1759 (14.2)	913 (15.3)	843 (13.3)	
15 years	1342 (10.8)	589 (9.8)	752 (11.8)	
16 years	3132 (25.3)	1487 (24.8)	1641 (25.8)	
17 Years or Older	2460 (19.9)	1251 (20.9)	1195 (18.8)	
City				*p*=0.22
Chengdu	1866 (15.1)	918 (15.3)	939 (14.8)	
Hangzhou	1720 (13.9)	826 (13.8)	892 (14.0)	
Shenyang	1756 (14.2)	851 (14.2)	892 (14.0)	
Wuhan	1961 (15.8)	908 (15.2)	1053 (16.6)	
Harbin	1486 (12.0)	720 (12.0)	758 (11.9)	
Kunming	1748 (14.1)	884 (14.8)	861 (13.6)	
Qingdao	1845 (14.9)	881 (14.7)	959 (15.1)	
Smoking Status				*p*<.0001
Never Smoker	7801 (63.5)	3182 (53.6)	4596 (72.9)	
Lifetime Smoker	2976 (24.2)	1680 (28.3)	1283 (20.3)	
Past 30-day Smoker	1207 (9.8)	829 (14.0)	377 (6.0)	
Daily Smoker	294 (2.5)	243 (4.1)	51 (0.8)	
Smoking Progression				
Never Smoker	1439 (18.6)	756 (24.0)	679 (14.8)	*p*<.0001
Lifetime Smoker	498 (16.8)	339 (20.2)	157 (12.3)	*p*<.0001
Past 30-day Smoker	139 (11.5)	127 (15.4)	11 (2.9)	*p*<.0001

Table 2

Associations between Cognitive Attributions and Subsequent Smoking Development

	Main Effect		Moderation Effect	
	β (se)	*p*	*β (se)*	*p*
Curiosity	0.03 (0.01)	**0.002**	0.09 (0.02)	**<.0001**
Coping	0.04 (0.01)	**<.0001**	0.03 (0.02)	0.089
Social Image	0.05 (0.02)	**0.004**	0.06 (0.04)	0.134
Social Belonging	0.02 (0.02)	0.360	0.03 (0.03)	0.439
Engagement	0.04 (0.02)	**0.020**	0.02 (0.04)	0.675
Autonomy	0.02 (0.02)	0.197	0.04 (0.03)	0.197
Mental Enhancement	0.03 (0.02)	0.193	0.03 (0.04)	0.473
Weight Control	−0.03 (0.03)	0.358	0.01 (0.05)	0.786
Smoking Status			−0.07 (0.01)	**<.0001**
Gender			0.09 (0.01)	**<.0001**
Curiosity*Smoking Status			−0.04 (0.01)	**0.006**
Coping*Smoking Status			0.00 (0.01)	0.747
Social Image*Smoking Status			−0.03 (0.02)	0.121
Social Belonging*Smoking Status			−0.01 (0.02)	0.487
Engagement*Smoking Status			−0.03 (0.02)	0.139
Autonomy*Smoking Status			−0.02 (0.02)	0.238
Mental Enhancement*Smoking Status			0.02 (0.02)	0.432
Weight Control*Smoking Status			−0.03 (0.03)	0.389
Curiosity*Gender			−0.04 (0.02)	0.058
Coping*Gender			0.00 (0.03)	0.979
Social Image*Gender			0.06 (0.04)	0.167
Social Belonging*Gender			0.02 (0.04)	0.626
Engagement*Gender			0.10 (0.04)	**0.010**
Autonomy*Gender			0.01 (0.04)	0.822
Mental Enhancement*Gender			−0.03 (0.05)	0.483
Weight Control*Gender			0.00 (0.07)	0.990

Note: P values smaller than 0.05 are shown in bold.

Addict Behav. Author manuscript; available in PMC 2013 March 1.

Table 3

Associations between Cognitive Attributions and Subsequent Smoking Development, Stratified by Gender and Year-one Smoking Status

	All		Male		Female	
	***β* (*se*)**	***p***	***β* (*se*)**	***p***	***β* (*se*)**	***p***
Year-one Never Smokers						
Curiosity	0.11 (0.02)	**<.0001**	0.01 (0.04)	0.905	0.15 (0.02)	**<.0001**
Coping	0.00 (0.02)	0.854	−0.06 (0.05)	0.156	0.02 (0.03)	0.480
Social Image	0.02 (0.04)	0.578	0.09 (0.07)	0.208	0.02 (0.05)	0.678
Social Belonging	0.03 (0.04)	0.469	0.06 (0.07)	0.374	−0.01 (0.05)	0.785
Engagement	0.04 (0.04)	0.368	0.19 (0.07)	**0.010**	−0.08 (0.06)	0.169
Autonomy	0.08 (0.03)	**0.019**	0.13 (0.05)	**0.017**	0.04 (0.04)	0.278
Mental Enhancement	0.01 (0.04)	0.742	−0.06 (0.06)	0.393	0.06 (0.04)	0.181
Weight Control	0.08 (0.06)	0.160	0.06 (0.14)	0.687	0.08 (0.06)	0.150
Year-one Lifetime Smokers						
Curiosity	−0.02 (0.01)	0.299	−0.01 (0.02)	0.604	−0.02 (0.02)	0.407
Coping	0.07 (0.02)	**<.0001**	0.10 (0.03)	**<.0001**	0.05 (0.02)	0.060
Social Image	0.10 (0.03)	**<.0001**	0.12 (0.04)	**0.001**	0.06 (0.04)	0.220
Social Belonging	0.03 (0.03)	0.350	0.04 (0.04)	0.311	0.00 (0.04)	0.979
Engagement	0.04 (0.03)	0.166	0.04 (0.04)	0.350	0.03 (0.04)	0.423
Autonomy	−0.05 (0.03)	0.130	−0.05 (0.04)	0.212	−0.03 (0.05)	0.581
Mental Enhancement	−0.01 (0.04)	0.832	−0.01 (0.05)	0.889	−0.05 (0.06)	0.388
Weight Control	−0.10 (0.06)	0.074	−0.09 (0.09)	0.306	−0.09 (0.07)	0.161
Year-one Past 30-day Smokers						
Curiosity	0.01 (0.02)	0.745	0.01 (0.03)	0.690	−0.01 (0.02)	0.728
Coping	0.04 (0.02)	0.053	0.05 (0.03)	0.082	0.05 (0.02)	**0.043**
Social Image	0.05 (0.03)	**0.043**	0.07 (0.03)	**0.028**	−0.03 (0.03)	0.340
Social Belonging	0.02 (0.03)	0.490	0.00 (0.03)	0.937	0.07 (0.03)	**0.015**
Engagement	0.07 (0.02)	**0.003**	0.10 (0.03)	**0.002**	−0.03 (0.03)	0.303
Autonomy	0.03 (0.03)	0.307	0.02 (0.04)	0.530	0.01 (0.03)	0.803
Mental Enhancement	0.15 (0.03)	**<.0001**	0.16 (0.04)	**<.0001**	0.07 (0.05)	0.104
Weight Control	−0.07 (0.04)	0.096	−0.05 (0.06)	0.337	−0.10 (0.05)	**0.041**

Note: P values smaller than 0.05 are shown in bold.

Table 4

Mediation Tests

	Path a [a]		Path b [b]		Path c [c]		Prodclin	Proportion of Mediated Effect
	β (se)	*p*	*β (se)*	*p*	*β (se)*	*p*	95% CL	
Year-one Never Smokers								
Curiosity	0.05 (0.01)	<.0001	0.12 (0.02)	<.0001	0.12 (0.02)	<.0001	**(0.003, 0.010)**	4.30%
Autonomy	0.09 (0.02)	<.0001	0.08 (0.03)	0.015	0.09 (0.03)	0.006	**(0.001, 0.014)**	11.50%
Susceptibility to Smoking			0.11 (0.02)	<.0001				
Year-one Lifetime Smokers								
Coping	0.23 (0.02)	<.0001	0.05 (0.02)	0.004	0.07 (0.02)	<.0001	**(0.004, 0.020)**	30.80%
Social Image	0.02 (0.03)	0.449	0.10 (0.03)	<.0001	0.10 (0.03)	<.0001	(−0.003, 0.008)	--
Susceptibility to Smoking			0.10 (0.02)	<.0001				
Year-one Past 30-day Smokers								
Social Image	0.19 (0.04)	<.0001	0.04 (0.03)	0.108	0.06 (0.03)	0.021	(−0.001, 0.018)	--
Engagement	0.25 (0.03)	<.0001	0.06 (0.02)	0.017	0.08 (0.02)	0.001	**(0.003, 0.026)**	24.30%
Mental Enhancement	0.23 (0.04)	<.0001	0.14 (0.03)	<.0001	0.16 (0.03)	<.0001	**(0.016, 0.051)**	12.00%
Susceptibility to Smoking			0.09 (0.02)	<.0001				

[a] cognitive attributions for smoking predict susceptibility to smoking.

[b] susceptibility to smoking predicts smoking progression, after controlling for cognitive attributions for smoking.

[c] cognitive attributions for smoking predict smoking progression.

Note: 95% confidence limits that do not include zero are shown in bold.

Addict Behav. Author manuscript; available in PMC 2013 March 1.