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Association between Psychological Factors and Adolescent Smoking in Seven Cities in China

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Background: *Cigarette smoking is a culturally accepted behavior among adult males in China. However, there is limited information on smoking among Chinese adolescents, particularly the information on the relationship between psychological well-being and smoking behavior among this population.* ***Purpose:*** *This study explored associations between three psychological factors—anxiety, hostility, and depressive symptoms—and smoking behavior among Chinese adolescents.* ***Methods:*** *The data presented in this study are a cross-sectional slice from a longitudinal investigation of tobacco use and lifestyle carried out in China. The study population consisted of 4,724 7th and 11th grade students from seven large cities in China.* ***Results:*** *Odds ratios showed that anxiety, hostility, and depressive symptoms were significantly associated with a higher risk of lifetime smoking for both boys and girls.* ***Conclusion:*** *Much like their Western counterparts, Chinese adolescents face developmental stress. The resulting distress may increase their risk for substance use and other health-risk behaviors.*

Key words: Chinese adolescents, cigarette smoking, anxiety, hostility, depressive symptoms

Introduction

China is the world's largest producer and consumer of tobacco. Although China is considered to be in an early stage of a tobacco epidemic, the burden of tobacco-related diseases will assume greater prominence in coming years (World Health Organization, 1997; Yang et al., 2001). It is esteemed that deaths attributable to smoking in China will increase from about 0.5 million annually in the 1990s to more than 2 million in 2025 (Niu, Yang, & Chen, 1998; Peto, Lopez, & Liu, 1997). The prevention of smoking in young Chinese has been described as the single greatest public health objective for preventing non-communicable disease, as two-thirds of the men become daily smokers before reaching 25 years of age (Yang, Fan, & Tan, 1999). However, the development of smoking control strategies for adolescents is hampered by a lack of localized information. Much of our current knowledge on teenage smoking has come from Western countries (Hesketh, Qu, & Tomkins, 2002; Zhang, Wang, Zhao, & Vartiainen, 2000). Therefore, there is a need for research investigating risk factors that contribute to smoking among adolescents in China.

A series of studies done in the Western countries noted that cigarette smoking among youth is a complex behavior with several identified determinants, including intrapersonal factors (individual motivation, attitude, and psychological determinants), interpersonal factors (family and peer influence), as well as cultural factors. The cultural pattern of smoking in China is well documented, in that smoking is a normative

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behavior among males, but is rare among females in both rural and urban areas of China (Chen, Unger, Cruz, & Johnson, 1999; Zhu, Liu, Shelton, Liu, & Giovino, 1996). Among adolescents, similar gender gaps in smoking appear, although the overall smoking rates are much lower (Mackay & Eriksen, 2002; Zhu et al., 996). However, there is a paucity of information on the psychological well-being of Chinese adolescents and how this may impact their smoking behavior. The goal of this study is to start filling this research gap by examining smoking prevalence among Chinese adolescents and exploring the relationship between smoking and psychological determinants such as anxiety, hostility, and depression among Chinese adolescents.

Anxiety and Adolescent Smoking

Anxiety among adolescents is widely prevalent in the U.S., with estimated rates ranging from 5.7% to 17.7% (Costello & Angold, 1995; Woodward & Fergusson, 2001; Zahn-Waxler, Klimes-Dougan, & Slattery, 2000). Many adolescents experience anxiety symptoms because they are concerned about peer acceptance, academic performance, parental expectations, and other environmental stressors, which play out against a backdrop of physical, cognitive, emotional, and other life changes (Bernstein, Borchardt, & Perwien, 1996; Verhulst, 2001). There is evidence suggesting that high levels of trait anxiety are related to coping strategies for substance use, including smoking (Comeau, Steward, & Loba, 2001; Steward & Zeitlin, 1995). Cooper's (1994) motivational theory proposed that negative affect plays a central role in substance use, including smoking. Lack of coping skills to stressful situations and unsuccessful adjustment to dramatic life changes may lead to the adoption of maladaptive behaviors among adolescents (Comeau et al., 2001; Coogan et al., 1998; Henker, Whalen, & Jamner, 2002; Koval & Pederson, 1999). We might expect Chinese adolescents, who are living in a rapidly changing social environment, to be especially likely to experience anxiety. Smoking may be seen as an affordable, easily obtained, coping mechanism. There is evidence suggesting that pressure from family, school, and peers lead Chinese adolescents to feel stressed and anxious, feelings known to be associated with increased risk of alcohol use and cigarette smoking (Jin & Zhang, 1998; Unger et al., 2001b).

Hostility and Adolescent Smoking

Hostility has been defined as either a mood state or personality trait characterized by temporary or stable negative affect toward others (Spielberger, 1988; Robinson, Brower, & Gomberg, 2001). Hostility is one of the components of the "AHA Syndrome": anger, hostility, and aggression (Johnson, 1990). There is some evidence suggesting that hostility is associated with unhealthy lifestyles and with increased likelihood of smoking (Whalen, Jamner, Henker, & Delfino, 2001; White, Johnson, & Buyske, 2000; Weiss et al., 2005). Hostility is positively correlated with negative affect, including stress, anxiety, irritation, anger, fatigue, and depression, which may in turn lead to the use of smoking as a coping mechanism to regulate mood and to reduce feelings of frustration (Calhoun, Bosworth, Siegler, & Bastian, 2001; Lee, Mendes, Carlos, & Markides, 1988; Whalen et al., 2001).

Little is known about hostility and its impact on Chinese adolescent smoking. Traditional Chinese child-rearing emphasizes conformity and self-control. This discipline is held to suppress feelings of anger and hostility, which may in turn reduce the display of aggression and antisocial behaviors (Chan, Hung, & Yip, 2001). There has been a rising trend of psychological disturbance and personality disorder traits among youth, especially among young women (Parker, Gladstone, & Chee, 2001; Qin & Mortensen, 2001). Increased consciousness regarding gender discrimination, economic disparity, and family conflict has led to a more open expression of anger (Yip, 2001). Knowledge of whether smoking is seen as a means to ventilate emotional distress and feelings of hostility for Chinese adolescents would inform smoking prevention programs in China.

Depressive Symptoms and Adolescent Smoking

Numerous studies in the U.S. have reported major depression and depressive symptoms to be important determinants of adolescent smoking. There is controversy on whether early-life smoking promotes the onset of depressed mood, or whether depressed mood promotes smoking initiation (Koval, Pederson, Mills, McGrady, & Carvajal, 2000; Patton et al., 1996; Wu & Anthony, 1999). The self-medication hypothesis proposes that smoking may develop in an attempt to cope with psychological distress and feelings of depression (Cooper, 1994; Glass, 1990; Penny & Robinson, 1986). Depressive symptoms can also leave adolescents more vulnerable to peer smoking influences. The anticipated improvement in mood and psychosocial functioning is a potentially powerful motivating factor for taking up smoking (Patton et al., 1998).

Recent research has shown increased prevalence of depressive symptoms and suicidal ideation in China. Financial pressure, family conflicts, and stress at work/school are identified as important contributing factors (Jin & Zhang, 1998; Pearson, Phillips, He, & Ji, 2002; Yip, 2001). Studies conducted in China indicated that family-, school-, and peer-related stressful life events among adolescents are related to depressive symptoms, alcohol use, and smoking (Hu, 1995; Unger et al., 2001b). The evidence of an association between

depression or depressive symptoms and smoking in previous research suggests that students might attempt to use smoking as self-medication, part of a coping strategy to regulate negative affect and alleviate related distress.

In this study, we examined whether Chinese adolescents' psychosocial well-being differs among never smokers, lifetime smokers, and past 30-day smokers. We hypothesized that students who scored higher on anxiety, hostility, or depressive symptoms would be more likely to smoke. We also expected that the associations between smoking and psychological factors varied by age and gender.

Method

Design

The data presented here are a cross-sectional slice from a longitudinal investigation of tobacco use and lifestyle carried out in seven large cities across Mainland China (Chou et al., 2006). The cities were Harbin and Shenyang (Northeast), Wuhan (Central), Chengdu and Kunming (Southwest), and Hangzhou and Qingdao (Coastal).

Participants

The study population consisted of 7th grade middle school students and 11th grade traditional high school students from each city. With the assistance of the city's education committee, middle and high schools were chosen to span the range of academic quality. Within each school, two classrooms were randomly selected, and all students in those classes were invited to participate. Of the 5,012 students invited, 4,724 provided consent and filled out questionnaires. Additional details of selection and consent procedures are reported elsewhere (Weiss et al., 2006).

Procedure

All questionnaires were anonymous, and participants were asked not to provide any information that might identify them on the questionnaires. All students completed the questionnaire during class time. Classroom teachers were not present during the survey period, so that students would feel more at ease in responding to the questionnaire items. Students were eligible to participate if their parents provided consent. To obtain student assent, we utilized an oral assent process with a standardized script. The consent procedure was approved by the University of Southern California's Institutional Review Board and by the Institutional Review Board established in China for this research. A trained public health employee in each city read the script, which appeared on the cover page of the youth version of the questionnaire, aloud verbatim to each class prior to questionnaire administration. The script explained the study objectives and procedures. Data collectors were prepared to answer questions that students might have about the study or questionnaire.

Survey Instruments

We developed a self-administered paper-and-pencil questionnaire for the survey. The questionnaire incorporated items from the U.S. Center for Disease Control's Behavioral Risk Factor Surveillance System, Youth Risk Behavioral System, 1995 Youth Risk Behavioral System, and the Transdisciplinary Tobacco Use Research Center-Wuhan Smoking Trial Survey (Unger et al., 2001a). The survey questionnaire was pilot tested in Wuhan in two schools that did not participate in the study. Questions addressed topics of tobacco use and dependence, exposure to smoking in the home and workplace, alcohol and drug use, psychological factors (anxiety, hostility, and depressive symptoms), and other health-related items. Questionnaire items were translated from English to Mandarin, then back-translated to English by translators fluent in both languages and trained in behavioral science theory and tobacco use research. To insure that each item captured the proper idiomatic language, each item in the Chinese version was reviewed for consensus by a group of bilingual tobacco researchers. The questionnaire booklets were printed in identical formats across all seven cities to insure consistency.

Measures

Lifetime smoking. To assess lifetime smoking, one question was asked, "Have you ever tried smoking, even a few puffs?" Those students who responded "no" were coded as "Never smokers." Those who responded "yes" were coded as "Lifetime smokers."

Past 30-day smoking. Respondents were asked, "Think about the last 30 days. On how many of these days did you smoke cigarettes?" Responses were reported on a 7-point scale ranging from "0 days" to "all 30 days." In this study, the analyses were performed on a dichotomized version of the past 30-day smoking variable. Responses were recoded as 0 days vs. 1 or more days. Those students who reported smoking during the past 30-days were coded as "past 30-day smokers."

Anxiety. Five items adapted from the MMPI-A content scale for anxiety (Williams, Butcher, Ben-Porath, & Graham, 1992) were used to assess adolescent-reported anxiety. These five items were: "I frequently find myself worrying about something;" "Life is a strain for me much of the time;" "I feel nervous or upset about something or someone almost all the time;" "I have certainly had more than my share

of things to worry about;" and "I have sometimes felt that difficulties were piling up so high that I could not overcome them." Students responded "yes" or "no" to these questions. Each student's score was the number of "yes" responses, with a possible range of 0 to 5. Cronbach's alpha for the anxiety scale was .73.

Hostility. In this study, we chose items that measure hostility as a relatively stable trait as opposed to a changing mood. To assess self-reported hostility, the following four questions adapted from the Buss-Durkee Hostility Inventory (Buss & Durkee, 1957) were asked: "I lose my temper easily;" "Sometimes people bother me just by being around;" "I can't help being a little rude to people I don't like;" and "Lately, I have been kind of grouchy." Responses were rated on a 4-point scale: 0 = "definitely no," to 3 = "definitely yes." Scores on these items were summed, yielding a possible range of 0–12. Cronbach's alpha for this scale was .69. A dichotomous variable was created such that those students with a score of 2.5 (the median for this sample) or greater were categorized as "high-hostile." Those with a score of less than 2.5 were categorized as "low-hostile."

Depressive symptoms. Five items were adapted from the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1991), a 20-item self-report scale that assesses depression during the past week. The CES-D is a valid and reliable measure for assessing depressive symptoms, but not for the broader construct of negative affect among adolescents (Galaif, Chou, Sussman, & Dent, 1998; Schoenbach, Kaplan, Grimson, & Wagner, 1982). In a pilot study, we factor analyzed the 20 CES-D items using the principal components method to determine which five items to use in the main trial of the longitudinal study. Consistent with suggestions from previous research, we chose the five items that loaded the highest on the factor, labeled *depression*. The factor loadings for these items ranged from 0.72 to 0.81, and Cronbach's alpha for this short scale was .87. The items were the following: "Think about how you felt during the past 7 days. On how many of these days did you . . . " (1) "Have trouble shaking off sad feelings?" (2) "Feel depressed?" (3) "Think your life had been a failure?" (4) "Feel lonely?" and (5) "Feel sad?" Response options were: 1 = 0–1 day, 2 = 2–3 days, 3 = 4–5 days, and 4 = 6–7 days. Scores on these items were summed for a possible range of 0–20. Students with a score of 1.2 (the median for this sample) or greater were categorized as "depressed," while those with a score less than 1.2 were categorized as "non-depressed."

Data Analysis

Chi-square analyses were used to assess differences in the prevalence of lifetime smoking and 30-day smoking by age, gender, and city. Stratified univariate logistic regression analyses were also performed to determine whether anxiety, hostility, and depressive symptoms were each associated with smoking behaviors for 7th and 11th grade boys and girls. We stratified on age because adolescent smoking prevalence increases with age, both in the U.S. and in China (Unger et al., 2001a). We also stratified on gender because smoking prevalence rates for males in China are much higher than for females (Gong, Koplan, Feng, & Chen, 1995). A multivariate logistic regression analysis was then performed to determine adjusted odds ratios for the psychosocial variables.

Results

The sample of this study consisted of approximately equal numbers of male and female participants for both grades (49.3% females in the 7th grade and 52.9% females in the 11th grade). The mean age of the respondents for the 7th and the 11th graders was 13.1 and 17 years, respectively. The proportion of participants from each of the seven cities in China was also about equal.

Differences in Smoking Prevalence by Demographic Characteristics

Gender and age differences As shown in Table 1, there were large gender gaps in both lifetime smoking and 30-day smoking prevalence rates, with boys twice as likely to report having smoked at some time and five times more likely to report having smoked within the past 30 days. Furthermore, older students (16- to 17-year-olds) were three times as likely to have tried smoking and six times as likely to have smoked within the past 30 days compared to younger students (12- to 13-year-olds).

Table 1. *Smoking Behavior by Demographic Characteristics*

Variable	Lifetime Smoking (%)	Past 30-day Smoking (%)
Gender		
Male	33.3	15.0
Female	15.8	3.4
χ^2value	196.54	188.75
df	1	1
p-value	< 0.001	< 0.001
Age		
12–13 years old (7th grade)	11.5	2.5
16–17 years old (11th grade)	35.8	14.9
χ^2value	58.04	213.93
df	1	1
p-value	< 0.001	< 0.001

Table 2. *Gender and Age Differences on Psychological Characteristics*

Variable	Anxiety (Standardized) Mean (SD)	Hostility (Standardized) Mean (SD)	Depression (Standardized) Mean (SD)
Gender			
Male	0.003 (0.984)	–0.076 (0.997)	–0.028 (1.001)
Female	–0.003 (1.015)	0.071 (0.997)	0.023 (0.997)
t-test	0.18	–5.02	–1.80
p-value	0.856	< 0.001	0.072
Age			
12–13 years old (7th grade)	–0.192 (.925)	–0.137 (0.985)	–0.149 (0.858)
16–17 years old (11th grade)	0.168 (1.032)	0.120 (0.998)	0.125 (1.090)
t–test	–12.52	–8.84	–9.44
p-value	< 0.001	< 0.001	<0.001

Gender and age differences on psychological characteristics. As shown in Table 2, there were significant age and gender differences on psychological characteristics. Specifically, females reported higher scores on hostility compared to males ($p < .001$), but there were no significant gender differences on anxiety or depression. On the other hand, older students reported higher scores than younger students on anxiety, hostility, and depression ($p < .001$ for all three psychological characteristics).

Differences among the Seven Cities on Smoking Behavior and Psychological Characteristics

As shown in Table 3, there was variation among the cities surveyed on smoking behavior, anxiety, hostility, and depression. Specifically, Chengdu was the city with the highest rate of smoking, and also had above average scores for anxiety, hostility, and depression. On the other end, Qingdao was the city with the lowest rate of smoking, and had the lowest average scores on the psychological variables.

Association between Smoking, Anxiety, Hostility, and Depressive Symptoms

Pearson's r revealed moderate connections among the three psychological variables; the correlation between anxiety and hostility was .44, between anxiety and depression .59, and between hostility and depression .35. However, the variables were considered sufficiently independent to be entered separately in a multivariate logistic regression model.

Table 4 shows the results of the multivariate logistic regression analysis. We examined the predictive relationships between the demographic variables (age and gender) and whether students had smoked at some point during their lifetime. Similarly, we examined the connections between the psychological variables (anxiety, hostility, and depression) and lifetime smoking. We then asked whether the same connections apply to recent smoking (past 30-day smoking) by conditionalizing the analysis, looking only at those who had smoked at some point. All of these analyses were controlled for covariates and partialled out the effects of the other independent variables. Significance implies independent association between the predictor and the smoking behavior.

As expected, older students were more likely to have tried smoking at some point. Males were also more likely to have smoked. The same relationships were obtained when we looked at recent smoking. Age and gender were significant predictors of whether someone who had tried smoking was also smoking within the past 30 days. As expected, older students were more likely to have tried smoking at some point. Males were also more likely to have smoked. The same relationships were obtained when we looked at recent smoking. Age and gender were significant predictors of whether someone who had tried smoking was also smoking within the past 30 days. All three of the psychological variables were significantly associated with lifetime smoking. However, the conditional analysis showed that they were not significantly associated with past

Table 3. *Differences among the Seven Cities on Smoking Behavior and Psychological Characteristics*

Variable	Lifetime Smoking (%)	Past 30-day Smoking (%)	Anxiety (Standardized)	Hostility (Standardized)	Depression (Standardized)
City			Mean (SD)	Mean (SD)	Mean (SD)
Chengdu	32.9	15.3	0.052 (1.007)	0.095 (1.009)	0.060 (1.070)
Hangzhou	25.3	8.5	–0.041 (0.998)	0.034 (0.960)	–0.061 (0.923)
Shenyang	19.5	5.6	–0.007 (0.978)	–0.075 (1.010)	–0.038 (0.948)
Wuhan	26.6	9.5	0.083 (1.006)	–0.018 (0.969)	0.085 (1.063)
Harbin	27.7	10.4	0.127 (1.029)	0.073 (1.016)	0.028 (1.006)
Kunming	21.3	8.0	–0.083 (0.981)	0.081 (0.973)	–0.004 (0.961)
Qingdao	16.2	5.4	–0.142 (0.974)	–0.205 (1.027)	–0.073 (1.008)
Total	24.3	9.0			
χ^2value	70.54	*F*	6.04	7.35	2.26
df	6	df	4,632	4,667	4,511
p-value	< 0.001	*p*	< 0.001	< 0.001	0.035

Table 4. *Multivariate Logistic Regression Model Testing Associations between Psychological Variables and Smoking*

	Lifetime Smoking		Past 30-Day Smoking among Lifetime Smokers	
Independent variables	AOR	95% CI	AOR	95% CI
Anxiety	1.28***	1.16, 1.40	1.06	0.90, 1.24
Hostility	1.36***	1.25, 1.49	1.06	0.92, 1.23
Depression	1.18***	1.09, 1.29	1.13	0.99, 1.29
Covariates				
Age	1.42***	1.36, 1.48	1.33***	1.21, 1.46
Gender	0.30***	0.25, 0.35	0.251***	0.18, 0.34

Note: Odds ratios are adjusted for all other variables in the model. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .0001$.

30-day smoking. This disparity most likely reflects the fact that we had a relatively large number of adolescents who had tried smoking within our sample, but not very many who had smoked within the past 30 days.

Discussion

To our knowledge, this is one of the very few studies that examines the relationships among adolescent smoking and psychological factors (anxiety, hostility, and depressive symptoms) in China. The main finding is that each of the psychological factors is independently associated with lifetime smoking but not with recent smoking. In general, those students who reported being more worried and nervous, having difficulty regulating anger, feeling sad and lonely, were more likely to have tried smoking.

Although research on a causal link between anxiety, hostility, and adolescent smoking is virtually nonexistent, the associations between anxiety, hostility, and increased risk for smoking found in our study is in agreement with the stress-reduction theory of addictive behaviors, in that smoking may be perceived as an effective tension reducer. Our findings are supported by previous studies done in the U.S., in that smoking is associated with reduction of frustration, irritation, and anger at a time of substantial distress (Jamner, Shapiro, & Murray, 1999; Johnson, 1990). Our findings are also consistent with a few relevant studies conducted in China, in that feelings of anxiety and irritation were associated with increased risk of alcohol use and cigarette smoking (Jin & Zhang, 1998; Unger et al., 2001b). The older adolescents in our study were more likely to report psychological distress, and they were more likely to smoke.

The connection between depressive mood and smoking initiation found in our study is consistent with previous studies in that the anticipated improvement in mood and psychosocial functioning may be a potentially powerful motivating factor for taking up smoking among adolescents (Koval & Pederson, 1999; Patton et al., 1998). Adolescents in modern China, in addition to facing the usual pressures from family, schools, and peers, may be experiencing uncertainty and worries about the future or unsuccessful adjustment to these life changes and the subsequent feeling of distress. This may lead them to adopt smoking as a coping mechanism. Further research is needed to understand how Chinese adolescents develop the expectancy that smoking will improve their mood, and how prevention curricula could help them challenge and alter that expectancy. We should note that our measure of depressive mood referred to the past 7 days, as is typical in studies with adolescents who are not clinically diagnosed with depression. The results do not speak to long-term, serious psychological issues.

The results of the current study showed significant gender differences in smoking prevalence rates. This finding is consistent with numerous findings that smoking is a gender-specific social behavior among Chinese (Mackay & Eriksen, 2002; Unger et. al., 2001a; Zhu et al., 1996). In addition, the result of this study showed significant age differences in smoking behavior, which is also consistent with previous studies conducted both in China and in the U.S. Age has been found to be associated with easier access to cigarettes and with friends' smoking (Unger et al., 2001a, USDHHS, 2001).

Limitations

Several limitations in this study need to be addressed. First, this study is cross-sectional, which does not allow us to establish the direction of causality between psychological impact and adolescent smoking behavior. Longitudinal studies are needed to determine the direction of causality.

It may appear puzzling that we found significant associations between psychological factors and lifetime smoking, but not between those factors and 30-day smoking. The difference is most likely attributable to the limited number of 30-day smokers in our sample, which reduced the power for those tests. Chinese youth usually develop the smoking habit at an older age than their counterparts in Western countries (Chen et al., 1999).

A second limitation is that while this sample is representative of urban areas in China, the results may not generalize to the approximately 70% of teens in China who live in rural areas. To extend generalizability, it will be important to confirm the findings in other samples of Chinese adolescents.

A third limitation is the standard caution that the results of this study are based on adolescents' self-reports of their psychological states, smoking behavior, and other demographic variables. Although we assured the students that their responses were anonymous, this guarantee may not have been meaningful to Chinese

students. In addition, while our measures were validated in the United States and carefully translated into Chinese, and then back-translated into English, we cannot rule out the possibility that slight differences in question structure and content affected students' understanding and interpretation of the questions, especially questions related to psychological states. The assessment may not have completely captured the psychological states of Chinese youth.

Conclusion

In summary, our results suggest a strong similarity between smoking initiation patterns in China and the U.S. We found anxiety, hostility, and depressive symptoms to be associated with smoking initiation among Chinese adolescents. Combined with research conducted in the U.S., there seems to be support for the assertion that smoking connotes a means of coping with anxiety, regulating negative affect, and controlling mood. Unless alternative means of dealing with adolescent stress can be implemented, the unfortunate health consequences of this connotation will continue to plague these societies.

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