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Original Research

Predictors of Cigarette Smoking among Chinese Adults

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Abstract

Background: Tobacco use remains the largest preventable cause of mortality and morbidity with a significant economic burden in China. The objectives of this study were to evaluate the rate of cigarette smoking among a convenience sample of Chinese adults (n=710) and to examine predictors of cigarette smoking.

Methods: A survey-based cross-sectional study was conducted among a convenience sample of adults aged 18 years or older at two sites (Nanjing, Jiangsu Province; Chuzhou, Anhui Province) in China. Individuals who smoked at least one cigarette in the past 30 days were defined as smokers and considered as the study cohort. Multivariate logistic regression models were constructed to determine predictors of cigarette smoking for three outcomes: past 30-day use vs. no use, past 7-day use vs. no use, and past 24-hour use vs. no use. All statistical analyses were conducted using SAS version 9.2 statistical package.

Results: More than half of the respondents had used a cigarette in the past 30 days (56.16%), 54.97% in the past 7 days, and almost half of the respondents in the past 24 hours (49.28%). Significant predictors of smoking status included gender (male), marital status (married), employment status (employed), educational level (less than high school degree), exposure to tobacco advertisements through media (TV), peer pressure (smoke if cigarettes offered by others), intention to smoke (try smoking in the next year), and a previous experience to use tobacco (tried cigar at least once during one's lifetime).

Conclusions: These findings underscore the magnitude of the smoking problem among Chinese adult smokers. Urgent measures are needed to effectively control the growing smoking epidemic. Future studies should focus on incorporating the identified factors when designing prevention and intervention strategies among Chinese adult smokers.

INTRODUCTION

Tobacco use caused more than five million deaths per year worldwide and 100 million deaths over the course of the 20th century with 70% of the deaths in developing countries since 2002 [1,2]. Current trend shows that tobacco use will cause more than ten million deaths worldwide annually by 2020 [1]. In China, a total of 673,000 deaths were attributed to smoking in 2005 [3] and over 320 million smokers (outnumbering any other country) account for 40% of cigarettes smoked in the world [4,5]. Current smoking prevalence is estimated to be 60.8% among Chinese males and 4.2% among Chinese females with 58.5% of the male smokers smoking daily [6].

Tobacco use leads to higher risk among a number of diseases, predominantly affecting the heart and lungs. The incidence of lung cancer has increased 30 times by cigarette smoking [7-12]. Tobacco consumption is also a risk factor for chronic obstructive pulmonary disease (COPD) [13] and increases the risk of heart attacks by nine times [14,15]. Other cancers associated with smoking include pharyngeal, esophageal, bladder, laryngeal, and pancreatic [16-19].

The reported economic costs of smoking in China in 2000 reached 5.0 billion U.S. dollars [20]. The direct costs of smoking accounted for 3.1% of China's national health expenditures [20] and impoverished more than 50 million people [21].

Despite these statistics, factors associated with tobacco use behaviors among Chinese adults have not been adequately examined, and intervention programs that promote quitting smoking have been mostly insufficient or ineffective [22]. To date, predictors that have been found to be significantly associated with cigarette smoking in previous studies conducted in China include gender, marital status, educational attainment, and employment status [23,24]. However, some other possible predictors of cigarette smoking have been identified in studies conducted in other countries and the extent to which these factors predict tobacco use in China is not known. For example, the extent to which exposure to tobacco advertisements through media, peer pressure, intention to smoke, and having had tobacco and/or substance use experience are yet to be fully explored. Furthermore, some possible predictors of cigarette smoking among the Chinese adult smokers such as exposure to tobacco advertisements through media, peer pressure, intention to smoke, and having had tobacco and/or substances use experience have yet to be explored.

The objectives of this study were to determine the rate of cigarette smoking in a convenience sample of Chinese adults as well as predictors of smoking among a sample of Chinese adults. This information will provide the basis for the development of a culturally appropriate intervention for this population.

METHODS

Study design and respondents

A cross-sectional survey utilizing a self-administered questionnaire was conducted in a convenience sample of willing adults 18 years or older in China between October 30, 2009 to February 5, 2010.

Survey procedures and measures

The questionnaire was adapted from a previously used self-report survey [25,26]. The surveys were distributed at two sites in China, a government agency (Chuzhou, Anhui Province), and a trading company (Nanjing, Jiangsu Province). These two sites were used to include adult respondents of diverse demographic and socioeconomic characteristics. Adults who visited these two sites were asked if they were willing to anonymously participate in filling out a 15- 20 minutes survey regarding smoking habits. If they agreed, they were given a survey and asked to drop the completed survey in a sealed box that was available at each of these sites. Informed consent was provided with the survey and participation was voluntary. To assure the quality of the survey data obtained, the survey used translation and back-translation to obtain a conceptual equivalence from English to Chinese.

The self-administrated questionnaire was divided into 4 sections: demographics and health condition; exposure to advertisements of smoking; tobacco and substance use experience; and parents' and friends' tobacco use.

Demographics and health condition

Various demographic characteristics such as gender, age, marital status, residence, monthly income, employment status, and educational level were examined.

Exposure to advertisements of smoking

This section assessed social functioning and consisted of 10 questions, such as "Have you seen or heard about the following types of advertisements about smoking in the past month: television advertisements or shows, radio advertisements or programs, billboards, posters?" Exposure to advertisements of smoking was defined as been exposed to any type of advertisements about smoking in the past 30 days regardless of whether they were for or against smoking.

Tobacco and substance use experience

This section assessed frequency of substances used during one's lifetime. Respondents were asked how many times they have used substances during their lifetime. Questions included use of the following substances: cigarettes, cigars, chewing tobacco, alcohol, marijuana, cocaine, crack cocaine, crystal meth, ecstasy, xanax, viagra, and promethazine hydrochloride cough syrup (CPHCS). Respondents were categorized as never used substance if they answered "0 time" or used at least once if they answered "1 time", "2-3 times", or "4 or more times".

Parents' and friends' tobacco use

This section of the survey assessed the impact of most important people in one's life, such as father, mother, brothers or sisters, close friends whose smoking behaviors might have an influence on the respondent's smoking behavior; and the likelihood of smoking if offered a cigarette by others in the next year, next 6 months or 3 months.

Outcome Measures

The US Centers for Disease Control and Prevention (CDC) defined the current smokers as "Adults who have smoked 100 cigarettes in their lifetime and currently smoke cigarettes every day (daily) or some days (non-daily)" [27]. In order to capture smoking frequency in terms of daily and non-daily smoking,

three primary outcome variables were identified for this study: (1) past 30-day use of cigarettes vs. no use, (2) past 7-day use of cigarettes vs. no use, and (3) past 24-hour use of cigarettes vs. no use. These outcomes were measured by respondent recall of whether they smoked cigarettes in the past 30 days, 7 days, and 24 hours. Three models were used to assess the predictors of cigarette smoking in this study.

Power Analysis

The G-power 3.1 statistical software package [28] was used for power analysis for a logistic regression statistical test with 0.05 α significant level, 0.80 power, and 1.3 odds ratio (OR) by two tails, and determined that 473 respondents would be needed.

Statistical Analysis

A test retest reliability of the instrument was evaluated and all correlation coefficients were above 0.7. Cronbach's alpha was used to measure internal consistency of constructs with likert scales and all coefficients were above 0.7.

Descriptive statistics and χ^2-test were used to assess the frequencies and associations of sample characteristics with the three outcomes: past 30-day use of cigarettes vs. no use, past 7-day use of cigarettes vs. no use, and past 24-hour use of cigarettes vs. no use. Univariate logistic regression analyses of patient characteristics were carried out with the outcome variables and results were presented as unadjusted OR with 95% confidence interval (95% CI). Three multivariate logistic regression models were carried out to determine predictors of being a cigarette user with the three outcomes after assessing co-linearity between the independent variables. Significant variables ($p<0.05$) in the univariate analyses were included in the multivariate models and backward elimination was used to arrive at the final models. Adjusted OR and 95% CI were calculated for predictors of the outcome variables in the models. All statistical analyses were conducted using SAS version 9.2 (SAS Institute, Cary, NC) statistical package at a priori significance level of 0.05.

RESULTS

A total of 780 out of 1,100 distributed surveys were returned, including 710 efficient surveys, 40 inefficient surveys, and 30 surveys for reliability testing analysis. Among the 40 inefficient surveys, 12 respondents returned a blank survey, and 2 respondents submitted the survey with pages removed. Nineteen respondents returned partially completed surveys, and of the remaining completed surveys, 7 could not be included due to inconsistency in responses. The overall response rate for this convenient sample was 68.2%.

Sample characteristics

In this study, 56.16% of the respondents used cigarettes in the past 30 days, 54.97% in the past 7 days, and 49.28% in the past 24 hours (Figure 1). Most of the respondents were male (65.41%, n=450) and the majority were aged between 26 to 40 years (42.13%, n=273), with a sample mean age of 36.13 (±11.31). The majority of the respondents were married (66.33%, n=463) and employed (65.80%, n=456). Table 1 summarizes the results of χ^2 test of various respondent characteristics within the three outcome variables: outcome 1: past 30-day use of cigarettes vs. not, outcome 2: past 7-day use of cigarettes vs. not, outcome 3: past 24-hour use of cigarettes vs. not.

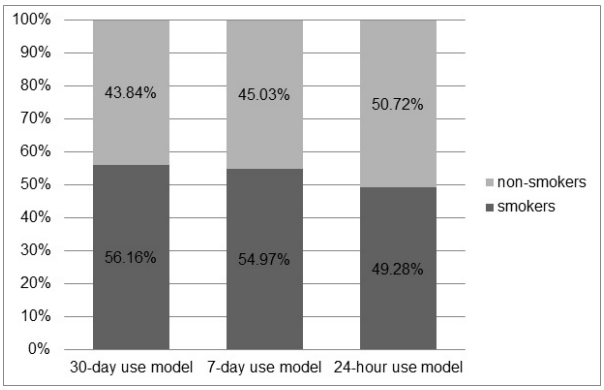

Figure 1. Proportion of smoking as defined by the three outcomes among the Chinese respondents

Logistic regression results

Univariate logistic regression (unadjusted OR) and multivariate logistic regression (adjusted OR) results with the three outcome variables are presented in Table 2.

The multivariate logistic regression analyses indicated that males were more likely to be cigarette smokers than females in all three models (OR: 9.03, 95% CI: 4.17-19.55 in model 1, OR: 8.22, 95% CI: 3.74 – 18.10 in model 2, OR: 4.47, 95% CI: 2.15 – 9.27 in model 3). Respondents who were unemployed were less likely to be cigarette smokers in all three models compared to those employed (OR: 0.28, 95% CI: 0.12 – 0.62 in model 1, OR: 0.22, 95% CI: 0.10 – 0.51 in model 2, OR: 0.37, 95% CI: 0.18 – 0.78 in model 3). Respondents who were exposed to any tobacco advertisements through media were more likely to be cigarette smokers in all three models than those who were not exposed to any tobacco advertisements (OR: 3.32, 95% CI: 1.61 – 6.86 in model 1, OR: 3.30, 95% CI: 1.56 – 6.97 in model 2, OR: 2.07, 95% CI: 1.08 – 3.97). Respondents who tried cigars at least once

throughout lifetime were more likely to be cigarette smokers than those who never tried cigars in all three models (OR: 10.36, 95% CI: 3.25 – 33.08 in model 1, OR: 8.48, 95% CI: 2.81 – 25.61 in model 2, OR: 4.19, 95% CI: 1.90 – 9.25 in model 3). Respondents who had a strong willingness to smoke next year were more likely to be cigarette smokers in all three models compared to those unwilling to smoke (OR: 5.06, 95% CI: 2.34 – 10.97 in model 1, OR: 5.00, 95% CI: 2.27 – 11.00 in model 2, OR: 5.39, 95% CI: 2.72 – 10.70 in model 3). Respondents who indicated a willingness to smoke if cigarettes were offered by friends were more likely to be cigarette smokers in all the three models compared to those not willing to smoke if cigarettes were offered (OR: 10.51, 95% CI: 4.83 – 22.89 in model 1, OR: 12.20, 95% CI: 5.38 – 27.64 in model 2, OR: 9.13, 95% CI: 4.37 – 19.10 in model 3). Those who were not married were less likely to be cigarette smokers as compared to respondents who were married in the past 7-day use model (OR: 0.39, 95% CI: 0.18 – 0.88) and in the past 24-hour use model (OR: 0.33, 95% CI: 0.17 – 0.64). Those who had a high school degree or lower were more likely to be cigarette smokers compared to respondents who had a college degree or higher in the past 30-day use model (OR: 3.32, 95% CI: 1.61 – 6.86) and in the past 7-day use model (OR: 3.30, 95% CI: 1.42 – 7.66).

Table 1. Characteristics with past cigarette use

		30-day use model (56.16%)		7-day use model (54.97%)		24-hour use model (49.28%)	
Characteristic	Total Frequency (Percentage)	Frequency (Percentage)	p-value	Frequency (Percentage)	p-value	Frequency (Percentage)	p-value
Demographics and health condition							
Gender							
Female	238 (34.59%)	33 (16.34%)	<0.0001*	30 (14.93%)	<0.0001*	27 (13.37%)	<0.0001*
Male	450 (65.41%)	304 (74.69%)		299 (73.46%)		268 (65.53%)	
Age,(years)							
18-25	147 (22.69%)	50 (37.31%)	<0.0001*	46 (34.33%)	<0.0001*	42 (30.88%)	<0.0001*
26-40	273 (42.13%)	155 (62.00%)		154 (61.50%)		135 (53.57%)	
>40	228 (35.19%)	123 (63.40%)		120 (62.83%)		82 (56.61%)	
Marital Status							
Married	463 (66.33%)	258 (62.93%)	<0.0001*	258 (63.08%)	<0.0001*	229 (55.99%)	<0.0001*
Non-married	235 (33.67%)	86 (42.16%)		78 (38.24%)		75 (35.89%)	
Employed status							
Employed	456 (65.80%)	249 (60.29%)	0.0013*	246 (59.28%)	0.0007*	228 (54.16%)	0.0003*
Unemployed	237 (34.20%)	91 (46.43%)		86 (44.56%)		74 (38.34%)	
Education level							
≥College degree	282 (40.87%)	127 (49.03%)	0.0049*	120 (46.33%)	0.0005*	114 (43.68%)	0.0352*
≤High school degree	408 (59.13%)	210 (60.52%)		210 (60.52%)		183 (52.29%)	
Exposure message of smoking							
TV ads or shows							
Not exposed	252 (38.71%)	106 (48.40%)	0.0106*	103 (47.03%)	0.0103*	98 (43.95%)	0.0560
Exposed	399 (61.29%)	210 (59.32%)		206 (58.03%)		186 (52.10%)	
Tobacco and substances use experience							
Ever use cigars							
Never	460 (71.99%)	152 (37.53%)	<0.0001*	146 (36.05%)	<0.0001*	126 (30.88%)	<0.0001*
At least once	179 (28.01%)	153 (93.87%)		154 (93.33%)		149 (89.22%)	
Ever use alcohol							
Never	238 (37.36%)	157 (44.35%)	<0.0001*	151 (42.66%)	<0.0001*	127 (35.98%)	<0.0001*
At least once	399 (62.64%)	144 (68.25%)		144 (67.61%)		144 (65.45%)	
Smoke in next year?							
No	368 (54.76%)	89 (26.89%)	<0.0001*	85 (25.76%)	<0.0001*	68 (20.48%)	<0.0001*
Yes	304 (45.24%)	254 (89.44%)		250 (88.03%)		235 (81.88%)	
Parents' and friends' tobacco use							
Siblings tobacco use							
Non smoker	374 (55.33%)	161 (49.69%)	0.0004*	159 (48.77%)	0.0005*	137 (41.90%)	<0.0001*
Smoker	302 (44.67%)	178 (64.03%)		173 (62.91%)		163 (58.21%)	
Friends' tobacco use							
Non smoker	237 (35.11%)	61 (30.05%)	<0.0001*	56 (27.72%)	<0.0001*	38 (18.72%)	<0.0001*
Smoker	438 (64.89%)	274 (68.84%)		272 (68.34%)		258 (63.86%)	
Smoking if get offered							
No	314 (46.31%)	50 (17.73%)	<0.0001*	44 (15.60%)	<0.0001*	32 (11.39%)	<0.0001*
Yes	364 (53.59%)	297 (87.87%)		295 (87.54%)		274 (79.88%)	

Table 2. Univariate logistic regression and multivariate logistic regression of cigarette smokers among the three outcomes

	30-day use model		7-day use model		24-hour use model	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Demographics and health condition						
Gender						
Female	Reference	Reference	Reference	Reference	Reference	Reference
Male	15.11 (9.78–23.34)*	9.03 (4.17 - 19.55)*	15.78 (10.10 -24.64)*	8.22 (3.74 –18.10)*	12.32 (7.83 -19.39)*	4.47 (2.15 – 9.27)*
Age,(years)						
18-25	Reference		Reference		Reference	
26-40	2.74 (1.78–4.23)*		3.07 (1.98 – 4.76)*		2.58 (1.66 – 4.01)*	
>40	2.91 (1.85–4.59)*		3.23 (2.04 – 5.13)*		2.92 (1.84 – 4.64)*	
Marital status						
Married	Reference		Reference	Reference	Reference	Reference
Non-married	0.43 (0.31–0.61)*		0.36 (0.26 – 0.51)*	0.39 (0.18-0.88)*	0.44 (0.31 – 0.62)*	0.33 (0.17 – 0.64)*
Employment status						
Employed	Reference	Reference	Reference	Reference	Reference	Reference
Unemployed	0.57 (0.41–0.80)*	0.28 (0.12 – 0.62)*	0.55 (0.39 – 0.78)*	0.22 (0.10 – 0.51)*	0.53 (0.37 – 0.75)*	0.37 (0.18 – 0.78)*
Education level						
≥College degree	Reference	Reference	Reference	Reference	Reference	
≤High school degree	0.63 (0.45–0.87)*	3.32 (1.61 – 6.86)*	0.56 (0.41 – 0.78)*	3.30 (1.42 – 7.66)*	0.71 (0.51 – 0.98)*	
Exposure message of smoking						
TV						
Not exposed	Reference	Reference	Reference	Reference	Reference	Reference
Exposed	1.56 (1.11–2.18)*	3.32 (1.61 – 6.86)*	1.56 (1.11 – 2.19)*	3.30 (1.56 – 6.97)*	1.39 (0.99 – 1.94)	2.07(1.08-3.97)*
Tobacco and substances use experience						
Ever use cigars						
Never	Reference	Reference	Reference	Reference	Reference	Reference
At least once	25.46 (13.02-49.77)*	10.36 (3.25 –33.08)*	24.83(13.04– 47.30)*	8.48 (2.81– 25.61)*	18.53(10.88 –31.55)*	4. 19(1.90– 9.25)*
Ever use alcohol						
Never	Reference		Reference		Reference	
At least once	2.70 (1.89 – 3.86)*		2.81 (1.97 –4.01)*		3.37 (2.37 – 4.80)*	
Smoke in next year						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	23.02 (14.68 –36.09)*	5.06 (2.34 – 10.97)*	21.19(13.72 –32.74)*	5.00 (2.27 – 11.00)*	17.54 (11.74–26.21)*	5.39(2.72–10.70)*
Parents' and friends' tobacco use						
Siblings tobacco use						
Non smoker	Reference		Reference		Reference	
Smoker	1.80 (1.30 – 2.50)*		1.78 (1.28 – 2.47)*		1.93 (1.40 – 2.67)*	
Friends' tobacco use						
Non smoker	Reference		Reference		Reference	
Smoker	5.14 (3.56 – 7.43)*		5.63 (3.87 – 8.18)*		7.67(5.11 –11.53)*	
Smoke if get offered						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	33.61 (21.49 –52.57)*	10.51 (4.83– 22.89)*	37.99(24.08 –59.94)*	12.20(5.38–27.64)*	30.90(19.64– 48.60)*	9.13(4.37–19.10)*

[a]OR: Odds Ratio
[b]95% CI: 95% Confidence Interval
* p<0.05.

DISCUSSION

Findings of this study indicate a high rate of cigarette smoking among the respondents (56.16% in model 1, 54.97% in model 2, 49.28% in model 3). Our sample had more males than females in all three models, which might be a result of a higher number of males employed than females at the two sites where the survey was distributed. Both male and female smoking rates exceeded the adjusted prevalence estimation of the World Health Organization (WHO) report on the global tobacco epidemic in 2008, where 60.8% are current male smokers (99% CI: 48.8-72.8) and 4.2% (99% CI: 3.5-4.9) are current female [6]. This might be because the definition for smokers in this study is different from that of the WHO report which defined current smokers as having smoked 100 cigarettes or more in their lifetime [29], while this study identified smokers as those having smoked cigarettes during the past 30 days (model 1), the past 7 days (model 2), and the past 24 hours (model 3). We opted our definition of smokers and non-smokers based on other research studies [30-32], for the sample size of our study would become very small using WHO definition, which subsequently would influence the power of the study. In our study, male respondents were more likely to be cigarette smokers as compared to female respondents in all three models. This finding was consistent with reports from Guindon and Boisclair (2003) [33], Stoll et al. (2008) [34], which indicated that more social acceptability to smoke for males as compared to females. Despite general awareness of the harmfulness of smoking and secondhand smoke to health, cigarette use remains very widely acceptable among the whole society and is also treated as a tool for social purposes. People view a cigarette as an important tool to approach others. People who do not smoke may also keep cigarettes with them just to pass them on to

smokers whom they come across, a habit more common in males. Also, cigarette is perceived as an "appropriate" gift for others, mainly for male smokers.

People who were married were more likely to be cigarette smokers compared to the unmarried (model 2 and model 3), which was consistent with studies conducted by Rahman et al. (2005) [35] and Mishra et al. (2005) [36]. Unmarried respondents tend to be younger and not as well established compared to married respondents both socially and financially; smoking as a social tool may not be as important for them as for those established people. Unmarried people might also be restricted by their girlfriend/boyfriend or their parents for the smoking behavior, which alternatively either stop or delay the initiation of smoking, or stop them from smoking. Marital status was no longer significant in model 1. This may partly be explained by the social smoking habits where social smokers limit smoking to contexts such as parties, bars, or nightclubs, and, mainly smoke based on the situation and places where they perceive smoking as necessary as a social tool.

The employed respondents were more likely than unemployed respondents to be smokers. This finding could be explained by the policy in China that smoking is not completely banned in workplaces. The workplace also provides a setting for social smoking with peers, and cigarette smoking is common when there is party, meeting, conversation, etc., wherever and whenever possible.

Additionally, the higher the level of degree held by the respondents, the higher the tendency to be a non-smoker (model 1 and model 2). This was also reported by Yang et al. (2008) [23], where the less educated were more likely to smoke underscoring the importance of educational interventions that explain potential harms. School education alone might not be enough to combat smoking. Anti-smoking educational interventions conducted among teenagers and adolescents in school may be more effective by involving the students in anti-smoking educational intervention programs that are conducted by the institutions, organizations, and the government.

Demographic and socio-economic factors were consistent with the study conducted by Ma et al. (2002) [24] among the Asian Americans. There were significant differences in sex, educational attainment, and marital and employment status between "never smokers", current smokers, and ex-smokers. In this study, adults aged 25 years and older were more likely to smoke than young adults aged 18 to 25 years in the univariate analysis, but was no longer a significant predictor after controlling for confounders in the multivariate analysis. Smoking seems to be universal among adults in China regardless of the specific age range. It might also be possible that other variables such as educational level, marital status, and employment status have covered the variances of smoking status that explained by age.

Respondents who were exposed to smoking advertisements through media, whether for or against smoking, were more likely to be cigarette smokers than those who were not (in all three models). This finding was different from other studies [37-39]. In China, the fact is that, an overwhelming majority perceive that smoking is harmful to health although some people may have a wrong perception that smoking can help relieve stress [40,41]. Nonetheless, it is difficult to stop smoking because of the nicotine dependence, as well as the social function of cigarette smoking. In addition, cigarette smokers may be more likely to pay attention to smoking advertisements through media regardless of they are for or against smoking as compared to non-smokers.

It is not surprising to find that respondents who had cigar use experience (in all three models) were more likely to be cigarette smokers as smokers may want to try different forms of tobacco. This finding is consistent with studies conducted by Stoll et al. (2008) [34] and Rahman et al. (2005) [35]. While alcohol use and cigarette smoking have been reported to be positively associated [42-44], we did not find this association in the multivariate model controlling for potential confounders despite initial significance in the univariate model. A possible reason could be that the measure of alcohol use in our study was ever used any alcohol in their lifetime, whereas smoking status was measured based on 30-day use, 7-day use, and 24-hour use. Since both alcohol consumption and smoking are widely accepted in China, it is highly likely that the majority of respondents had at least tried alcohol once in their lifetime, regardless of their smoking status. We might also have controlled for variables in the model that have not been included previously in other studies. Other reasons for this finding need to be explored in the future.

Having an intention to smoke was one of the strong predictors of smoking in our study. This was also reported by Eckhardt et al. (1994) [45], Johnson et al. (2002) [46], and Christophi et al. (2009) [47] in various study populations identifying intention to smoke as the strongest predictor of smoking. According to Theory of Reasoned Action/Planned Behavior (TRA/TPB), behavior is influenced by the intention to perform the behavior which is influenced by the subjective norms, attitudes, as well as self-efficacy or confidence of the ability to successfully perform the behavior [48]. Therefore, if the respondent has a strong intention to smoke, it is highly likely that she/he is a smoker.

Respondents who indicated peer pressure, measured by a possibility of smoking if cigarettes were offered by others, were more likely to be cigarette smokers than those who were not. This finding is also consistent with the finding by Ho et al. (2010) [37], with an explanation that offering cigarettes to others is a traditional way of interacting in social events and gaining social acceptance. In China, smoking is a symbol of status; the more expensive the cigarettes, the greater the smokers' success. In addition, smokers offering cigarettes to others is a way to show their friendliness. Given China's smoking culture in which offering cigarettes to others is a traditional way of interacting in social events, gaining social acceptance, and showing their friendliness, any intervention should take into consideration this social aspect. Although we found siblings' tobacco use was a strong predictor in the univariate analysis, the association was no longer significant in the adjusted models. Future interventions that educate smokers with their friends who are also smokers regarding the harms of smoking and the healthy behaviors that are suggested to promote cessation may aid in helping smokers quit through peer pressure. Social anti-smoking advertisements including TV advertisements, posters, shows, radio advertisements, and internet may also help in educating the smokers about smoking harms and possibly change the culture where offering cigarettes to friends or colleagues is not a good nor healthy way of interacting in social events, gaining social acceptance, or expression of friendliness.

Based on the sample, the predictors of cigarette smoking in the Chinese adult population included gender (male), marital status (married), employment status (employed), educational level (less than high school degree), exposure to tobacco advertisements through media, peer pressure (smoke if cigarettes offered by friends), intention to smoke (try smoking in the next year), and had tobacco and substances use experience (tried cigar at least once during one's whole life). These findings were similar to what has been reported among US populations which demonstrated that these variables were significant factors associated with smoking status [32,46-47, 49-52].

This study has several limitations. First, causality cannot be inferred based on the cross-sectional study design. A longitudinal cohort study design may provide additional information regarding characteristics trends of smokers and changes in factors affecting tobacco use. Second, this research was based on a convenience sample, thus we were unable to describe non-respondents. The generalizability of the sample might be limited due to the convenience sampling. Respondents were only picked from two sites in China when respondents visited or worked during the time the survey was administered

Implication

Despite these limitations, this study is the first, to our knowledge, that examines predictors of cigarette smoking among a sample of Chinese adult smokers by using multivariate models, categorized by use of cigarettes in the past 30 days, the past 7 days, and the past 24 hours. While some predictors of cigarette smoking such as gender, marital status, educational attainment, and employment status were previously described [35,36], new predictors among Chinese adult smokers were found including having an intention to smoke, peer pressure, had cigar use experience, and exposed to smoking advertisements through media. It is important for professionals and policy makers to understand that the intention to smoke is affected by both nicotine dependence and the perception of cigarette smoking as a social tool of interaction. As many smokers are aware of the harmfulness of smoking and secondhand smoking, smoking cessation strategies should consider changing the social acceptable behavior. Recently, China has implemented a ban of indoor smoking in some places and the reinforcement of this rule has yet to be examined. Laws that have been enacted in China to prevent driving under the influence of alcohol can serve as a template for appropriate smoking cessation programs.

The high rates of cigarette smoking found in this study underscore the magnitude of the smoking problem in the Chinese population. Urgent effective measures are needed to curb the growing smoking epidemic. Future studies should focus on incorporating the predictors identified in this study in prevention and intervention strategies, such as reduce and limit the urge of intention to smoke in the smoking cessation intervention using both behavioral and pharmacological methods; incorporating smokers in the educational smoking cessation intervention and prevention strategies that influence peer pressure surrounding other smokers; regulatory bans and rules to stop smokers smoking in all the indoor areas with effective regulative methods; taking other forms of tobacco use into consideration, which means not only being restricted to cigarette smoking.

CONCLUSIONS

Findings suggest a high level of cigarette smoking among Chinese adults, underscoring the urgent need to develop effective interventions that can ensure successful cessation among those smokers. New findings from this study that can be added into the literature regarding the predictors among Chinese adult smokers including having an intention to smoke, peer pressure, had cigar use experience, and exposed to

smoking advertisements through media. Predictors associated with cigarette smoking among Chinese adult smokers found in this study should be considered when designing interventions.

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Ethics approval

The study involved human subjects, so the protocol of the study was submitted to the Institutional Review Boards (IRBs) at the University of Houston, the Committee for the Protection of Human Subjects, and was approved for data collection. The IRBs deemed the protocol to be exempt from federal human subjects' regulations because the survey was anonymous and did not expose the respondents to risk. The subjects that were included in the study were Chinese adults aged 18 years and older. Those who were aged below 18 years were excluded. All surveys were voluntarily completed by the respondents. No personal information or identifier was asked in the questionnaire to maintain the confidentiality and anonymity of the respondents. The informed consent was printed on the cover page of the survey. Also, questions based on the consent, if any, were solved orally by investigators prior to completion of the questionnaire.

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Competing interests

None declared.

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