

The Relationship Between Stress, Coping Style and Smoking in Guangxi, China During the COVID-19 Epidemic: A Cross-Sectional Study

Fuqun Xiao, Kun Yang, Jiahong Li*, Yong Yu, Fang Shao, Qianyue Huang,
Liyun Zhu, Xiaojun Ma

Department of politics and public administration, Guangxi Normal University, Guilin 541006,
Guangxi, China

Abstract

Introduction Although positive coping styles have been confirmed to enable individuals to cope positively with stress and reduce smoking in various studies, few have paid attention to the specific stress during COVID-19. This study aimed to examine the relationship between stress, coping styles, and smoking in Guangxi, China during the COVID-19 pandemic. **Methods** Survey data were derived from a cross-sectional study conducted from 1 April to 30 June 2023 in Guangxi, China. The Chinese version of the Simplified Coping Style Questionnaire (SCSQ) was used to measure individuals' coping styles, and the Depression Anxiety and Stress Scale (DASS)-21 was used to measure individuals' stress. Linear regression model and binary Logistic regression model were used to analyze the relationship between stress, coping style and smoking. **Results** A total of 2,723 valid questionnaires were collected, of which 1,426 (67.5%) and 886 (32.5%) were categorized into the non-smoker and smoker groups, respectively. Participants with greater stress were more likely to choose negative coping styles ($B=-0.042$, $t=-19.319$, $P<0.001$). Participants with higher stress were more likely to smoke ($OR=1.027$, $95\%CI:1.02\sim 1.034$, $P<0.001$), and participants with negative coping styles were more likely to smoke ($OR=0.576$, $95\%CI:0.503\sim 0.66$, $P<0.001$). **Conclusions** This study shows that smoking rates have increased during the COVID-19 pandemic. Individuals with higher levels of stress have a higher risk of smoking, individuals with more negative coping styles have a higher risk of smoking, and individuals with higher levels of stress have more negative coping styles. Public health activities should focus on stress and coping styles to take targeted measures for the prevention, treatment, and rehabilitation of smokers.

Keywords

Stress, Coping style, Smoking, COVID-19.

1. Introduction

The tobacco epidemic is one of the biggest public health threats the world has ever faced. The health hazards of smoking are not limited to premature death, but also significantly increase the risk of diseases that are not directly fatal, such as asthma, peptic ulcers, cataracts, diabetes, and other metabolic diseases[1]. In China, more than 1 million people die every year from smoking-related diseases, and the number keeps rising[2].

Since the outbreak of COVID-19, most countries have taken measures including locking down cities, isolating patients, and promoting mask-wearing and social distancing to contain the spread of the epidemic, which has put severe psychological stress on residents. On the one hand, residents are terrified of the risk of infection, especially in the hardest-hit areas. On the other hand, prolonged lockdown and isolation measures have led many people to feel lonely,

depressed, and anxious because they are unable to interact with relatives and friends or continue normal social activities. In addition, long-term uncertainty and information overload have also increased the psychological burden on residents. A study comprising 113,285 participants from India, China, Spain, Italy, and Iran revealed that among this surveyed population, the prevalence of stress was 53% during the pandemic and it seems to be increasing day by day[3]. Studies from multiple perspectives, including biology, sociology, and psychology, have demonstrated a link between psychological stress and smoking behavior[4-6]. Smoking can enhance an individual's sense of control over their own emotions and effectively cope with negative emotions such as stress and anxiety, thus making people feel relaxed[7]. Studies have shown that during the COVID-19 pandemic, people increase the frequency of adverse health behaviors such as smoking to cope with social isolation and pandemic-related psychological distress[8, 9]. Smoking is most likely associated with the negative progression and adverse outcomes of COVID-19[10]. Early indications suggest the proportion of current and former smokers is higher among those with severe disease and among those admitted to intensive care and requiring ventilation[11, 12]. Therefore, in the face of the COVID-19 pandemic, more proactive stress responses should be explored to reduce tobacco abuse.

Under the same pressure environment, some individuals will smoke due to psychological pressure, while others will not choose to smoke. The internal characteristics of individuals have a direct predictive effect on smoking behavior[13]. When studying the relationship between individual psychological stress and smoking behavior, it is necessary to consider the influence of other factors. Coping styles are specific activities taken in the process of coping and after cognitive evaluation, which are important factors affecting individual environmental adaptability and mental health[14], playing an important role in the influence of psychological stress on smoking behavior[15]. The study found that there was a stress-coping model in the smoking population, with significant associations between smoking and stress, negative emotions, and negative coping styles [16]. A team of researchers at Griffith University in Australia found that college students with positive coping styles were significantly less likely to smoke when given the same high level of stress. Similarly, Sussman and Brannon's study showed that adolescents with good problem-solving skills and positive help-seeking behaviors were less likely to smoke at the same perceived stress level[14]. Therefore, in the process of the formation of smoking behavior, positive coping styles are helpful to improve the effect of smoking prevention and intervention.

There are currently limited researches regarding the relationship between psychological stress, coping style and smoking. Most of them were carried out before the COVID-19 pandemic, and little attention was paid to the psychological stress of residents during the special period of the COVID-19 pandemic. Therefore, the present study examines the relationship between stress, coping styles, and smoking in Guangxi, China during the COVID-19 pandemic, to understand the impact of public health emergencies on public health-related behaviors and lifestyles and provide recommendations for improving the health and well-being of smokers.

2. Methods

2.1. Participants and Procedure

The data for this study were obtained from a cross-sectional survey of residents of Zhuang Nationality Areas in China. The survey was conducted from 1 April to 30 June 2023 in the Guangxi Zhuang Autonomous Region of the Chinese Mainland. Researchers designed a survey questionnaire including informed consent forms, and participants were asked to review their smoking behavior, stress, and coping style during the COVID-19 pandemic (from 1 January 2020 to 31 December 2022). The online questionnaire was implemented using Questionnaire Star. Researchers selected 300 students from the School of Politics and Public Administration

of Guangxi Normal University as initial participants. Each student was asked to send an online questionnaire to their 10 relatives or friends through email or other channels and to fill out the questionnaire while ensuring their informed consent. Once the questionnaire is submitted, researchers will clean and organize the collected data to ensure its accuracy and completeness. During the sample recruitment period, 3,000 met the criteria for participant enrollment, and 2,723 participated in this study and completed the questionnaire survey, with a response rate of 90.8%. The inclusion criteria were: (1) age ≥ 16 years; (2) resided in Guangxi Zhuang Autonomous Region, China from 1 January 2020 to 31 December 2022 (annual travel time ≤ 1 month); (3) voluntary participation in the study, with informed consent; (4) willing to participate in the study and sign the informed consent form. Exclusion criteria were: (1) unable to be investigated due to severe physical or mental illness; (2) participation in other similar research topics. The study was reviewed and approved by the Ethics Committee of Guangxi Normal University (GXNU[2023]0004), and the data collection process follows ethical norms and requirements.

2.2. Measures

Demographics Demographics included sex, age, area of residence, nationality, marital status, education level, occupation, living style, and monthly household income.

Smoking Participants were asked: "What is your current smoking status?" Response options were: (1) "Never smoker (Never smoked or have quit smoking)", (2) "Occasional smoker (Smoking only on special occasions such as parties and entertainment, with an average of less than 1 cigarette per day)", and (3) "Regular smoker (Smoke more than 1 cigarette a day for 6 consecutive or cumulative months)". Taking into account occasional smokers had little to do with the stress analysis in this study, smoking status was dummy-coded as (1) non-smoking (participants who had selected the option of "Never smoker" or "Occasional smoker") or (2) smoking (participants who had selected the option of "Regular smoker")

Coping Style The Chinese version of the Simplified Coping Style Questionnaire (SCSQ) was developed by Yaning Xie et al. to measure an individual's coping style [17]. The scale consists of 20 items, which are divided into two questionnaires: negative coping and positive coping. Items 1 to 12 were used to measure the positive coping characteristics of the population, and items 13 to 20 were used to measure the negative coping characteristics of the population. Each item was scored on a scale of 1 to 4, with positive coping criteria score = positive coping questionnaire score / 12, negative coping criteria score = negative coping questionnaire score / 8, and coping tendency score = positive coping criteria score - negative coping criteria score. The coping tendency score is positive, indicating that individuals are more inclined to adopt positive coping styles to deal with problems. A negative coping tendency score indicates that individuals tend to adopt negative coping styles to cope with stressful events. The Cronbach's coefficient for this scale in this study was 0.90.

Stress The Depression Anxiety and Stress Scale (DASS)-21 was developed by Lovibond et al. to measure an individual's depression, anxiety, and stress. DASS-21 (Chinese Version) revised by Xian Xu et al. was adopted in this study [18]. The whole scale contains 21 items, and the three subscales of depression, anxiety, and stress each contain 7 items, all of which are rated on a 4-point scale, from 0 to 3. The score of each subscale is multiplied by 2, which is the score of the subscale. The higher the score is, the more you have this emotion. The stress scores were obtained from 1, 6, 8, 11, 12, 14 and 18 items. A total score of 0-14 indicates normal, 15-18 indicates mild stress, 19-25 indicates moderate stress, 26-33 indicates severe stress, and 34-42 indicates very serious stress. The Cronbach's coefficient for this scale in this study was 0.89, and the Cronbach's coefficient for stress subscale is 0.75.

2.3. Statistical analysis

We utilized EpiData 3.1 software for data entry and SPSS 26.0 for statistical analysis. Measurement data were expressed as mean \pm standard deviation, while categorical data were conveyed as numbers of cases and proportional ratios. The t-test was used for continuous variables, and the chi-squared test was used for categorical variables to compare the differences between smoking and non-smoking groups. Spearman correlation analysis was used to examine the correlation between stress, coping style, and smoking. For multi-factor analysis, linear regression model and binary Logistic regression model were used. Statistical significance was determined at $\alpha=0.05$ with a significance level of $P<0.05$.

3. Results

3.1. General characteristics

Table 1. The characteristics of the study participants (N=2723)

Variables	All Participants n (%)	Non-smoking n (%)	Smoking n (%)	χ^2	P-value
Sex				128.08	<0.001
Man	2315 (85.0)	1463 (63.2)	852 (36.8)		
Woman	408 (15.0)	374 (91.7)	34 (8.3)		
Age (years old)				43.48	<0.001
<27	1990 (73.1)	1414 (71.1)	576 (28.9)		
≥ 27	733 (26.9)	423 (57.7)	310 (42.3)		
Area of residence				0.01	0.938
Urban	1263 (46.4)	835 (67.5)	410 (32.5)		
Rural	1460 (53.6)	984 (67.4)	476 (32.6)		
Nationality				0.34	0.559
The Han nationality	2183 (80.2)	1467 (67.2)	716 (32.8)		
Minority nationality	540 (19.8)	370 (68.5)	170 (31.5)		
Marital status				49.66	<0.001
Unmarried	2011 (73.9)	1429 (71.1)	582 (28.9)		
In marriage	620 (22.8)	364 (58.7)	256 (41.3)		
Divorced	54 (2.0)	26 (48.1)	28 (51.9)		
Widowed	38 (1.4)	18 (47.4)	20 (52.6)		
Educational level				76.54	<0.001
Junior high school and below	386 (14.2)	208 (53.9)	178 (46.1)		
Senior high school	350 (12.9)	210 (60.0)	140 (40.0)		
Junior college	410 (15.1)	254 (62.0)	156 (38.0)		
Undergraduate	1381 (50.7)	1019 (73.8)	362 (26.2)		
Postgraduate and above	196 (7.2)	146 (74.5)	50 (25.5)		
Occupation				127.97	<0.001
Student	1484 (54.5)	1126 (75.9)	358 (24.1)		
Civil servant	357 (13.1)	233 (65.3)	124 (34.7)		
Enterprise employee	420 (15.4)	248 (59.0)	172 (41.0)		
Other occupations	462 (17.0)	230 (49.8)	232 (50.2)		
Living style				77.66	<0.001
Live alone	342 (12.6)	200 (58.5)	142 (41.5)		
Live with roommates	1427 (52.4)	1061 (74.4)	366 (25.6)		
Joint tenancy	136 (5.0)	66 (48.5)	70 (51.5)		
Live with family	795 (29.2)	499 (62.8)	296 (37.2)		
Live with others	23 (0.8)	11 (47.8)	12 (52.2)		
Monthly household income (RMB)				114.40	<0.001
≤ 2000	1396 (51.3)	1052 (75.4)	344 (24.6)		
2001-5000	698 (25.6)	462 (66.2)	236 (33.8)		
5001-10000	466 (17.1)	248 (53.2)	218 (46.8)		
≥ 10001	163 (6.0)	75 (46.0)	88 (54.0)		

Table 1 shows the basic characteristics of the 2,723 participants. Among the participants, 886 (32.5%) were smokers and 1,426 (67.5%) were non-smokers. The participants had an average age of 27.13 ± 10.11 years. The majority were men (85.0%), rural dwellers (53.6%), the Han nationality (80.2%), and unmarried (73.9%). Slightly over half had a bachelor's degree (50.7%) and were students (54.5%). Approximately, 52.4% lived with roommates, and 51.3% had a monthly income below 2000 yuan. The chi-squared test showed that men, aged 27 and above, married, divorced or widowed, with a lower level of education, enterprise employee or other occupations, and with higher monthly income were more likely to smoke (All $P < 0.05$).

3.2. Prevalence of stress and coping style during the COVID-19

Table 2 shows the prevalence of stress and coping style in 2,723 participants during the COVID-19. In terms of stress, 68.6% reported normal, 8% reported mild, 10% reported moderate stress, 8.2% reported severe and 5.3% reported very severe. In terms of coping style, 17.3% reported negative coping. 26.3% reported negative positive equivalence, and 56.4% reported positive coping. The mean stress score for the total sample was 12.02 ± 10.98 , with smokers having a higher stress score than non-smokers. The mean coping style score for the total sample was 0.38 ± 0.66 , with smokers having a lower coping style score than non-smokers.

Table 2. Prevalence of stress and coping style during the COVID-19 (N=2723)

Variables	All Participants n (%) / $\bar{x} \pm S$	Non-smoking n (%) / $\bar{x} \pm S$	Smoking n (%) / $\bar{x} \pm S$	χ^2/t	P-value
Stress	12.02±10.98	10.95±10.85	14.23±10.94	-7.389	<0.001
Normal	1867 (68.6)	1329 (71.2)	538 (28.8)	61.666	<0.001
Mild	218 (8.0)	152 (69.7)	46 (30.3)		
Moderate	273 (10.0)	147 (53.8)	126 (46.2)		
Severe	222 (8.2)	114 (51.4)	108 (48.6)		
Very severe	143 (5.3)	95 (66.4)	48 (33.6)		
Coping style	0.38±0.66	0.48±0.68	0.23±0.59	8.647	<0.001
Negative coping	470 (17.3)	258 (54.9)	212 (45.1)	46.03	<0.001
Negative positive equivalence	717 (26.3)	479 (66.8)	238 (33.2)		
Positive coping	1536 (56.4)	1100 (71.6)	436 (28.4)		

3.3. Relationships between stress, coping style and smoking

As smoking was a binary variable, stress and coping style were continuous variables, and Spearman correlation analysis was used. Table 3 shows the correlation coefficients between stress, coping style and smoking. Stress was associated with coping style ($r = -0.326$, $P < 0.001$). The scores for stress ($r = 0.161$, $P < 0.001$) and coping style ($r = -0.154$, $P < 0.001$) were also related to smoking.

Table 3. Correlation among variables of the study participants in China

	Stress	Coping style	Smoking
Stress	1		
Coping style	-0.326**	1	
Smoking	0.161**	-0.154**	1

** $P < 0.001$

Other variables were controlled, coping style was the dependent variable and stress was the independent variable for linear regression analysis. Table 4 shows that participants with greater stress were more likely to choose negative coping styles ($B = -0.042$, $t = -19.319$, $P < 0.001$).

Table 4. Linear regression analysis with coping style as dependent variable

Dependent Variable	Independent Variable	B	SE	β	t	P-value
Coping style	Stress	-0.042	0.002	-0.347	-19.319	<0.001

Other variables were controlled, and a binary Logistic regression analysis was performed with smoking (non-smoking=0, smoking=1) as the dependent variable, and stress and coping style as the independent variables, respectively. Table 5 shows that participants with higher stress were more likely to smoke (OR=1.027, 95%CI:1.020~1.034, P<0.001), and participants with negative coping styles were more likely to smoke (OR=0.576, 95%CI:0.503~0.66, P<0.001).

Table 5. Logistic regression analysis with smoking as the dependent variable

Dependent Variable	Independent Variable	β	SE	Wald χ^2	aOR (95%CI)	P-value
Smoking	Stress	0.027	0.004	53.309	1.027 (1.020~1.034)	<0.001
	Coping style	-0.552	0.069	63.755	0.576 (0.503~0.660)	<0.001

4. Discussion

The results of this study show that the overall smoking rate among the population during the COVID-19 pandemic was 32.5%. Globally, smoking rates vary significantly between countries, influenced by a variety of factors including culture, socioeconomic level, regulations, and health promotion. China ranks first in the world in the number of smokers, tobacco consumption, smoking deaths, and other indicators, but the decline in smoking rate is lower than the global average, and the situation of tobacco control is not optimistic[19].

In this study, smoking rates were much higher among men than women. This may be because estrogen may inhibit women's desire to smoke to some extent, while men may be biologically more likely to develop nicotine dependence[20]. In addition, social and cultural factors also play an important role in shaping smoking behavior. In some cultures, smoking may be seen as a sign of masculinity, and this cultural perception may cause men to be more inclined to smoke[21]. In this study, smoking rates were higher among residents aged 27 and older. This may be because nicotine addiction makes older smokers more resistant to quitting, both physically and psychologically[22]. The study found that respondents with less education had higher rates of smoking, which may be because individuals with less education have lower health literacy and less awareness of the dangers of smoking, thus increasing the likelihood of smoking[23, 24]. In this study, the higher the monthly income of the respondents, the higher the smoking rate. Higher-income levels may mean more disposable income, giving individuals greater power to consume tobacco[25].

This study found that psychological stress is a risk factor for the occurrence of smoking behavior, indicating that the greater the perceived psychological pressure, the more likely to occur smoking behavior, which is more consistent with the results of previous studies[26, 27]. Nicotine is one of the main components of tobacco, it can stimulate the central nervous system, and the release of dopamine and other neurotransmitters, so people produce a sense of pleasure and relaxation, and smoking is seen as a way to cope with negative emotions such as stress. Long-term smoking may lead to nicotine addiction, making smoking a habitual choice for individuals to cope with psychological stress[28]. In addition, studies have also shown that smoking can only temporarily relieve an individual's stress, and as nicotine levels decrease, an individual's negative mood may increase, which will further increase the individual's tobacco intake to relieve stress[29].

According to the results of the 2018 Adult Tobacco survey, the adult smoking rate in China is 26.6%[30]. This study found that the smoking rate of Chinese residents was higher during the COVID-19 pandemic than before the COVID-19 pandemic, which is consistent with the results of some foreign studies[31]. The COVID-19 pandemic has exacerbated negative feelings such as depression, anxiety, and stress among residents[32]. On the one hand, during the COVID-19 pandemic, measures such as home quarantine, lockdown, and mask orders have restricted residents' freedom of movement and led to social problems such as unemployment. On the other hand, the risk of contracting COVID-19 scares some residents. In the face of stress, smokers' desire for tobacco increases, their ability to deal with smoking cessation weakens, and the amount of smoking increases[33, 34]. However, some studies have come to the opposite conclusion, with smoking becoming less frequent due to measures such as social distancing and mask bans during the COVID-19 pandemic. In addition, tobacco use increases the risk of death and disease severity in COVID-19 patients, which may also reduce smoking rates to some extent[35, 36].

It can be seen that the influencing factors of smoking are very complex. Under the same external environment, not all individuals will be affected by pressure to produce smoking behaviors, which indicates that the internal characteristics of individuals should be considered when studying individual smoking behaviors. The study found that respondents with more active coping styles had lower rates of smoking. Similar studies have reported similar results, suggesting that problem-solving coping styles may have a buffer effect between stress and smoking and that individuals who tend to adopt more positive coping styles are less likely to engage in smoking behavior[37, 38].

This study found that respondents with greater psychological stress had more negative coping styles. Studies have also shown that the higher an individual's level of psychological stress, the more likely they are to employ irrational, immature coping styles to relieve anxiety, conflict, and pain. Negative coping styles will make the individual lose other good coping abilities, can not effectively solve the problem, and make the individual feel more pressure, while the positive coping style can effectively relieve the psychological pressure brought by the individual[39]. During the COVID-19 pandemic, negative events continue, and when individuals do not have adequate resilience and coping capacity, they are more likely to suffer adverse mental and psychological consequences[40], which in turn exacerbate the abuse of substances such as tobacco. Therefore, this also suggests that in the face of major public health emergencies, tobacco control intervention treatment should not only consider improving the stress of smokers but also design more intervention methods related to coping styles.

5. Limitations

This study has several limitations. First, it was based on cross-sectional data. The results can only demonstrate association but cannot establish a causal relationship. In the future, longitudinal studies are needed to analyze the relationship between stress, coping style and smoking. Second, stress, coping style and smoking during the COVID-19 pandemic were measured by self-administered questionnaires in this study, and the results may be affected by self-report biases and recalling biases. Third, there may be other unmeasured confounding variables affecting the observed associations, despite controlling for some factors. Future studies should consider including additional potential confounders for more reliable and valid results. Lastly, this study adopts a convenient sampling method to carry out an investigation, which may be under-representative in sample selection, and there is a certain selection bias.

6. Conclusion

In conclusion, this cross-sectional study of 2,723 Guangxi residents in China shows that smoking rates have increased during the COVID-19 pandemic compared to the previous period. Individuals with higher levels of stress have a higher risk of smoking, individuals with more negative coping styles have a higher risk of smoking, and individuals with higher levels of stress have more negative coping styles. Active smoking cessation interventions are critical to improving the health and well-being of smokers during the COVID-19 pandemic. Our findings contribute key practical and theoretical insights for future tobacco control campaigns during disaster events such as public health emergencies from the perspective of stress and coping style.

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