

Preplanned Studies

The Trend of Smoking-Related Cognition and Its Association with Smoking Behaviors Among Junior High School Students — China, 2013–2021

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Summary

What is already known about this topic?

In 2013, 31.61% of students perceived quitting smoking as difficult, 61.73% considered smoking less attractive, and 73.89% believed that secondhand smoke is definitely harmful to health.

What is added by this report?

The percentage of students who perceived quitting smoking as difficult increased from 31.61% in 2013 to 38.83% in 2021, while the percentage of students who found smoking less attractive rose from 61.73% to 69.40%. Conversely, there was a decrease in the percentage of students who perceived secondhand smoke as harmful, from 73.89% to 68.46%. An increased awareness of the hazards of secondhand smoke was associated with a reduction in smoking behaviors.

What are the implications for public health practice?

It is imperative to enhance health education efforts that aim to raise awareness of the hazards of secondhand smoke.

Adolescent smoking is a significant global public health issue. Data from the 2021 China National Youth Tobacco Survey (NYTS) show that the current smoking prevalence among junior high school (JHS) students in China is 3.3%, translating to approximately 1.58 million smokers. Additionally, 12.9% of JHS students have attempted smoking, representing an estimated 6.16 million individuals (1). Early initiation of smoking contributes to adolescents' dependence on tobacco and other addictive substances while also exposing them to various health risks, including respiratory, cardiovascular, and reproductive diseases (2–3).

Smoking-related cognitions significantly influence smoking behavior. Previous studies have underscored the importance of knowledge and awareness about

smoking-related health risks in fostering behavior change (4). Evidence also indicates that students who perceive secondhand smoke as harmful are less likely to smoke (5). Conversely, students who find smoking attractive are more likely to smoke in the future (6), while those who believe smoking decreases personal attractiveness are more likely to autonomously reject smoking and secondhand smoke exposure (7). Early initiation of smoking among adolescents is associated with reduced likelihood of future cessation and increased probability of becoming regular smokers. However, there is limited research on the longitudinal development of smoking-related cognitions and their association with smoking behavior among Chinese JHS students. This study, using data from three consecutive China NYTS conducted among JHS students from 2013 to 2021, aims to characterize the temporal trends of smoking-related cognitions and assess their association with smoking behavior.

The China NYTS is a cross-sectional survey conducted by the China CDC to evaluate the prevalence of smoking and the effectiveness of tobacco control policies among JHS students in China. The survey employed a multistage stratified cluster random sampling design. Initially, 5 urban districts and 5 rural counties were selected from each of the 31 provincial-level administrative divisions (PLADs) in China using the probability proportional to the population size (PPS) sampling method. Subsequently, within each selected district or county, 3 JHSs were randomly chosen using the PPS method. Finally, one class from each grade in the sampled schools was randomly selected, and all students enrolled in the chosen classes on the survey day participated. The survey was conducted in 2013, 2019, and 2021, with participation from 155,117, 147,270, and 136,296 JHS students, respectively.

This study assessed various smoking-related cognitions derived from the China NYTS, based on the Global Youth Tobacco Survey. Specifically, it

examined difficulties in quitting smoking, perceived hazards of secondhand smoke, and smoking's attractiveness. The survey included the following questions: 1) Do you believe it is difficult to quit smoking once someone has started? 2) Do you perceive the smoke generated by other smokers as harmful to yourself? 3) Do you think that smoking makes young people appear more attractive or less attractive? Responses of "definitely hard," "definitely will," or "less attractive" indicated endorsement of the respective cognition. Additionally, smoking behavior was categorized as current smoking (having smoked in the past 30 days) and attempted smoking (having tried or experimented with smoking cigarettes, even just 1 or 2 puffs).

This study utilized complex sampling design weights to estimate point values and 95% confidence intervals (CIs). The three China NYTSs were conducted in the same PLADs, providing provincial-level representativeness and enabling the use of a province-fixed effects model. This model was applied to analyze the association between smoking-related cognitions and smoking behavior among JHS students, using data from three cross-sectional surveys while controlling for potential confounders. A *P* value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SAS (version 9.4; SAS Institute, Inc., Cary, NC, USA).

The proportion of students perceiving quitting smoking as difficult increased consistently, from 31.61% in 2013 to 34.95% in 2019 and further to 38.83% in 2021. Conversely, the proportion of students acknowledging the harmful effects of secondhand smoke on health decreased from 73.89% in 2013 to 73.71% in 2019 and further to 68.46% in 2021. Additionally, the proportion of students finding smoking less attractive showed an upward trend, rising from 61.73% in 2013 to 67.99% in 2019 and further to 69.40% in 2021 (Table 1). Non-smoking students consistently held more positive perceptions compared to smokers, and urban students consistently exhibited more favorable attitudes toward smoking than their rural counterparts from 2013 to 2021. However, the proportion of students with positive attitudes towards the difficulty of quitting smoking and the appeal of smoking decreased with increasing age during this period (Table 1).

In our analysis, we examined several control variables at the provincial level. These included the proportion of male students (the percentage of male students among the total students surveyed), the

proportion of ≥ 8 th grade students (the percentage of students in grades 7 and 8 among the total students surveyed), the proportion of students with pocket money ≤ 30 Chinese Yuan (CNY, the percentage of students with weekly pocket money less than 30 CNY among the total students surveyed), the proportion of students who witnessed teachers smoking at school, parental smoking exposure (the percentage of students with at least one smoking parent among the total students surveyed), friend smoking exposure (the percentage of students with friends who smoke among the total students surveyed), tobacco advertising exposure among JHS students (the ratio of students exposed to tobacco advertising in the past 30 days to the total students surveyed), and the population protected by smoke-free laws (the percentage of the total population in the PLAD covered by smoke-free laws, based on local government data). The results of the province-fixed effects model indicated that adolescent smoking behaviors were significantly associated with the perception of the hazards of secondhand smoke, with the coefficients of -0.138 ($P < 0.05$) for the current smoking rate and -0.286 ($P < 0.05$) for the attempted smoking rate (Table 2). Specifically, a one percent increase in secondhand smoke hazard perception was associated with a 0.138 percent decrease in the current smoking rate and a 0.286 percent decrease in the attempted smoking rate. This suggests that higher awareness of secondhand smoke hazards leads to lower smoking rates among adolescents. However, other smoking-related cognitions, such as the perceived difficulty in quitting and attraction to smoking, showed no significant association with smoking behaviors (Table 2).

DISCUSSION

This study investigated trends in smoking-related cognitions and their associations with smoking behaviors among Chinese JHS students from 2013 to 2021. During this period, there was an increase in the proportion of students who perceived quitting smoking as difficult and found smoking less attractive. Conversely, awareness of the dangers associated with smoking decreased. Additionally, the perception of secondhand smoke hazards was found to play a crucial role in smoking behaviors.

The present study demonstrates that the cognitive abilities of Chinese JHS students remain high, reflecting the continued efforts to improve education and health among youth and the establishment of

TABLE 1. Trends in smoking-related cognitions among JHS students in China, 2013–2021.

Characteristics	2019						2021					
	Difficulty in quitting smoking		Attraction to smoking		Hazard perception of secondhand smoke		Difficulty in quitting smoking		Attraction to smoking		Hazard perception of secondhand smoke	
	Unweighted n	Weighted % (95% CI)	Unweighted n	Weighted % (95% CI)	Unweighted n	Weighted % (95% CI)	Unweighted n	Weighted % (95% CI)	Unweighted n	Weighted % (95% CI)	Unweighted n	Weighted % (95% CI)
Total	48,732	(30.99, 32.23)	115,859	(73.26, 74.53)	97,202	(60.90, 62.55)	51,356	(34.33, 35.57)	101,013	(67.06, 68.93)	94,087	(67.46, 69.46)
Smoking												
Yes	1,804	(18.10, 20.40)	6,081	(62.55, 65.74)	3,375	(33.56, 36.68)	1,228	(21.77, 25.61)	1,692	(32.06, 36.00)	2,221	(46.79, 53.80)
No	45,852	(32.11, 33.36)	106,858	(74.15, 75.38)	91,708	(63.30, 64.88)	49,904	(34.85, 36.07)	98,934	(68.66, 70.34)	91,480	(68.26, 70.07)
Gender												
Boy	25,705	(30.93, 32.29)	60,710	(74.01, 75.41)	44,524	(53.25, 55.06)	28,415	(36.08, 37.52)	48,513	(61.67, 63.83)	51,337	(70.49, 72.56)
Girl	23,027	(30.80, 32.41)	55,149	(72.18, 73.76)	52,716	(69.32, 71.13)	22,941	(32.09, 33.55)	52,500	(73.14, 74.92)	42,750	(63.87, 66.01)
Age group (years)												
<13	8,848	(36.08, 37.85)	18,013	(72.02, 73.94)	16,664	(66.35, 68.60)	9,912	(41.01, 43.23)	17,252	(70.54, 73.05)	16,880	(66.27, 68.89)
13–15	29,102	(31.60, 33.05)	68,521	(73.22, 74.63)	58,072	(61.71, 63.41)	31,633	(34.21, 35.51)	63,027	(67.81, 69.52)	61,586	(67.67, 69.64)
15–17	10,519	(26.68, 28.55)	28,575	(73.50, 75.27)	21,918	(56.96, 58.54)	9,457	(28.90, 30.75)	20,080	(61.71, 65.09)	15,282	(67.00, 71.11)
≥17	247	(22.06, 27.13)	702	(65.97, 75.32)	548	(52.05, 58.68)	305	(21.60, 31.65)	569	(51.41, 62.01)	275	(40.20, 60.89)
Grade												
7th	19,911	(37.79, 39.71)	38,289	(69.97, 71.78)	33,871	(61.99, 63.98)	20,639	(41.28, 43.22)	34,005	(66.61, 69.17)	30,533	(64.64, 67.24)
8th	15,651	(29.64, 31.04)	38,295	(72.03, 73.81)	32,839	(61.17, 63.20)	16,418	(31.94, 33.55)	34,470	(68.14, 70.40)	31,018	(65.97, 68.69)
Attraction to smoking												
Unweighted	95,040	(68.47, 70.32)										
Weighted												

Continued

Characteristics	2013			2019			2021														
	Difficulty in quitting smoking		Hazard perception of secondhand smoke	Difficulty in quitting smoking		Hazard perception of secondhand smoke	Difficulty in quitting smoking		Hazard perception of secondhand smoke												
	Unweighted	Weighted, % (95% CI)	Unweighted	Unweighted	Weighted, % (95% CI)	Unweighted	Weighted, % (95% CI)	Unweighted	Weighted, % (95% CI)												
9th	13,170	(25.09, 26.59)	29,275	77.82	(77.05, 78.58)	14,299	29.28	(28.30, 30.26)	37,538	76.84	(75.65, 78.03)	16,215	35.93	(34.86, 37.01)	32,536	72.33	(71.21, 72.46)	30,673	66.95	(66.95, 69.35)	
Region																					
Eastern	12,323	(31.71, 34.34)	28,913	77.06	(76.11, 78.01)	11,332	36.96	(35.81, 38.11)	24,216	77.05	(75.54, 78.55)	12,422	40.48	(39.18, 41.78)	22,360	71.72	(70.08, 73.37)	21,718	68.72	(68.72, 71.99)	
Northern	7,480	(29.75, 33.73)	17,646	(72.23, 76.12)	(74.18, 74.49)	8,424	(32.18, 35.59)	(32.18, 35.59)	18,440	(71.40, 75.32)	(71.40, 75.32)	8,984	8.984	(37.63, 39.32)	16,139	(64.76, 68.53)	(64.76, 68.53)	16,686	(62.67, 71.21)	(62.67, 71.21)	
Central	5,982	(29.41, 31.56)	14,801	(72.89, 76.09)	(72.89, 76.09)	8,877	(34.13, 37.26)	(34.13, 37.26)	18,885	(74.34, 77.07)	(74.34, 77.07)	5,765	(37.47, 41.17)	(37.47, 41.17)	10,230	(67.16, 71.08)	(67.16, 71.08)	10,146	(67.82, 70.57)	(67.82, 70.57)	
Southern	5,088	(28.77, 32.78)	11,679	(66.06, 69.46)	(66.06, 69.46)	4,493	(31.92, 35.89)	(31.92, 35.89)	9,117	(66.19, 71.18)	(66.19, 71.18)	5,104	(36.56, 40.24)	(36.56, 40.24)	8,589	(60.63, 66.98)	(60.63, 66.98)	8,733	(64.83, 69.90)	(64.83, 69.90)	
Southwestern	8,146	(31.78, 34.90)	18,285	(71.34, 75.08)	(71.34, 75.08)	7,492	(31.78, 34.96)	(31.78, 34.96)	15,499	(73.54, 74.33)	(73.54, 74.33)	7,670	(35.50, 39.92)	(35.50, 39.92)	13,739	(61.66, 69.65)	(61.66, 69.65)	14,293	(68.21, 72.12)	(68.21, 72.12)	
Northwestern	5,174	(24.82, 27.99)	14,149	(72.26, 75.43)	(72.26, 75.43)	6,492	(31.10, 34.47)	(31.10, 34.47)	15,427	(73.54, 77.90)	(73.54, 77.90)	8,046	(36.94, 42.90)	(36.94, 42.90)	14,722	(70.05, 73.88)	(70.05, 73.88)	14,685	(70.65, 74.45)	(70.65, 74.45)	
Southeastern	4,539	(31.64, 33.64)	10,386	(72.92, 76.50)	(72.92, 76.50)	4,246	(32.59, 35.90)	(32.59, 35.90)	8,844	(70.10, 73.91)	(70.10, 73.91)	4,661	(34.84, 39.08)	(34.84, 39.08)	8,308	(63.57, 68.03)	(63.57, 68.03)	8,779	(67.83, 70.91)	(67.83, 70.91)	
Urban/Rural																					
Urban	21,993	(30.22, 31.68)	54,208	76.24	(75.38, 77.11)	27,624	36.12	(35.16, 37.07)	59,512	76.36	(75.42, 77.30)	29,969	39.83	(38.84, 40.81)	53,642	70.98	(69.84, 72.12)	53,939	(69.97, 72.97)	(69.97, 72.97)	
Rural	26,739	(31.05, 32.67)	61,651	(72.18, 73.78)	(72.18, 73.78)	23,732	(33.50, 35.07)	(33.50, 35.07)	50,916	(70.65, 73.75)	(70.65, 73.75)	22,683	37.95	(36.97, 38.94)	40,445	(64.67, 67.79)	(64.67, 67.79)	41,101	(66.41, 68.73)	(66.41, 68.73)	

Note: The total amount does not equal the sum of subgroups due to missing data. Abbreviation: JHS=Junior high school; CI=confidence interval.

TABLE 2. Association between smoking-related cognitions and smoking behaviors among JHS students in China, 2013–2021.

Variables	Current smoking rate [§]			Attempted smoking rate [¶]		
	(1)	(2)	(3)	(4)	(5)	(6)
Difficulty in quitting smoking	0.012 (0.13)			0.036 (0.19)		
Hazard perception of secondhand smoke		-0.138* (-2.45)			-0.286* (-2.55)	
Attraction to smoking			0.137 (1.70)			0.155 (0.86)
Control variable [†]	Yes	Yes	Yes	Yes	Yes	Yes
PALD effect	Control	Control	Control	Control	Control	Control
Adjusted R square	0.844	0.867	0.854	0.815	0.844	0.816
F value	67.40	41.77	55.92	35.93	42.82	39.65

Note: *t* statistics in parentheses.

Abbreviation: JHS= junior high school; PLAD=provincial-level administrative division; CNY=Chinese Yuan.

* $P < 0.05$.

[†] Control variables include a proportion of male students, ≥ 8 th grade students, students with pocket money ≤ 30 CNY, witnessing teacher smoking in school, parental smoking exposure, friend smoking exposure, tobacco advertising exposure among JHS students, and population protected by smoke-free laws.

[§] Proportion of current smokers to the total students in the survey.

[¶] Proportion of attempted smokers to the total students in the survey.

smoke-free homes and campuses in China. However, our findings show a decrease in awareness of the hazards of secondhand smoke from 2019 to 2021. This decline is likely attributed to the impact of the coronavirus disease 2019 (COVID-19) pandemic, which may have hindered the implementation of tobacco control health education initiatives and the acquisition of related knowledge among students during this period.

Smokers exhibit poorer smoking-related cognition compared to non-smokers. Research suggests that smokers may underestimate the risks associated with smoking. Additionally, adolescents with limited awareness of the dangers of secondhand smoke are more likely to take up smoking (8). From 2013 to 2021, urban students consistently demonstrated more positive smoking-related cognition than their rural counterparts. This indicates a significant tobacco cognition gap between rural and urban students, likely due to disparities in health education. To address this, increased funding for awareness and education programs in rural areas is necessary to improve tobacco cognition among rural JHS students.

The association between the perception of secondhand smoke hazards and smoking behaviors is significant and aligns with previous research (9). Adolescents knowledgeable about the harmful effects of secondhand smoke are more likely to avoid smoking

and exposure to secondhand smoke. A study in South Asia indicated that adolescents are more prone to smoking if they are not educated about its dangers at school or home (10). Contrary to prior studies (11), this research found that smoking-related cognitions — specifically that quitting is difficult and that smoking is unattractive — did not significantly influence smoking behaviors among JHS students.

This study is subject to some limitations. First, the cross-sectional design precluded establishing a causal relationship between smoking behaviors and smoking-related cognitions among JHS students. Second, the analyses did not account for potential effects arising from inconsistent time intervals across the three surveys. Third, reliance on self-reported paper questionnaires could have introduced recall bias due to misunderstandings or inaccurate responses from students. However, the large sample size likely mitigated the impact of these biases.

In conclusion, the findings indicate a high level of tobacco-related cognitions among JHS students in China. However, there is a need to enhance education on the hazards of secondhand smoke. Improving perceptions of secondhand smoke hazards can effectively decrease smoking behaviors among adolescents and safeguard their physical and mental well-being.

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