

Preplanned Studies

Smoking Behavior Among Secondary School Students — China, 2021

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Summary

What is already known about this topic?

In 2019, China CDC conducted the National Youth Tobacco Survey among secondary school students, and the prevalence rates of ever, current, and frequent smoking were 17.9%, 5.9%, and 1.8%, respectively.

What is added by this report?

The prevalence rate of cigarette use in males decreased largely from 2019 to 2021 in China, while it increased in 18 provincial-level administrative divisions (PLADs) for females. The tobacco control situation remains challenging among vocational senior high school (VSHS) students. Significant geographical disparities existed in cigarette use.

What are the implications for public health practice?

Targeted tobacco control policies aimed at VSHS students are needed, specifically those PLADs with higher smoking rates. Additionally, close attention should be paid to female smokers.

Based on the framework of the Global Youth Tobacco Survey (1), China CDC had conducted the China National Youth Tobacco Survey (NYTS) among junior high school (JHS) students in 2014 and among junior and senior high school (SHS) students [including vocational senior high school (VSHS) students] in 2019, respectively (2). Similarly, China CDC again implemented NYTS in 2021. The 2021 China NYTS was approved by the Institutional Review Board of China CDC (No. 202110). In this study, we reported smoking behaviors at the national level with ever, current, and frequent cigarette smoking from the 2021 China NYTS and compared them with 2019. We also examined provincial-level disparities in cigarette smoking in 2021 and provincial-level disparities in their change between 2019 and 2021.

With a design similar to the 2014 and 2019 China NYTS (2), a 3-stage stratified cluster random sampling was also applied in the 2021 China NYTS covering 31 provincial-level administrative divisions (PLADs) in

the mainland of China. First, 5 districts (for urban areas) and 5 counties (for rural areas) were selected in each PLAD using proportionate to population size sampling scheme (PPS). Second, 3 JHSs, 2 SHSs, and 1 VSHS within each selected district and county were selected using PPS method. Third, within selected schools, 1 class (which must include more than 40 students in each grade) was randomly selected and all of the students of the selected class were interviewed. Finally, 936 JHSs, 637 SHSs, and 254 VSHSs from 317 districts/counties participated in the survey. A total of 269,250 eligible students (136,296 JHS students, 96,852 SHS students, and 36,102 VSHS students) completed the survey, of which 138,007 were male and 131,243 were female. The overall survey response rate was 95.9%.

Throughout the investigation, we implemented strict quality control. Before the field interview, all interviewers and supervisors should be trained and tested. During the interview, the interviewers explained to the students the purpose and content of the survey, emphasizing that the survey was voluntary and anonymous, that the responses would be kept confidential, etc. Students completed the questionnaire independently without teachers present. The quality controllers checked the completeness of the finished questionnaires. After the interview, the subsequent data entry was completed by a professional company, and the entry quality (<5/10,000 error rate) was guaranteed by a sampling check. Missing data, outlier values, and logic mistakes were processed by China CDC before final utilization.

Structured paper-based questionnaires with no logical skips were used. In terms of smoking behavior, all of the participants were asked about smoking frequency, smoking amount, smoking age, etc. Ever cigarette smokers (ES) were defined as those who had smoked cigarettes in the past, even one or two puffs, and current smokers (CS) as smoking cigarettes at least 1 day during the past 30 days. Those who reported smoking cigarettes on 20 or more days in the past 30 days were frequent smokers (FS). Data were weighted

according to the complex sampling design. Prevalence estimates and their corresponding 95% confidence intervals (CI) were calculated and their difference with no overlap in CI was referred to be statistically significant between subgroups. SAS (version 9.4, SAS Institute, Inc. Cary, NC, USA) was used for all analyses.

In 2021, the ES prevalence rate among secondary school students was 16.7%, higher for males (23.2%) than for females (9.5%), higher in rural areas (18.5%) than in urban areas (14.5%), and highest among VSHS students (28.9%), followed by SHS students (18.9%), and JHS students (12.9%). Among ES, 66.1% smoked their first cigarette at 13 years old and before, with no significant difference for males and females, in urban areas and rural areas, and highest among JHS students (81.8%), followed by SHS students (60.9%), and VSHS students (44.1%) (Table 1).

In 2021, the CS prevalence rate among secondary school students was 4.7%, higher for males (7.1%) than for females (1.9%), higher in rural areas (5.3%) than in urban areas (3.9%), and highest among VSHS students (12.1%), followed by SHS students (4.2%), and JHS students (3.3%). The proportion of FS was 1.3% which means more than a quarter of CS were FS. Similar to ES and CS, the FS prevalence rate was much higher among males (2.1%) than that among females (0.3%), lowest in JHS (0.6%), followed by SHS (1.3%), and highest in VSHS (4.1%) (Table 1).

There was a wide geographical variation in the proportion of CS among PLADs, ranging from 0.9% to 13.2%. The highest CS prevalence rates were reported for Xizang (Tibet), Yunnan, and Qinghai, while the lowest CS prevalence rates were in Shanghai, Beijing, and Jiangxi. Significant provincial disparities were also present in the percentage change of CS from 2019 to 2021. The CS prevalence rate decreased in 26 of 31 PLADs, of which Beijing, Jiangxi, and Shanghai had the largest decreases, while Shandong, Anhui, Hainan, and Xizang (Tibet) had increased. For males, the rate increased only in 3 PLADs, while it increased in 18 PLADs for females (Figure 1).

DISCUSSION

Several studies indicated that nicotine addiction beginning during adolescence could be hard to quit and increase the risk of future addiction (3–4). It is effective to prevent tobacco use initiation during adolescence in mitigating and controlling the adult

tobacco epidemic. According to Wang et al., 77.9% of current smokers attempted cigarette smoking at puberty (5). In this survey, 66.1% of ever smokers tried their first cigarette at 13 years old and before.

The prevalence of current cigarette smoking among secondary school students was 4.7%, which can project that an estimated 3.68 million secondary school students currently smoke cigarettes in 2021 in China. Among JHS students aged 13–15 years, the prevalence rate of CS was 4.5% for males and 1.9% for females, which was much lower than the global level (7.9% for males, 3.5% for females) and also lower than that of the western pacific region (7.0% for males, 2.4% for females) (6).

Compared with the 2019 China NYTS, the prevalence rates of ES, CS, and FS for males in 2021 decreased by 10.8% (26.0% vs. 23.2%), 26.0% (9.6% vs. 7.1%), and 34.4% (3.2% vs. 2.1%) (2), respectively, while they were unchanged for females. These decreases in cigarette use may be partially due to the development of tobacco control interventions, such as creating smoke-free school grounds nationwide, banning smoking in school, and actively implementing health promotion and education on tobacco control (7–8). The increasing popularity of e-cigarette use might attract some young cigarette smokers to smoke e-cigarettes instead. Compared to 2019 which predated the coronavirus disease 2019 (COVID-19) pandemic, students might spend more time at home taking classes and under parental supervision in 2021, so they were likely not to smoke during the past 30 days.

Previous studies had reported that in European countries such as France and Denmark, rates of tobacco use among VSHS students were usually 1–3 times higher than those among SHS students (9–10). In this study, cigarette use was much more prevalent in VSHS students than among SHS and JHS students, with the prevalence rate of CS among VSHS students being 4 times and 3 times among JHS and SHS students and the prevalence rate of FS being 7 times and 3 times. This indicated that targeted measures of tobacco control are urgently needed to protect VSHS students from tobacco.

There were significant geographical differences in cigarette smoking across PLADs in China. The coastal and wealthier PLADs in eastern and southeastern China generally have lower CS prevalence rates than those in the southwestern and central regions, similar to the epidemiologic characteristics of tobacco use among Chinese adults. Significant provincial disparities were also present in the percentage change

TABLE 1. Smoking behavior among secondary high school students of China in 2021.

Region	Variable	Total			Junior high school			Senior high school			Vocational senior high school		
		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)		
	Both												
	Ever cigarette smokers	43,934	16.7 (15.8–17.5)	16,472	12.9 (11.9–13.8)	17,380	18.9 (17.7–20.1)	10,082	28.9 (26.4–31.3)				
	Smoking first cigarette at 13 years old and before among ever smokers	22,767	66.1 (64.6–67.6)	10,301	81.8 (79.8–83.8)	8,727	60.9 (59.4–62.3)	3,739	44.1 (41.5–46.7)				
	Current cigarette smokers	12,934	4.7 (4.3–5.0)	4,382	3.3 (2.9–3.7)	4,255	4.2 (3.7–4.7)	4,297	12.1 (10.5–13.6)				
	Frequent cigarette smokers	3,782	1.3 (1.1–1.4)	830	0.6 (0.5–0.7)	1,386	1.3 (1.1–1.5)	1,566	4.1 (3.4–4.8)				
	Males												
	Ever cigarette smokers	31,986	23.2 (22.0–24.3)	11,581	17.0 (15.7–18.3)	12,824	28.0 (26.4–29.7)	7,581	40.1 (36.8–43.4)				
	Smoking first cigarette at 13 years old and before among ever smokers	16,900	66.1 (64.3–67.8)	7,410	82.8 (81.0–84.7)	6,534	60.3 (58.4–62.1)	2,956	45.2 (42.5–47.9)				
	Current cigarette smokers	10,403	7.1 (6.6–7.7)	3,173	4.5 (3.9–5.1)	3,653	7.4 (6.5–8.3)	3,577	18.5 (16.2–20.9)				
	Frequent cigarette smokers	33,36	2.1 (1.9–2.4)	667	1.0 (0.8–1.1)	1,250	2.4 (2.1–2.7)	1,419	7.0 (5.8–8.2)				
	Females												
	Ever cigarette smokers	11,948	9.5 (8.8–10.1)	4,891	8.1 (7.4–8.8)	4,556	9.8 (8.7–10.9)	2,501	15.2 (13.8–16.5)				
	Smoking first cigarette at 13 years old and before among ever smokers	5,867	66.1 (63.9–68.4)	2,891	79.3 (76.0–82.6)	2,193	62.6 (58.9–66.4)	783	40.3 (36.3–44.3)				
	Current cigarette smokers	2,531	1.9 (1.7–2.1)	1,209	1.9 (1.6–2.2)	602	1.1 (0.9–1.3)	720	4.2 (3.5–4.9)				
	Frequent cigarette smokers	446	0.3 (0.2–0.3)	163	0.2 (0.2–0.3)	136	0.2 (0.2–0.3)	147	0.6 (0.4–0.8)				

TABLE 1. (Continued)

Region	Variable	Total		Junior high school		Senior high school		Vocational senior high school	
		Unweighted N	Weighted % (95% CI)	Unweighted N	Weighted % (95% CI)	Unweighted N	Weighted % (95% CI)	Unweighted N	Weighted % (95% CI)
	Both								
	Ever cigarette smokers	20,870	14.5 (13.6–15.5)	7,361	10.4 (9.2–11.5)	8,698	17.0 (15.7–18.3)	4,811	27.5 (24.1–31.0)
	Smoking first cigarette at 13 years old and before among ever smokers	10,685	64.5 (62.2–66.8)	4,610	83.2 (81.4–85.0)	4,307	59.9 (58.1–61.6)	1,768	42.6 (38.4–46.7)
	Current cigarette smokers	5,696	3.9 (3.5–4.4)	1,693	2.3 (1.9–2.8)	1,995	3.9 (3.3–4.5)	2,008	11.5 (9.2–13.7)
	Frequent cigarette smokers	1,794	1.2 (1.0–1.3)	359	0.5 (0.4–0.6)	678	1.3 (1.0–1.5)	757	4.0 (3.0–5.1)
	Males								
	Ever cigarette smokers	14,979	20.1 (18.7–21.4)	5,159	13.8 (12.1–15.5)	6,330	24.8 (22.8–26.8)	3,490	37.6 (32.5–42.6)
	Smoking first cigarette at 13 years old and before among ever smokers	7,859	64.8 (62.3–67.3)	3,323	84.2 (82.2–86.2)	3,168	59.2 (56.9–61.4)	1,368	44.5 (40.4–48.5)
	Current cigarette smokers	4,515	6.0 (5.4–6.6)	1,208	3.1 (2.5–3.8)	1,694	6.8 (5.6–7.9)	1,613	17.0 (13.7–20.4)
	Frequent cigarette smokers	1,581	2.0 (1.7–2.3)	294	0.7 (0.5–0.9)	608	2.4 (1.9–2.8)	679	6.9 (5.0–8.8)
	Females								
	Ever cigarette smokers	5,891	8.4 (7.8–9.1)	2,202	6.5 (5.8–7.2)	2,368	9.2 (8.3–10.1)	1,321	15.4 (13.4–17.3)
	Smoking first cigarette at 13 years old and before among ever smokers	2,826	63.5 (60.3–66.7)	1,287	80.6 (76.8–84.4)	1,139	61.8 (58.2–65.4)	400	36.6 (30.8–42.5)
	Current cigarette smokers	1,181	1.7 (1.5–1.9)	485	1.4 (1.1–1.6)	301	1.1 (0.8–1.3)	395	4.8 (3.7–6.0)
	Frequent cigarette smokers	213	0.2 (0.2–0.3)	65	0.2 (0.1–0.2)	70	0.2 (0.1–0.3)	78	0.6 (0.4–0.9)
Urban									

TABLE 1. (Continued)

Region	Variable	Total		Junior high school		Senior high school		Vocational senior high school	
		Unweighted N	Weighted % (95% CI)	Unweighted N	Weighted % (95% CI)	Unweighted N	Weighted % (95% CI)	Unweighted N	Weighted % (95% CI)
	Both								
	Ever cigarette smokers	23,064	18.5 (17.2–19.9)	9,111	15.1 (13.6–16.5)	8,682	20.6 (18.6–22.6)	5,271	30.2 (26.8–33.5)
	Smoking first cigarette at 13 years old and before among ever smokers	12,082	67.2 (65.3–69.1)	5,691	81.0 (78.1–84.0)	4,420	61.6 (59.4–63.8)	1,971	45.4 (42.3–48.5)
	Current cigarette smokers	7,238	5.3 (4.7–5.9)	2,689	4.1 (3.5–4.8)	2,260	4.5 (3.8–5.2)	2,289	12.6 (10.4–14.7)
	Frequent cigarette smokers	1,988	1.3 (1.2–1.5)	471	0.7 (0.6–0.9)	708	1.3 (1.1–1.6)	809	4.1 (3.2–5.1)
	Males								
	Ever cigarette smokers	17,007	25.9 (24.1–27.7)	6,422	19.9 (18.0–21.8)	6,494	30.9 (28.5–33.3)	4,091	42.4 (38.5–46.3)
	Smoking first cigarette at 13 years old and before among ever smokers	9,041	66.9 (64.5–69.4)	4,087	82.0 (79.4–84.6)	3,366	61.0 (58.3–63.8)	1,588	45.8 (42.3–49.4)
	Current cigarette smokers	5,888	8.2 (7.3–9.0)	1,965	5.7 (4.8–6.7)	1,959	8.0 (6.7–9.2)	1,964	19.9 (16.7–23.0)
	Frequent cigarette smokers	1,755	2.3 (2.0–2.6)	373	1.2 (0.9–1.4)	642	2.4 (2.0–2.8)	740	7.1 (5.6–8.5)
	Females								
	Ever cigarette smokers	6,057	10.4 (9.2–11.5)	2,689	9.5 (8.3–10.6)	2,188	10.4 (8.5–12.3)	1,180	15.0 (13.1–16.9)
	Smoking first cigarette at 13 years old and before among ever smokers	3,041	68.0 (64.9–71.0)	1,604	78.7 (74.0–83.3)	1,054	63.3 (57.4–69.1)	383	44.0 (39.0–49.0)
	Current cigarette smokers	1,350	2.1 (1.7–2.4)	724	2.3 (1.8–2.8)	301	1.1 (0.8–1.4)	325	3.7 (2.8–4.6)
	Frequent cigarette smokers	233	0.3 (0.2–0.4)	98	0.3 (0.2–0.3)	66	0.2 (0.1–0.4)	69	0.5 (0.3–0.8)
Rural									

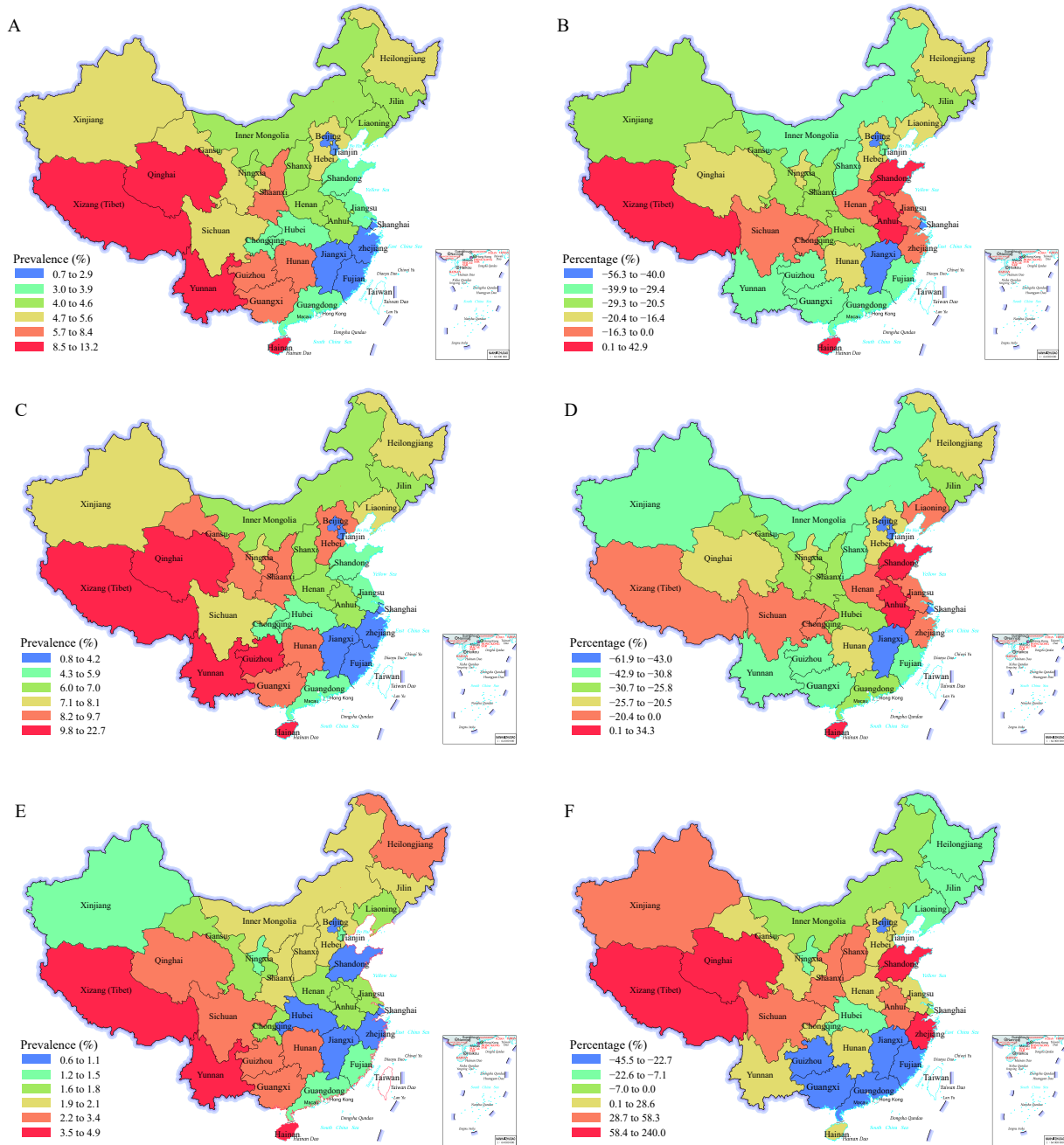


FIGURE 1. Provincial disparities in the prevalence of current cigarette smoking in 2021 and its percentage change by sex from 2019 to 2021. (A) Prevalence of current smoking for both; (B) Percentage change in prevalence of current smoking for both; (C) Prevalence of current smoking for males; (D) Percentage change in prevalence of current smoking for males; (E) Prevalence of current smoking for females; (F) Percentage change in prevalence of current smoking for females.

of CS from 2019 to 2021. Notably, the PLADs with low levels of CS prevalence, such as Shanghai, Beijing, and Jiangxi, had greater reductions, while those PLADs with high levels, such as Xizang (Tibet), Hainan, and Qinghai, decreased slowly or even increased. This suggested that developing area-tailored and enforced interventions and measures were urgent for PLADs with high prevalence of smoking on the basis of

national policies and strategies. In this study, the CS prevalence rate of males in all PLADs decreased significantly, except for Shandong, Hainan, and Anhui, while it was far less decreased among females and even increased in 18 PLADs. Given the rising trend of tobacco use among females, more attention should be paid to female smokers.

This study was subject to some limitations. The data

was collected by self-reporting which was subject to recall and reporting bias, which may lead to underreporting. In addition, the classification of urban-rural areas is based only on the name of the area with “district or QU” and “county, XIAN, MENG, or QI”, but it is consistent with most studies in China.

In conclusion, the prevalence rates of ES, CS, and FS for males decreased from 2019 to 2021 in China, while CS of females increased in 18 PLADs. Tobacco control remains challenging for VSHS. Significant regional disparities in the prevalence of cigarette use and its percentage change suggested that tailored tobacco control measures were needed for PLADs with higher smoking rates.

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REFERENCES

- World Health Organization. Global youth tobacco survey. 2022. <https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/global-youth-tobacco-survey>. [2022-5-4]
- Liu SW, Xiao L, Zeng XY, Di XB, Li XH. Tobacco use and exposure among secondary school students—China, 2019. *China CDC Wkly* 2020;2(22):385 – 93. <http://dx.doi.org/10.46234/ccdcw2020.100>.
- National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. Preventing tobacco use among youth and young adults: a report of the surgeon general. Atlanta (GA): Centers for Disease Control and Prevention (US); 2012. <https://pubmed.ncbi.nlm.nih.gov/22876391/>.
- DiFranza JR. Which interventions against the sale of tobacco to minors can be expected to reduce smoking? *Tob Control* 2012;21(4):436-42. <http://dx.doi.org/10.1136/tobaccocontrol-2011-050145>.
- Wang MH, Luo X, Xu SB, Liu WH, Ding FF, Zhang XX, et al. Trends in smoking prevalence and implication for chronic diseases in China: serial national cross-sectional surveys from 2003 to 2013. *Lancet Respir Med* 2019;7(1):35 – 45. [http://dx.doi.org/10.1016/S2213-2600\(18\)30432-6](http://dx.doi.org/10.1016/S2213-2600(18)30432-6).
- World Health Organization. WHO global report on trends in prevalence of tobacco use 2000-2025, fourth edition. Geneva: World Health Organization; 2021. <https://www.who.int/publications/i/item/9789240039322>.
- Ministry of Education and the Ministry of Health. Opinions on further strengthening tobacco control in schools. 2010. http://www.gov.cn/gzdt/2010-07/13/content_1653147.htm. [2022-5-4]. (In Chinese)
- Ministry of Education. Notice on smoking ban in schools at all levels throughout the country. 2014. http://www.moe.gov.cn/srcsite/A06/s3325/201401/t20140117_163289.html. [2022-5-4]. (In Chinese)
- Chyderiotis S, Benmarhnia T, Spilka S, Beck F, Andler R, Legleye S, et al. Why do apprentices smoke much more than high school students? Understanding educational disparities in smoking with a Oaxaca-blinder decomposition analysis. *BMC Public Health* 2020;20(1):924. <http://dx.doi.org/10.1186/s12889-020-09050-4>.
- Aho H, Koivisto AM, Paavilainen E, Joronen K. The relationship between peer relations, self-rated health and smoking behaviour in secondary vocational schools. *Nurs Open* 2019;6(3):754 – 64. <http://dx.doi.org/10.1002/nop2.260>.