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Tobacco retailers around schools in 10 cities across China

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ABSTRACT

Objective This study explored the nature and extent of tobacco product availability at retailers near junior, senior and vocational high schools in rural and urban areas in 10 cities across China, including Shanghai, Beijing, Guangzhou, Chongqing, Shenyang, Jinan, Kunming, Guilin, Kaifeng and Baiyin.

Methods Tobacco sales at 1612 retailers around 904 schools (within 100 m for urban schools and within 250 m for rural schools) were observed by trained data collectors with an online observation form in 2021. Multistage sampling with simple random sampling at each stage was used to select schools from the city district-level/rural county-level divisions. χ^2 tests and analyses of variance were used to analyse the data.

Findings Over half of urban schools (57.0%) and a large majority of rural schools (71.0%) had a cigarette retailer within a 100 m and a 250 m radius, respectively. Nearly all cigarette and electronic cigarette (e-cigarette) retailers displayed tobacco products inside. Majority of cigarette retailers (63.2%) sold flavoured cigarettes, of which 88.6% sold menthol/mint-flavoured cigarettes. Approximately half of these retailers did not display required signage prohibiting sales to minors. Overall, outcomes varied across cities and between urban and rural areas, but not by school type.

Conclusion Display of tobacco products is very prevalent near schools in 10 cities across China. In contrast, compliance with posting 'no sales to minors' signs is low. Our findings suggest that effective enforcement of prohibiting tobacco retailers around schools and stronger restrictions on tobacco displays and flavoured cigarettes and e-cigarettes are needed to protect youth in China.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The presence of tobacco retailers in school neighbourhoods and exposure to tobacco marketing and tobacco product display at retailers are associated with susceptibility to smoking and smoking initiation among adolescents.
⇒ Studies in urban areas of developed cities in China observed a high density of tobacco retailers and tobacco product displays at retailers near schools.

WHAT THIS STUDY ADDS

⇒ This study observed an overall high density of cigarette retailers and pervasive tobacco product displays at retailers in school neighbourhoods in both urban and rural areas and a variation in these outcomes across cities.
⇒ More e-cigarette retailers were found near urban schools in economically developed cities and a majority sold fruit-flavoured and menthol-flavoured e-cigarettes.
⇒ It is also concerning that half of tobacco retailers did not display the required 'no sales to minors' sign.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE AND/OR POLICY

⇒ Specifying a distance within which tobacco sales are prohibited around schools in the laws and regulations, effective enforcement of existing regulations banning tobacco sales near schools and display of "no sales to minors" signage, and new regulations to limit tobacco displays and cigarette and e-cigarette flavors are needed to protect youth in China.

INTRODUCTION

According to the Chinese Center for Disease Control and Prevention's (CDC) national tobacco survey in 2019, 3.9% of junior high school students (typically aged 13–15 years), 5.6% of senior high school students (typically aged 16–18 years) and 14.7% of vocational high school students (typically aged 16–18 years) currently smoke cigarettes.[1] Cigarette smoking rates among Chinese adolescents vary significantly by region, with higher smoking prevalence found among students from the southwest compared with other regions.[1] Although cigarette smoking rates among junior high school students decreased from 5.9% to 3.9% from 2014 to 2019, use of electronic cigarettes (e-cigarettes) among junior high schoolers increased from 1.2% to 2.7%.[1]

People who initiate tobacco use at an early age are more likely to regularly smoke in adulthood.[2] The presence of tobacco retailers around schools and the number of tobacco retailers passed on the way to school are associated with increased receptivity to tobacco marketing and tobacco use rates among youth.[3–6] A 2019 survey conducted by China CDC found 48.9% of junior high school students, 46.7% of vocational senior high school students and 42.0% of senior high school students were exposed to tobacco advertisements at retail stores.[1] Exposure to tobacco marketing may lead to positive attitudes about tobacco and normalising tobacco use behaviours.[7] Several studies also showed that tobacco display at points-of-sale (POS) was associated with susceptibility to smoking and/or smoking initiation,[8–11] and awareness of e-cigarette displays at POS was associated with e-cigarette use among adolescents.[12]

Banning tobacco sales around primary or secondary schools and prohibiting tobacco marketing at POS have been shown to reduce tobacco brand awareness among youth, smoking initiation and smoking prevalence.[13] Existing studies that explored tobacco retailers around schools and tobacco marketing at these retailers were mainly conducted in high-income countries and noted that advertising strategies varied according to location.[14 15] Very few studies have been conducted in China to observe tobacco product availability near schools and all of them focused on urban areas of highly developed cities, such as Beijing, Hangzhou and Changsha.[16–18] The 2008 China tobacco control report showed that there were on average two tobacco retailers around schools in Beijing.[17] Gong *et al*[17] found that 80% of schools in Hangzhou had at least one tobacco retailer within a 100 m radius. Wang *et al*[18] studied compliance with zoning regulations banning tobacco sales near schools in Changsha and found that on average there were three tobacco retailers within 100 m of schools.

Little is known about tobacco retailers near schools in cities across China with a range of geographical location, economic development and population size. This study explored tobacco retailers near junior, senior and vocational high schools in both urban and rural areas of Chinese cities and addressed three research questions. (1) What is the density of cigarette and e-cigarette retailers near junior, senior and vocational high schools in districts (ie, urban) and counties (ie, rural) of cities across China? (2) What are the types of cigarette and e-cigarette flavours that are available at these retailers? (3) What is the nature and extent of cigarette and e-cigarette advertisements at these retailers? Also, we examined whether these outcomes differ by location (urban vs rural), geographical region, economic development level and school type. Findings of this study can provide evidence to inform the development, implementation and enforcement of Chinese tobacco control laws at both local and national levels to protect Chinese youth from cigarette and e-cigarette marketing in their school neighbourhoods.

METHODS

This study used the Strengthening the Reporting of Observational Studies in Epidemiology cross-sectional reporting guidelines.[19]

Study setting

We conducted this study in 10 cities across China, including Shanghai, Beijing, Guangzhou, Chongqing, Shenyang, Jinan, Kunming, Guilin, Kaifeng and Baiyin, in March 2021. These cities were purposefully chosen with consideration of geographical location, population size and level of economic development as measured by gross domestic product per capita. Further, to assess any differences in marketing strategies in urban and rural areas, we visited districts in urban areas and counties in rural areas as defined in the Chinese Statistical Yearbook.[20] Three cities (Shanghai, Beijing and Guangzhou) do not have any rural counties. The remaining seven cities have both urban city districts and rural counties. The list of districts and counties was retrieved from the administrative-level code published by the National Bureau of Statistics of the People's Republic of China.

Sample selection

Multistage sampling with simple random sampling at each stage was used to select schools from the city district-level/rural county-level divisions in 10 selected cities (figure 1). We first randomly selected districts and counties from 10 cities; then, from the selected districts and counties, junior high schools,

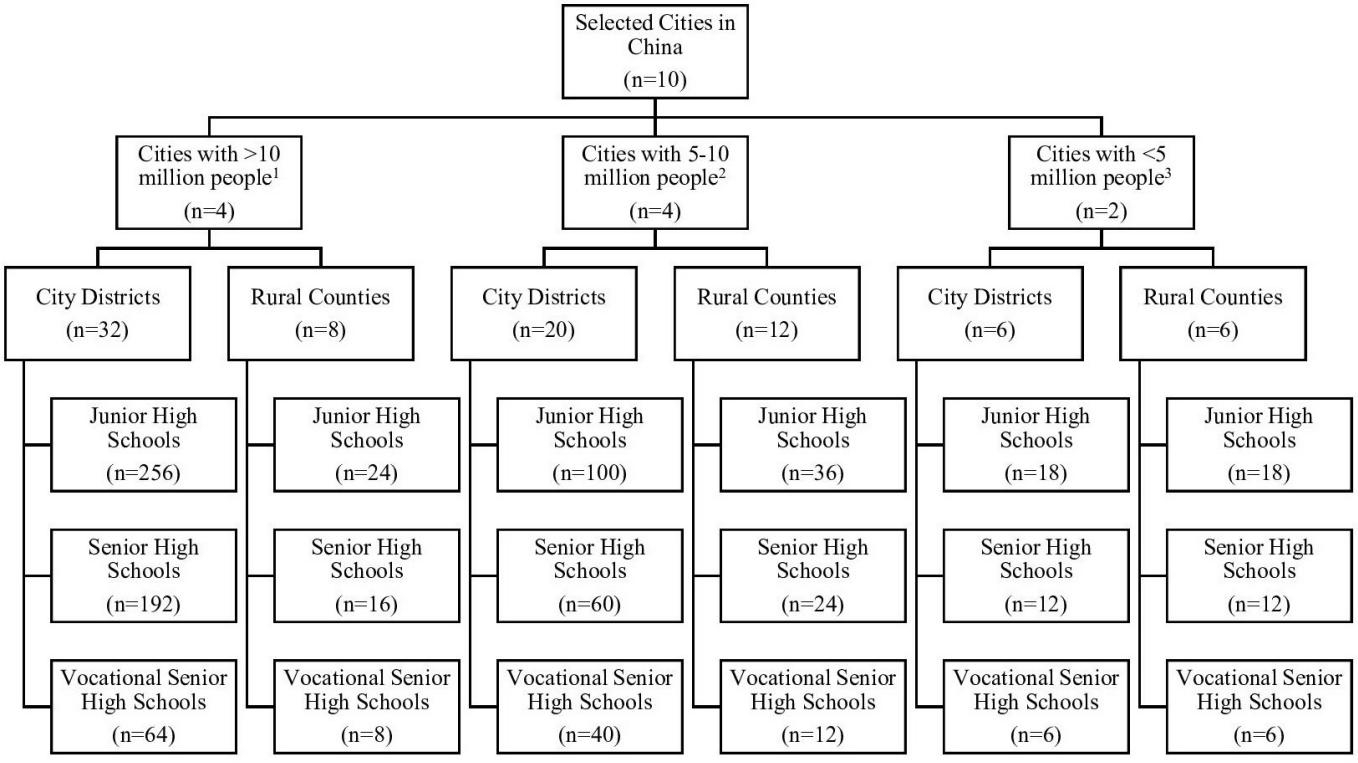

Figure 1 Multistage Sampling with Simple Random Sampling. [1]The four cities with >10 million people are Shanghai, Beijing, Guangzhou, and Chongqing; [2]The four cities with 5-10 million people are Shenyang, Jinan, Kunming, Guilin; and 3 The two cities with <5 million people are Kaifeng and Baiyin.

senior high schools and vocational senior high schools were randomly chosen. The number of city districts, rural counties and schools selected per city was based on its population (figure 1). If there were not enough rural counties, schools per city district or rural county, counties from other cities or schools from other districts or counties that share similar characteristics were added to the sample.

In total, we selected 904 schools (urban: 748; rural: 156), including 452 junior high schools, 316 senior high schools and 136 vocational senior high schools. The sampling ensured that each analysis group (eg, junior, senior and vocational senior high school) had a minimum of 53 schools to achieve statistical power at 0.8 (α=0.05) for an effect size of 0.25 using analysis of variance (ANOVA) to test the difference in tobacco retailer density.

Data collection protocol

An online mapping application (ie, Baidu Map app) along with a walking protocol was used to locate various types of retailers (including supermarket, hypermarket, tobacco and alcohol specialty store, vape shop, convenience store/mini mart, independent small grocer, and shopping mall) that may sell tobacco products within a 100 m and 250 m radius from the front entrance of selected urban and rural schools, respectively. The distances were chosen with consideration of the population and commercial density and whether POS were less than a 5 min walk from schools. A global positioning system application was used to record geographical coordinates of the retailers. Data collectors conducted the work in pairs and accessed the online form through a link to complete the observation checklist (online supplemental appendix 1). One-day online training and 2-day infield practice were provided to all data collectors before data collection. Sixty-four selected schools did not exist, changed school type or moved. The substituted schools were randomly selected from the pool of schools with similar characteristics (ie, school type, location).

Measures

The observation form was designed to collect data regarding (1) retailer features (ie, store name, address, geographical coordinates and store type); (2) availability and characteristics of tobacco products (ie, type of tobacco product: cigarettes, e-cigarettes, and tobacco products besides cigarettes and e-cigarettes, such as cigars, hookah, chewed tobacco products, etc; and flavour of cigarettes and e-cigarettes); (3) tobacco product displays (ie, outside and inside display, including display in the cashier zone, on a power wall, and within 30 cm of candy, beverages or snacks) and advertisements (including print signage apart from a product display, print signage as part of a product display, electronically illuminated tobacco product advertisements, three-dimensional signage and others, including advertisement on television, tobacco company branding, etc); and (4) display of 'no sales to minors' sign in a visible way outside and inside retailers as required by law.

Furthermore, tobacco retailer distribution around schools was measured by (1) percentage of schools having tobacco retailer(s) around and (2) the density of tobacco retailer(s) (ie, number of retailers within 100 m of urban and 250 m of rural schools).

Statistical analysis

Statistical analyses were performed using SPSS for Windows V.27.0. Descriptive statistics, including mean and SD or frequency distributions, were used to describe the study sample and variables. ANOVA models were conducted to analyse the differences in tobacco retailer density in relation to school type, city, geographical location and level of economic development. Tukey's honest significant difference test was used as a post-hoc test to detect significant differences in tobacco retailer density between various groups. In addition, χ^2 tests were used to test differences between groups with various types of schools, cities, geographical locations and levels of economic development with respect to availability and flavours of tobacco products, tobacco display, advertisements and display of 'no sales to minors' signage. For each analysis, a two-sided $p<0.05$ was used to determine statistical significance. There were no missing data in this study.

RESULTS

Sample

In total, we visited 1775 retailers near 904 selected schools in urban and rural areas of 10 Chinese cities in 2021. Over 90% of stores sold cigarettes (n=1612) and 3.4% sold e-cigarettes (n=60).

Tobacco retailers around schools

In urban areas, over half of schools (57.0%) had a cigarette retailer (on average, 1.46 retailers) and 5.7% had an e-cigarette retailer (on average, 0.07 retailers) within 100 m (table 1). In rural areas, 71.0% of schools had a cigarette retailer (on average, 3.55 retailers) and 1.9% had an e-cigarette retailer (on average, 0.03 retailers) within 250 m. No significant difference was found by school type. Urban schools in Chongqing (on average, 2.36 retailers) in southwest and Shenyang (on average, 2.22 retailers) in north China were more likely than schools in other cities to have a cigarette retailer nearby ($p<0.001$). Approximately one in ten schools (10.9%) in Guangzhou in south China had an e-cigarette retailer nearby, which is more than the other cities ($p<0.05$). There was no e-cigarette retailer around selected schools in Shenyang, Kunming and Baiyin.

Availability and characteristics of tobacco products

Among 1612 retailers that sold cigarettes, 63.2% sold flavoured cigarettes (n=1019), of which menthol/mint (88.6%) and capsule (55.6%) were the two most commonly available cigarette flavours (table 2). Approximately one-tenth of retailers that sold capsule cigarettes had Chinese culture-focused capsule flavours (eg, Pericarpium Citri Reticulatae (chenpi), fritillary and loquat). A significantly greater percentage of cigarette retailers in urban areas (66.7%) sold flavoured cigarettes than retailers in rural areas (56.0%) ($p<0.001$). Cigarette retailers in northern China (ie, 93.5% in Beijing and 92.6% in Shenyang) were more likely to sell flavoured cigarettes than retailers in south China (ie, 36.6% Guangzhou) ($p<0.001$). Among the 60 e-cigarette retailers, a majority sold fruit-flavoured (86.7%) and menthol-flavoured (70.0%) e-cigarettes. There was no significant difference regarding availability and characteristics of tobacco products between junior high, senior high and vocational high schools.

Tobacco product displays and advertising

Nearly all cigarette retailers (97.1%) and e-cigarette retailers (86.7%) displayed tobacco products inside the stores, and 41.6% of cigarette retailers and 15.0% of e-cigarette retail stores displayed tobacco products in a way that was visible from the outside of the stores (tables 3 and 4). More than half of stores displayed tobacco products at the cashier area (cigarette retailer: 57.1%; e-cigarette retailer: 61.7%). Cigarette retailers near rural

Table 1 Retailers around schools that sell tobacco products, by city, school type and city characteristics

	Urban area (tobacco retailers within a 100 m radius of schools)							Rural area (tobacco retailers within a 250 m radius of schools)						
		Cigarette retailers			E-cigarette retailers				Cigarette retailers			E-cigarette retailers		
	Schools (n)	n	%*	M (SD)†	n	%*	M (SD)†	Schools (n)	n	%*	M (SD)†	n	%*	M (SD)†
Total	749	1092	57.0	1.46 (1.99)	56	5.7	0.07 (0.35)	155	520	71.0	3.55 (3.94)	4	1.9	0.03 (0.20)
By city														
Shanghai	128	141	53.1	1.10 (1.42)	12	7.8	0.09 (0.34)	–	–	–	–	–	–	
Beijing	128	107	41.4	0.84 (1.20)	3	2.3	0.02 (0.15)	–	–	–	–	–	–	
Guangzhou, Guangdong	128	194	57.0	1.52 (1.88)	18	10.9	0.14 (0.45)	–	–	–	–	–	–	
Chongqing	128	302	72.7	2.36 (2.92)	16	7.0	0.13 (0.58)	48	287	83.3	5.98 (5.08)	4	6.3	0.08 (0.35)
Shenyang, Liaoning	50	111	74.0	2.22 (2.19)	0	–	–	12	24	83.3	2.00 (1.13)	0	–	–
Jinan, Shandong	51	71	60.8	1.39 (1.70)	2	3.9	0.04 (0.20)	10	39	90.0	3.90 (2.64)	0	–	–
Kunming, Yunnan	51	91	62.7	1.78 (2.31)	0	–	–	25	70	64.0	2.80 (3.49)	0	–	–
Guilin, Guangxi	49	36	44.9	0.73 (0.93)	4	8.2	0.08 (0.28)	24	24	50.0	1.00 (1.29)	0	–	–
Kaifeng, Henan	24	33	58.3	1.38 (1.38)	1	4.2	0.04 (0.20)	18	49	77.8	2.72 (2.95)	0	–	–
Baiyin, Gansu	12	6	33.3	0.50 (0.80)	0	–	–	18	27	50.0	1.50 (1.89)	0	–	–
ANOVA (p value)	–	–	<0.001	<0.001	–	N/A	N/A	–	–	0.01	<0.001	–	N/A	N/A
By school type														
Junior high schools	374	521	54.8	1.39 (2.06)	23	5.3	0.06 (0.28)	78	252	67.9	3.23 (4.11)	2	1.3	0.03 (0.23)
Senior high schools	264	404	58.7	1.53 (1.96)	25	6.4	0.09 (0.45)	52	193	75.0	3.71 (4.07)	1	1.9	0.02 (0.14)
Vocational senior high schools	111	176	60.4	1.50 (1.79)	6	5.4	0.07 (0.32)	25	75	72.0	3.00 (3.12)	1	4.0	0.04 (0.20)
ANOVA (p value)	–	–	0.46	0.67	–	0.83	0.51	–	–	0.68	0.71	–	N/A	N/A
By geographical location														
Central (Kaifeng)	24	33	58.3	1.38 (1.38)	1	4.2	0.04 (0.20)	18	42	77.8	2.72 (2.95)	0	0.0	0
East (Shanghai, Jinan)	179	212	55.3	1.18 (1.50)	14	6.7	0.08 (0.31)	10	39	90.0	3.90 (2.64)	0	0.0	0
North (Beijing)	128	107	41.4	0.84 (1.20)	3	2.3	0.02 (0.15)	–	–		–	–	–	–
Northeast (Shenyang)	50	111	74.0	2.22 (2.19)	0	–	–	12	24	83.3	2.00 (1.13)	0	–	–
Northwest (Baiyin)	12	6	33.3	0.50 (0.80)	0	–	–	18	27	50.0	1.50 (1.89)	–	–	–
South (Guangzhou)	128	194	57.0	1.52 (1.88)	18	10.9	0.14 (0.45)	–	–		–	0	–	–
Southwest (Chongqing, Kunming, Guilin)	228	429	64.5	1.88 (2.56)	20	5.7	0.09 (0.45)	97	381	70.1	3.93 (4.54)	4	3.1	0.04 (0.25)
ANOVA (p value)	–	–	<0.001	<0.001	–	N/A	N/A	–	–	0.14	0.09	–	N/A	N/A
By city population														
<5 million people (Kaifeng, Baiyin)	36	39	50.0	1.08 (1.27)	1	2.8	0.03 (0.17)	36	115	63.9	2.11 (2.52)	0	–	–
5–10 million people (Shenyang, Jinan, Kunming, Guilin)	201	309	60.7	1.54 (1.93)	6	3.0	0.03 (0.17)	71	466	66.2	2.21 (2.62)	0	–	–
>10 million people (Shanghai, Beijing, Guangzhou, Chongqing)	512	744	56.1	1.45 (2.05)	49	7.0	0.10 (0.41)	48	1031	83.3	5.98 (5.08)	4	6.3	0.08 (0.35)
ANOVA (p value)	–	–	0.36	0.45	–	N/A	N/A	–	–	0.07	<0.001	–	N/A	N/A
By economic development type														
Less developed cities (Chongqing, Shenyang, Kunming, Guilin, Kaifeng, Baiyin)	314	579	64.3	1.84 (2.40)	21	4.5	0.07 (0.39)	145	450	69.7	3.32 (4.02)	4	2.1	0.03 (0.20)
Developed cities (Shanghai, Beijing, Guangzhou, Jinan)	435	513	51.7	1.18 (1.57)	35	6.7	0.08 (0.33)	10	70	90.0	3.90 (2.64)	0	–	–
t-test (p value)	–	–	<0.001	<0.001	–	0.20	0.61	–	–	0.17	0.65	–	N/A	N/A

*Percentage of schools with cigarette/e-cigarette retailers within 100m of urban schools or within 250m of rural schools.
†Average number of cigarette/e-cigarette retailers within 100m of urban schools or within 250m of rural schools.
ANOVA, analysis of variance; e-cigarette, electronic cigarette; N/A, not applicable.

Table 2 Characteristics of tobacco products sold near schools, by city, school type and city characteristics

	Cigarette retailers selling flavoured products				E-cigarette retailers selling flavoured products*					
	n	Flavoured products (%)	Menthol/mint† (%)	Capsule beads† (%)	n	Fruit (%)	Menthol (%)	Food/beverage (%)	Candy (%)	Tobacco (%)
Total	1612	63.2	88.6	55.6	60	86.7	70.0	50.0	35.0	13.3
By city										
Shanghai	141	84.4	99.2	69.7	12	100.0	91.7	66.7	33.3	16.7
Beijing	107	93.5	99.0	27.0	3	100.0	66.7	0.0	0.0	0.0
Guangzhou, Guangdong	194	36.6	97.2	29.6	18	83.3	44.4	94.4	72.2	16.7
Chongqing	589	53.1	71.2	76.0	20	75.0	75.0	10.0	10.0	10.0
Shenyang, Liaoning	135	92.6	99.2	24.8	–	–	–	–	–	–
Jinan, Shandong	110	92.7	89.2	83.3	2	100.0	100.0	0.0	100.0	0.0
Kunming, Yunnan	161	41.6	100.0	7.5	–	–	–	–	–	–
Guilin, Guangxi	60	43.3	76.9	57.7	4	100.0	100.0	75.0	0.0	25.0
Kaifeng, Henan	82	81.7	94.0	91.0	1	100.0	0.0	0.0	0.0	0.0
Baiyin, Gansu	33	87.9	100.0	3.4	–	–	–	–	–	–
χ^2 (p value)	–	<0.001	<0.001	<0.001	–	N/A	N/A	N/A	N/A	N/A
By urban/rural										
Urban (0–100 m)	1092	66.7	88.9	52.5	56	87.5	67.9	53.6	35.7	14.3
Rural (0–250 m)	520	56.0	88.0	63.6	4	75.0	100.0	0.0	25.0	0.0
χ^2 (p value)	–	<0.001	0.68	0.02	–	0.48	0.18	0.04	0.66	0.42
By school type										
Junior high schools	773	61.3	89.2	53.8	25	88.0	68.0	48.0	44.0	12.0
Senior high schools	597	64.0	88.5	58.4	26	84.6	69.2	50.0	30.8	11.5
Vocational senior high schools	242	67.4	87.1	54.6	9	88.9	77.8	55.6	22.2	22.2
χ^2 (p value)	–	0.54	0.77	0.17	–	0.92	0.86	0.93	0.42	0.70
By geographical location										
Central (Kaifeng)	82	81.7	94.0	91.0	1	100.0	0.0	0.0	0.0	0.0
East (Shanghai, Jinan)	251	88.0	94.6	76.0	14	100.0	92.9	57.1	42.9	14.3
North (Beijing)	107	93.5	99.0	27.0	3	100.0	66.7	0.0	0.0	0.0
Northeast (Shenyang)	135	92.6	99.2	24.8	–	–	–	–	–	–
Northwest (Baiyin)	33	87.9	100.0	3.4	–	–	–	–	–	–
South (Guangzhou)	194	36.6	97.2	29.6	18	83.3	44.4	94.4	72.2	16.7
Southwest (Chongqing, Kunming, Guilin)	810	50.1	76.4	63.5	24	79.2	79.2	20.8	8.3	12.5
χ^2 (p value)	–	<0.001	<0.001	<0.001	–	N/A	N/A	N/A	N/A	N/A
By city population										
<5 million people (Kaifeng, Baiyin)	115	83.5	95.8	64.6	1	100.0	0.0	0.0	0.0	0.0
5–10 million people (Shenyang, Jinan, Kunming, Guilin)	466	68.7	94.4	42.5	6	100.0	100.0	50.0	33.3	16.7
>10 million people (Shanghai, Beijing, Guangzhou, Chongqing)	1031	58.5%	84.4	61.2	53	84.9	67.9	50.9	35.8	13.2
χ^2 (p value)	–	<0.001	<0.001	0.05	–	N/A	N/A	N/A	N/A	N/A
By economic development type										
Less developed cities (Chongqing, Shenyang, Kunming, Guilin, Kaifeng, Baiyin)	1060	59.2	83.9	56.0	25	80.0	76.0	20.0	8.0	12.0
Developed cities (Shanghai, Beijing, Guangzhou, Jinan)	552	71.0	96.2	55.1	35	91.4	65.7	71.4	54.3	14.3
χ^2 (p value)	–	<0.001	<0.001	<0.001	–	0.20	0.39	<0.001	<0.001	0.80

*Examples of flavours are fruits: mango, orange, banana, etc; food: cookie, chips, yoghurt, green tea, etc; and candy: chocolate, bubblegum, etc.
†Percentage of retailers selling flavoured cigarettes.
N/A, not applicable.

Table 3 Exterior and interior display and advertising features at cigarette retailers, by city, school type and city characteristics

			Display inside (%)				Ads (%)			
	n	Display outside (%)	Inside display	Cashier area	Power wall*	Within 30 cm from sweets, drinks or snacks	Inside display	Cashier area	Ads inside	CNTC branding
Total	1612	41.6	97.1	57.1	57.9	41.0	9.5	3.8	7.8	1.1
By city										
Shanghai	141	20.6	98.6	60.3	89.4	43.3	29.8	8.5	27.7	2.1
Beijing	107	5.6	91.6	23.4	77.6	9.3	5.6	3.7	1.9	–
Guangzhou, Guangdong	194	24.2	96.4	32.0	89.2	8.2	5.7	3.6	2.6	1.5
Chongqing	589	79.6	99.0	71.6	27.2	64.5	2.4	1.9	1.4	2.1
Shenyang, Liaoning	135	0.7	100.0	12.6	79.3	8.1	8.9	5.9	6.7	0.7
Jinan, Shandong	110	19.1	98.2	60.9	76.4	59.1	26.4	4.5	25.5	1.8
Kunming, Yunnan	161	29.8	90.7	72.7	74.5	15.5	8.7	5.0	7.5	–
Guilin, Guangxi	60	68.3	93.3	85.0	45.0	21.7	16.7	8.3	16.7	0.0
Kaifeng, Henan	82	8.5	98.8	86.6	47.6	75.6	18.3	4.9	15.9	15.2
Baiyin, Gansu	33	3.0	100.0	12.1	45.5	54.5	0.0	0.0	0.0	–
χ^2 (p value)	–	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
By urban/rural										
Urban (0–100 m)	1092	34.4	96.7	53.0	65.8	35.7	8.7	3.3	7.2	2.4
Rural (0–250 m)	520	56.5	98.1	65.8	41.3	52.1	11.2	5.0	9.0	1.7
χ^2 (p value)	–	<0.001	0.12	<0.001	<0.001	<0.001	0.12	0.10	0.21	0.11
By school type										
Junior high schools	773	41.9	96.4	54.3	59.6	38.4	10.1	5.0	8.0	0.8
Senior high schools	593	42.5	97.7	59.5	54.1	42.7	8.4	3.4	7.1	1.3
Vocational senior high schools	246	38.0	98.3	60.3	62.0	45.0	10.2	2.4	8.9	1.2
χ^2 (p value)	–	0.47	0.18	0.17	0.03	0.17	0.54	0.12	0.63	0.84
By geographical location										
Central (Kaifeng)	82	8.5	98.8	86.6	47.6	75.6	18.3	4.9	15.9	6.1
East (Shanghai, Jinan)	251	19.9	98.4	60.6	83.7	50.2	28.3	6.8	26.7	1.6
North (Beijing)	107	5.6	91.6	23.4	77.6	9.3	5.6	3.7	1.9	–
Northeast (Shenyang)	135	0.7	100.0	12.6	79.3	8.1	8.9	5.9	6.7	0.7
Northwest (Baiyin)	33	3.0	100.0	12.1	45.5	54.5	0.0	0.0	0.0	–
South (Guangzhou)	194	24.2	96.4	32.0	89.2	8.2	5.7	3.6	2.6	1.5
Southwest (Chongqing, Kunming, Guilin)	810	68.9	96.9	72.8	37.9	51.6	4.7	3.1	3.7	0.5
χ^2 (p value)		<0.001	<0.01	<0.001	<0.001	<0.001	<0.001	0.14	<0.001	<0.001
By city population										
<5 million people (Kaifeng, Baiyin)	115	7.0	99.1	65.2	47.0	69.6	13.0	3.5	11.3	4.3
5–10 million people (Shenyang, Jinan, Kunming, Guilin)	466	23.8	95.5	54.1	72.5	24.5	13.9	5.6	12.7	0.4
>10 million people (Shanghai, Beijing, Guangzhou, Chongqing)	1031	53.4	97.7	57.6	52.6	45.3	7.1	3.1	5.2	1.0

Continued

Table 3 Continued

	n	Display outside (%)	Display inside (%)				Ads (%)			
			Inside display	Cashier area	Power wall*	Within 30 cm from sweets, drinks or snacks	Inside display	Cashier area	Ads inside	CNTC branding
χ^2 (p value)		<0.001	0.03	<0.001	<0.001	<0.001	<0.001	0.07	<0.001	0.11
By economic development type										
Less developed cities (Chongqing, Shenyang, Kunming, Guilin, Kaifeng, Baiyin)	1060	53.5	97.5	64.3	44.2	48.0	8.3	3.4	4.9	0.9
Developed cities (Shanghai, Beijing, Guangzhou, Jinan)	552	18.7	96.4	43.3	84.4	27.5	11.8	4.7	13.4	1.3
χ^2 (p value)		<0.001	0.18	<0.001	<0.001	<0.001	<0.001	0.19	<0.001	<0.001

*Power wall is a prominent, concentrated display of tobacco products that visually attract consumers.
CNTC, China National Tobacco Corporation.

schools were more likely to display tobacco products in a visible way outside the store than retailers near urban schools (56.5% vs 34.4%, p<0.001). Greater percentage of retailers near schools in southwest (68.9%) and in less developed cities (53.5%) displayed cigarette products visible outside compared with their counterparts (p<0.001). Nearly 80% of stores in Chongqing (79.6%) displayed cigarettes visibly from the outside, significantly higher than the other cities (p<0.001).

Approximately one in ten cigarette retailers had tobacco advertising. The main form of advertising observed was printed advertisement. Over a quarter of cigarette retailers in Shanghai (27.7%) and Jinan (25.5%) had tobacco advertisements inside stores, significantly greater than the other cities (p<0.001). A significantly greater percentage of retailers near schools in developed cities had cigarette advertisements inside stores than their counterparts (13.4% vs 4.9%, p<0.001). No significant difference was found with regard to tobacco marketing by school type.

Display of 'no sales to minors' signage

About half of tobacco retailers displayed the required 'no sales to minors' sign either inside or outside the store (table 5). Cigarette retailers near urban schools were more likely to display this signage than those near rural schools (53.8% vs 42.3%, p<0.001). Among all cities, Beijing (80.4%) had the highest and Kunming (16.1%) had the lowest percentage of cigarette retailers compliant with the regulation of posting 'no sales to minors' signage either inside or outside the store (p<0.001). Significantly greater percentage of cigarette retailers and significantly lower percentage of e-cigarette retailers in developed cities displayed 'no sales to minors' signage compared with retailers in less developed cities (56.7% vs 46.7%, 37.1% vs 68.0%, respectively) (p<0.05).

DISCUSSION

To the best of our knowledge, this is the first study that has observed tobacco retailers located around both urban and rural schools and the availability of tobacco products at these retailers in cities across China that have various characteristics with regard to geographical location, economic development level and population size. Over one in two urban schools (57.1%) had at least one cigarette retailer within a 100 m radius and over 70% rural schools had at least one cigarette retailer within a 250 m radius. Approximately half of tobacco retailers around schools did not display the 'no sales to minors' sign. Students were exposed to various levels of tobacco marketing across cities with respect to tobacco retailer density in school neighbourhood, tobacco display and advertisements, and display of tobacco control signage.

Our findings suggest that tobacco retailer density was higher in China (on average, 1.46 retailers within 100 m of an urban school; 3.55 retailers within 250 m of a rural school) compared with high-income countries. In the USA, one study reported an average of 0.4 and 1.5 tobacco retailers within 305 m (1000 feet) of a school in Missouri and New York State, respectively.[21] In Canada, the average number of tobacco retailers within 1000 m of a school was 2.68 per school.[10] In New Zealand, about half of schools had at least one tobacco retailer within a 500 m radius.[22] The corresponding figures from previous studies for cities in China, such as Hangzhou (over 80% of schools had at least one tobacco retailer within a 100 m radius) and Changsha (about three tobacco retailers within 100 m of a school), are slightly higher than our results.[17 18] Greater density of tobacco retailers was associated with greater exposure to tobacco marketing at

Table 4 Exterior and interior display and advertising features at e-cigarette retailers, by city, school type and city characteristics

			Display inside (%)				Ads (%)		
	n	Display outside (%)	Inside display	Cashier area	Power wall	Within 30 cm from sweets, drinks or snacks	Any ad inside or outside	Ads outside	Ads inside
Total	60	15.0	86.7	61.7	33.3	31.7	10.0	3.3	10.0
By city									
Shanghai	12	8.3	58.3	33.3	33.3	33.3	16.7	0.0	16.7
Beijing	3	0.0	100.0	0.0	33.3	33.3	33.3	0.0	33.3
Guangzhou, Guangdong	18	5.6	94.4	83.3	33.3	33.3	11.1	11.1	11.1
Chongqing	20	25.0	95.0	80.0	25.0	35.0	5.0	0.0	5.0
Shenyang, Liaoning	–	–	–	–	–	–	–	–	–
Jinan, Shandong	2	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0
Kunming, Yunnan	–	–	–	–	–	–	–	–	–
Guilin, Guangxi	4	50.0	75.0	50.0	50.0	25.0	0.0	0.0	0.0
Kaifeng, Henan	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Baiyin, Gansu	–	–	–	–	–	–	–	–	–
χ^2 (p value)	–	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
By urban/rural									
Urban (0–100 m)	56	16.1	85.7	58.9	33.9	33.9	10.7	3.6	10.7
Rural (0–250 m)	4	0.0	100.0	100.0	25.0	0.0	0.0	0.0	0.0
χ^2 (p value)	–	0.38	0.42	0.19	0.57	0.11	0.49	0.70	0.49
By school type									
Junior high schools	25	8.0	80.0	52.0	28.0	32.0	8.0	4.0	8.0
Senior high schools	26	26.9	100.0	73.1	38.5	30.8	7.7	3.8	7.7
Vocational senior high schools	9	0.0	66.7	55.6	33.3	33.3	22.2	0.0	22.2
χ^2 (p value)	–	0.07	0.02	0.65	0.80	0.62	0.42	0.83	0.42
By geographical location									
Central (Kaifeng)	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
East (Shanghai, Jinan)	14	7.1	64.3	28.6	42.9	28.6	14.3	0.0	14.3
North (Beijing)	3	0.0	100.0	0.0	33.3	33.3	33.3	0.0	33.3
Northeast (Shenyang)	–	–	–	–	–	–	–	–	–
Northwest (Baiyin)	–	–	–	–	–	–	–	–	–
South (Guangzhou)	18	5.6	94.4	83.3	33.3	33.3	11.1	11.1	11.1
Southwest (Chongqing, Kunming, Guilin)	24	29.2	91.7	75.0	29.2	33.3	4.2	0.0	4.2
χ^2 (p value)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
By city population									
<5 million people (Kaifeng, Baiyin)	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
5–10 million people (Shenyang, Jinan, Kunming, Guilin)	6	33.3	83.3	33.3	66.7	16.7	0.0	0.0	0.0
>10 million people (Shanghai, Beijing, Guangzhou, Chongqing)	53	13.2	86.8	66.0	30.2	34.0	11.3	3.8	11.3
χ^2 (p value)		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
By economic development type									
Less developed cities (Chongqing, Shenyang, Kunming, Guilin, Kaifeng, Baiyin)	25	28.0	92.0	72.0	28.0	32.0	4.0	0.0	4.0
Developed cities (Shanghai, Beijing, Guangzhou, Jinan)	35	5.7	82.9	54.3	37.1	31.4	14.3	5.7	14.3
χ^2 (p value)		0.02	0.30	0.31	0.29	0.82	0.19	0.22	0.19

e-cigarette, electronic cigarette; N/A, not applicable.

Table 5 Exterior and interior display of 'no sales to minors' sign, by city and school type

	Cigarette retailers (%)				E-cigarette retailers (%)			
	n	Signage inside or outside	Signage outside	Signage inside	n	Signage inside or outside	Signage outside	Signage inside
Total	1612	50.1	16.5	49.3	60	50.0	15.0	48.3
By city								
Shanghai	141	78.0	10.6	77.3	12	50.0	8.3	41.7
Beijing	107	80.4	4.7	80.4	3	33.3	0.0	33.3
Guangzhou, Guangdong	194	39.2	7.7	38.7	18	33.3	0.0	33.3
Chongqing	589	56.5	35.1	55.5	20	75.0	35.0	75.0
Shenyang, Liaoning	135	57.8	1.5	57.0	–	–	–	–
Jinan, Shandong	110	37.3	0.9	37.3	2	0.0	0.0	0.0
Kunming, Yunnan	161	16.1	5.0	15.5	–	–	–	–
Guilin, Guangxi	60	35.0	20.0	30.0	4	50.0	25.0	50.0
Kaifeng, Henan	82	32.9	0.0	32.9	1	0.0	0.0	0.0
Baiyin, Gansu	33	30.3	3.0	30.3	–	–	–	–
χ^2 (p value)	–	<0.001	<0.001	<0.001	–	N/A	N/A	N/A
By urban/rural								
Urban (0–100 m)	1092	53.8	16.0	53.0	56	46.4	14.3	44.6
Rural (0–250 m)	520	42.3	17.5	41.5	4	100.0	25.0	100.0
χ^2 (p value)	–	<0.001	0.46	<0.001	–	0.04	0.56	<0.001
By school type								
Junior high schools	773	47.3	15.5	46.4	25	48.0	8.0	48.0
Senior high schools	597	54.3	20.3	53.6	26	57.7	26.9	53.8
Vocational senior high schools	242	48.8	10.3	47.9	9	33.3	0.0	33.3
χ^2 (p value)		0.02	<0.001	<0.01	–	0.44	0.07	0.18
By geographical location								
Central (Kaifeng)	82	32.9	0.0	32.9	1	0.0	0.00	0.0
East (Shanghai, Jinan)	251	60.2	6.4	59.8	14	42.9	7.14	35.7
North (Beijing)	107	80.4	4.7	80.4	3	33.3	0.00	33.3
Northeast (Shenyang)	135	57.8	1.5	57.0	–	–	–	–
Northwest (Baiyin)	33	30.3	3.0	30.3	–	–	–	–
South (Guangzhou)	194	39.2	7.7	38.7	18	33.3	0.00	33.3
Southwest (Chongqing, Kunming, Guilin)	810	46.9	28.0	45.7	24	70.8	33.33	70.8
χ^2 (p value)		<0.001	<0.001	<0.001		N/A	N/A	N/A
By city population								
<5 million people (Kaifeng, Baiyin)	115	32.2	0.9	32.2	1	0.0	0.0	0.0
5–10 million people (Shenyang, Jinan, Kunming, Guilin)	466	35.6	4.9	34.5	6	33.3	16.7	33.3
>10 million people (Shanghai, Beijing, Guangzhou, Chongqing)	1031	58.7	23.5	57.9	53	52.8	15.1	50.9
χ^2 (p value)		<0.001	<0.001	<0.001		N/A	N/A	N/A
By economic development type								
Less developed cities (Chongqing, Shenyang, Kunming, Guilin, Kaifeng, Baiyin)	1060	46.7	21.7	45.7	25	68.0	32.0	68.0
Developed cities (Shanghai, Beijing, Guangzhou, Jinan)	552	56.7	6.5	56.3	35	37.1	2.9	34.3
χ^2 (p value)		<0.001	<0.001	<0.001		0.02	<0.01	<0.001

e-cigarette, electronic cigarette; N/A, not applicable.

POS,[23] an increased susceptibility to smoking,[10 24] a greater intention to smoke[5 25] and a lower readiness to quit smoking among adolescents[25] by providing easy access to tobacco and locating retailers that sell to them illegally.[23] Although the Minor Protection Law and the Tobacco Monopoly Licensing Management Regulations state that a tobacco retail licence shall not be issued in a location around a primary or secondary school in China, there is no specification of the prohibited distance

around a school nor how to calculate the distance.[26 27] This study found that compliance with the law was low in several cities. Among cities with more than 10 million people, Beijing had the lowest density of cigarette retailers near urban schools and Chongqing had the highest (0.84 vs 2.36), and among cities with 5–10 million people Guilin had the lowest density of cigarette retailers near urban schools and Shenyang had the highest (0.73 vs 2.22). Findings may partially relate to the availability and variation of local zoning and tobacco retail licensing policies. In China, the distance within which sales are prohibited is not specified in the national regulations; however, municipalities have the authority to issue zoning and licensing regulations with specific distance rule. Among the 10 studied cities, Beijing and Jinan municipalities prohibit tobacco sales within 100 m of schools[28 29]; Shanghai, Guangzhou, Chongqing, Shenyang, Kaifeng and Guilin municipalities prohibit tobacco sales within 50 m of schools[30–35]; and Kunming and Baiyin[36–39] do not specify the distance in their city regulations. The compliance and enforcement of existing local regulations may influence the density of tobacco retailers near schools.

The Chinese Minor Protection Law prohibits the sale of tobacco products, including e-cigarettes, to adolescents under the age of 18 and tobacco retailers are required to display a 'no sales to minors' sign visible to customers.[26] Approximately half of cigarette and e-cigarette retailers near schools in this study did not display the required signage prohibiting sales to minors, and differences between cities and between urban and rural areas were observed. A large majority of cigarette retailers in Beijing (80.4%) and Shanghai (78.0%) displayed the required signage; however, only 16.1% of cigarette retailers in Kunming displayed the sign. Studies in Hangzhou and Changsha also showed low prevalence of stores posting the 'no sales to minors' sign.[17 18] Given that more than 80% of youth have reported buying tobacco without rejection in China, greater enforcement of laws and monitoring of implementation are needed.[1 16 40] Furthermore, the main body of law enforcement on prohibition of tobacco sales to minors around schools in China is not clear. In order to strengthen the enforcement and to avoid conflicts of interests, local governments may consider transferring the enforcement authorisation from the Tobacco Monopoly Bureau to the market supervision and management department. Monitoring the enforcement of these regulations is also recommended.[17]

Tobacco displays were very prominent at retailers near schools and they appear to target youth. We found that 41.6% of cigarette retailers displayed cigarette packages that were visible from the outside of the store, nearly all (97.1%) displayed cigarette packages inside the store, and 41.0% displayed cigarette packages within 30 cm from sweets, drinks or snacks in China. The high rate of cigarette display at retailers near schools increases youth exposure to tobacco products. Instore tobacco display alongside products targeted at young customers helps develop a sense that tobacco is socially acceptable and commonly used, reduce awareness of the health risks of tobacco products and increase access to tobacco products among youth.[41–43] Studies in Scotland, Australia and Canada suggested that banning tobacco product display may lead to a reduction in brand awareness, exposure to tobacco marketing among youth and adults, and impulse purchasing of cigarettes.[13 44] Findings of this study underscore the importance of considering tobacco display as a form of advertising in Article 22 of the Advertising Law in China in the future and implementing strategies to prohibit tobacco displays to protect youth.[45]

The overall prevalence of tobacco advertising is low. Less than 10% of tobacco retailers near schools had advertising, which is lower than what was reported in Hangzhou in 2011 (exterior: 28%; interior: 12.4%) and Changsha in 2016 (exterior: 25%; interior: 16%).[17 18] In addition, significant differences across cities were detected. Over one in four cigarette retailers near schools in Shanghai and Jinan had advertising inside stores. The results may partially relate to the enforcement of the existing law and the unclear definition of tobacco advertising in the law. Reducing the visibility of tobacco marketing at retailers in school neighbourhoods may reduce the risk of experimental and habitual smoking among adolescents.[7] Given the impact of tobacco marketing at retailers, law implementation should be evaluated and local governments should employ strategies to enforce the law to protect adolescents.

The sale of flavoured cigarettes near schools was pervasive (63.2%), especially in northern China (Beijing: 93.5%; Shenyang: 92.6%). A majority of cigarette retailers (88.6%) in this study selling flavoured cigarettes sold menthol/mint-flavoured cigarettes. Flavoured tobacco products are more popular among youth and young adults than other age groups.[46] Bans on flavoured cigarettes are associated with reductions in smoking initiation and an increase in smoking cessation.[47 48] Some countries, such as Turkey, Moldova and Canada, have banned menthol cigarettes.[49] The current law in China does not restrict any cigarette flavourings. The Chinese government should consider restrictions on cigarette flavourings as part of efforts to protect adolescents and adults from tobacco product health risks.

The use of e-cigarettes has been increasing among adolescents in China in recent years.[50] The prevalence of e-cigarette users among junior high school students has doubled from 1.2% in 2014 to 2.7% in 2019.[1] This study found that e-cigarette retailer density was greater in urban areas of economically developed cities compared with less economically developed cities and rural areas. Exposure to e-cigarette marketing at retailers is positively associated with trying e-cigarettes.[51] China should consider enacting national laws to regulate sales of e-cigarettes and ban e-cigarette flavourings to potentially decrease the accessibility, acceptability and popularity of e-cigarettes among youth.

Findings from this study are based on observations of retailers near schools that were selected using multistage sampling in 10 Chinese cities that vary in geographical location, population size and economic development level. Trained data collectors observed flavours and marketing of both cigarettes and e-cigarettes and the display of required signage prohibiting sales to minors at retailers. One limitation of this study is that data collectors may not have been able to document all available flavours, although we provided training that helped data collectors record the flavours of tobacco products (eg, showing pictures of packages of flavoured tobacco products, etc). In addition, we did not assess the price of tobacco products nor the sale of single cigarettes at retailers around schools.

CONCLUSION

Overall, cigarette retailer density is high and tobacco product display is very prevalent at tobacco retailers near schools in 10 cities across China. Meanwhile, 'no sales to minors' signage is nonexistent in half of tobacco retailers near schools. Variations in these outcomes are observed across cities. These findings provide evidence to support the enforcement of existing tobacco control laws on banning tobacco sales around schools that specify the distance from schools and prohibition of tobacco sales to minors at both local and national levels, and suggest a need for new laws and regulations banning tobacco display at POS and regulating cigarette flavours and e-cigarettes.

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