

Preplanned Studies

The Impact of New Regulations on Prevention and Control of E-Cigarettes on Adolescents in Middle Schools — A City in China, 2022–2023

Meng Lyu¹; Wenlong Lu²; Lanhua Zou¹; Jingfan Xiong^{2,#}; Jie Yang^{1,#}

Summary

What is already known about this topic?

To protect the health of young people from the harmful impacts of electronic cigarettes (e-cigarettes), China has enacted various policies and regulations since 2018. As of October 1, 2022, the *Electronic Cigarette Management Measures* were put into action. They prohibited the sale of flavored e-cigarettes, permitting only those of plain tobacco flavor to be sold.

What is added by this report?

The illegal market for flavored e-cigarettes, often disguised as milk tea cups, cola cans, and violent bear images, continues to flourish. There is an increased need to bolster support for the prohibition of flavored e-cigarettes and enhance public awareness of associated regulations.

What are the implications for public health practice?

To advance the health of China's youth, it is crucial to improve the implementation and understanding of e-cigarette policies and guidelines.

Electronic cigarette (e-cigarette) emissions is typically comprised of nicotine, known to adversely affect brain development in children and adolescents, potentially leading to learning and anxiety disorders (1). Non-smoking teenagers who engage in e-cigarette use are twice as likely to initiate traditional smoking later in life (1). In response, China has enforced regulations to safeguard young individuals from the detrimental consequences of e-cigarette use. A directive in June 2021 prohibited the sale of e-cigarettes to minors (2). Subsequently, in November 2021, new tobacco products, including e-cigarettes, were required to align with mandates applicable to conventional cigarettes (3). Further, the *Electronic Cigarette Management Measures*, put into action on October 1, 2022 (4), explicitly banned the sale of e-cigarettes featuring flavors other than tobacco and outlawed the

use of e-cigarettes capable of generating aerosols independently.

In October 2023, a survey was conducted among middle school students in Shenzhen City, Guangdong Province using a custom-made questionnaire. The purpose of the study was to evaluate the effects of certain *Measures* on adolescents' knowledge, attitude/belief, practice (KAP) regarding e-cigarettes. The intention was for the results of the study to contribute scientific evidence and data to help enhance e-cigarette regulation. The analysis disclosed a lack of awareness among the students about policies and regulations pertaining to e-cigarettes. Furthermore, bans related to e-cigarettes had not been effectively put into practice. As such, a more robust effort to promote and enforce e-cigarette regulations is proposed.

This study utilized convenience sampling to select one junior high school, one senior high school, and one vocational high school in Shenzhen. We employed a cluster sampling technique to select three classes from each grade at these schools, excluding the fourth grade in the senior high school. A selection criterion stated that class sizes should consist of at least 40 students. If fewer than 40, classes were combined. Without the interference of teachers, students autonomously completed the questionnaire survey. The final tally showed that 1,089 students completed the questionnaire, yielding an overall response rate of 95.61%. Additionally, using convenience sampling, we selected 20 e-cigarette stores in Shenzhen, comprised of 12 specialty and eight combined stores, for evaluating the availability of fruit-flavored e-cigarette cartridges. The data obtained were analyzed using SAS software (Version 9.3, SAS Institute Inc., Cary, USA). We used statistical tests, including the chi-square and Fisher's exact probability tests, to examine group differences, maintaining a significance level at $\alpha = 0.05$. The study secured approval from the Chinese Center for Disease Control and Prevention Institutional Review Board (No. 202321).

We gathered a total of 1,089 valid questionnaires, of which 61.07% were from male respondents and 38.93% were from female respondents. When considering education level, 37.74% of respondents were junior high school students, 31.31% were senior high school students, and 30.95% were students from vocational high schools.

Approximately 82.37% of survey participants indicated concerns over potential health risks linked to e-cigarette use. Among varying education levels, a reduced perception of the hazards of e-cigarettes was observed in senior high school (80.06%) and vocational high school respondents (78.34%) in comparison to those from junior high school (87.59%). In addition, a lower awareness of the hazards associated with e-cigarettes was demonstrated by males (80.15%), as compared to females (85.85%). These observed differences were statistically significant ($P < 0.05$).

The survey encompassed six queries related to knowledge of e-cigarette policies and regulations. Overall, male respondents demonstrated a higher awareness level than females, and students from senior high schools exhibited greater understanding compared with those in vocational high schools (Table 1). Middle school students obtained information on e-cigarette regulations and policies primarily from the Internet (77.50%), followed by public place slogans (55.60%), television broadcasts (50.95%), alternative sources (50.95%), billboards or posters (43.45%), and finally from newspapers or magazines (28.69%).

The study found that 5.51% of the participants had used e-cigarettes. In 2022, 43 people reported using e-cigarettes, of whom 27 continued their usage into

2023. In 2023, a total of 29 individuals reported e-cigarette usage. When asked about their perception of e-cigarette usage among their peers, 16.80% of the participants perceived an increase in 2023 compared to 2022. On the other hand, 25.53% perceived a decrease and 57.67% believed there had been no change in usage from 2022 to 2023.

In 2023, e-cigarettes were purchased by 23 participants in our study. Of these, 78.26% opted for models shaped like milk tea cups, cola cans, or “violent bears”. Moreover, among these buyers, 18 chose flavors other than the traditional tobacco variant (Table 2). In a survey of 20 e-cigarette retail outlets, it was discovered that 17 stocked fruit-flavored cartridges. Of the 21 participants who made e-cigarette purchases in both 2022 and 2023, 14.29% reported that obtaining these products was more difficult in 2023 compared to 2022; however, 85.71% reported no change in accessibility. Surprisingly, almost half (47.83%) of the 2023 purchasers reported no age-related restrictions at the point of sale. In addition, among those who shopped in physical outlets in 2023, 27.27% did not take notice or show any concern to health warnings exhibited in the stores.

In 2023, of a total of 1,029 students who reported they had never used e-cigarettes, 284 (27.60%) had peers who did. Out of these, 150 students knew the flavor that their peers were using, and 148 of those students disclosed that their peers used non-tobacco flavored e-cigarettes. Information about how these e-cigarettes were obtained was familiar to 92 students, with the majority reporting that they were procured from physical e-cigarette stores (Table 3). In the preceding year, 59 students expressed interest in trying

TABLE 1. Awareness of e-cigarette-related policies and regulations among middle school students in Shenzhen, categorized by gender and school type, 2022–2023.

Project	Total (%)	Male (%)	Female (%)	χ^2	P value	Junior high school (%)	Senior high school (%)	Vocational high school (%)	χ^2	P value
Electronic Cigarette Management Measures	58.77	61.35	54.72	4.706	<0.05	60.10	58.65	57.27	0.614	0.736
Ban on the sale of fruit-flavored e-cigarettes	66.67	68.87	63.21	—	0.056*	65.21	71.85	63.20	6.330	<0.05
Ban on the sale of e-cigarettes through Taobao, Pinduoduo and WeChat	65.56	68.42	61.08	6.172	<0.05	64.72	70.09	62.02	5.098	0.078
Prohibit the sale of e-cigarettes to minors	89.07	88.12	90.57	1.591	0.207	90.02	92.08	84.87	9.681	<0.05
Prohibit the sale of 'milk tea cup' and 'violent bear' shaped electronic cigarettes	68.04	70.38	64.39	4.271	<0.05	66.67	73.31	64.39	6.781	<0.05
E-cigarettes are managed according to the relevant provisions of cigarettes.	55.10	58.35	50.00	7.290	<0.05	56.20	58.94	49.85	—	0.051*

Note: “—” means not applicable.

* This value is the Fisher's exact probability value.

TABLE 2. Types, flavors, and purchasing methods of e-cigarettes procured by middle school students in Shenzhen, 2022–2023.

Project	Response		Percentage of cases (%)
	n	Percentage (%)	
Types of e-cigarettes purchased			
Disposable e-cigarettes (excluding modelling e-cigarettes)	20	30.77	86.96
Milk tea cups, coke cans, violent bears and other modelling e-cigarettes	18	27.69	78.26
Replaceable cartridge e-cigarettes	18	27.69	78.26
Refillable e-cigarettes	9	13.85	39.13
Flavors of e-cigarettes purchased			
Tobacco flavor	10	30.30	43.48
Fruits, beverages, herbs or tea flavors	18	54.55	78.26
Other flavors	5	15.15	21.74
Ways to buy e-cigarettes			
E-cigarette stores	18	28.57	78.26
Online social platforms	16	25.40	69.57
E-commerce platforms	9	14.29	39.13
Supermarkets, convenience stores, and grocery stores	7	11.11	30.43
Relatives, friends, classmates, and agents	13	20.63	56.52
Ways to buy non-tobacco flavored e-cigarettes			
E-cigarette stores	14	26.92	77.78
Online social platforms	14	26.92	77.78
E-commerce platforms	7	13.46	38.89
Supermarkets, convenience stores, and grocery stores	6	11.54	33.33
Relatives, friends, classmates, and agents	11	21.16	61.11

e-cigarettes. A year later, 74.58% maintained their earlier stance, 5.08% indicated an increased interest, but 20.34% saw a decrease in their willingness to try e-cigarettes.

Over half of the participants (52.16%) asserted their support for the prohibition of flavored e-cigarettes. The level of support varied significantly across different school levels; it was lower amongst vocational high school students (41.25%) compared to their counterparts in junior high school (57.18%) and senior high school (56.89%) ($P<0.05$). Support for the ban was more pronounced amongst those who were aware of the *Measures* (57.19%) in comparison to their unaware peers (44.99%). A higher proportion of flavored e-cigarette ban support of individuals (60.17%) were knowledgeable about the management of e-cigarettes according to the relevant regulations on cigarettes compared to those who were not aware (42.33%) and was markedly greater among respondents conscious of the detrimental effect of e-cigarettes on health (55.41%) compared to those unaware of the risks (36.98%). All these disparities

were statistically significant ($P<0.05$). On another note, the ban encountered more favor among non-users of e-cigarettes in the period running from 2022 to 2023 (53.16%), compared to the users (28.89%), a difference that was statistically significant ($P<0.05$).

DISCUSSION

Among middle school students, 82.37% acknowledged the risks associated with e-cigarettes. However, familiarity with e-cigarette-related regulations generally fell below 70%. Surprisingly, 23.10% of these students, specifically those from Chengdu City, Sichuan Province, were not aware that e-cigarettes produce second-hand smoke, and 38.60% reported receiving no information about the associated harm or regulatory measures over the last 30 days (5). Additionally, in 2023, 27.60% of the surveyed students disclosed that their peers were using e-cigarettes. Past research has suggested that peer influence contributes significantly to middle school students' temptation to experiment with e-cigarettes

TABLE 3. Flavors of e-cigarettes and purchasing methods used by peer middle school students in Shenzhen, 2022–2023.

Project	Response		Percentage of cases (%)
	<i>n</i>	Percentage (%)	
Flavors of e-cigarettes purchased			
Tobacco flavor	41	19.07	27.33
Fruits, beverages, herbs or tea flavors	145	67.44	96.67
Other flavors	29	13.49	19.33
Methods of buying e-cigarettes			
E-cigarette stores	61	30.05	66.30
Online social platforms	52	25.62	56.52
E-commerce platforms	43	21.18	46.74
Relatives, friends, classmates, and agents	47	23.15	51.09

(6–7). Those who were cognizant of the dangers of e-cigarettes and their respective governance were more inclined to support the prohibition of flavored e-cigarettes. Notably, vocational high school students had less awareness of the pertinent policies and indicated less support for a ban on flavored e-cigarettes. These students are often identified as having a higher susceptibility to e-cigarette use (8). Therefore, it is imperative to amplify public information campaigns concerning the hazards of e-cigarettes and associated regulatory measures.

A total of 78.26% of survey participants reported purchasing e-cigarettes with unique designs, such as those resembling milk tea cups, soda cans, and cartoon bears. Among these, 18 respondents indicated that they obtained flavored e-cigarettes that did not have a tobacco flavor. It was also observed that fruit-flavored cartridges were still available for purchase at brick-and-mortar e-cigarette retailers in Shenzhen. One reporter's field visit confirmed the continued sale of both designed e-cigarettes styled as milk tea cups and fruit flavored cartridges (9). Furthermore, in 2023, 47.83% of respondents reported that they were not denied a sale of e-cigarettes due to their age. Similarly, among middle school students who had used e-cigarettes in 2021, 70.8% indicated that they were not refused their latest e-cigarette purchase (10). In 2023, of the e-cigarette buyers, 27.27% reported not encountering or noticing any health warning notices at stores. It appears that e-cigarette-related policies and regulations, including the *Measures*, have not been effectively enforced.

This study was subject to some limitations. Due to a cross-sectional survey, recall bias cannot be neglected. In addition, owing to the sample selection that is not random, it cannot reflect the overall study population.

In conclusion, there is a clear requirement for

improved awareness surrounding policies and regulations of e-cigarettes, in addition to endorsing the prohibition of flavored e-cigarettes. The enforcement of the ban on both flavored e-cigarettes and the sale of e-cigarettes to minors has not been effectively implemented. Thus, it is advisable to augment the advocacy of these *Measures* and to expand the understanding of middle school students about the hazards of e-cigarettes and related regulations. Appropriate guidance should be furnished to students in vocational training. Regulatory policies, such as the ban on selling e-cigarettes to minors and flavored e-cigarettes, must be stringently executed to shield adolescents from the potential risks posed by e-cigarettes.

Conflicts of interest: No conflicts of interest.

Funding: This research was approved by the Chinese Center for Disease Control and Prevention Institutional Review Board (No. 202321).

doi: 10.46234/ccdcw2024.056

Corresponding authors: Jie Yang, bjyangjie@163.com; Jingfan Xiong, xiongjingfan@126.com.

¹ Tobacco Control Office, Chinese Center for Disease Control and Prevention, Beijing, China; ² Shenzhen Center for Chronic Disease Control, Shenzhen City, Guangdong Province, China.

Submitted: December 29, 2023; Accepted: March 21, 2024

REFERENCES

- World Health Organization. Tobacco: e-cigarettes. 2022. <https://www.who.int/news-room/questions-and-answers/item/tobacco-e-cigarettes>. [2023-12-13].
- Standing Committee of the National People's Congress. Law of the People's Republic of China on the protection of minors. 2020. https://www.gov.cn/xinwen/2020-10/18/content_5552113.htm. [2020-10-17]. (In Chinese).
- The State Council of the People's Republic of China. Decision of the State Council on Amending the Regulation on the Implementation of

- the Law of the People's Republic of China on Tobacco Monopoly. 2021. https://www.gov.cn/zhengce/content/2021-11/26/content_5653631.htm. [2023-12-15]. (In Chinese).
4. State Tobacco Monopoly Administration. Measures for the administration of electronic cigarettes. 2022. https://www.gov.cn/govweb/gongbao/content/2022/content_5697988.htm. [2023-12-15]. (In Chinese).
 5. Liao HL, Yang L, Zheng PP, Deng H, He Y, Gao X, et al. Current situation and influencing factors of e-cigarette use among adolescents in Chengdu. *Med Soc* 2022;35(5):71 - 4,85. <https://doi.org/10.13723/j.yxysh.2022.05.014>.
 6. Xu QQ, Zhu YY, Ding SG, Jin QY, Dong Y. Investigation on e-cigarette use among middle school students in Ningbo City. *J Prev Med* 2023;35(9):814 - 9. <https://doi.org/10.19485/j.cnki.issn2096-5087.2023.09.019>.
 7. Zhang FF, Zhang WC, Shen K, Zhang SY, Jiang YG, Xi C. Analysis on influencing factors of adolescent students trying cigarettes and e-cigarettes in Songjiang District of Shanghai. *Occup Health* 2021;37(19):2687 - 91. <https://doi.org/10.13329/j.cnki.zyyjk.2021.0632>.
 8. Zhou L, Huang XJ, Luo Y, Ma LN, Xu JD. Status of current e-cigarettes use and its influencing factors among current middle school students in Hubei. *Mod Prev Med* 2021;48(19):3524-7,3578. <https://d.wanfangdata.com.cn/periodical/xdyfyx202119015>. (In Chinese).
 9. Han DD, Wang YT. "Three noes" e-cigarette, easy to buy online and offline for teenagers. *Legal Daily*. 2023. <http://epaper.legaldaily.com.cn/fzrb/content/20230619/Article08002GN.htm>. [2023-12-15]. (In Chinese).
 10. Chinese Center for Disease Control and Prevention. Results of tobacco epidemic surveillance among middle school and college students in China in 2021 were released. 2022. http://www.xjcdc.com/jkzt1/spaq/xxws1/content_4300. [2023-12-15]. (In Chinese).