



COMMENT

Regulations on e-cigarettes: China is taking action

Y. Cao^{a,#}, H. Yi^{b,#}, J. Zhou^c, Y. Cheng^{d,*}, Y. Mao^{b,*}^a Peking University Health Science Center, Peking University, Beijing 100191, China^b Department of Thoracic Surgery, National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100021, China^c Department of Chemistry and Biochemistry, University of California San Diego, San Diego, CA 92093, USA^d Department of Thoracic Surgery, Xiangya Hospital, Central South University, Changsha 410008, China

Received 14 December 2022; accepted 10 February 2023

Available online 2 April 2023

Invented in China in 2003, electronic nicotine delivery systems (ENDS), commonly known as electronic cigarettes (e-cigarettes), are battery-powered devices that convert a mixture containing nicotine into an inhalable aerosol.¹ They structurally comprise four components: a battery, a reservoir with the liquid formulation, a vaporizing chamber with a heating element, and a mouthpiece for inhalation.² In recent years, China has issued dozens of regulations to control the e-cigarette industry due to the increasing use of e-cigarettes along with their significant health risks.

The use of e-cigarettes has gained great popularity, especially among youngsters. An online survey in China showed that 89.52% of adolescents aged between 12 and 18 years were aware of e-cigarettes while the ever-use rate was 26.44%.³ Another survey in China showed that 88.40% of young Chinese adults aged between 19 and 29 years were aware of e-cigarettes and 24.45% of them have used e-cigarettes.⁴ Among Chinese adults, the weighted prevalence of past 30-day e-cigarette use among Chinese adults increased from 1.3% in 2015–2016 to 1.6% in 2018–2019, indicating that e-cigarette use in China has increased substantially.⁵ Reasons why e-cigarettes have attracted millions of people are (1) their variety of flavors; (2) convenience in smoking and purchasing; (3) similar satisfaction to conventional

cigarettes; (4) the popular belief that e-cigarettes help in quitting smoking and are less harmful to the body.

However, a variety of studies have still confirmed the harmful effects of e-cigarettes. Firstly, nicotine, as the main bioactive component in e-cigarettes, can easily lead to addiction. Furthermore, unlike nicotine replacement treatment (NRT), which was believed to have a safe and low-addictive nicotine content to help smokers quit, the unregulated amount of nicotine in e-cigarettes combined with the reinforcement of smoking behavior may generate a more addictive product. Secondly, the most commonly used organic solvent of e-cigarette oil, propylene glycol (PG), is identified to function in altering physiological processes and producing acute toxicity and airway irritation. Additionally, in the process of aerosol generation, it can be oxidized to form carcinogens such as formaldehyde and acetaldehyde. Thirdly, flavors added to e-cigarettes have varied degrees of cytotoxicity and can cause oxidative stress reactions. Fourthly, the components of e-cigarettes contain a variety of carcinogenic metals, the most common of which are chromium, nickel, and aluminum. When heated, these metals can be released into the liquid, entering the user's body along with the smoke. In conclusion, the inhaled toxic and carcinogenic ingredients will result in impaired physiological function of corresponding tissues and organs and lead to a variety of acute and chronic diseases, and even cause cancer. Among these hazards, smoking is particularly harmful to the respiratory system, since the respiratory tract is directly exposed to e-cigarette aerosol, which causes individuals to

* Corresponding authors.

E-mail addresses: chyd0508@csu.edu.cn (Y. Cheng), youshengmao@gmail.com (Y. Mao).

These authors contributed equally to this work.

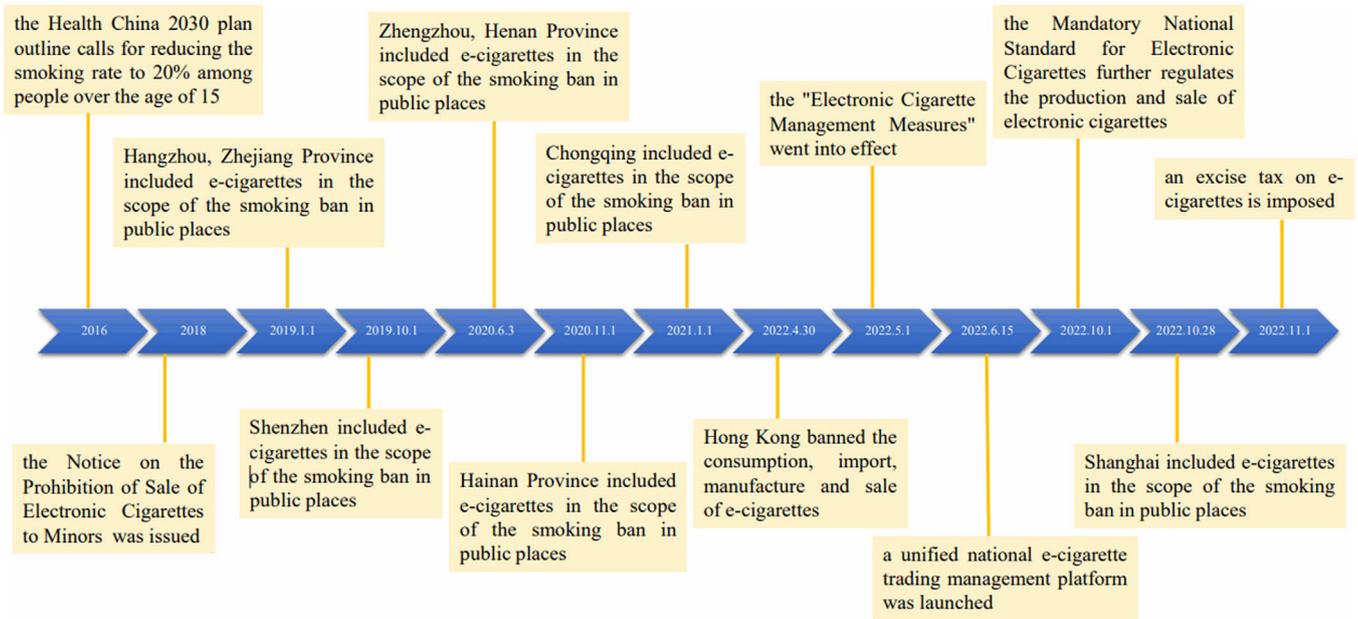


Fig. 1 The timeline of China's actions in regulating e-cigarettes.

become more sensitive to asthma, COPD, and lung cancer.¹ Besides, there is not a single type of e-cigarette, but several different types of e-cigarettes, which further complicates the harmful effects of e-cigarettes. In addition, e-cigarettes increase the risk of starting and relapsing smoking conventional cigarettes and do not increase smoking cessation, and results are more favorable in clinical settings.^{6,7} This may cause a combination of health damage from two or more products.

Since the harm of smoking became clearer and the World Health Organization Framework Convention on Tobacco Control came into force, an increasing number of countries have adopted effective measures to control tobacco use. From 2007 to 2017, the prevalence of smoking among people over the age of 15 dropped to 19.2%.⁸ However, there are more than 300 million smokers in China. In 2018, the smoking rate among people over the age of 15 was 26.6%, higher than the global average, with the rate of e-cigarette smoking increasing yearly.⁹ Tobacco kills more than 1 million people in China annually and is expected to rise to 2 million a year by 2030 and 3 million a year by 2050 if no effective action is taken.¹⁰

To regulate the e-cigarette industry and reduce the smoking-related disease burden, China has taken a series of measures (Fig. 1). As a significant first step, the Outline of the Healthy China 2030 Plan released in October 2016 has called for comprehensive strengthening of tobacco control to reduce the smoking rate to 20% among people over the age of 15 by 2030.¹¹ Subsequently, to enhance the protection of teenagers, the Notice on the Prohibition of Sale of Electronic Cigarettes to Teenagers, issued on August 28, 2018, bans the sale of e-cigarettes to teenagers and requires the withdrawal of e-cigarette advertisements on the Internet.¹² As a step further, on May 1, 2022, the "Electronic Cigarette Management Measures" went into effect, explicitly prohibiting the sale of flavored e-cigarettes other than tobacco flavors and reducing the number of young people

interested in e-cigarettes merely because of their taste. To better implement the previous regulations, the Mandatory National Standard for Electronic Cigarettes, implemented on October 1, 2022, further regulates the production and sale of electronic cigarettes.¹³ On October 28, Shanghai, following Shenzhen, Hangzhou, etc., integrated e-cigarettes into the scope of the smoking ban in public places.¹⁴ Lately, an excise tax on e-cigarettes was imposed on November 1, 2022, to reduce e-cigarette consumption through high taxes that affect sales prices.¹⁵

It is believed that with tightening regulations, the rate of e-cigarette users will gradually decrease, which will lower the electronic cigarette-related disease burden and greatly benefit public health. We are glad to see the sale of e-cigarettes has been banned on major online shopping platforms in China, and vendors selling e-cigarettes to teenagers have also been heavily punished. However, there is still a lot to be done. At present, illegally produced e-cigarettes are still sold to people, especially teenagers, through illegal selling channels. Firstly, to strengthen the regulation of e-cigarette sales, the government should eliminate illegal e-cigarette manufacturers and punish those who are still producing e-cigarettes without licenses. Secondly, the circulation of illegal e-cigarettes could be reduced by limiting the number of related products posted per person per day. Thirdly, to reduce e-cigarette purchasing, the government is supposed to conduct health education about the danger of e-cigarettes. It is strongly believed that, through the joint efforts of the government and all citizens, the goal of the Outline of the Healthy China 2030 Plan will be realized steadily.

Conflicts of interest

The authors have no conflicts of interest to declare.

CRedit authorship contribution statement

Y. Cao: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft. **H. Yi:** Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft. **J. Zhou:** Writing – original draft, Writing – review & editing. **Y. Cheng:** Conceptualization, Writing – review & editing. **Y. Mao:** Conceptualization, Writing – review & editing.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- Gordon T, Karey E, Rebuli ME, Escobar YH, Jaspers I, Chen LC. E-cigarette toxicology. *Annu Rev Pharmacol Toxicol.* 2022; 62:301–22.
- Cherian SV, Kumar A, Estrada-Y-Martin RM. E-cigarette or vaping product-associated lung injury: a review. *Am J Med.* 2020;133(6):657–63.
- Chinese Center for Disease Control and Prevention. Results of tobacco epidemic surveillance for middle and college students in China, 2021 [online]. 2022. https://www.chinacdc.cn/jkzt/sthd_3844/slhd_12885/202205/t20220529_259439.html. (accessed 31 October 2022)
- Wang X, Zhang X, Xu X, Gao Y. Perceptions and use of electronic cigarettes among young adults in China. *Tob Induc Dis.* 2019;17:17.
- Zhao Z, Zhang M, Wu J, Xu X, Yin P, Huang Z, et al. E-cigarette use among adults in China: findings from repeated cross-sectional surveys in 2015-16 and 2018-19. *Lancet Public Health.* 2020;5(12):e639–49.
- S. Gallus, C. Stival, M. McKee, G. Carreras, G. Gorini, A. Odone, et al., Impact of electronic cigarette and heated tobacco product on conventional smoking: an Italian prospective cohort study conducted during the COVID-19 pandemic, *Tob Control*, 2022, :tobaccocontrol-2022-057368. doi: 10.1136/tc-2022-057368.
- Hartmann-Boyce J, Lindson N, Butler AR, McRobbie H, Bullen C, Begh R, et al. Electronic cigarettes for smoking cessation. *Cochrane Database Syst Rev.* 2022;11(11):CD010216.
- World Health Organization. WHO report on the global tobacco epidemic, 2019: offer help to quit tobacco use. <https://www.who.int/publications/i/item/9789241516204> (accessed 4 February 2023).
- National Health Commission of the People's Republic of China. China Smoking Report in 2020 released by National Health Commission of the People's Republic of China [online]. 2021. <http://www.nhc.gov.cn/guihuaxxs/s7788/202105/c1c6d17275d94de5a349e379bd755bf1.shtml> (accessed 31 October 2022).
- Wang M, Luo X, Xu S, Liu W, Ding F, Zhang X, 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.
- Chinese government website. The outline of the healthy China 2030 plan [online]. 2016. http://www.gov.cn/zhengce/2016-10/25/content_5124174.htm (accessed 2 November 2022).
- Chinese Center for Disease Control and Prevention. Protect teenagers from e-cigarettes [online]. 2022. https://www.chinacdc.cn/jkzt/sthd_3844/slhd_12884/202203/t20220325_257979.html (accessed 1 November 2022).
- State Administration for Market Regulation. The national standard for e-cigarettes will come into effect in October [online]. 2022. https://www.samr.gov.cn/xw/mtjj/202204/t20220414_341288.html (accessed 1 November 2022).
- Shanghai Municipal People's Government. E-cigarettes are banned from public places [online]. 2022. <https://www.shanghai.gov.cn/nw4411/20221031/2bd0e227b3614f06b7b0cc6b1-fe23cd9.html> (accessed 2 November 2022).
- China Tobacco. Announcement on excise duty on e-cigarettes [online]. 2022. <http://www.tobacco.gov.cn/gjyc/dzyglzcyj/202210/02d0adf298ec4dd392c1e2d022c9157e.shtml> (accessed 1 November 2022).