



Factors Associated with the Use of Electronic Cigarettes among Youths

Thaniya Klinsophon¹, Premtip Thaveeratitham¹, Pooriput Waongenngarm²

¹Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University, ²Faculty of Health Science Technology, HRH Princess Chulabhorn College of Medical Science, Chulabhorn Royal Academy, Bangkok, Thailand

Background: Electronic cigarettes (e-cigarettes) are rapidly becoming a popular new trend among youths and adolescents. However, there is little information available about the causes of e-cigarette use in youths, especially the mental, belief/attitude, and marketing factors that lead to e-cigarette usage. **Aim:** This study aimed to evaluate the factors associated with e-cigarette use among youths. **Methods:** We conducted a cross-sectional study of 1164 youths, administering a self-report questionnaire relating to the risk factors for e-cigarette usage: individual, family and friends, mental, belief/attitude, and marketing factors. We used logistic regression analysis to examine the factors and their association with e-cigarette use. **Results:** The prevalence of current e-cigarette use was 10.6%, while 19.4% of participants had used e-cigarettes at some time in their lives. History of drug use and attitudes about e-cigarette use (e-cigarettes are not harmful to health, using e-cigarettes can help stop smoking, and e-cigarettes help people improve social skills) were significantly associated with the current use of e-cigarettes. GPAX was a protective factor against current e-cigarette use. **Conclusion:** E-cigarette use is relatively high among youths. We discovered erroneous beliefs and attitudes (misunderstanding or disinformation regarding the harmful effects of e-cigarette use). Interventions to enhance knowledge about e-cigarettes are required for youths to reduce current e-cigarette use.

Key words: Electronic cigarette, youth, smoking, risk factor

INTRODUCTION

Electronic cigarettes (e-cigarettes) are battery-operated devices that heat a solution to create an aerosol that usually contains nicotine, flavorings, and other chemicals. A previous study showed increasing e-cigarette use in many countries.^{1,2} E-cigarettes have gained popularity, particularly among youths and young adults. Although e-cigarettes are considered illegal in Thailand, the prevalence of current e-cigarette use was 22.2% in college students and 3.7% in 7th-grade students.^{3,4} A previous systematic review showed that e-cigarettes were considered to be less expensive, less dangerous, trendier, and more pleasurable in taste than conventional cigarettes.⁵

In recent years, evidence has pointed out the negative effect of e-cigarettes on health. E-cigarettes deliver nicotine to the bloodstream, which leads to harmful effects on the cardiovascular system by activating the sympathetic nervous system.⁶ Previous systematic reviews showed potentially

harmful cardiovascular effects from e-cigarettes by inducing sympathetic nerve activation, oxidative stress, endothelial dysfunction, and platelet activation.⁷ E-cigarettes also affect the pulmonary system: substantial evidence revealed that e-cigarettes and vaping products can lead to lung injury.⁸⁻¹¹ In addition, evidence revealed that there is an association between e-cigarette use in adolescents and asthma exacerbation and chronic bronchitis.^{12,13} Moreover, another systematic review found that e-cigarette use may contribute to social maladjustments in adolescents and young adults, including poor concentration, increased aggressive and impulsive behavior, poor learning performance, increased depression and suicidal behaviors, reduced sleep quality, and impaired cognition and memory.¹⁴

E-cigarettes are increasingly being used by smokers for a variety of reasons, especially attempts to stop conventional

Received: April 10, 2023; Revised: June 26, 2023;
Accepted: June 27, 2023; Published: August 29, 2023
Corresponding Author: Asst. Prof. Pooriput Waongenngarm,
Faculty of Health Science Technology, HRH Princess
Chulabhorn College of Medical Science, Chulabhorn
Royal Academy, Bangkok, Thailand. Tel: +66 829269229;
Fax: +6622183767. E-mail: pooriput.wao@cra.ac.th

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Klinsophon T, Thaveeratitham P, Waongenngarm P. Factors associated with the use of electronic cigarettes among youths. J Med Sci 2023;43:252-7.

cigarette smoking. Previous systematic reviews and meta-analyses revealed that e-cigarette use is associated with reduced smoking cessation in the real world. Those who used e-cigarettes had a 28% lower chance of stopping smoking than those who did not (odds ratio [OR] =0.72 and 95% confidence interval [CI] =0.57–0.91).¹⁵ Moreover, a recent systematic review and meta-analysis showed that e-cigarette use increases the risk of future cigarette smoking in youths and young adults.¹⁶

The prevalence and risk factors of e-cigarette use in the 7th grade and college students in Thailand have been studied.^{3,4} However, factors associated with e-cigarette use among youths are less documented, and there has been no report regarding the mental, belief/attitude, and marketing factors related to e-cigarette use. Therefore, the specific purpose of the present study was to evaluate the factors associated with e-cigarette use among Thai youths.

MATERIALS AND METHODS

Ethical policy

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Sciences Group, Chulalongkorn University, Thailand (COA No. 195/2021). Informed written consent was obtained from all patients before their enrollment in this study.

Participants

We conducted a cross-sectional study of Thai youths who currently study in secondary school or university. We defined youths as persons between the ages of 15 and 24 years. Participants were recruited if they ever heard or knew about e-cigarettes and were able to read and understand the Thai language. The sample size used in this study was calculated based on the prevalence of current e-cigarette use observed in previous research,⁴ a 95% CI, and a 2% margin of error. A total of 1066 participants were required for this study.

Equipment

We used a self-report questionnaire to investigate risk factors for e-cigarette usage, which we constructed based on evidence of risk factors for e-cigarette use. The questionnaire consisted of individual, family and friends, mental, belief/attitude, and marketing factors. After we developed the questionnaire, we asked 20 students (10 secondary school students and 10 college students) to provide comments and suggestions on the questionnaire and to identify words or phrases that were difficult to understand. Then, we adapted the questionnaire according to the comments. We tested the validity and

reliability of the questionnaire. The index of item-objective congruence was one. The intraclass correlation coefficient (3, 1) demonstrated excellent reliability in both secondary school students (0.93) and college students (0.92).

Experimental procedure

We recruited participants from secondary schools, colleges, and universities in Thailand using an advertisement sent out on online platforms such as Line, Facebook, and Twitter. Interested students scanned the QR code or entered the link, and they were asked to consent to participate in this study after reading about it. Then, they were asked to complete a screening questionnaire. Those who agreed to participate and who met the inclusion criteria were able to continue to complete the main questionnaire. We collected data online in September–October 2021. Data included the extent of e-cigarette use and associated factors – individual, family and friends, mental, belief/attitude, and marketing. To avoid multiple submissions from the same participants, respondents were asked to sign in with their email addresses to access the form. However, their email addresses will not be recorded or documented in the response sheet.

Measures

E-cigarette use

E-cigarette use was measured with two items: (1) “Have you ever used an electronic cigarette (E-cigarette), even if it was just a puff?” (Yes, No); (2) “During the past 30 days (1 month), have you ever used an electronic cigarette (E-cigarette)?” (Yes, No).

Factors associated with the use of electronic cigarettes

Individual factor

We asked about age, gender, education level, income per month, accumulated grade point average (GPAX), residence (dorm or home), and history of drug use (drug in this study was defined as cigarettes, baraku, cannabis, or alcohol).

Family and friends factor

We asked about family income and history of substance use (e.g., cigarette, e-cigarette, baraku, cannabis, and alcohol) among family and friends.

Mental factor

We collected data on the number of days participants had a negative effect in the past 30 days. The definition of negative affect is feelings of emotional distress such as irritability, upset, and distress.

Belief and attitude factor

We asked the participants to rate their level of agreement (5-point Likert scale, ranging from “strongly disagree” to “strongly agree”) with the following items: (1) e-cigarettes are not harmful to health, (2) e-cigarettes are less harmful than cigarettes, (3) e-cigarettes are less addictive than cigarettes, (4) using e-cigarettes can help people stop

smoking, (5) e-cigarettes help people improve social skills, (6) e-cigarette users are attractive, (7) using e-cigarettes is cheaper than using cigarettes, and (8) unpleasant smell from e-cigarettes is less than that from cigarettes.

Marketing factor

We asked the participants the following question: “Have you ever seen any advertisements or promotions for e-cigarettes?” In addition, we asked the participants to rate their level of agreement (5-point scale, ranging from “strongly disagree” to “strongly agree”) with the following statements: (1) e-cigarettes have many flavors and scents, (2) e-cigarette packaging is attractive, and (3) e-cigarettes have many channels of distribution and are convenient.

Statistical analysis

We expressed the characteristics of the participants as means and standard deviation, or proportions. We calculated the prevalence of e-cigarette use. To handle missing data in our study, we employed different approaches based on the type of data. For continuous variables, we used the “mean imputation” method. For categorical variables, we utilized the “hot deck” approach. By doing so, we aimed to maintain the statistical power of the data and ensure a complete dataset for analysis. We performed univariate analysis to examine the relationship between e-cigarette use and the factors of individual, family and friends, mental, belief/attitude, and marketing. Any univariate factors with $P \leq 0.05$ will be added to the binary logistic regression analysis. We adjusted the ORs associated with specific factors for the effect of all other factors in the final model. The unadjusted and adjusted OR and 95% CI for the final model are presented in the results. We performed all statistical analyses using IBM SPSS Statistics for Windows, Version 28.0 (Armonk, NY: IBM Corp). We set statistical significance at the 5% level.

RESULTS

Of the 1891 youths who received a link or QR code to participate in this study, 1421 agreed to participate (75.16%) and 1164 were eligible (61.55%) and did participate. We described the characteristics of the participants using means or proportions. Table 1 shows the characteristics of the participants. The study population comprised mainly high school females. Only one participant did not disclose their age. Thus, we imputed one missing piece of data, and the results from the imputed dataset are reported.

One hundred and twenty-three participants (10.6%) reported using e-cigarettes during the previous 30 days. Two hundred and twenty-six participants (19.4%) had a history of e-cigarette use at least once in their lives.

Our univariate logistic regression analyses revealed that factors showing $P \leq 0.05$ were age, gender, education level,

Table 1: Characteristics of participating youths ($n=1164$)

Characteristics	<i>n</i> (%)
Age (years), mean (SD)	17.62 (2.18)
Gender	
Male	378 (32.5)
Female	786 (67.5)
Education level	
High school	836 (71.8)
University	328 (28.2)
Regions	
Bangkok Metropolitan	327 (28.1)
Central (except Bangkok Metropolitan)	235 (20.2)
Northern	89 (7.6)
Northeastern	176 (15.1)
Southern	89 (7.6)
Eastern	223 (19.2)
Western	25 (2.1)
Income per month (>5000 THB)	256 (22.0)
Family income per month (>45,000 THB)	343 (29.5)
GPAX (>3.00)	796 (68.4)
History of drug use (not including electronic cigarettes)	
Ever	425 (36.5)
Place for buying electronic cigarette	
Retail store	40 (3.4)
Website	56 (4.8)
Line	46 (6.5)
Facebook	45 (3.9)
Twitter	12 (1.0)
Instagram	60 (5.2)
History of parental drug use	
Cigarette	474 (40.7)
Electronic cigarette	105 (9.0)
Alcohol	774 (66.5)
Baraku	234 (20.1)
Cannabis	68 (5.8)
Others	7 (0.6)
History of friend's drug use	
Cigarette	287 (24.7)
Electronic cigarette	371 (31.9)
Alcohol	689 (59.2)
Baraku	73 (6.3)
Cannabis	114 (9.8)
Marketing factor	

Contd...

Table 1: Contd...

Characteristics	n (%)
Ever seen any advertisements or promotions for electronic cigarettes	695 (59.7)
Electronic cigarettes have many flavors and scents	1029 (88.4)
Electronic cigarette packaging is attractive	932 (80.1)
Electronic cigarettes have many channels of distribution and are convenient	963 (82.7)

SD=Standard deviation

income per month, family income per month, GPAX, history of drug use, history of parental e-cigarette use, history of parental Baraku use, history of parental cannabis use, history of parental alcohol use, history of friends' cigarette use, history of friends' e-cigarette use, history of friends' Baraku use, history of friends' cannabis use, history of friends' alcohol use, history of seeing e-cigarette advertisements, beliefs and attitudes about e-cigarette use (e-cigarettes are not harm to health, e-cigarettes are less harmful than cigarettes, e-cigarettes are less addictive than cigarettes, using e-cigarettes can help stop smoking, e-cigarettes help people improve social skills, e-cigarette users are attractive, using e-cigarettes is cheaper than using cigarettes, and unpleasant smell from e-cigarettes is less than from cigarettes), and marketing factors (e-cigarettes have many flavors and scents, e-cigarette packaging is attractive, and e-cigarettes have many channels of distribution and are convenient).

The results of our multivariable logistic regression analyses revealed that history of drug use, GPAX, and attitudes about e-cigarette use (e-cigarettes are not harmful to health, using e-cigarettes can help stop smoking, and e-cigarettes help people improve social skills) strongly correlated with the use of e-cigarettes in the preceding 30 days [Table 2].

DISCUSSION

In the present study, we investigated the prevalence and risk factors of e-cigarette use among youths in Thailand. The prevalence of having ever used e-cigarettes was 19.4%, and the current e-cigarette use was 10.6%. These findings are in line with the Savigamin *et al.*'s⁴ study, which indicated that the prevalence of current e-cigarette use was 22.2% in college students. However, Patanavanich *et al.*'s³ study found that the prevalence of current e-cigarette use was 3.7% in Thai youths. The reason for the discrepancy between the present and Patanavanich *et al.*'s³ study could be related to different populations. The definition of Thai youths in our study included those aged between 15 and 24 years and currently studying in secondary school or university. In contrast, in the Patanavanich *et al.*'s³ study, they recruited only 7th-grade students, with an average age of 13 years. For comparison, previous systematic

reviews indicated that the prevalence of current e-cigarette use was 9.8% for Asian American youth,¹⁷ and the Cullen *et al.*'s¹⁸ study showed that the prevalence of current e-cigarette use among US youths was 10.5%, which was lower than our results. It should be noted that e-cigarette use in the US is legal. Therefore, current e-cigarette use among Thai youths is relatively high when compared to that in other legalized countries.

E-cigarettes have become particularly popular among young people worldwide due to their appealing flavors, sleek designs, and aggressive marketing tactics. The rise in youth e-cigarette use has raised alarms about addiction, leading to traditional tobacco use. Although e-cigarettes were banned for import and sale in Thailand, the prevalence of current e-cigarette use among youths in Thailand and other legalized countries (such as the US and European) is comparable. Thus, our findings indicated that Thailand's e-cigarette regulations and law enforcement were unsuccessful. Our results showed that most e-cigarette users buy e-cigarettes through online platforms (e.g. Facebook, Line, Instagram, and website). To prevent youths from initiating these purchases, the government must regularly monitor e-cigarette advertising and improve enforcement of tobacco advertising, promotion, and sponsorship, particularly on online platforms. Addressing this issue is crucial for safeguarding the health of future generations.

The results of this study show that a history of drug use (cigarette, Baraku, cannabis, or alcohol) is a risk factor for e-cigarette use in the previous 30 days. This finding is in line with previous studies,¹⁹⁻²¹ showing that the use of cigarettes, cannabis, and alcohol was associated with current e-cigarette use. Our findings imply that e-cigarette users are mostly youths who are attracted to risky behaviors and are sensation-seeking.²² Moreover, our results demonstrate that attitudes about e-cigarette use (e-cigarettes are not harmful to health, using e-cigarettes can help stop smoking, and e-cigarettes help people improve social skills) are risk factors of current e-cigarette use. E-cigarettes were believed to be not as addictive as conventional cigarettes.^{23,24} Previous research found that e-cigarette advertisements influence people's attitudes and beliefs about e-cigarettes, which may encourage e-cigarette use.²⁴ However, previous systematic reviews revealed that e-cigarette use was associated with reduced smoking cessation and harmful cardiovascular effects.^{7,15} Our findings may imply that college students lack knowledge, awareness, and information about the adverse effect of e-cigarette use. Educational programs are needed to reduce the knowledge gap and increase awareness. It is important to create more objective sources of information to balance the entrenched interests of television advertising and publicity.

Our study indicated that GPAX ≥ 3.00 was a protective factor against e-cigarette use. This finding is consistent with Patanavanich *et al.*'s³ study. Their results showed that

Table 2: Odds ratio and 95% confidence interval of the factors associated with e-cigarette use among youths in Thailand ($n=1164$)

Variables	Un AOR (95% CI)	<i>P</i>	AOR* (95% CI)	<i>P</i>
History of drug use	5.66 (4.29–7.46)	<0.001	3.61 (2.63–4.96)	<0.001
GPAX ≥ 3.00	0.62 (0.42–0.91)	0.014	0.62 (0.38–0.99)	0.049
Belief and attitude factor				
Electronic cigarettes are not harmful to health	3.39 (2.32–4.97)	<0.001	2.18 (1.31–3.63)	0.003
Using electronic cigarettes can help stop smoking	3.47 (2.23–5.41)	<0.001	1.97 (1.07–3.60)	0.028
Electronic cigarettes help people to improve their social skills	3.64 (2.44–5.43)	<0.001	1.95 (1.11–3.44)	0.021

*Adjusted for age, gender, education level, income per month, family income per month, GPAX, history of drug use, history of parental electronic cigarette use, history of parental baraku/cannabis/alcohol use, history of friend's cigarette/electronic cigarette/baraku/cannabis/alcohol use, history of seeing e-cigarette advertisements, belief and attitude factors, and marketing factors. AOR=Adjusted odds ratio; CI=Confidence interval

e-cigarette use was associated with a lower grade point average (GPA). Moreover, previous research revealed a significantly lower GPA in everyday e-cigarette users when compared to “never users.”²⁵ It is probable that students with higher GPAs have a greater capacity to acquire knowledge about health and to understand the impact of health-related problems caused by e-cigarettes. Further research should examine the effect of educational programs (knowledge about the harmful effects of e-cigarettes and self-efficacy) that help reduce the use of e-cigarettes.

Five methodological limitations should be taken into consideration when interpreting the results of our study. First, the design was cross-sectional; thus, it was not possible to establish the causal relationship between exposure and outcome. We examined only the association between exposure and outcome. Therefore, a prospective study is needed to validate our findings. Second, we used cross-sectional surveys, which are prone to selection bias due to the use of a convenience sample. Third, participants were Thai youths who were in secondary school or university and were between the ages of 15 and 24 years, which restricts external validity. Therefore, generalization of our findings to other populations (e.g., older adults) should be made with caution. Fourth, the relationship between prior drug usage and e-cigarette use could not be demonstrated due to a lack of information regarding the history of drug use for each substance. Further study should collect information about the history of cigarette, baraku, cannabis, or alcohol use separately. Lastly, the study's findings regarding the prevalence of e-cigarette use may be affected by certain biases. The participants in this study were only included if they had ever heard of or knew about e-cigarettes. Therefore, the prevalence of using e-cigarettes could be overestimated. In addition, the majority of the participants in this study were female high school students, which may result from convenience sampling. The cigarette smoking rate for males was more than four times the rate for females.²⁶ Thus, it is possible that the prevalence rate of e-cigarette use in this study is understated.

CONCLUSION

The present study revealed that e-cigarette use among Thai youths was relatively high. History of drug use and attitudes about e-cigarette use (e-cigarettes are not harmful to health, using e-cigarettes can help stop smoking, and e-cigarettes help people improve social skills) were risk factors of e-cigarette use. Higher academic performance (GPAX) was a protective factor against current e-cigarette use. We found false beliefs (lack of knowledge or misinformation about the negative health effects of e-cigarette use). Further research should focus on education as a tool to reduce the prevalence of e-cigarette use among Thai youths.

Acknowledgments

The authors wish to thank Miss Phakwan Charoenwattanasuksom, Miss Nutnicha Jongtragansombut, Miss Kanrapee Phalasirisith, Miss Varisa Wattanapichayakuland, Miss Suphisara Kaeosondi, and Miss Tanaporn Sirimaha who assisted in data collection.

Data availability statement

The data that support the findings of this study are available from the corresponding author, Waongenngarm P., upon reasonable request.

Financial support and sponsorship

This work was supported by the Thai Health Promotion Foundation and Faculty of Allied Health Sciences, Chulalongkorn University. 1. The Thai Health Promotion Foundation: No. 63-00-1493. 2. The Faculty of Allied Health Science: No. 1374201000.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Czoli CD, Hammond D, White CM. Electronic cigarettes in Canada: Prevalence of use and perceptions among youth and young adults. *Can J Public Health* 2014;105:e97-102.
2. Uddin SM, Osei AD, Obisesan OH, El-Shahawy O, Dzaye O, Cainzos-Achirica M, *et al.* Prevalence, trends, and distribution of nicotine and marijuana use in E-cigarettes among US adults: The behavioral risk factor surveillance system 2016-2018. *Prev Med* 2020;139:106175.
3. Patanavanich R, Aekplakorn W, Glantz SA, Kalayasiri R. Use of E-cigarettes and associated factors among youth in Thailand. *Asian Pac J Cancer Prev* 2021;22:2199-207.
4. Savigamin C, Jitwimungsanon J, Rattananupong T, Sittipunt C, Sriprasart T. Prevalence and risk factors of E-cigarette users in Thai college student. *Clin Med Res* 2021;10:47.
5. Romijnders KA, van Osch L, de Vries H, Talhout R. Perceptions and reasons regarding e-cigarette use among users and non-users: A narrative literature review. *Int J Environ Res Public Health* 2018;15:1190.
6. Khadka S, Awasthi M, Lamichhane RR, Ojha C, Mamudu HM, Lavie CJ, *et al.* The cardiovascular effects of electronic cigarettes. *Curr Cardiol Rep* 2021;23:40.
7. Kennedy CD, van Schalkwyk MC, McKee M, Pisinger C. The cardiovascular effects of electronic cigarettes: A systematic review of experimental studies. *Prev Med* 2019;127:105770.
8. Layden JE, Ghinai I, Pray I, Kimball A, Layer M, Tenforde MW, *et al.* pulmonary illness related to E-cigarette use in Illinois and Wisconsin – Final report. *N Engl J Med* 2020;382:903-16.
9. Kalininskiy A, Bach CT, Nacca NE, Ginsberg G, Marraffa J, Navarette KA, *et al.* E-cigarette, or vaping, product use associated lung injury (EVALI): Case series and diagnostic approach. *Lancet Respir Med* 2019;7:1017-26.
10. Centers for Disease Control and Prevention. Outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products; 2020. Available from: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html. [Last accessed on 2022 Aug 30].
11. Moritz ED, Zapata LB, Lekachvili A, Glidden E, Annor FB, Werner AK, *et al.* Update: Characteristics of patients in a national outbreak of E-cigarette, or vaping, product use-associated lung injuries – United States, October 2019. *MMWR Morb Mortal Wkly Rep* 2019;68:985-9.
12. Kim SY, Sim S, Choi HG. Active, passive, and electronic cigarette smoking is associated with asthma in adolescents. *Sci Rep* 2017;7:17789.
13. Landman ST, Dhaliwal I, Mackenzie CA, Martinu T, Steel A, Bosma KJ. Life-threatening bronchiolitis related to electronic cigarette use in a Canadian youth. *CMAJ* 2019;191:E1321-31.
14. Tobore TO. On the potential harmful effects of E-Cigarettes (EC) on the developing brain: The relationship between vaping-induced oxidative stress and adolescent/young adults social maladjustment. *J Adolesc* 2019;76:202-9.
15. Kalkhoran S, Glantz SA. E-cigarettes and smoking cessation in real-world and clinical settings: A systematic review and meta-analysis. *Lancet Respir Med* 2016;4:116-28.
16. Soneji S, Barrington-Trimis JL, Wills TA, Leventhal AM, Unger JB, Gibson LA, *et al.* Association between initial use of E-cigarettes and subsequent cigarette smoking among adolescents and young adults: A systematic review and meta-analysis. *JAMA Pediatr* 2017;171:788-97.
17. Shi M, Gette JA, Gissandaner TD, Cooke JT, Littlefield AK. E-cigarette use among Asian Americans: A systematic review. *J Ethn Subst Abuse* 2020;21:1-34.
18. Cullen KA, Gentzke AS, Sawdey MD, Chang JT, Anic GM, Wang TW, *et al.* E-cigarette use among youth in the United States, 2019. *JAMA* 2019;322:2095-103.
19. Copeland AL, Peltier MR, Waldo K. Perceived risk and benefits of E-cigarette use among college students. *Addict Behav* 2017;71:31-7.
20. Tavoracci MP, Vasiliu A, Romo L, Kotbagi G, Kern L, Ladner J. Patterns of electronic cigarette use in current and ever users among college students in France: A cross-sectional study. *BMJ Open* 2016;6:e011344.
21. Subica AM, Guerrero E, Wu LT, Aitaoto N, Iwamoto D, Moss HB. Electronic cigarette use and associated risk factors in U.S.-Dwelling Pacific Islander young adults. *Subst Use Misuse* 2020;55:1702-8.
22. Cohn A, Villanti A, Richardson A, Rath JM, Williams V, Stanton C, *et al.* The association between alcohol, marijuana use, and new and emerging tobacco products in a young adult population. *Addict Behav* 2015;48:79-88.
23. Wills TA, Knight R, Williams RJ, Pagano I, Sargent JD. Risk factors for exclusive E-cigarette use and dual E-cigarette use and tobacco use in adolescents. *Pediatrics* 2015;135:e43-51.
24. Trumbo CW, Kim SJ. The effect of electronic cigarette advertising on intended use among college students. *Addict Behav* 2015;46:77-81.
25. Jones RD, Asare M, Lanning B. A retrospective cross-sectional study on the prevalence of E-cigarette use among college students. *J Community Health* 2021;46:195-202.
26. Reitsma MB, Flor LS, Mullany EC, Gupta V, Hay SI, Gakidou E. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and initiation among young people in 204 countries and territories, 1990-2019. *Lancet Public Health* 2021;6:e472-81.