

Factors Associated with E-Cigarette Misconceptions and Intention to Use Among High School Students in Bangkok, Thailand: A PRECEDE-Based Study

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ABSTRACT:

Introduction: Despite Thailand's comprehensive prohibition of e-cigarettes, adolescent usage persists as a significant concern, mostly attributable to misconceptions regarding safety, nicotine, addiction, cessation, and facilitated availability via digital marketing and social influence. This cross-sectional analytical study, informed by the PRECEDE model, investigated the predisposing, enabling, and reinforcing factors related to e-cigarette misconceptions among high school students in Bangkok. **Objective:** To investigate the social and behavioral determinants of e-cigarette misconceptions among Thai adolescents and identify characteristics that could guide focused public health interventions. A total of 441 participants in grades 10 to 12 were recruited using multi-stage cluster sampling from three schools in Bangkok. **Results:** Multiple linear regression indicated that predisposing factors accounted for 8.9% of the variance in misconceptions, with male gender, elevated grade, and higher GPA positively correlated, whereas a history of conventional smoking was negatively correlated; enabling factors accounted for the largest variance at 18.3%, with free giveaways and exposure to digital advertising significantly augmenting misconceptions; reinforcing factors accounted for 3.8% of the variance. **Conclusion:** Targeted digital marketing, illegal accessibility, peer influence, and gender related attitudes significantly contribute to e-cigarette misconceptions, suggesting that public health interventions should focus on rectifying misinformation and enhancing digital health literacy among adolescents.

Keywords: E-cigarettes; Misconceptions; Adolescents; Bangkok; PRECEDE model.

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Introduction

Electronic cigarettes, commonly known as e-cigarettes or vapes, have emerged as one of the most significant public health challenges of the twenty-first century (Walley et al., 2019). Originally marketed as smoking cessation aids, these devices have been widely adopted by populations—most alarmingly, by adolescents and young adults—who have never smoked conventional cigarettes (Fadus et al., 2019; Marques et al., 2021).

The rapid proliferation of e-cigarettes is fueled in part by erroneous beliefs that these devices are safe, non-addictive, and a viable means of quitting traditional tobacco products (Gorukanti et al., 2017). These misconceptions, often propagated through sophisticated marketing strategies and social media platforms, have contributed to an unprecedented rise in youth vaping across the globe (Chu et al., 2024).

The World Health Organization (WHO, 2019) has documented alarming increases in youth e-cigarette use in the United States and parts of Europe. In the United States, the prevalence of e-cigarette use among youth rose sharply from 1.5% in 2011 to 20.8% in 2018. In Australia, current e-cigarette use among adolescents aged 14–17 years increased from 0.8% to 14.5% between 2018 and 2023, while usage among young adults aged 18–24 rose from 2.0% to 19.8%, making young Australians the most prolific e-cigarette users in the country (Jongenelis & Thoonen, 2023). By 2024, e-cigarettes had become the most used tobacco product among middle and high school students in the United States, with approximately 1.63 million students (5.9%) reporting current use—comprising 410,000 middle school students (3.5%) and 1.21 million high school students (7.8%) (Centers for Disease Control and Prevention, 2024).

Thailand has not been exempted from this worldwide trend. Notwithstanding its status as one of 34 nations that have enacted a comprehensive prohibition on the importation and sale of e-cigarettes, the incidence of e-cigarette usage among Thai adolescents has

escalated at a concerning pace (Chotmac & Pitayarangsarit, 2022; Pattanavanich et al., 2023). Therefore, the primary objective of this study was to investigate the factors shaping e-cigarette misconceptions and their subsequent impact on the intention to use e-cigarettes among high school students in Bangkok. Specifically, the study aimed:

To examine the influence of predisposing, enabling, and reinforcing factors (based on the PRECEDE model) on the level of misconceptions regarding e-cigarettes among high school students in Bangkok.

To determine the association between the level of e-cigarette misconceptions and the intention to use e-cigarettes among high school students in Bangkok.

Literature Review

E-Cigarettes

Electronic cigarettes (e-cigarettes), also known as electronic nicotine delivery systems (ENDS), are battery-operated devices that vaporize a liquid solution containing nicotine, propylene glycol, vegetable glycerin, and flavoring agents for inhalation (WHO, 2020). E-cigarettes include first-generation “cigalikes”, second-generation vape pens, third-generation box mods, and fourth-generation pod-based systems such as JUUL (Glantz & Bareham, 2018). Under the Tobacco Products Control Act B.E. 2560 (2017) and the Customs Act, all e-cigarettes are illegal to import, export, or sell in Thailand (Ministry of Public Health Thailand, 2017; Patanavanich & Glantz, 2021).

Misconceptions About e-Cigarettes Among Adolescents

A substantial body of literature has documented widespread misconceptions regarding the safety, health effects, and addictive potential of e-cigarettes among adolescent populations worldwide. These misconceptions are particularly consequential because they directly influence attitudes, intentions, and behaviors related to e-cigarette use (Amrock et al., 2016; Kong et al., 2015).

Misconception 1: e-Cigarettes are harmless or significantly safer than conventional cigarettes. Perhaps the most pervasive misconception among adolescents is the belief that e-cigarettes are either completely harmless or substantially safer than combustible tobacco products. While e-cigarettes do not produce tobacco smoke and thus eliminate exposure to certain combustion-related carcinogens, the aerosol generated by e-cigarettes is not benign. It contains ultrafine particles, volatile organic compounds, heavy metals such as lead and nickel, and nicotine—all of which carry documented health risks (Golan et al., 2023). WHO (2020) has stated explicitly that e-cigarettes are harmful to health and are not safe. Despite mounting scientific evidence, surveys of adolescents in multiple countries continue to reveal a substantial proportion who perceive e-cigarettes as risk-free or minimally risky (Amrock et al., 2016; Gorukanti et al., 2017).

Misconception 2: e-Cigarettes do not contain nicotine. A considerable proportion of adolescent e-cigarette users, including those who use nicotine-containing devices, erroneously believe that e-cigarettes do not contain nicotine (Kong et al., 2015). This misconception may be attributable partly to marketing strategies that de-emphasize the nicotine content and highlight the flavoring ingredients. Research has demonstrated that nicotine-containing e-cigarettes can deliver nicotine at concentrations comparable to or exceeding those of conventional cigarettes, particularly in pod-based systems, such as JUUL, which may contain up to 5% nicotine by weight (Goniewicz et al., 2018; Willett et al., 2019). Misunderstanding the nicotine content has direct implications for adolescents' risk assessment and their susceptibility to nicotine dependence.

Misconception 3: e-Cigarettes are effective smoking cessation tools. Frequently, e-cigarettes are marketed—both explicitly and implicitly—as tools for quitting conventional cigarette smoking. While some clinical evidence suggests that e-cigarettes may assist certain adult smokers in reducing cigarette consumption (Hartmann-Boyce et al., 2022), the scientific consensus does not support their use as a first-line cessation tool, particularly for adolescents. The U.S. Food and

Drug Administration has not approved any e-cigarette product as a cessation device (Dai et al., 2023). Among adolescents, the adoption of e-cigarettes under the guise of smoking cessation is particularly problematic, as it may introduce nicotine dependence in individuals who might otherwise remain nicotine-naïve.

Misconception 4: Second-hand aerosol from e-cigarettes is harmless. Misconceptions also extend to the perceived harmlessness of second-hand exposure to e-cigarette aerosol. Studies have demonstrated that bystanders exposed to e-cigarette aerosol inhale measurable quantities of nicotine, fine particulate matter, and various chemical compounds, posing potential health risks—particularly for vulnerable populations, including children and individuals with respiratory conditions (Czogala et al., 2014; Protano et al., 2017). Adolescents who underestimate second-hand aerosol risks may be less inclined to object to e-cigarette use in shared spaces or to advocate for smoke-free environments.

In the Thai context, limited research has specifically examined the nature and prevalence of e-cigarette misconceptions among adolescents. Benjakul et al., (2022) noted that frequently, Thai adolescents obtained information about e-cigarettes from peers and social media rather than from authoritative health sources, creating fertile ground for the propagation of inaccurate beliefs. The absence of widely accessible, culturally appropriate health literacy campaigns addressing e-cigarette misconceptions represents a major gap in Thailand's public health communication strategy.

Methodology

Study design and setting

This study applied cross-sectional analytical research. The study population comprised upper secondary school students in Bangkok during the 2025 academic year, categorized into three affiliations: institutions governed by the Office of the Basic Education Commission, Ministry of Education; those under the Bangkok Metropolitan Administration; and those affiliated

with the Ministry of Higher Education, Science, Research and Innovation.

Participants and sample procedure

A multi-stage cluster sampling method was applied to select a final sample of 441 high school students (grades 10-12) in 2025, calculated from a population of 80,408, using Taro Yamane's formula (Yamane, T. (1967)¹¹ with a 5% error margin and an 11% buffer to account for data loss. The process began by randomly selecting Chatuchak district from Bangkok's 50 districts. Next, three schools were chosen to represent different educational affiliations: Horwang School, Prachanivet Secondary School, and Kasetsart University Demonstration School. Finally, the sample size was divided equally among the three schools and grade levels, with individual students selected through simple random sampling by drawing student numbers within their classrooms to ensure an even and representative distribution

Variables

The PRECEDE-PROCEED Model (Green & Kreuter, 1991; Green & Kreuter, 2005) underpinned the current work. This framework suggests three interrelated groups of characteristics influence Thai teenagers' e-cigarette use. Misconceptions regarding e-cigarettes' safety, nicotine content, quitting efficacy, addiction potential, and second-hand aerosol directly affect adolescents' attitudes and behavioral intentions toward e-cigarette usage. Enabling elements, including social media exposure, perceived ease of access, and informal market availability, help turn misunderstandings into behavior. Peer norms and approval reinforce misconceptions and usage intentions by socially validating e-cigarette experimentation.

These three kinds of characteristics influence Thai teenagers' e-cigarette views, behavioral intentions, and behavior. The diagnostic assessment and health promotion intervention design followed this concept.

Figure 1 The conceptual framework integrates the PRECEDE model with the specific variables of the present study

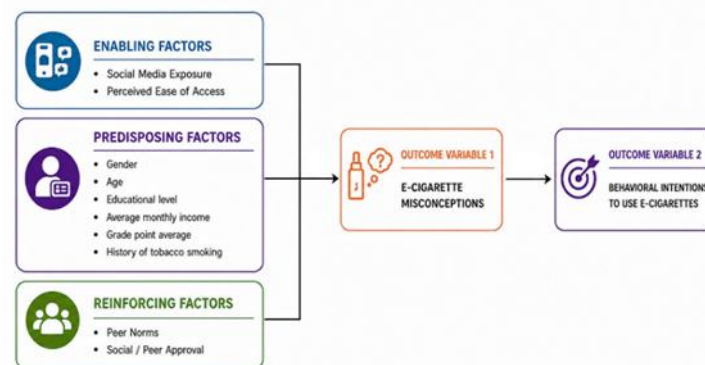


Figure 1: Proposed Conceptual Framework

Instruments

The data collection tool for this study was a researcher-developed self-assessment questionnaire. It was created based on two primary steps:

1. Literature review: Gathering relevant background knowledge from books, journals, documents, and existing research.
2. Defining parameters: Designing the questionnaire's framework to align with the research objectives. This involved determining the variables, operational definitions, the number

of questions, the format of the questionnaire, and the evaluation criteria.

The average of the Item-Objective Congruence index of 3 experts was above 0.97, with Cronbach's Alpha Coefficient of 0.89.

Data Collection Instruments

A questionnaire was used to collect data on e-cigarette misconceptions and usage trends among high school students in Bangkok. The tool was divided into three main sections:

Section 1: General information (14 items): A checklist based on the PRECEDE model, covering predisposing factors (demographics, smoking history), enabling factors (accessibility, advertising), and reinforcing factors (family/peer usage and encouragement).

Section 2: Misconceptions about e-cigarettes (30 items): Assessed knowledge regarding e-cigarette components, health impacts, and related laws using a 4-point Likert scale (strongly agree, agree, disagree, strongly disagree).

Section 3: Intention to use e-cigarettes (6 items): The questionnaire on the tendency of e-cigarette smoking behavior included closed-ended questions regarding the intention to use e-cigarettes in the future. The response options were "Yes" and "No."

Data Analysis

- Descriptive statistics were used; frequency distribution, percentage, mean, standard deviation to study the predisposing factors, enabling factors, reinforcing factors, misconceptions about e-cigarettes, and trends in e-cigarette use among high school students in Bangkok.

- Multiple Linear Regression Analysis statistics were employed to examine the impact of predisposing, enabling, and reinforcing factors on misconceptions regarding e-cigarette usage among high school students in Bangkok. The statistical significance threshold was established at .05.

Results

A total of 441 high school students participated in the study. The multiple linear regression analysis revealed that the model explained 18.3% of the variance in e-cigarette misconceptions. Male students had significantly higher misconception scores than female students. Students in higher grade levels also demonstrated higher misconception scores, and GPA was positively associated with misconception level. In contrast, students with a history of conventional cigarette smoking showed significantly lower misconception scores. In addition, enabling factors, particularly free distribution and exposure to digital advertising, were significantly associated with higher misconception scores. These findings indicate that both personal characteristics and environmental exposures were related to e-cigarette misconceptions among the participants.

Demographic data

Analysis of the quantity and proportion of predominant factors within the 441-sample cohort indicated that females constituted most of the sample (56.00%), while males comprised 44.00%. The predominant age group was 17–18 years (61.00%), succeeded by 15–16 years (39.00%). Concerning educational attainment, there was an even distribution of participants across grades 10, 11, and 12, with each grade comprising 33.33%, 33.33%, and 33.34% of the total, respectively. The majority (94.10%) exhibited average academic achievement with a grade point average (GPA) score in the range 2.51–4.00, whilst a lesser proportion (5.90%) had a GPA score in the range 1.00–2.50. In addition, the analysis encompassed monthly expenditure, with the predominant group of respondents earning THB 2,001–5,000 (49.40 %), followed by those earning less than THB 2,000 (34.20 %), and those earning over THB 5,000 (16.30 %). In terms of smoking history, the predominant portion of the sample had never engaged in smoking (94.10 %), whereas 5.90 % had a history of smoking.

Table 1: Examination of results on misunderstandings regarding e-cigarettes among high school students in Bangkok.

Misconceptions about e- cigarettes	Level of opinion (%)								$\bar{x}$	SD
	Strongly agree		Agree		Disagree		Strongly disagree			
	n	%	n	%	n	%	n	%		
1. E-liquid does not contain nicotine.	23	5.20	34	7.70	107	24.30	277	62.80	3.45	0.85
2. E-liquid contains only one chemical: nicotine.	17	3.90	34	7.70	152	34.50	238	54.00	3.39	0.79
3. Regularly replacing the coil in your e-cigarette helps reduce health risks for the user.	13	2.90	59	13.40	137	31.10	232	52.60	3.33	0.82
4. E-cigarettes use heat from electrical energy instead of a flame for combustion, so they are not dangerous.	17	3.90	43	9.80	105	23.80	276	62.60	3.45	0.82
5. E-cigarette users can control the amount of nicotine in the e-liquid, thus preventing addiction.	10	2.30	25	5.70	107	24.30	299	67.8	3.58	0.70
6. E-liquids have pleasant scents and are not harmful.	8	1.80	24	5.40	90	20.40	319	72.30	3.63	0.67
7. E-cigarettes use water vapor without any chemical additives.	8	1.80	27	6.10	111	25.20	295	66.90	3.57	0.69
8. E-cigarette batteries do not pose a risk of explosion or fire.	11	2.50	26	5.90	115	26.10	289	65.50	3.55	0.72
9. E-cigarettes do not contain any addictive substances because they do not produce smoke like regular cigarettes.	7	1.60	18	4.10	71	16.10	345	78.20	3.71	0.62
10. The coils in e-cigarettes do not contain chemicals that affect the user.	6	1.40	26	5.90	112	25.40	297	67.30	3.59	0.67
11. E-cigarettes are a gateway to drug use.	191	43.30	110	24.90	48	10.90	92	20.90	2.91	1.17
12. E-cigarettes cannot help people quit traditional cigarettes.	137	31.10	124	28.10	78	17.70	102	23.10	2.67	1.14
13. E-cigarettes are less harmful than traditional cigarettes.	26	5.90	44	10.00	113	25.60	258	58.50	3.37	0.89

Misconceptions about e- cigarettes	Level of opinion (%)								$\bar{x}$	SD
	Strongly agree		Agree		Disagree		Strongly disagree			
	n	%	n	%	n	%	n	%		
14. E-cigarette use among students may affect concentration and academic performance.	252	57.10	82	18.60	38	8.60	69	15.60	3.17	1.12
15. E-cigarette use does not affect anxiety or depression.	17	3.90	42	9.50	134	30.40	248	56.20	3.39	0.81
16. E-cigarette vapor is just an aerosol and does not affect nearby individuals.	14	3.20	23	5.20	77	17.50	327	74.10	3.63	0.73
17. Using e-cigarettes can help relieve stress.	19	4.30	101	22.90	119	27.00	202	45.80	3.14	0.92
18. Using e-cigarettes is a way to gain acceptance from friends.	7	1.60	31	7.00	93	21.10	310	70.30	3.60	0.69
19. The chemicals in e-cigarettes harm the ecosystem.	248	56.20	94	21.30	44	10.00	55	12.50	3.21	1.06
20. E-cigarettes cause lung inflammation.	273	61.90	79	17.90	30	6.80	59	13.40	3.28	1.07
21. Selling e-cigarettes through online platforms is prohibited.	296	67.10	66	15.00	35	7.90	44	10.00	3.39	0.99
22. Possessing e-cigarettes is illegal.	253	57.40	79	17.90	54	12.20	55	12.50	3.20	1.08
23. Using e-cigarettes in public places is permitted.	13	2.90	25	5.70	100	22.70	303	68.70	3.57	0.73
24. Importing e-cigarettes is not illegal.	21	4.80	25	5.70	101	22.90	294	66.70	3.51	0.81
25. Selling e-liquid is not illegal.	7	1.60	36	8.20	96	21.80	302	68.50	3.57	0.71
26. It is legal to manufacture e-cigarettes for sale.	8	1.80	27	6.10	89	20.20	317	71.90	3.62	0.68
27. Importing e-cigarettes from foreign countries for personal use is not illegal.	14	3.20	41	9.30	102	23.10	284	64.40	3.49	0.79
28. People over 18 years of age can legally purchase e-cigarettes.	22	5.00	63	14.30	116	26.30	240	54.40	3.30	0.89
29. There are no clear penalties for minors under 18 years of age who use e-cigarettes.	42	9.50	54	12.20	107	24.30	238	54.00	1.77	0.99

Misconceptions about e- cigarettes	Level of opinion (%)								$\bar{x}$	SD
	Strongly agree		Agree		Disagree		Strongly disagree			
	n	%	n	%	n	%	n	%		
30. E-cigarettes can be legally used in private areas such as homes, condominiums, and bedrooms.	41	9.30	102	23.10	104	23.60	194	44.00	3.02	1.02

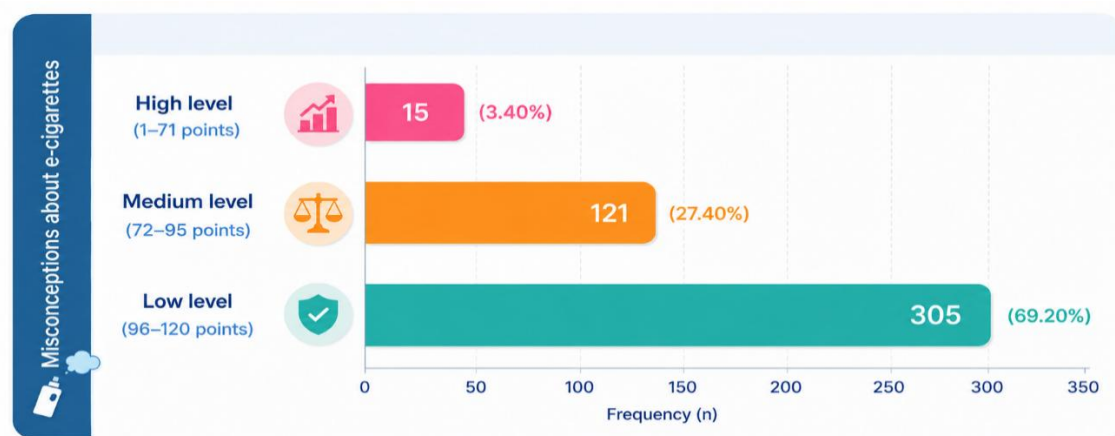
The result from table 1 presents an analysis of the influence of predisposing, enabling, and reinforcing factors on misconceptions about e-cigarettes among high school students in Bangkok. Based on the sample of 441 students, the analysis of itemized misconceptions about e-cigarettes revealed that students generally disagreed with the misconception statements (mean = 1.77–3.71, SD = 0.62–1.17).

Based on individual items, the highest level of misconception (mean = 1.00–2.00) was the belief that "there are no clear legal penalties for youths under 18 using e-cigarettes" (mean = 1.77, SD =

0.99). Items with a moderate level of misconception (mean = 2.01–3.00) were the beliefs that "e-cigarettes cannot help quit conventional smoking" (mean = 2.67, SD = 1.14) and "e-cigarettes act as a gateway to drug use" (mean = 2.91, SD = 1.17).

In conclusion, while most students had an accurate understanding of e-cigarettes in several areas, the findings highlighted a critical need for further education, specifically regarding the health impacts and legal regulations associated with e-cigarette use.

Figure 2: Analysis of results on misconceptions regarding e-Cigarettes among high school students in Bangkok.



The sample group of 441 individuals is shown in Figure 2 to have several misconceptions about electronic cigarettes, as well as a percentage of those beliefs. The data analysis revealed that most of the sample group had a low level of misconceptions about e-cigarettes (305 people, 69.20%), followed by a moderate level (121 people, 27.40%), and a high level (15 people, 3.40%).

In conclusion, most students had a low level of misconceptions about e-cigarettes.

Misconceptions about e-cigarettes among high school students in Bangkok are influenced by the predisposing, enabling, and reinforcing factors that are explained in Table 2-4.

Table 2: Results of analysis of influence of predisposing factors on misconceptions about e-cigarettes.

Predisposing factor	Misconceptions about e-cigarettes				
	B	SE	β	t	p-value
- Gender	4.303	1.199	0.169	3.590	< .001*
- Age	-2.945	1.922	-0.114	-1.532	.126
- Education level	2.500	1.166	0.162	2.144	.033*
- Average GPA	6.250	2.492	0.117	2.508	.012*
- Average monthly income	-1.279	0.846	-0.070	-1.512	.131
- Smoking history (cigarettes)	-7.233	2.478	-0.135	-2.919	.004*

Note: $R = .299$, $R^2 = 0.089$, Adjusted $R^2 = 0.077$, *p-value < .05

Table 2 shows the results of the influence analysis of factors on misconceptions about e-cigarettes among high school students in Bangkok, based on multiple linear regression analysis. The variables with statistically significant influence at the .05 level were gender ($\beta = 0.169$, $p < .001$), education level ($\beta = 0.162$, $p = .033$), average grade point average ($\beta = 0.117$, $p = .012$), and smoking history ($\beta = -0.135$, $p = .004$). Gender,

education level, and average grade point average had a positive influence on misconceptions about e-cigarettes, while smoking history had a negative influence. Age ($\beta = -0.114$, $p = .126$) and average monthly income ($\beta = -0.070$, $p = .131$) had no statistically significant influence. Furthermore, the model explained 8.9% of the variance in misconceptions about e-cigarettes ($R^2 = 0.089$), which was significant at the .05 level.

Table 3: Results of analysis of influence of enabling factors contributing to misconceptions about e-cigarettes.

Enabling factor	Misconceptions about e-cigarettes				
	B	SE	β	t	p-value
Access to e-cigarettes					
- Ease of purchasing e-cigarettes	-3.904	1.885	-0.097	-2.071	.039*
- Not knowing where to buy e-cigarettes	-4.012	2.168	-0.140	-1.850	.065
- Ordering e-cigarettes online	-1.352	1.894	-0.051	-0.714	.476
- Receiving e-cigarettes from a group of friends	1.862	1.413	0.071	1.318	.188
- Receiving e-cigarettes from an acquaintance	-1.078	1.471	-0.038	-0.733	.464
- Receiving e-cigarettes from a family member	-5981	2.851	-0.107	-2.097	.037*

Enabling factor	Misconceptions about e-cigarettes				
	B	SE	β	t	p-value
- Receiving e-cigarettes as a free giveaway	-11.523	2.860	-0.207	-4.030	< .001*
- Purchasing e-cigarettes from a physical store	2.669	1.307	0.097	2.043	.042*
Access to e-cigarette advertising.					
- I've never seen an e-cigarette ad.	1.004	1.825	0.040	0.551	.582
- I've seen e-cigarette ads on Facebook.	0.379	1.566	0.014	0.242	.809
- I've seen e-cigarette ads on Instagram.	-2.100	1.639	-0.067	-1.281	.201
- I've seen e-cigarette ads on Twitter.	2.282	1.906	0.061	1.197	.232
- I've seen e-cigarette ads on Shopee.	1.760	2.195	0.056	0.802	.423
- I've seen e-cigarette ads on Lazada.	1.126	2.516	0.031	0.447	.655
- I've seen e-cigarette ads on TikTok.	1.436	1.616	0.054	0.889	.375
- I've seen e-cigarette ads on Telegram	-10.121	2.932	-0.185	-3.452	< .001*

Note: $R = 0.428$, $R^2 = 0.183$, Adjusted $R^2 = 0.152$, *p-value < .05

The multiple linear regression analysis examining the influence of enabling factors on e-cigarette misconceptions among high school students in Bangkok revealed that the model accounted for 18.3% of the variance ($R^2 = 0.183$, Adjusted $R^2 = 0.152$). Variables showing a statistically significant influence at the .05 level included purchasing e-cigarettes from physical stores. Additionally, ease of purchase ($\beta = 2.043$), receiving them from family ($\beta = -0.097$), receiving them for free ($\beta = -4.030$), and exposure to advertisements via Telegram ($\beta = -3.452$) significantly impacted

these misconceptions, with the latter three exerting a negative influence. Conversely, several other facilitating and advertising factors had no statistically significant effect on students' misunderstandings. These non-significant factors comprised obtaining e-cigarettes from unknown sources, making online purchases, and receiving them from friends or acquaintances, as well as never seeing advertisements or being exposed to them through major platforms such as Facebook, Instagram, Twitter, TikTok, Shopee, or Lazada.

Table 4: Analysis of influence of reinforcing factors on misconceptions about e-cigarettes.

Reinforcing factor	Misconceptions about e-cigarettes				
	B	SE	β	t	p-value
- Smoking a friend's cigarette	0.087	2.130	0.003	0.041	.967
- Smoking a friend's e-cigarette	-4.753	1.915	-0.166	-2.482	.013*
- Smoking a family member's cigarette	0.709	1.349	0.027	0.526	.599
- Smoking a family member's e-cigarette	-1.670	1.927	-0.044	-0.866	.387
- Being encouraged by a friend to use an e-cigarette	-1.787	1.905	-0.049	-0.938	.349

Note: $R = 0.196$, $R^2 = 0.038$, Adjusted $R^2 = 0.027$, *p-value < .05

The results of the multiple linear regression analysis examining the influence of various factors on misconceptions about e-cigarettes among high school students in Bangkok revealed that, among the reinforcing factors, only friends' e-cigarette smoking had a statistically significant influence on misconceptions at the .05 level ($\beta = -0.166$). This model accounted for 3.8% of the variance in e-cigarette misconceptions ($R^2 = 0.038$). Other reinforcing factors, such as

cigarette or e-cigarette smoking by family members and peer persuasion, had no significant influence. Furthermore, regarding the predisposing factors, gender, educational level, and cumulative grade point average (GPA) also demonstrated a statistically significant influence on e-cigarette misconceptions at the .05 level, except for smoking history, which had no significant effect.

Table 5: Analysis of the relationship between misconceptions about e-cigarettes and trends in e-cigarette use.

variable	Trends in e-cigarette use.	
	R	p-value
Misconceptions about e-cigarettes	-0.187	<.001*

*p-value < .05

The research findings revealed that misconceptions about e-cigarettes had a significant negative (inverse) correlation with the tendency to use e-cigarettes at a low level; if students' misconceptions increased, the tendency to use e-cigarettes decreased slightly. This was because, overall, students had a low level of misconceptions and a good awareness of the dangers of e-cigarettes. Even if some misunderstandings existed (such as the lack of knowledge about penalties for juvenile offenders), they were not sufficient to drive the behavior.

However, the study found that three factors significantly influenced the tendency to use e-cigarettes:

1. Predisposing factors: Average academic performance and history of smoking traditional cigarettes.
2. Enabling factors: Access to e-cigarettes (received from family or given away for free) and access to online advertising (Twitter, TikTok, Telegram).
3. Reinforcing factors: Having friends who use e-cigarettes.

The tendency of high school students in Bangkok to use e-cigarettes is associated with misconceptions about e-cigarettes.

Based on the results of the current research, misunderstandings regarding e-cigarettes were associated substantially with the propensity for e-cigarette usage among high school students in Bangkok ($p < .05$)

Erroneous ideas and perceptions significantly impact the decision-making of adolescents, a demographic inclined towards novel experiences and susceptible to external influences. Students frequently encounter erroneous information via social media, covert advertising, and peer influence. Typically, this information emphasizes only favorable features, while minimizing health risks. This influences students' "favorable perceptions" of e-cigarettes, ultimately resulting in their consumption. This finding aligned with the research conducted by Kitsangthong et al., (2024); Sutthisahat et al., (2025) and which established that the prevalence of erroneous knowledge and perceptions fostering favorable attitudes towards e-cigarettes was significantly correlated with, and served as a primary determinant influencing the propensity of youth and university students to utilize e-cigarettes.

Discussion

This study utilized the PRECEDE model to examine the predisposing, enabling, and reinforcing factors influencing e-cigarette

misconceptions and future use intentions among upper secondary students in Bangkok. Despite Thailand's strict national ban on the importation and sale of e-cigarettes (Ministry of Public Health Thailand, 2017; Patanavanich & Glantz, 2021), the current findings revealed a concerning prevalence of misconceptions driven by specific demographic and environmental factors. The predictive model explained 18.3% of the variance in e-cigarette misconceptions ($R^2 = 0.183$), highlighting the complex interplay of individual and external variables.

Predisposing Factors: Gender, Academic Achievement, and Prior Smoking

Male was the strongest positive predictor of e-cigarette misconceptions ($\beta = 0.169$, $p < .001$). This aligned with other research in Thailand and globally, which has demonstrated consistently that male adolescents are more susceptible to e-cigarette initiation and harbor more permissive attitudes toward their use (Chotmac & Pitayangsarit, 2022; Patanavanich et al., 2021). Often, males are primary targets for digital marketing campaigns that frame vaping as a trendy, masculine, or technologically appealing behavior, thereby reinforcing false beliefs about safety (Fadus et al., 2019).

Notably, higher education levels ($\beta = 0.162$, $p = .033$) and better GPAs ($\beta = 0.117$, $p = .012$) were significant, positive predictors of misconceptions. While counterintuitive, this suggested that academic proficiency did not inherently translate to high health literacy regarding novel tobacco products. High-achieving students may be overconfident in their ability to filter information, making them vulnerable to sophisticated, pseudo-scientific marketing claims that frame e-cigarettes as harmless or "cleaner" alternatives to combustible tobacco (Golan et al., 2023; Gorukanti et al., 2017).

Conversely, prior cigarette smoking had a significant negative association with misconceptions ($\beta = -0.135$, $p = .004$). Adolescents with a history of combustible cigarette use may have a more realistic understanding of nicotine addiction and the

adverse health effects of inhalation behaviors than their tobacco-naïve peers. However, this also highlights a critical public health threat that e-cigarettes are successfully attracting youths who have never smoked conventional cigarettes by exploiting their lack of prior experience and masking the risks associated with nicotine and ultrafine particles (Amrock et al., 2016; Kong et al., 2015; Walley et al., 2019).

Enabling and Reinforcing Factors: Accessibility and Digital Marketing

Based on the current results, enabling factors, specifically exposure to free e-cigarette distribution and online advertisements, had strong negative associations ($p < .05$) with accurate knowledge, thereby exacerbating misconceptions and use intentions. Despite the comprehensive legislative ban in Thailand (Pattanavanich et al., 2023), the "banned but booming" phenomenon is heavily facilitated by unregulated digital platforms. Social media and messaging applications, such as Telegram, serve as primary conduits for illicit sales and promotional content that bypass traditional regulatory frameworks (Chu et al., 2024).

These platforms not only provide easy access to the products but also serve as echo chambers that normalize vaping behavior among peers. The PRECEDE model emphasizes that enabling and reinforcing factors are critical in transitioning an individual from intention to actual behavior (Green & Kreuter, 2005). The widespread availability of flavored e-liquids and aggressive youth-oriented marketing subvert the perceived risks, leading students to believe falsely that these products are non-addictive and legally benign (Willett et al., 2019).

Specific Areas of Misconception: Legal Ambiguities and Health Impacts

The itemized analysis of misconceptions (Table 2) and the overall misconception levels (Figure 2) provide nuanced insights into the specific knowledge gaps among Bangkok high school students. Encouragingly, most of the samples (69.20%) had a low overall level of misconceptions, correctly disagreeing with statements claiming that e-cigarettes contain no

nicotine, emit harmless water vapor, or are completely safe. These findings indicated that public health messaging regarding the basic harmful effects of e-cigarettes had reached a significant portion of the youth population, countering some of the pervasive myths documented in earlier global studies (Amrock et al., 2016; Gorukanti et al., 2017).

However, a critical vulnerability remains in the realm of legal knowledge. The highest level of misconception identified in the study was the belief that "there are no clear legal penalties for youths under 18 using e-cigarettes". This finding highlights starkly the "banned but booming" paradox in Thailand. Although the Tobacco Products Control Act B.E. 2560 (2017) strictly prohibits the importation, sale, and possession of e-cigarettes (Ministry of Public Health Thailand, 2017; Patanavanich & Glantz, 2021), the lack of visible enforcement at the consumer level—especially among minors—creates a false sense of legal immunity. When adolescents do not perceive legal risks, the enabling factors provided by easy online access are amplified, facilitating continued use and experimentation (Pattanavanich et al., 2023).

Furthermore, the data revealed moderate misconceptions regarding the role of e-cigarettes in smoking cessation and their potential as a gateway to other drug use. The confusion surrounding whether e-cigarettes can help to quit conventional smoking mirrors the ongoing debate in the broader scientific community and the mixed messaging adolescents encounter online (Glantz & Bareham, 2018; Hartmann-Boyce et al., 2022). While sometimes, e-cigarettes are framed by industry as harm-reduction tools, the WHO strictly advises against their use, noting their high addictive potential and the risk of transitioning youth to combustible tobacco or other substances (WHO, 2020; Fadus et al., 2019). The presence of these moderate misconceptions suggests that while students understand e-cigarettes are not entirely safe, they are still susceptible to industry narratives that downplay their long-term developmental and behavioral risks.

Limitations

This research is limited by legal and ethical issues, as e-cigarettes are outlawed in Thailand. Studying e-cigarette use among children and teens, a "vulnerable population," is difficult. Researchers must be careful while constructing research instruments and surveys to prevent breaching rights, causing fear, or affecting sample behavior.

Under human research ethics, parents must give informed consent before collecting data from kids. This is a touchy matter since some parents may object. Permission from target educational institutions requires many approvals owing to image issues. These overlapping limits made data gathering and sample group access difficult, delaying the research timeline.

Conclusion

This study highlights the concerning prevalence of e-cigarette beliefs among high school students in Bangkok, Thailand, despite stringent government regulations. The use of the PRECEDE model indicates that predisposing factors—namely male gender, elevated grade levels, and superior academic performance (GPA)—are substantial predictors of erroneous views concerning the safety, addictiveness, and legality of e-cigarettes. A history of traditional cigarette smoking correlated with a more precise comprehension of e-cigarette hazards, indicating that adolescents who have never smoked are especially susceptible to the industry's misleading portrayal of vaping as a benign, non-addictive lifestyle option.

Moreover, the study illustrates that facilitating variables, particularly exposure to targeted digital advertising (such as Telegram channels) and the illicit free distribution of vaping items, significantly compromise appropriate health perceptions. The combined effect of online disinformation, peer influence, and unrestricted accessibility constitutes a significant public health concern that normalizes vaping and propels future usage intentions among Thai adolescents.

To properly address this epidemic, public health initiatives must transcend simple legislative prohibitions. Health promotion activities must be

precisely focused and swiftly counter internet falsehoods by enhancing students' digital media literacy. Educational efforts must be customized to confront gender-specific attitudes and incorporated throughout all academic levels to systematically eradicate vaping misconceptions. Ultimately, rigorous enforcement of current regulations on digital marketing and the unlawful distribution of e-cigarettes is essential to safeguard the health and welfare of Thai adolescents.

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Ethical Approval Statement

The Kasetsart University Institutional Review Board approved the Declaration of Helsinki-compliant study. The Human Research Ethics Committee of Kasetsart University, Bangkok

Campus, Thailand, approved this study for human participant research under project code KUREC-HSR68/045, dated October 20, 2025. All participants supplied informed consent, stating they understood the study's purpose, data confidentiality, and their ability to withdraw at any time.

Author Declaration

Conflicts of Interest: The authors declare there are no conflicts of interest.

Declaration of Generative AI: In the process of preparing this work, the author(s) utilized Microsoft Copilot (GPT-5) and Google Gemini to refine text and formatting. Subsequently, all AI-generated outputs were examined, validated, and amended by the authors. The authors bear complete responsibility for the manuscript's accuracy, integrity, and final content.

Certificate of English language proofreading and revision was completed and certified by a qualified native speaker.

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