ORIGINAL ARTICLE

# Determinants of electronic cigarette use among vocational students in Buriram province, Thailand: an examination of behavioral and environmental influences

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## ABSTRACT

The increasing prevalence of electronic cigarette use among adolescents is a global concern, particularly due to misconceptions about their safety. This study aims to explore the factors influencing e-cigarette smoking behavior among vocational students in Buriram Province, Thailand. This cross-sectional descriptive study involved 1,434 vocational students from Buriram vocational colleges, selected using a multi-stage sampling method. Data were collected through questionnaires addressing personal information, perceptions of e-cigarette harm, stress, depression, social support, and media influence. Binary logistic regression was used to identify factors associated with e-cigarette use. The study found that 34.9% of the participants had engaged in e-cigarette smoking. Significant factors associated with e-cigarette use included low grade point average (AOR=1.76; 95% CI: 1.282-2.424), peer e-cigarette smoking (AOR=4.39; 95% CI: 3.167-6.101), family member e-cigarette smoking (AOR=1.70; 95% CI: 1.130-2.576), being persuaded by friends (AOR=2.08; 95% CI: 1.566-2.775), easy access to e-cigarettes (AOR=1.98; 95% CI: 1.488-2.634), smoking marijuana (AOR=8.93; 95% CI: 5.961-13.398), and visiting entertainment venues (AOR=2.33; 95% CI: 1.714-3.170). Protective factors included being male (AOR=0.32; 95% CI: 0.206-0.525) and e-cigarette education in schools (AOR=0.60; 95% CI: 0.402-0.920). E-cigarette smoking among vocational students is influenced by multiple factors, including peer and family behaviors, academic performance, and social environments. Effective prevention programs must address these factors comprehensively. Policy Applications: The findings suggest the need for targeted interventions in schools and communities to reduce e-cigarette use among adolescents. Policies should focus on enhancing educational programs about the risks of e-cigarettes, restricting access, and engaging parents and peers in prevention efforts. Additionally, regulations to control the online sale and advertisement of e-cigarettes should be strengthened to mitigate their accessibility to youth.

**Key words:**
factors; behavior; electronic cigarette smoking; adolescents

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# INTRODUCTION

E-cigarettes are among the most widely used addictive substances worldwide. They pose significant health risks and are often underestimated because of the misconception that e-cigarettes are safer than traditional cigarettes. Their widespread availability, particularly through online media, exacerbates this issue. According to a survey by the World Health Organization, the use of e-cigarettes has surged among high school students in the United States, with the smoking rate increasing from 1.5% in 2011 to 19.6% in 2020. Similarly, in European countries, the prevalence increased from 1.5% in 2014 to 1.8% in 2017. In the United Kingdom, the rate of e-cigarette use among adolescents increased from 22% in 2014 to 25% in 2016. Moreover, in regions such as Russia, the Americas, Europe, Asia, and Oceania, the rates of e-cigarette use among adolescents were 28.6%, 24%, 26%, 16%, and 25%, respectively. These data illustrate the global rise in e-cigarette popularity. The primary reasons for their use include the ability to choose from various flavors and colors, with up to 70% of users citing these options as significant factors.[1,2] The International Tobacco Control Policy Evaluation Project conducted by the University of Waterloo, Canada, surveyed youths aged 16-19 in three countries: England, Canada, and the United States from 2017-2022. The data revealed that smoking and e-cigarette use among British youth has skyrocketed. The rate of youth smoking e-cigarettes increased from 8% to 24% and the youth tend to smoke e-cigarettes more. Smoking e-cigarettes at least 20 days in a month increased from 1.5% to 7.9%.[3]

From the results of a survey of tobacco product consumption among 6,700 Thai youths aged 13-15 years old in schools across the country, it was found that the use of e-cigarettes has increased dramatically since 2015, when 3.3 percent of youth smoked cigarettes, which rose to 17.6 percent in 2022.[4]

Adolescents are particularly prone to experimenting and seeking new experiences. When coupled with a lack of awareness regarding the dangers of e-cigarettes, this has led to an increase in e-cigarette usage.[5] Additionally, a survey of e-cigarette consumption behavior among high school students in Bangkok revealed an e-cigarette smoking rate of 30.2%.[6] A 2021 survey of Thai adolescents in educational institutions further examined e-cigarette use among students at high school, vocational, and tertiary levels across various regions of Thailand. The prevalence of e-cigarette use was 4.6% at the tertiary level, 4.2% at the vocational level, and 1.6% at the high school level.[7]

Currently, the use of e-cigarettes among adolescents is increasing and can be categorized into three groups: 36% who smoke both traditional cigarettes and e-cigarettes, 34% who have quit smoking traditional cigarettes and switched to e-cigarettes, and 30% who have started using e-cigarettes without previously smoking traditional cigarettes. It was also found that 72% of adolescents had a moderate knowledge and understanding of e-cigarettes, while 19% had no knowledge or understanding of them.[8] E-cigarettes are harmful to health, yet they remain popular among adolescents due to the misconception that they are safer than traditional cigarettes. Their widespread online availability and ease of access have contributed to this trend, encouraging more adolescents to experiment with e-cigarettes. Furthermore, the perception of e-cigarettes as attractive, modern, and cool adds to their appeal among adolescents, particularly among new smokers.[9,10,11] Smoking e-cigarettes is still considered a gateway to

the use of other substances among adolescents.[12]

E-cigarettes are a new product that delivers nicotine through electricity. Nicotine is a most addictive substance, and synthetic nicotine does not have a bad smell, does not irritate the throat, and is absorbed quickly. It is possible to produce e-cigarette liquid which contains synthetic nicotine that exceeds the quantity found in rolled cigarettes by up to 100 times. It can harm all of the various bodily systems both in the short term and in the long term. The impact of e-cigarettes on general health is dangerous and can also cause addiction to nicotine. This causes the heart rate to increase, leading to high blood pressure and negative effects on brain development in children and adolescents. The toxic effects of e-cigarettes from vaping expose the lungs to harmful chemicals that can lead to respiratory problems such as coughing and wheezing, as well as the worsening of existing diseases such as asthma and chronic obstructive pulmonary disease (COPD). The nicotine in e-cigarettes contains toxins that can constrict blood vessels, increasing the risk of blood clots and increasing heart rate and blood pressure. This can result in cardiovascular problems such as heart disease and stroke. Moreover, e-cigarettes contain more than 100 other toxins that are harmful to both smokers and those around them. There are also additional dangers posed by e-cigarettes that are not associated with traditional rolled cigarettes. E-cigarette liquid can cause EVALI. The flavorings can be irritating and contain carcinogens and there is a risk of the device exploding. Furthermore, nicotine also affects the baby's brain in the womb as the brain is still growing and developing.[13]

From a review of the literature, it was found that factors associated with smoking included residential secondhand smoke exposure (AOR=15.31; 95% CI: 14.47-16.20) and regular alcohol use (AOR=4.44; 95% CI: 4.14-4.76). In addition, social marketing factors include not agreeing with or being unsure of the opinion that cigarettes should be classified as dangerous goods (AOR=3.15; 95% CI: 2.94-3.37); never being exposed to the disadvantages of smoking on social media (AOR=1.51; 95% CI: 1.43-1.61); never receiving information on the negative effects of smoking from newspapers, television, radio, advertisements, or other sources (AOR=1.46; 95% CI: 1.37-1.62); being warned about or having seen the dangerous effects of smoking but ignoring them (AOR=4.81; 95% CI: 4.54-5.09); and having seen advertisements or billboards promoting smoking in various places (AOR=1.33; 95% CI: 1.24-1.42).[14] Further factors include being male (AOR: 6.36, 95% CI: 5.80-6.94, P-value < 0.001), age (AOR: 4.35, 95% CI: 3.59-5.25, P-value < 0.001), current work status (AOR: 1.40, 95% CI: 1.23-1.59, P < 0.001), very good physical health (AOR: 2.64, 95% CI: 2.05-3.40, -value < 0.001), alcoholic beverage consumption (AOR: 7.06, 95% CI: 6.44-7.43, P-value < 0.001), and participation in community group/club activities (AOR: 1.17, 95% CI: 1.08-1.28, P- value < 0.001),[15] while the most important factor related to drinking alcohol is smoking (AOR: 1.97, 95% CI: 1.85-2.11).[16]

In Buriram Province, the smoking rate among individuals aged 15 years or older is 18.2%, ranking second in Health Region 9. A survey of current smoking rates by age group found that the smoking rate among those aged 15-19 years is 11.2%, also ranking second in Health Region 9. The youngest age at which individuals started smoking was 12 years old,[17] and from studies in Buriram Vocational College, it was found that among males, 59.8% had experience with e-cigarettes.[18] These data indicate that adolescent smoking in Buriram province remains a significant concern. In addition, e-cigarette use is becoming increasingly prevalent among the younger generation, and at present, female teenagers find

meaning in smoking e-cigarettes. The positive aspects are perceived to outweigh the negative ones. E-cigarettes make no difference and there is equality between the genders. You can smoke them anywhere because they have a pleasant smell.[19] Therefore, it is crucial to implement preventive measures at an early age.[20]

The researcher is therefore interested in studying the factors affecting the e-cigarette smoking behavior of vocational students, both male and female, in both public and private vocational colleges. The study explores different variables than those examined previously in order to understand various factors related to e-cigarette smoking, covering both females and males in Buriram Province, and controlling for or promoting factors related to vaping more effectively. The results of the study will be used to develop effective programs to prevent and control e-cigarette use among teenagers in the future.

# METHODS

### *Study design and population*

This cross-sectional descriptive study was conducted with vocational students in Buriram vocational colleges from October to December 2023.

The population consisted of vocational students enrolled in the vocational certificate level (years 1-3) at public and private colleges in Buriram Province under the Office of the Vocational Education Commission, totaling 9,605 individuals.

A sample of 1,434 vocational students studying at the vocational certificate level (years 1-3) in these colleges was selected. The sample size was calculated using the G*Power package, based on related research,[18] with an odds ratio of 0.45, an error value (α) of 0.05, a test power of 0.95, and a required sample size of 1,291 individuals. To account for potential non-responses, the sample size was increased by an additional 10%,[21] resulting in a total sample size of 1,434 individuals. Inclusion criteria: vocational students who are studying at the vocational certificate level (Vocational Certificate), years 1-3, and have received consent from their parents and are willing to participate in the project. Exclusion criteria: The questionnaire is not completed as specified.

### *Research instrument*

The research instruments used in this study were developed by the researcher and included the following questionnaires: a questionnaire on perceptions of harm associated with e-cigarettes, a questionnaire on social support, and a questionnaire on the influence of media models. These instruments were validated by five experts, resulting in content validity indices (CVI) of 0.82, 0.83, and 0.87. Questionnaires on perceptions of harm associated with e-cigarettes, stress, depression, social support, and the influence of media models were administered to 30 vocational students who had similar qualifications and environments to the study sample. Reliability was assessed using the Cronbach's alpha coefficient and the KR-20, yielding reliability values of 0.82, 0.91, 0.92, 0.87, and 0.91, respectively. The research instruments are divided into six parts:

Part 1: Questionnaire on personal information. This part includes questions about vocational students' general information, such as age, gender, grade point average, education level, income, religion, and information about e-cigarette use.

Part 2: Questionnaire on knowledge of harm associated with e-cigarettes. This questionnaire, created by the researcher, consists of 14 questions with true or false answers. For the interpretation of results, a high level of knowledge regarding the harm

associated with e-cigarettes is indicated by a score of 8-14 points, while a low level of knowledge regarding the harm related to e-cigarettes is indicated by a score of 0-7 points.

Part 3: Questionnaire on stress. This part, consisting of five questions from the Department of Mental Health,[22] uses a four-point rating scale: none, sometimes, often, and regularly. For the interpretation of results, less stressed is indicated by a score of 0-7 points, while very stressed is indicated by a score of 8-15 points.

Part 4: Questionnaire on depression. This part includes nine questions by Manote Lotrakul[23] using a four-point rating scale: not at all, some days, quite often, and almost every day. For the interpretation of results, very depressed is indicated by a score of 14-25 points, while mild depression is indicated by a score of 0-13 points.

Part 5: Questionnaire on social support. This questionnaire, adapted by the researcher from the study of Apinan Panyanupap,[24] includes 25 questions using a five-point rating scale: highest, high, moderate, low, and lowest. For the interpretation of results, high social support is indicated by a score of 63-125 points, while low social support is indicated by a score of 0-62 points.

Part 6: Questionnaire on the influence of media models adapted from the study of Wikanda Mongmat.[25] This part included seven questions using a five-point rating scale: highest, high, moderate, low, and lowest. For the interpretation of results, high model influence from the media is indicated by a score of 18-35 points, while low model influence from the media is indicated by a score of 0-17 points.

### *Data collection procedures*

The researcher wrote letters to the school directors requesting permission to collect data from the sample group, and coordinating with the relevant officials. The objectives of the study were explained, and cooperation in data collection was requested. The participants were required to sign a consent form before participating in the study. The researcher and the team then distributed the questionnaires to the sample group, allowing approximately 15-30 minutes for completion. To maintain confidentiality, codes were used instead of the participants' real names and surnames. All returned questionnaires contained complete answers.

### *Data analysis*

Descriptive statistics, including frequency distribution, percentage, mean, and standard deviation, were calculated. The relationships between the studied factors were analyzed using binary logistic regression, with a statistical significance level set at 0.05.

### *Ethical approval*

The research was approved by the Human Research Ethics Committee, Mahasarakham University. No. 411-283/2023. Certification date: October 5, 2023 – October 4, 2024.

## RESULTS

### *Participant characteristics*

The analysis revealed that 54.2% of the sample participants were aged 17-19 years, with the highest age being 19 years and the lowest age being 15 years. The average age was 16.6 years (SD = 0.90). The majority of participants, 82.2%, were male. The average grade point average (GPA) was between 3.00-4.00 for 76.4% of the sample. Nearly all the participants, 98.9%, were Buddhists. The sample consisted of 39.3% first-year vocational education students at the vocational certificate level. Regarding parental education, fathers and mothers had mainly completed primary school, accounting for 36.3% and 34.5%, respectively. Fathers and mothers mainly worked as employees, accounting for

42.3% and 38.1%, respectively. Most parents, 61.2%, were married. The majority, 87.8%, had an income of 500-5,000 baht, with 59.6% receiving their income from family, while 64.4 % had adequate income.

Among the sample, 58.6% had friends who smoked e-cigarettes, 87.9% had no family members who smoked e-cigarettes, and 57.5% had never been persuaded by a friend to smoke. Half of the sample had easy access to e-cigarettes, while for the other half, it was difficult. Among the sample, 65.1% had never smoked e-cigarettes, while 34.9% had smoked them before. The average age at initiation was 14.7 years, with a frequency of once a week for 53.8% of participants. Regarding the primary motivation for starting to smoke e-cigarettes, 60.8% cited that it was due to curiosity, and 32.5% received e-cigarettes from someone else. The number of e-cigarettes smoked per day was 0-5 puffs for 46.1% of the sample, while 33.8% of the sample regularly used e-cigarette pods, and 19.0% of them smoked when they were with close friends. The majority of the expenses for purchasing e-cigarettes were covered by the individuals themselves (54.6%), with an average daily cost of less than 100 baht. Most participants did not drink alcohol (60.5%) or smoke marijuana (83.5%). Additionally, 62.8% reported no education on e-cigarettes in school. Lastly, 73.5% had not visited entertainment venues in the past three months.

***Factors studied and the use of electronic cigarettes***

When categorizing the e-cigarette smoking behavior of the sample group into 2 groups, namely the e-cigarette smoking group and the group that did not smoke e-cigarettes, it was found that 31.2 percent of the sample aged 14-16 years smoked e-cigarettes and 38.1 percent of those aged 17-19 years smoked e-cigarettes. The sample groups of males and females had the proportions of smoking e-cigarettes at 37.4 percent and 23.5 percent, respectively. Samples with high and low GPAs had proportions of 30.9 percent and 61.5 percent, respectively. Samples with sufficient income and insufficient income had proportions of people smoking e-cigarettes at 35.2 percent and 34.5 percent, respectively. For the sample group that had no friends who smoke e-cigarettes and the group who did have friends who smoke e-cigarettes, the proportions of people smoking e-cigarettes were 13.1 percent and 50.4 percent, respectively. For the sample group who had no family or caregivers who smoked e-cigarettes and the group who did have family or caregivers who smoked e-cigarettes, the proportions of people who smoked e-cigarettes were 33.0 percent and 48.9 percent, respectively. For the sample group who had no friends persuading them to smoke and the group who did have friends persuading them to smoke, the proportions of people smoking e-cigarettes were 21.4 percent and 53.3 percent, respectively. For the sample groups with difficult access to e-cigarettes and easy access to e-cigarettes, the proportions of e-cigarette smokers were 21.5 percent and 48.5 percent, respectively. Among the samples that did not drink alcohol and those that did drink alcohol, the proportions of e-cigarette smokers were 35.2 percent and 34.6 percent, respectively. For the sample group that did not smoke marijuana and the group that did smoke marijuana, the proportions of people smoking e-cigarettes were 25.5 percent and 82.7 percent, respectively. For the sample group that had received education about e-cigarettes in school and the group that had not received education about e-cigarettes in school, the proportions of people who smoked electronic cigarettes were 32.2 percent and 36.6 percent, respectively. For the group

that did not visit entertainment venues and the group that did visit entertainment venues, the proportions of people smoking e-cigarettes were 28.3 percent and 53.4 percent, respectively. For the sample group that had a high perception of the dangers of e-cigarettes and the group with a low perception of the dangers of e-cigarettes, the proportions of people smoking e-cigarettes were 34.2 percent and 41.8 percent, respectively. In the sample group with low stress and the group with high stress, the proportions of people who smoked electronic cigarettes were 33.8 percent and 39.1 percent, respectively. For high social support and low social support, the proportions of people smoking e-cigarettes were 34.4 percent and 38.8 percent, respectively. For the sample group that was less depressed and the group that was more depressed, the proportions of people smoking e-cigarettes were 33.6 percent and 40.4 percent, respectively. For the sample groups with high influence from media models and those with low influence from media models, the proportions of people smoking e-cigarettes were 35.0 percent and 34.3 percent, respectively. These data can be seen in Table 1.

**Table 1.** Numbers and percentages of the sample classified according to the factors studied and e-cigarette use (n = 1434)

| Factors studied | Non-smokers | | Smokers | |
|---|---|---|---|---|
| | Quantity | Percentage | Quantity | Percentage |
| Age | | | | |
| 14-16 years | 452 | 68.8 | 205 | 31.2 |
| 17-19 years | 481 | 61.9 | 296 | 38.1 |
| Gender | | | | |
| Female | 195 | 76.5 | 60 | 23.5 |
| Male | 738 | 62.6 | 441 | 37.4 |
| Grade Point Average | | | | |
| High | 757 | 69.1 | 338 | 30.9 |
| Low | 15 | 38.5 | 24 | 61.5 |
| Income | | | | |
| Adequate | 599 | 64.8 | 325 | 35.2 |
| Inadequate | 334 | 65.5 | 176 | 34.5 |
| Peer e-cigarette smoking | | | | |
| No | 516 | 86.9 | 78 | 13.1 |
| Yes | 417 | 49.6 | 423 | 50.4 |
| Family member e-cigarette smoking | | | | |
| No | 844 | 67.0 | 416 | 33.0 |
| Yes | 89 | 51.1 | 85 | 48.9 |
| Being persuaded by friends to smoke | | | | |
| No | 648 | 78.6 | 176 | 21.4 |
| Yes | 285 | 46.7 | 325 | 53.3 |
| Access to e-cigarettes | | | | |
| Difficult to access | 565 | 78.5 | 155 | 21.5 |
| Easy to access | 368 | 51.5 | 346 | 48.5 |
| Drinking alcohol | | | | |
| No | 562 | 64.8 | 305 | 35.2 |

| Factors studied | Non-smokers | | Smokers | |
|---|---|---|---|---|
| | Quantity | Percentage | Quantity | Percentage |
| Yes | 371 | 65.4 | 196 | 34.6 |
| Smoking marijuana | | | | |
| No | 892 | 74.5 | 305 | 25.5 |
| Yes | 41 | 17.3 | 196 | 82.7 |
| E-cigarette education in schools | | | | |
| Yes | 362 | 67.8 | 172 | 32.2 |
| No | 571 | 63.4 | 329 | 36.6 |
| Visiting entertainment venues | | | | |
| No | 756 | 71.7 | 298 | 28.3 |
| Yes | 177 | 46.6 | 203 | 53.4 |
| E-cigarette harm perception | | | | |
| High | 855 | 65.8 | 445 | 34.2 |
| Low | 78 | 58.2 | 56 | 41.8 |
| Stress | | | | |
| Low | 738 | 66.2 | 376 | 33.8 |
| High | 195 | 60.9 | 125 | 39.1 |
| Social support | | | | |
| High | 829 | 65.6 | 435 | 34.4 |
| Low | 104 | 61.2 | 66 | 38.8 |
| Depression | | | | |
| Low | 769 | 66.4 | 390 | 33.6 |
| High | 164 | 59.6 | 111 | 40.4 |
| Influence from media models | | | | |
| High | 814 | 65.0 | 439 | 35.0 |
| Low | 119 | 65.7 | 62 | 34.3 |

***Factors affecting e-cigarette smoking behavior***

When controlling for the effects of other factors, several variables were significantly associated with e-cigarette use ($p < 0.05$). These factors included grade point average, having friends who smoked e-cigarettes, family or caregivers who smoked e-cigarettes, being invited by friends to smoke, access to e-cigarettes, smoking marijuana, and visiting entertainment venues. Protective factors against e-cigarette smoking include gender and education about e-cigarettes in schools. The analysis revealed that the sample group with a low GPA had a 1.76 times higher risk of using e-cigarettes (AOR = 1.76, 95% CI = 1.282–2.424) than the group with a high GPA. Those with friends who smoked e-cigarettes had a 4.39 times higher risk of using e-cigarettes (AOR = 4.39, 95% CI = 3.167–6.101) than those without friends who smoked e-cigarettes. Participants with family members who smoked e-cigarettes had a 1.70 times higher risk (AOR = 1.70, 95% CI = 1.130 – 2.576) than those without such family members or caregivers. Additionally, individuals persuaded by friends to smoke had a 2.08 times higher risk of using e-cigarettes (AOR = 2.08, 95% CI = 1.566-2.775) compared to those who were not persuaded by friends. Easy access to e-cigarettes increased the risk by 1.98 times (AOR = 1.98, 95% CI = 1.488–2.634) compared to those with difficult access. Those who smoked marijuana had an 8.93 times higher risk (AOR = 8.93, 95% CI = 5.961–13.398) than non-marijuana

smokers. Visiting entertainment venues was associated with a 2.33 times higher risk (AOR = 2.33, 95% CI = 1.714–3.170) compared to those who did not visit such venues. Females were more likely to smoke e-cigarettes by 3.12 times (OR = 1/0.32, 95% CI = 0.206–0.525) compared to males. Participants who did not receive e-cigarette education in school were more likely to smoke e-cigarettes by 1.67 times (AOR = 1/0.60, 95% CI = 0.402–0.920), compared to those who received such education. The detailed statistical results are presented in Table 2.

**Table 2.** Factors affecting the e-cigarette smoking behavior of vocational students in Buriram Province used in binary logistic regression (n = 1,434)

| Factors studied | **OR (95% CI)** | **p-value** | **AOR (95% CI)** | **p-value** |
|---|---|---|---|---|
| Age | | | | |
| 14-16 years (r) | | | | |
| 17-19 years | 1.35 (1.089 - 1.690) | 0.006 | 1.21 (0.915 - 1.601 ) | 0.182 |
| Gender | | | | |
| Female ( r) | | | | |
| Male | 0.51 (0.377 - 0.704) | <0.001 | 0.32 (0.206 - 0.525 ) | <0.001 |
| Grade Point Average | | | | |
| High (r) | | | | |
| Low | 2.07 (1.618 - 2.660) | <0.001 | 1.76 (1.282 - 2.424 ) | <0.001 |
| Income | | | | |
| Adequate (r) | | | | |
| Inadequate | 1.03 (0.820 - 1.292) | 0.801 | 1.14 (0.568 - 2.307) | 0.706 |
| Peer e-cigarette smoking | | | | |
| No (r) | | | | |
| Yes | 6.71 (5.103 - 8.824) | <0.001 | 4.39 (3.167 -6.101) | <0.001 |
| Family member e- cigarette smoking | | | | |
| No (r) | | | | |
| Yes | 1.93 (1.408 - 2.667) | <0.001 | 1.70 (1.130 - 2.576) | 0.011 |
| Being persuaded by friends to smoke | | | | |
| No (r) | | | | |
| Yes | 4.19 (3.335 - 5.286) | <0.001 | 2.08 (1.566 - 2.775) | <0.001 |
| Access to e-cigarettes | | | | |
| Difficult to access (r) | | | | |
| Easy to access | 3.42 (2.722 - 4.316) | <0.001 | 1.98 (1.488 - 2.634) | <0.001 |
| Drinking alcohol | | | | |
| No (r) | | | | |
| Yes | 0.97 (0.779 - 1.216) | 0.812 | 1.09 (0.534 - 2.250) | 0.803 |
| Smoking marijuana | | | | |
| No (r) | | | | |
| Yes | 13.98 (9.746 - 20.056) | <0.001 | 8.93(5.961 - 13.398) | <0.001 |

| Factors studied | OR (95% CI) | p-value | AOR (95% CI) | p-value |
|---|---|---|---|---|
| E-cigarette education in schools | | | | |
| Yes [r] | | | | |
| No | 1.21 (0.967 - 1.521) | 0.095 | 0.60 (0.402 - 0.920) | 0.018 |
| Visiting entertainment venues | | | | |
| No [r] | | | | |
| Yes | 2.91 (2.284 - 3.706) | <0.001 | 2.33 (1.714 - 3.170) | <0.001 |
| E-cigarette harm perception | | | | |
| High [r] | | | | |
| Low | 1.37 (0.961 - 1.981) | 0.081 | 1.50 (0.912 - 2.493) | 0.109 |
| Stress | | | | |
| Low [r] | | | | |
| High | 1.25 (0.973 - 1.626) | 0.079 | 0.90 (0.589 - 1.381) | 0.636 |
| Social support | | | | |
| High [r] | | | | |
| Low | 1.20 (0.870 - 1.682) | 0.258 | 1.20 (0.718 - 2.009) | 0.484 |
| Depression | | | | |
| Low [r] | | | | |
| High | 1.33 (1.019 - 1.748) | 0.036 | 1.30 (0.833 - 2.036) | 0.248 |
| Influence from media models | | | | |
| High [r] | | | | |
| Low | 0.96 (0.696 - 1.341) | 0.837 | 0.92 (0.549 - 1.562) | 0.772 |

## DISCUSSION

The study found that 34.9% of vocational education students at the vocational certificate level (years 1-3) in Buriram province smoked e-cigarettes. This increase is higher than a previous study showing that 28.7 percent of vocational students used e-cigarettes.[26] This may be because e-cigarettes are now easier to purchase through social media and markets, and the scent, design, and product appearance can attract teenagers to have a positive view of e-cigarettes, causing an increase in demand. Several factors were significantly related to e-cigarette use, including gender, grade point average, peer e-cigarette smoking, family member e-cigarette smoking, being persuaded by friends to smoke, access to e-cigarettes, smoking marijuana, e-cigarette education in schools, and visiting entertainment venues. The findings are detailed as follows:

**Gender:** Currently, e-cigarette companies are targeting women by developing strategies to produce e-cigarettes specifically designed for women.[27] Men may be less likely to smoke e-cigarettes than women. In line with the study on smoking cessation among university students, it was found that the majority of the sample was male, 74.30 percent, and those who were aware of the dangers of smoking developed a positive attitude towards not smoking, and quitting smoking. Especially if there is increased awareness, it can change the relationship

with smoking cessation behavior.[28] This is consistent with studies that have found that gender has a positive influence on smoking prevention behavior in upper primary school students,[29] and smoking e-cigarettes is more prevalent in females than in males.[30]

**Grade Point Average (GPA):** Grade point average is a factor that reflects an individual's intelligence level, which can naturally affect personality, individual health decisions, and behavior. However, a low GPA may be due to the intellectual limitations of the individual. This is one of the factors that causes students to have limitations in studying and finding activities that interest them and make them happier than they are in the classroom. This makes them more likely to experiment with smoking e-cigarettes or become obsessed with e-cigarettes than other groups of students. This finding is consistent with studies that found that academic performance is related to smoking electronic cigarettes among students.[30,31]

**Peer e-cigarette smoking:** This may be attributed to the significant influence of friends on adolescents, particularly during the rapid developmental stage of adolescence, which is marked by social development. Socializing with a group of friends and exchanging experiences can make friends highly influential during this period. Individuals want to be accepted by friends in their peer group, so they do similar activities, such as smoking electronic cigarettes. This finding is consistent with previous studies that found a correlation between close friends who use e-cigarettes and adolescent e-cigarette smoking behavior. [26,32]

**Family member e-cigarette smoking:** Family members are the first source of guidance and knowledge for children. If family members or caregivers smoke e-cigarettes, adolescents may perceive them as harmless. This causes teenagers to imitate the behavior of smoking e-cigarettes. This finding is consistent with a study showing a relationship between family members who smoke e-cigarettes and adolescent e-cigarette smoking behavior. [26,32]

**Being persuaded by friends to smoke:** Adolescents are drawn to stimulants that are exotic and exciting. Specifically, when friends invite them to smoke e-cigarettes, adolescents are more likely to decide to smoke e-cigarettes than those who are not invited. This tendency may be because e-cigarettes are a new product. It is possible to choose their preferred flavors, while the appearance of e-cigarettes is desirable, causing teenagers to develop a positive view of the product, and therefore, they are more inclined to try smoking it as suggested by their friends. This finding is consistent with studies that have shown that peer invitations are related to e-cigarette use among students.[27] Additionally, friends' persuasion to smoke is significantly related to the use of various types of drugs.[33]

**Access to e-cigarettes:** Adolescents currently have easy access to e-cigarettes, which can be purchased through various channels, particularly social media and the general market. Furthermore, the law is not strict enough, causing more teenagers to smoke e-cigarettes. This accessibility has led to an increase in e-cigarette use among adolescents. This finding is consistent with that of a study showing a correlation between access to e-cigarettes and their use among students.[27] The factor that promotes the smoking of electronic cigarettes is that they are easily available including widely available online.[6]

**Smoking marijuana:** The current liberalization of marijuana has reduced the regulation of the consumption and use of marijuana in Thai society, so there is a lack of security and control. They may feel that marijuana is increasingly accepted by society and is easier to access.[34] This, along with the widespread use of e-cigarettes, may lead most adolescents to believe that e-

cigarettes and marijuana are safe. This is consistent with a previous study, which found that marijuana use was significantly related to e-cigarette use.[35] Notably, marijuana use has increased significantly among youths who also use e-cigarettes.[36]

**E-cigarette education in schools:** Participants who did not receive e-cigarette education in school were more likely to smoke e-cigarettes than those who did receive e-cigarette education in school. This may be because the sample group who did not receive education about e-cigarettes in school did not gain knowledge about the dangers of e-cigarettes from school, thus causing more students to smoke e-cigarettes.This is consistent with a study that found that receiving knowledge about e-cigarettes on social media was related to the level of attitudes toward e-cigarettes.[37] Teaching about e-cigarettes in the classroom can help students avoid getting involved with e-cigarettes.[31]

**Visiting entertainment venues:** This may be because most entertainment venues allow visitors to smoke e-cigarettes because they do not smell like rolled cigarettes. Adolescents are at an age when they are curious and want to fit into their peer groups. The gathering of adolescents at night increases the likelihood of engaging in inappropriate behaviors, such as drinking alcohol, e-cigarette smoking, and drug use. This finding is consistent with a study that found a relationship between visiting entertainment venues and smoking behavior.[38,39]

## CONCLUSION

Adolescent e-cigarette smoking is complex and is caused by multiple factors, both individual and environmental. Solving the problem therefore requires serious cooperation from all relevant sectors.

## RECOMMENDATIONS

A limitation of this study is its cross-sectional design, which cannot determine causality, as it only identifies associations with e-cigarette use at one point in time. This study reveals the significant prevalence of e-cigarette use among vocational students in Buriram Province, influenced by factors such as low academic performance, peer and family e-cigarette use, social pressures, and accessibility. Protective factors like being male and receiving school-based e-cigarette education were also identified. To address this issue, it is essential to enhance educational programs within schools, involve families in prevention efforts, and leverage peer influence positively. Additionally, stricter regulations on the sale and marketing of e-cigarettes are needed, alongside community initiatives offering healthy recreational alternatives. Policymakers should focus on comprehensive tobacco control strategies that encompass e-cigarettes to mitigate their use among adolescents. Further research is recommended to explore the long-term effects and additional protective factors, ensuring a robust approach to preventing e-cigarette use in this vulnerable population.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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## REFERENCES

1. World Health Organization. WHO report on the global tobacco epidemic 2021: Addressing new and emerging products [Internet]. [Cited 2024 Apr 10]. Available from: https://www.who.int/publications/i/item/9789240032095.
2. Tehrani H, Rajabi A, Ghojogh M, Nejatian M, Jafari A. The prevalence of electronic cigarette vaping globally: A systematic review and meta-analysis. Arch Pub Health. 2022;80:1-15.
3. Thai Health Promotion Foundation. Concerned about the increase in youth smoking e-cigarettes [Internet]. [Cited 2024 Jun 20]. Available from: https://shorturl.asia/KhJBr.
4. Watheesathakakit P. Concerns about youth smoking electronic cigarettes have increased nearly 5.3 times, with more women smoking [Internet]. [Cited 2024 Jun 20]. Available from: https://www.hfocus.org/content/2024/04/30166.
5. Chuangchaiya J, Kengganpanich M, Benjakul S, Sompopcharoen M. The Effects of Smoking Prevention Program and Using Facebook Among Grade 8 Students, Amphoe Mueang, Prachuap Khiri Khan Province. J Bamrasnaradura Infect Dis Institute. 2021;15(2):94-105.
6. Lapyai S. New Tobacco Products on Social Media and Law Enforcement on New Tobacco Products Control. J.PH.PL. 2019;5(1):13-29.
7. Tobacco Control Research and Knowledge Management Center. Concerned about Thai youth Easy access to e-cigarettes After discovering a large number of e-cigarettes being sold on social media [Internet]. [Cited 2024 Apr 10]. Available from: https://nuradio.nu.ac.th/?p=4706.
8. Phosaeng S. Youth Association reveals that a worrying 12.3 percent of "Thai teenagers" smoke e-cigarettes. More than two-thirds smoke e-cigarettes as their first tobacco product in life [Internet]. [Cited 2024 Apr 10]. Available from: https://www.hfocus.org/content/2022/06/25365.
9. Jornburom Y, Chaiyasung P, Yakasem P, Sridet R, Nanudorn A. Nurses' role in enhancing adolescents' perceptions of the dangers of electronic cigarettes. TJN. 2021;70(1):52-60.
10. Chankaew T, Baiya P, Chinwong D, Yoodee V, Chinwong S. Electronic Cigarettes in Thailand: Behaviour, Rationale, Satisfaction, and Sex Differences. Int J Environ Res Public Health. 2022;19(14):8229.
11. Ofuchi T, Zaw AMM, Thepthien BO. Adverse childhood experiences and prevalence of cigarette and e-cigarette use among adolescents in Bangkok, Thailand. Asia Pac J Public Health. 2020;32(8):398-405. doi: 10.1177/1010539520962956
12. Sadeghi R, Mahmoodabad S, Fallahzadeh H, Rezaeian M, Bidaki R, Khanjani N. Predictive factors for preventing hookah smoking and health promotion among young people based on the protection motivation theory. J Educ Health Promot. 2019;8:169. doi: 10.4103/jehp.jehp_78_19
13. Ruangkanchanasetr S, Jongkhajornpong P, Kasemsub V, Hamann S, Charoenca N, Sirichotiratana N, et al . E-cigarette: a Dangerous Threat Destroying Youth. J Health Sci Thai. 2023;32(5):946-961.
14. Thammawongsa P, Laohasiriwong W, Yotha N, Nonthamat A, Prasit N.

Influence of socioeconomics and social marketing on smoking in Thailand: A National Survey in 2017. Tob Prev Cessat. 2023;9:28. doi: 10.18332/tpc/169501
15. Yanarueng S, Laohasiriwong W, Phimha S, Yotha N, Phanyotha S, Pinsuwan C, et al. Health determinant factors associated with smoking behaviour of older adults in Thailand. J Pub Health Dev. 2023;21(1):32-44.
16. Prasit N, Laohasiriwong W, Nonthamat A, Sresutham P, Nidthumsakul N, Nilnate N, et al. Investigating the Challenges in Alcoholic Beverage Control and Law Enforcement: Analyzing Binge Drinking Prevalence Among the Working-Age Population in Thailand Based on 2017 National Survey. J Pop Soc Studies. 2024; 32:481–493.
17. National Statistical Office. The 2021 Health Behavior of Population Survey. Bangkok: Statistical Forecasting Division Publication; 2021.
18. Ruanphet K, Homsin P, Leelukkanaveera Y. Factors Related to Electric Smoking among Male Vocational Students. J Royal Thai Army Nurses. 2022;23(2):531-539.
19. Charupash C. The Experiences of Smoking E-cigarettes among Teenage Girls in Higher Education Institutions in Khon Kaen Province. Journal of the Office of DPC 7 Khon Kaen. 2021; 28(3):1-6.
20. Abdollahi SZ, Mahmoodabad SSM, Lotfi MH, Ardakani SMY. Development and validation of a questionnaire based on the protection motivation theory to predict cigarette smoking preventive behavior in the Iranian university students. J Educ Health Promot. 2023;12:12. doi: 10.4103/jehp.jehp_1566_21
21. Chaimay B. Sample Size Determination in Descriptive Study in Public Health. Thaksin. J. 2013;16(2):9-18.
22. Department of Mental Health. Stress Test Questionnaire (ST-5). [Internet]. [Cited 2024 Apr 10]. Available from: https://catalog.dmh.go.th/dataset/test-st5.
23. Lotrakul M. Patient Health Questionnaire (PHQ-9). [Internet]. [Cited 2024 Apr 10]. Available from: https://www.rama.mahidol.ac.th/th/depression_risk.
24. Panyanupap A. Factors affecting preventive behavior on smoking among male students in colleges under the provincial vocational education of Nakhon Pathom. MPA [Thesis]. Bangkok: Silpakorn University; 2006.
25. Mongmat W. Factors affecting smoking prevention behaviors of upper secondary school male students in Mueang district, Nakhon Pathom province . MPA [Thesis]. Bangkok: Silpakorn University; 2019.
26. Benjakul S, Nakju S, Termsirikulchai L. Factors associated with e-cigarette use among vocational students: A cross-sectional multistage cluster survey, Thailand. Tob Induc Dis. 2023;21:120. doi: 10.18332/tid/170421
27. Maneekun C, Homsin P, Srisuriyawet R. Factors Related to the Early Electric Smoking Stage Among Secondary School Students in Chachoengsao Province. Nursing J CMU. 2023; 50(4):158-69.
28. Chaitiang N, Vongruang P. The Perception of Smoking Cessation among the Students in a Northern University of Thailand. JSH. 2021;14(1):37-49.

29. Siritrakul P. Factors affecting smoking prevention behaviors among the elementary school students. MPA [Thesis]. Phitsanulok: Naresuan University; 2021.
30. Panaschai P. Prevalence and Factors Related to Electronic cigarette Smoking Behavior Among High School Students in Samut Prakan Province. PJST. 2023;4(2):8–21.
31. Suwatpinyo P, Kengganpanich M, Kengganpanich T. Factors Related to E-Cigarette Smoking among Senior High School Students in Bangkok Metropolitan area. Thai J Health Edu. 2021;44(2):88-101.
32. Onmoy P, Buarueang A, Paponngam C, Janrungrueang T, Laonoi N, Boonrawd A. Factors Associated with Electronic Cigarette Smoking Behaviors of Adolescents in Uttaradit Province. JHS. 2022;31(Supplement)2:197-205.
33. Ham E, Thepthein B, Chucharoen P, Hong SA. Patterns of polysubstance use and associated factors among grade 11 students in Bangkok, Thailand. J Public Hlth Dev. 2019;17(2):3-19.
34. Roengrudee P. Teenagers who smoke e-cigarettes increase their risk of smoking cannabis by 4 times [Internet]. [Cited 2024 Apr 10]. Available from: https://dol.thaihealth.or.th/Media/Pdfview/3a2b9775-6d0c-ed11-80fa-00155db45613
35. Sonthon P, Janma N, Sonthon A. Prevalence of Electronic Cigarettes and Association with Alcohol Drinking, Cannabis Use and Cigarette Smoking among Senior High School Students, Phetchabun [Internet]. [Cited 2024 Apr 10]. Available from: https://cads.in.th/cads/content?id=324.
36. Chadi N, Schroeder R, Jensen J.W, Levy S. Association Between Electronic Cigarette Use and Marijuana Use Among Adolescents and Young Adults [Internet]. [Cited 2024 Jul 12]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6692686/.
37. Jumpajan J, Thawongna T, Yakamsee N, Mueangkhong P, Khantee N, Wontaisong N, et al. Factors Related to Knowledge and Attitude on Electronic Cigarettes of Students in Sakon Nakhon Rajabhat University. RHPC 9 Journal. 2019;17(2):631-644.
38. Kantub N. Smoking Behavior of Students in The Medical Faculty University Upper Northern, Thailand. MPA [Thesis]. Phayao: University of Phayao; 2022.
39. Kengganpanich M, Suwanrassami S, Phavaputanondh C, KengganpanichT. Factors Associated with Smoking Behavior Among Female Adolescents in Bangkok Metropolitan. Thai J Hlth Edu. 2014;37(128):29–44.