E-Cigarette Use and Predictors of Vaping Behavior among Undergraduate Students in Thailand's Health Region 10

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Abstract
The increasing prevalence of e-cigarette use among youth has become a significant public health concern worldwide and in Thailand. This study aimed to determine the prevalence of e-cigarette use and identify predictors of vaping behavior among undergraduate students in Thailand's Health Region 10. A cross-sectional study was conducted from August to September 2025 among 555 undergraduate students selected through a cluster sampling method. Data were collected using an anonymous, self-administered multiple-choice questionnaire via Google Forms. Descriptive statistics and multiple logistic regression analysis were employed to examine factors predicted with e-cigarette use. Adjusted odds ratios (AOR) and 95% confidence intervals (CI) were reported. The prevalence of e-cigarette use among undergraduate students was 12.25%. Predictors of e-cigarette use included social factors (Adjusted OR = 5.057, 95% CI = 2.48–10.32, p < 0.001), environmental factors (Adjusted OR = 2.044, 95% CI = 1.04–4.01, p = 0.037), and risky health behaviors (Adjusted OR = 5.735, 95% CI = 1.56–21.02, p = 0.008) were significant predictors of e-cigarette use. In addition, students with higher GPA had a lower likelihood of using e-cigarettes compared to those with moderate GPA (Adjusted OR = 0.366, 95% CI = 0.16–0.81, p = 0.013). E-cigarette use among undergraduate students in Health Region 10 was significant. Implementing smoke-free environmental strategies, along with interventions that promote positive health behaviors, will be crucial in reducing and preventing e-cigarette use among this group.

Keywords: E-cigarette, Health Region 10, Predictors, Thailand, Undergraduate Students, Vaping Behavior

1. Introduction

In recent years, the use of electronic cigarettes among young people has expanded widely. Over time, become widely adopted by adolescents and university-age individuals, including those who have never smoked traditional cigarettes at all [1]. According to global estimates, approximately 82 million people were using e-cigarettes in 2021. By 2023, this number had increased to approximately 114 million, indicating a steady and significant rise over time [2]. From the study, it was found that the prevalence of e-cigarette use among school or college students worldwide was 10.2% [3]. In Thailand, data from the Global School-based Student Health Survey indicate a notable increase in e-cigarette use among school-aged adolescents. The prevalence of e-cigarette use among students aged 13–15 years rose from 3.3% in 2015 to 8.1% in 2021 [4]. Among Thais aged 15 years and older, 8.7% have ever used e-cigarettes. The highest prevalence was found in the 15–29 age group, at 22.6% [5].

This pattern has raised several concerns. While e-cigarettes are often promoted as less harmful than conventional tobacco, accumulating research highlights a range of potential risks, including nicotine dependence, adverse respiratory effects, and possible long-term consequences for brain development. E-cigarettes are increasingly marketed to young people through social media, online personalities, a wide range of flavors, and device designs that mimic toys or gaming gadgets. These tactics are highly attractive to adolescents and correspond with a noticeable rise in youth vaping, in some cases surpassing usage among adults. Even limited exposure to vaping-related content online has been shown to heighten curiosity and foster more positive attitudes toward e-cigarette use among young viewers [1]. Thailand offers an illustrative

example of these complexities. Despite a national ban on the sale and importation of e-cigarettes since 2015, ongoing surveys show continued use among adolescents and young adults [6].

Previous research has highlighted several factors associated with e-cigarette use. Individual characteristics such as birth order, school type, and the presence of chronic illness have been noted as contributing factors [**7**]. Curiosity and a willingness to try new experiences often serve as initial motivations for vaping. Misbeliefs that e-cigarettes are safer than traditional tobacco and the perception that vaping can help manage emotions may further influence experimentation. For some individuals, early positive experiences can reinforce continued use. Social context also plays a significant role. Adolescents and young adults who have friends who vape, who receive peer encouragement, or who live with family members who smoke or vape are more likely to use e-cigarettes Environmental influences also play a role; exposure to online marketing and the widespread availability of e-cigarettes primarily through social media platforms and in retail outlets near schools and shopping areas further increases access to and use of these products [8]. Higher rates of use have also been reported among LGBTQ youth, students with lower academic performance, and those dealing with stress, limited knowledge, low self-efficacy, or depressive symptoms [9] and [10]. Studies examining factors that predict e-cigarette use among Thai youth remain limited, and existing evidence does not yet represent all regions of the country. This is particularly true in Health Region 10, a border area adjacent to Laos and Cambodia. The location may create opportunities for the informal or unlawful movement of products such as e-cigarettes into the country, increasing access among young people. As a result, there is a clear need for area-specific research better to understand the drivers of e-cigarette use in this context. To address this gap, the present study examines e-cigarette use among undergraduate students in Thailand's Health Region 10 and identifies key predictors associated with vaping behavior. Using multiple logistic regression, the study aims to provide evidence to guide preventive measures, strengthen campus-based enforcement efforts, and inform health promotion strategies designed to reduce vaping among young adults.

2. Methods

2.1 Study Area

The study was conducted in Health Region 10 of Thailand, which includes five provinces in the lower northeastern area, such as Ubon Ratchathani, Si Sa Ket, Yasothon, Amnat Charoen, and Mukdahan (Figure 1). In this region, there are six universities offering undergraduate programs (not including branch campuses), four located in Ubon Ratchathani and two in Si Sa Ket [11].

2.2 Research Methodology

The study population consisted of undergraduate students enrolled in higher education institutions within the research area who were 18 years of age or older. The sample size was calculated using the G*Power 3.1.9.4 program for z test logistic regression analysis. The parameters were set with an odds ratio (OR) of 2.18 and $Pr(Y = 1 \mid X = 1)$ H_0 = 0.12, [12]. The level of significance (α) was set at 0.05, and the statistical power (1−β) at 0.80. To minimize the potential impact of incomplete responses from the online questionnaire distributed via Google Form, the sample size was increased by 10% [13].

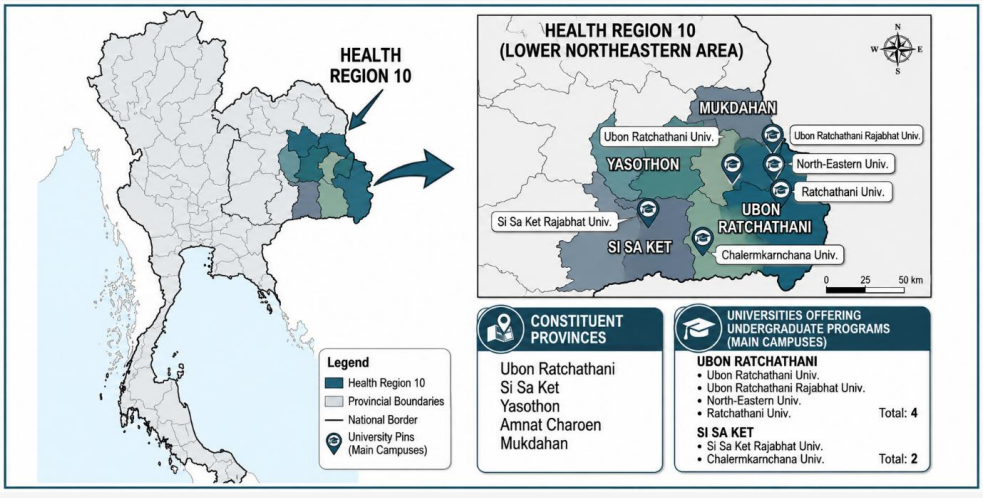


Figure 1: Thailand's Health Region 10

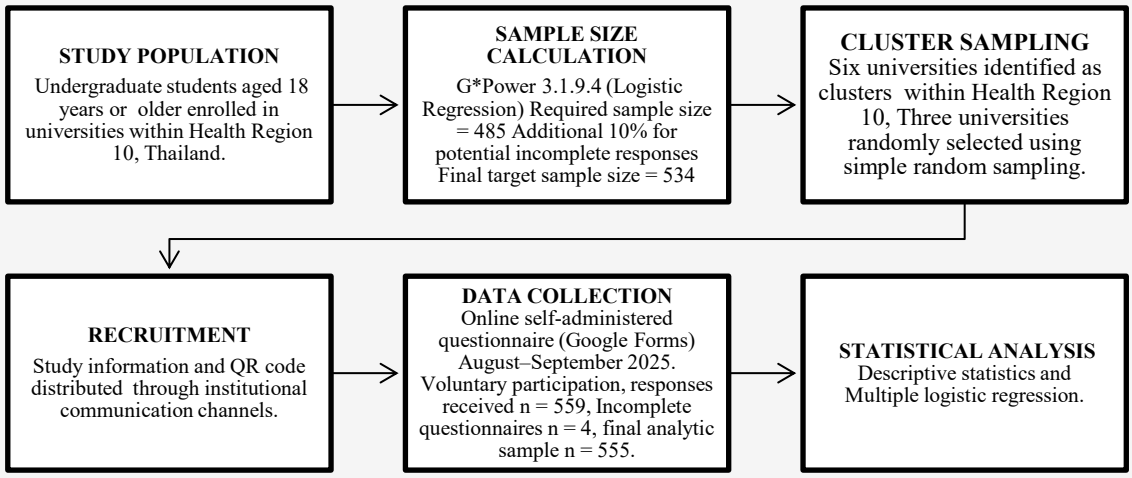


Figure 2: Research flow diagram of participant selection, recruitment, data collection, and analysis

Consequently, the calculated sample size increased from 485 to 534 participants. By the end of data collection, 559 responses were received, of which 555 were complete and included in the final analysis. This study employed a cluster sampling approach at the institutional level as shown in Figure 2, following the steps below:

1) *Defining the target population*: The target population comprised undergraduate students enrolled in universities located in Health Region 10.
2) *Forming clusters*: Each university was treated as one cluster.
3) *Selecting clusters*: Three universities were randomly selected from a total of six using simple random sampling.
4) *Data collection*: Students from the selected universities were invited to participate at the institutional (cluster) level, and individual participation within each cluster was voluntary. The research project was publicized through official communication channels, and a QR code linking to an online questionnaire was distributed to potential participants. Students completed the questionnaire voluntarily. The survey was open for responses from August to September 2025.

This sampling strategy applied probability sampling at the cluster level and voluntary participation at the individual level, which may introduce self-selection bias. This limitation was acknowledged in the study. The study employed a multiple-choice questionnaire as the research instrument**.** The research instrument was a structured questionnaire using a multiple-choice response format. The questionnaire consisted of 11 sections covering personal factors, social factors, environmental factors, policy and governance factors, knowledge regarding e-cigarettes, attitudes toward e-cigarettes, perceived behavioral control over e-cigarette use, stress factors, health-risk behaviors, economic factors, and e-cigarette use behavior. The questionnaire was developed to comprehensively assess the multidimensional factors associated with e-cigarette use among the study participants. Three experts assessed content validity. The Index of Item Objective Congruence (IOC) values of 0.67 or higher were retained. Reliability was determined through a pilot test with 30 undergraduate students from higher-education institutions in Health Region 10. The instrument had Cronbach's alpha values of 0.77 and 0.82, and a KR-20 coefficient of 0.73.

Descriptive statistics were used to summarize participant characteristics and vaping prevalence. Multiple logistic regression analysis was performed to examine predictors of e-cigarette use. Adjusted odds ratios (AOR) and 95% confidence intervals (CI) were reported. Statistical analyses were conducted using Jamovi 2.6.44 [14]. This research is part of the development of an operational model for controlling e-cigarette consumption among undergraduate students in Health Region 10. The study is currently in the exploratory phase, focusing on determining the prevalence of e-cigarette use and identifying predictors of vaping behavior among undergraduate students in Thailand's Health Region 10. The research received ethical approval for human studies from Ubon Ratchathani University, with certificate number UBU-REC-105/2568, granted on June 23, 2025. The research flow diagram is presented below.

3. Results

3.1General information about the sample

The sample consisted of 555 participants. Most of the participants were female (78.38%). Over half were between 18 and 19 years old (56.76%). The majority

were first- to third-year students (63.60%) and studied in the Humanities and Social Sciences group (63.42%). A large proportion reported having high GPA (83.42%) and average monthly income between 0 and 5,000 Baht (58.02%). A total of 84.86% of the participants had appropriate social factors, while 62.88% had appropriate environmental factors. Additionally, 94.23% reported the presence of appropriate policy and governance factors. Most participants had a moderate level of knowledge about e-cigarettes (61.98%) and a high level of appropriate attitudes toward e-cigarettes (69.73%). The majority also exhibited health risk behaviors (76.58%). A large proportion showed a high level of perceived self-efficacy in controlling e-cigarette use (85.41%). Regarding mental health, 36.94% had a moderate level of stress, and 56.94% had normal depression-screening results.

3.2 E-cigarette user in the Study Area

Of the 555 participants, 55.32% were studying at institutions in Ubon Ratchathani and 44.68% in Si Sa Ket. A total of 68 participants (12.25%) reported using e-cigarettes. Among them, 46 (67.65%) were studying in Ubon Ratchathani, and 22 (32.35%) were studying in Si Sa Ket. The ratio of e-cigarette users among undergraduate students in Ubon Ratchathani Province was 1:6.67, while the ratio among undergraduate students in Si Sa Ket Province was 1:11.27**.** Details are shown in Table 1.

Table 1: General information about the sample (n=555)

General information	Numbers	Percentage (%)
Sex		
Male	98	17.66
Female	435	78.38
LGBTQ	22	3.96
Age		
18-19 years	315	56.76
20 years and above	240	43.24
Year of Study		
Years 1–3	353	63.60
Year 4 and above	202	36.40
Faculty/Program Group		
Science and Technology	13	2.34
Humanities and Social Sciences	352	63.42
Health Sciences	190	34.24
GPA		
0.00-1.33 (Low)	0	0.00
1.34-2.66 (Moderate)	92	16.58
2.67-4.00 (High)	463	83.42
Average monthly income (Baht)		
0 -5,000	322	58.02
5,001-10,000	186	33.51
10,001 and above	47	8.47
Social factors		
Appropriate	471	84.86
Inappropriate	84	15.14
Environmental factors		
Appropriate	349	62.88
Inappropriate	206	37.12
Policy and governance factors		
Appropriate	523	94.23
Inappropriate	32	5.77
Level of knowledge about e-cigarettes		
Low	62	11.17
Moderate	344	61.98
High	149	26.85
Level of Attitude about e-cigarettes		
Low appropriateness	1	0.18
Moderate appropriateness	167	30.09
High appropriateness	387	69.73
Health risk behaviors		
Not at risk	130	23.42
At risk	425	76.58

General information	Numbers	Percentage (%)
Level of perceived self-efficacy in controlling e-cigarette use		
Low	17	3.06
Moderate	64	11.53
High	474	85.41
Level of stress (ST-5)		
Low	246	44.32
Moderate	205	36.94
High	59	10.63
Very high	45	8.11
Depression screening (2Q)		
Normal	316	56.94
At risk of depression	239	43.06
Location of the educational institution		
Ubon Ratchathani	307	55.32
Sisaket	248	44.68
E-cigarette users		
Ubon Ratchathani	46	67.65
Sisaket	22	32.35

3.3 Predictors of Vaping Behavior

The multiple logistic regression analysis showed that, after adjusting for gender, age, year of study, and faculty/program group, four variables were significantly associated with e-cigarette use ($p < 0.05$) including;

1. GPA: Students with high GPA (2.67–4.00) were less likely to use e-cigarettes compared with those with moderate GPA (Adjusted OR = 0.366, 95% CI = 0.16–0.81), suggesting a protective effect of academic performance.
2. Social Factors: Unfavorable social conditions increased the likelihood of vaping more than fivefold (Adjusted OR = 5.057, 95% CI = 2.48–10.32). Influences included family or peer vaping, peer acceptance, partner behavior, and social pressure.
3. Environmental Factors: Students exposed to unfavorable environmental conditions had twice the odds of e-cigarette use (Adjusted OR = 2.044, 95% CI = 1.04–4.01). Key factors included access to e-cigarettes, exposure to vaping information, and observing vaping in public areas.
4. Health-Risk Behaviors: Students engaging in other health-risk behaviors were nearly six times more likely to use e-cigarettes (Adjusted OR = 5.735, 95% CI = 1.56–21.02), including alcohol use, combustible cigarette smoking, substance use, and visiting entertainment venues.

Factors such as monthly income, policy and governance, knowledge, attitudes, perceived self-efficacy, stress, and depression were not significantly associated with e-cigarette use ($p > 0.05$). Details are shown in Table 2. Figure 3 presents a GIS-based spatial visualization of e-cigarette use among undergraduate students in Thailand's Health Region 10.

The map classifies the study area by predicted risk intensity using the empirical findings of the study. Ubon Ratchathani is displayed in red, indicating the highest observed burden and predicted vulnerability, with 46 e-cigarette users among 307 students. Si Sa Ket is displayed in orange, representing a moderate level of observed burden, with 22 users among 248 students. Yasothon, Amnat Charoen, and Mukdahan are displayed in light orange to indicate contextual surveillance areas within Health Region 10, as no university-level sample from these provinces was included in the final analysis. The predictor panel summarizes the multivariable logistic regression results, showing that unfavorable social factors, environmental exposure, and health-risk behaviors increased the likelihood of e-cigarette use, whereas higher GPA showed a protective association. This GIS-based presentation enhances the interpretation of the findings by linking statistical predictors with spatial context; however, the mapped risk should be interpreted as an epidemiological visualization of study findings rather than evidence of province-level causal effects.

Table 2: Predictors of vaping behavior (Adjusted by sex, age, year of study, and faculty/program group)

Factors	Number of e-cigarette users	Percentage (%)	Crude OR	Adjusted OR	95%CI for adjusted OR	p-value
GPA						
1.34-2.66 (Moderate)	31	45.59	1			
2.67-4.00 (High)	37	54.41	0.355	0.366	0.16-0.81	0.013*
Average monthly income (Baht)						
0 -5,000	25	36.76	1			
5,001-10,000	33	48.53	1.709	1.747	0.83-3.67	0.141
10,001 and above	10	14.71	0.657	0.777	0.26-2.35	0.656
Social factors						
Appropriate	31	45.59	1			
Inappropriate	37	54.41	5.561	5.057	2.48-10.32	<0.001*
Environmental factors						
Appropriate	22	32.35	1			
Inappropriate	46	67.65	2.118	2.044	1.04-4.01	0.037*
Policy and governance factors						
Appropriate	64	94.12	1			
Inappropriate	4	5.88	1.743	1.671	0.46-6.12	0.438
Level of knowledge about e-cigarettes						
Low	11	16.18	1			
Moderate	45	66.17	2.015	0.277	0.80-6.45	0.122
High	12	17.65	1.381	1.494	0.44-5.03	0.517
Level of Attitude about e-cigarettes						
Low appropriateness	1	1.47	1			
Moderate appropriateness	35	51.47	2.06e-6	2.70e-6	0.00-Inf	0.988
High appropriateness	32	47.06	1.62e-6	2.24e-6	0.00-Inf	0.988
Health risk behaviors						
Not at risk	3	4.41	1			
At risk	65	95.59	5.888	5.735	1.56-21.02	0.008*
Level of perceived self-efficacy in controlling e-cigarette use						
Low	5	7.35	1			
Moderate	20	29.41	0.611	0.694	0.13-3.82	0.675
High	43	63.24	0.224	0.271	0.05-1.42	0.122
Level of stress (ST-5)						
Low	17	25.00	1			
Moderate	37	54.42	1.401	1.414	0.67-3.01	0.368
High	7	10.29	1.646	1.673	0.54-5.15	0.370
Very high	7	10.29	1.166	1.090	0.33-3.59	0.887
Depression screening (2Q)						
Normal	35	51.47	1			
At risk of depression	33	48.53	1.173	1.066	0.55-2.06	0.850

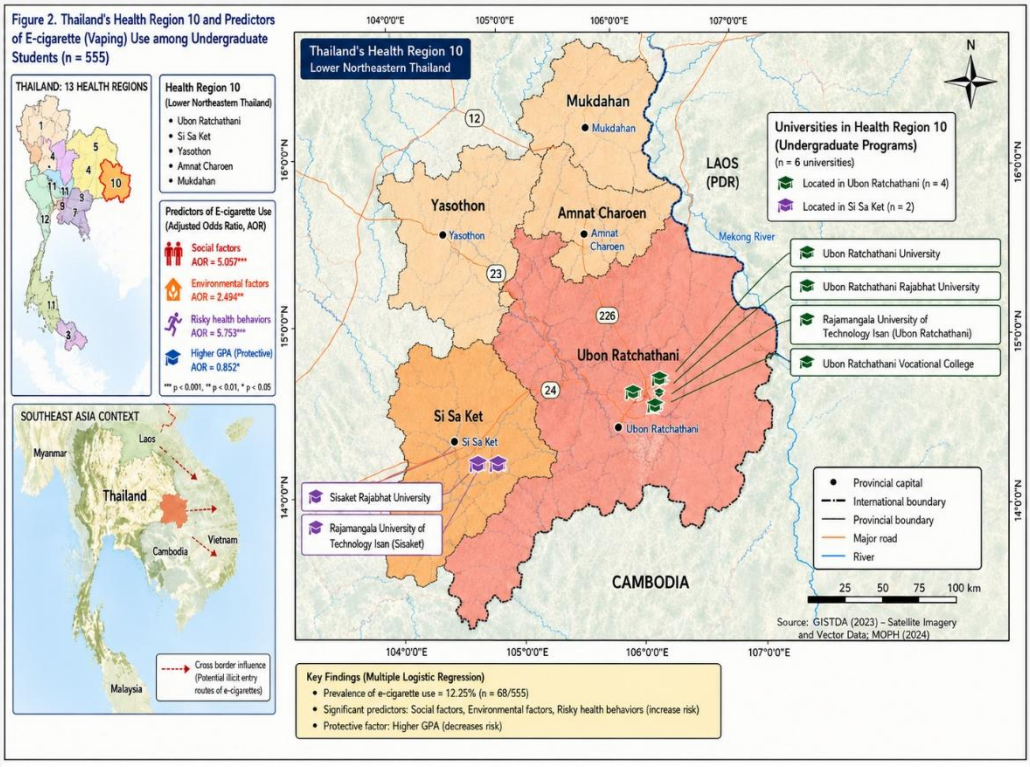


Figure 3: Thailand's health region 10 and predictors of e-cigarette (vaping) use among undergraduate students

4. Discussion

This study examined vaping behaviors and predicted factors among undergraduate students in Health Region 10. The prevalence of e-cigarette use (12.25%) is consistent with national and global evidence indicating a growing trend in vaping among youth. The higher proportion of users in Ubon Ratchathani compared to Si Sa Ket may reflect the urban characteristics of Ubon Ratchathani, which serves as the region's leading educational and social hub. Larger numbers of universities, entertainment venues, and youth gathering spaces may increase students' exposure to vaping and facilitate easier access to e-cigarette products through informal vendors and online markets. Prior research confirms that accessibility has a strong influence on youth vaping behavior [15] and [16]. The 7th National Health Examination Survey (2024–2025) also reported higher e-cigarette use in urban than rural areas [5], supporting this interpretation.

Undergraduate students with higher GPA were less likely to use e-cigarettes compared with those with moderate academic performance (Adjusted OR = 0.366). Academic success may serve as a protective factor against vaping. Similar findings were observed in a study of U.S. middle and high school students, which reported that lower academic performance was linked to more frequent e-cigarette use [17]. Social factors were among the strongest predictors of vaping. Having friends, partners, or family members who use e-cigarettes, or experiencing peer pressure, was strongly associated with e-cigarette use (Adjusted OR = 5.057). This aligns with previous evidence showing that social acceptance and vaping within peer and family networks increase the risk of youth vaping [18] and [19]. These findings also reflect the Social Learning Theory, which posits that individuals learn behaviors through observing and imitating significant others such as peers and family members [20]. Environmental exposure such as frequently seeing others vape, encountering advertisements, or having convenient access to e-cigarette products also increased the likelihood of vaping (Adjusted OR = 2.044). This is consistent with prior research showing that exposure to e-cigarette marketing and public vaping increases the likelihood of use among young people [21]. These findings also align with the Ecological Systems Theory, which emphasizes that human behavior is shaped by multiple environmental layers, including peers, educational settings, online media, and cultural norms in urban communities [22]. Finally, students who engaged in other health-risk behaviors including alcohol consumption, combustible cigarette smoking, substance use, and visits to entertainment venues had a substantially

higher likelihood of vaping (Adjusted OR = 5.735). This is consistent with findings from Northeastern Thailand showing associations between cannabis use, nightlife exposure, and e-cigarette use [16]. These patterns also reflect Problem Behavior Theory, which suggests that adolescent risk behaviors commonly occur together as interconnected behavioral syndromes rather than independent actions [23].

In addition, the GIS-based presentation used in this study strengthens the interpretation of vaping risk by transforming statistical findings into spatially meaningful evidence. This approach is consistent with recent geoinformatics literature emphasizing that GIS can enhance disease surveillance, spatial analysis, data integration, and public health preparedness by linking health outcomes with geographic context [24]. Although the present study did not perform spatial regression or hotspot analysis, the visualization of Health Region 10 provides an applied framework for interpreting the distribution of undergraduate institutions, observed vaping burden, and key predictors within a defined regional health system. Similar applications of GIS in Thai public health research have demonstrated that combining epidemiological data with spatial visualization can support area-based health planning and problem identification [25]. Therefore, the use of GIS in this study represents a practical methodological contribution by improving the communicability and policy relevance of findings related to e-cigarette use among undergraduate students in Health Region 10.

5. Conclusion

This study found that 12.25% of undergraduate students in Thailand's Health Region 10 reported e-cigarette use, indicating that vaping remains a notable public health concern among young adults despite existing national restrictions on e-cigarette sales and importation. The prevalence was higher in Ubon Ratchathani Province, suggesting possible differences in exposure and accessibility across local contexts. The findings identified several factors associated with e-cigarette use. Students with higher academic performance were less likely to use e-cigarettes, whereas unfavourable social influences, environmental exposure to vaping, and engagement in other health-risk behaviors were associated with a greater likelihood of use. Among these factors, social influences emerged as one of the strongest predictors of vaping behavior. Overall, the findings suggest that e-cigarette use among undergraduate students is shaped by a complex interaction of individual, social, and environmental factors. These results contribute to a better understanding of vaping behavior among Thai university students and provide important evidence for understanding the determinants of e-cigarette use among young adults in Thailand.

6. Recommendations

The findings from this study show the need for practical actions to address e-cigarette use among undergraduate students. Easy access and frequent exposure, especially in urban areas, make vaping more common, so authorities should tighten controls on online sales and informal distribution. Stronger and more consistent enforcement around campuses can also help reduce the availability of these substances. Universities can support these efforts by establishing clear e-cigarette-free campus policies, providing straightforward health education, and monitoring students who exhibit multiple high-risk behaviors. Because peer influence plays a significant role, prevention that involves student leaders, friends, and families is likely to be more effective than relying on information alone. Regular monitoring and updated guidelines are needed to keep up with changing trends and ensure that policies remain practical and effective. Future research should employ longitudinal study designs to better understand the causal pathways underlying the observed associations. Studies involving larger and more representative samples across different regions of Thailand are also recommended. In addition, intervention-based research is needed to evaluate the effectiveness of university-based prevention programs, digital health interventions, and policy enforcement strategies. Future studies should also explore psychosocial factors, social media influences, and emerging vaping products to provide a more comprehensive understanding of vaping behavior among Thai youth and young adults.

7. Limitation

This study has several limitations that should be taken into consideration. Because the research was conducted at a single point in time, it cannot establish cause and effect. The data were collected through an online questionnaire, so the accuracy of some responses may vary. Participation was voluntary, which means the students who chose to respond may not fully represent all students in Health Region 10. The study was conducted at only three universities, and the sample consisted of more female respondents than male respondents, which may have impacted the balance of the findings. The study also lacked in-depth information that could help clarify the reasons behind e-cigarette use.

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