

# Intention to quit smoking according to smoking preferences and perceptions of electronic cigarettes among university students in South Korea

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## Abstract

This study aimed to alleviate unhealthy smoking habits among university students and provide the basic data necessary for public health-oriented approaches such as developing regulations and policies on electronic cigarettes by analyzing the relationship between university students' smoking preferences, perceptions of electronic cigarettes, and intention to quit smoking.

This study involved 567 college students and conducted frequency and chi-squared analyses of the general characteristics, smoking preferences, and perceptions of electronic cigarettes. This study also performed logistic regression analysis to analyze the relationship between intention to quit smoking stratified by smoking preferences and the perceptions about electronic cigarettes. SPSS version 25.0 was used for data analysis.

This study showed that electronic cigarette smokers were approximately 6.4 to 10.8 times more likely to think that electronic cigarettes positively affect smoking cessation attitude than nonsmokers. This study showed that regular cigarette smokers were approximately 1.7 to 2.2 times and other smoker 3.3 to 3.9 times more likely to think that electronic cigarettes positively affect smoking cessation attitude than nonsmokers. Those who perceived harmless to the human body, capable of reducing the frequency of smoking, and less harmful than tobacco were approximately 2.6 to 2.9, 11.6 to 12.8, and 3.3 to 3.7 times more likely have intention to quit smoking, respectively.

Regular health education, advertising awareness of health hazards, and public health science-oriented approaches and policies for smoking cessation support services are needed to create awareness on electronic cigarettes among university students.

**Abbreviations:** CI = confidence interval, OR = odds ratio.

**Keywords:** electronic cigarette, smoking, smoking preference, tobacco, university students

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This study was a programmed evaluation, and it did not require ethical approval.

Consent for Publication is not applicable.

All data and material supporting our findings are contained within the manuscript.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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## 1. Introduction

Smoking is responsible for approximately 6 million deaths each year. According to the World Health Organization (WHO), more than 5 million deaths are caused by direct tobacco use, and more than 600,000 result from exposure to secondhand smoke.<sup>[1]</sup> As of 2014, Korean adults' daily smoking rate was 20.0%, which was higher than the mean daily smoking rate of Organization for Economic Cooperation and Development (OECD) adults (19.7%) and the third-highest among OECD member countries. Adults' smoking rate ( $\geq 19$  years old) tended to decrease from 66.3% for men and 6.5% for women in 1998 to 43.2% for men and 5.7% for women in 2014, and men's mean smoking rate (43.2%) was higher than the overall smoking rate (24.2%).<sup>[2]</sup> Smoking causes respiratory and cardiovascular diseases, including cancer (Centers for Disease Control, 2008). It affects most of the body, and female smokers are at high risk of being underweight and give birth to sick newborns.<sup>[3]</sup>

It was estimated that approximately 100,000 Americans were electronic cigarette users. Approximately 10% of Japanese smokers switched from ordinary cigarettes to electronic cigarettes as of the first half of 2017.<sup>[4]</sup> Approximately 4% of the total population used electronic cigarettes in Italy, which was approximately 4 times more than the previous year.<sup>[4]</sup> According to a previous study in South Korea, 80% of smokers knew about

electronic cigarettes, 16% of them tried it at least once, and 15% of them used them every day.<sup>[5]</sup> The Ministry of Economy and Finance<sup>[6]</sup> reported in 2020 that the sales of e-cigarettes increased by 9.3% from 330 million packs in 2018 to 360 million packs in 2019; vapes had sold 16.5 million pods since their launch in May 2019, and 3.7 million packs of tobacco solid electronic cigarettes had been sold since their launch in July 2019.

With the increasing use of electronic cigarettes, 179 countries unanimously agreed to regulate all products that could promote tobacco use at the Framework Convention Alliance for Tobacco Control of the World Health Organization (2014)<sup>[7]</sup> regardless of the nicotine content. It was decided that all governments should prohibit the indoor use of electronic cigarettes and ban the promotion and advertisement of the use of electronic cigarettes to facilitate smoking cessation until enough evidence was secured to prove their safety.

Electronic cigarettes are attracting both nonsmokers as well as existing smokers despite the atmosphere and campaigns recommending smoking cessation because they do not contain carcinogens such as tar, carbon monoxide, and benzopyrene like ordinary cigarettes. They also reduce smokers' withdrawal symptoms related to the inhalation of nicotine or other liquid components contained in the cartridge in a gaseous state; thus, they have been advertised as less harmful for health than ordinary cigarettes.<sup>[8]</sup> The US FDA<sup>[9]</sup> declared that carcinogens such as tobacco-specific nitrosamines and acetaldehyde were present in liquid-type electronic cigarettes. A study in South Korea also identified tobacco-specific nitrosamines and phthalate in the liquid and gas types of electronic cigarettes. The Korean Ministry of Health and Welfare<sup>[10]</sup> announced that electronic cigarettes contained the same carcinogens as ordinary cigarettes in January 2015, and that it would strictly regulate the advertisement that it was effective for quitting smoking.

Etter<sup>[11]</sup> showed that the percentage of American university students who knew about electronic cigarettes had nearly doubled from 16.4% in 2009 to 32.2% in 2010, and the rate of use of electronic cigarettes had also increased approximately 4-fold from 0.6% in 2009 to 2.7% in 2010. The students perceived electronic cigarettes as less harmful than ordinary cigarettes and considered them as smoking cessation aids that could mitigate withdrawal symptoms and reduce the consumption of ordinary cigarettes.<sup>[12]</sup> The Korean Ministry of Health and Welfare<sup>[13]</sup> conducted a survey on the perceptions of electronic cigarettes and found that 83.9% of the respondents knew about electronic cigarettes; 40.1% considered electronic cigarettes as substitutes for quitting smoking; and 37.2% thought that electronic cigarettes were less harmful to health than the ordinary cigarettes and believed that they gave the effects of smoking without smoke or they were more economical. Most studies have targeted adolescents and adults and evaluated the factors related to the experience of using electronic cigarettes,<sup>[14–21]</sup> and there are inadequate studies on healthy university students' smoking preferences and perceptions of electronic cigarettes.

Therefore, this study aimed to provide basic data to facilitate the cultivation of healthy attitudes and habits related to smoking among university students and the development of public health-related approaches such as the development of electronic cigarette-related regulations and policies by analyzing the relationship between university students' smoking intention, smoking preferences, and perceptions about electronic cigarettes. From the health perspective, smoking during college years is more likely to result in the formation of a lifelong smoking habit. This

may increase social costs and the use of medication during old age, in addition to decreasing the level of individual health and increasing associated expenses.<sup>[20,22]</sup>

## 2. Methods and materials

### 2.1. Study participants and data collection

This study was conducted using the “survey method” that allowed the respondents to fill out the questionnaire, which was developed by the researcher, by themselves. The subjects were university students attending 4-year university located in the urban area. A surveyor handed out the questionnaire to the student in person, explained the objectives of this study, and retrieved it. The number of participants in this study was determined using G\*Power 3.1 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany), a power analysis program that uses Cohen sampling formula. The analysis showed that the minimum sample size required for logistic regression analysis with a significance level ( $\alpha$ ) of 0.05, 95% power, 15 predictors, and an effect size of 0.15 was 147. Of 600 questionnaires, 567 were used for the final analysis, and 33 were excluded for unreliability. The survey lasted for 21 days from April 5 to 25, 2015. This study was conducted after obtaining approval from the Bioethics Committee of the researchers' university (CUPIRB-2015-007).

### 2.2. Research tools

The questionnaires used by Korea Disease Control and Prevention Agency<sup>[23]</sup> were modified to meet the objectives of this study. This study conducted a pilot test involving 30 participants in advance before using the questionnaire. The questionnaire was revised and supplemented before it was used for this study. The dependent variable of this study was the response to the following question – “Do you think electronic cigarettes positively affect smoking cessation attitude?” The responses were “No=0” or “Yes=1”. The independent variables were related to the general characteristics, smoking preferences, and perceptions of electronic cigarettes. The socio-demographic items comprised sex (male=0 or female=1), year (freshman=0, sophomore=1, junior=2, and senior=3), residence type (own home=0, living alone or boarding house=1, dormitory=2, and other=3), and major (art and physical education=0, science and engineering=1, and humanities and social science=2). The smoking preferences included – “non-smoker=0”, “ordinary cigarette smoker=1”, “electronic cigarette smoker=2”, and “other smokers (smokers who were smoking electronic cigarettes instead of ordinary cigarettes and reverted to ordinary cigarettes)=3”. The perceptions of electronic cigarettes were assessed using the following questions – “Do you think electronic cigarettes are the same as ordinary (tobacco) cigarettes?”; “Do you think electronic cigarettes are harmless to humans?”; “Do you think electronic cigarettes help people to reduce the frequency of smoking?”; “Do you think e-cigarettes are less harmful than regular (tobacco) cigarettes?”; “Do you think electronic cigarettes are more convenient than ordinary (tobacco) cigarettes?”; “Do you think smoking electronic cigarettes are allowed everywhere?”; “Have you ever heard of the safety of electronic cigarettes?”; “Have you ever heard of the harm caused by electronic cigarettes?”; and “Do you think electronic cigarettes also cause adverse secondhand smoke effects?” These questions were scored as “No=0” or “Yes=1.”

### 2.3. Data analysis

This study conducted frequency analyses and a chi-squared test using SPSS version 25.0 (International Business Machines Corp., Armonk, NY) to evaluate the relationships between the general characteristics of the study participants, smoking type, and perceptions about electronic cigarettes. Cronbach  $\alpha$  coefficient of the perceptions about electronic cigarettes was 0.692, which indicated good reliability. Logistic regression analysis was used to investigate the relationships between participants' general characteristics, their smoking preferences, and their perceptions of electronic cigarettes. This study calculated the odds ratio (OR) using Model 1 (perception regarding the electronic cigarette) and Model 2 (general characteristics + smoking attitude + perception regarding the electronic cigarette) to further analyze the factors affecting each characteristic. Statistical significance was denoted by  $P = .05$  and the confidence interval (CI) was set to 95%.

## 3. Results

### 3.1. Characteristics of study participants

The participants were predominantly male (68.3%). The other predominant distributions were as follows – year: junior (28.9%), sophomore (28.0%); living arrangement: own home (67.7%), living alone or boarding house (18.2%); and major: science and engineering major (63.5%) and humanities and social science (26.6%). The majority of the subjects were nonsmokers (44.6%), followed by smokers of ordinary cigarettes (29.6%), others (17.8%), and smokers of electronic cigarettes (17.9%).

The following findings were obtained from the results of the study – 60.8% indicated that they were “not the same as tobacco”; 83.6% indicated that “they are not harmless to the human body”; 61.6% indicated that they were “not helpful for reducing the amount of smoking”; 60.7% indicated that they were “not less harmful than tobacco”; 59.4% responded that they are “more convenient than tobacco”; 58.7% responded that “smoking is not allowed everywhere”; 71.3% responded that “I have never heard of its safety”; 60.8% responded that “I have heard about its harm”; and 66.0% responded that “secondary smoking has adverse effects” (Table 1).

### 3.2. Relevance to smoking cessation attitude

The results of this study showed that intention to quit smoking and general characteristics were significantly ( $P < .05$ ) affected by sex and year. Most participants were male (73.6%), and the distribution by year was as follows – sophomore, 33.0%; junior, 31.3%; and senior, 25.3% (Table 2).

The distributions of the following responses significantly differed across the groups: “It is like tobacco” ( $P < .05$ ); “It is harmless to the human body” ( $P < .001$ ); “It decreases the amount of smoking” ( $P < .001$ ); “It is less harmful than tobacco” ( $P < .001$ ); “It is allowed everywhere” ( $P < .001$ ); “I have heard of its safety” ( $P < .001$ ); and “It has adverse secondhand smoking effects” ( $P < .001$ ). The analysis results showed that it was easier to quit smoking – those who perceived them as not harmless to the human body (66.5%), those who realized that the frequency of smoking reduced with their use (80.2%), those who perceived them as less harmful than tobacco (68.1%), those who perceived that smoking was allowed everywhere (51.6%), those who perceived that they had never heard of its safety (53.3%), and

**Table 1**  
Characteristics of study subjects.

Variable	N	%	
General Characteristics	Gender		
	Male	387	68.3
	Female	180	31.7
	Grade		
	Freshman	90	15.9
	Sophomore	159	28.0
	Junior	164	28.9
	Senior	154	27.2
	Residence type		
	Own	384	67.7
	Living alone or boarding house	103	18.2
	Dormitory	69	12.2
	Others	11	1.9
	Major		
Arts or physical education	56	9.9	
Natural sciences or engineering	360	63.5	
Humanities or social sciences	151	26.6	
Smoking type	Smoking type		
	Nonsmoker	253	44.6
	Regular cigarette smoker	168	29.6
	Electronic cigarette smoker	45	7.9
	Other smoker	101	17.8
Perception of the Electronic Cigarette	It is the same as tobacco.		
	Yes	222	39.2
	No	345	60.8
	It is harmless to the human body		
	Yes	93	16.4
	No	474	83.6
	It reduces the amount of smoking		
	Yes	218	38.4
	No	349	61.6
	It is less harmful than tobacco		
	Yes	223	39.3
	No	344	60.7
	It is more convenient than tobacco		
	Yes	337	59.4
	No	230	40.6
It can be used at any place			
Yes	234	41.3	
No	333	58.7	
I have heard of the safety of it			
Yes	163	28.7	
No	404	71.3	
I have heard of the hazard of it			
Yes	345	60.8	
No	222	39.2	
Secondhand smoking damage			
Yes	374	66.0	
No	193	34.0	
Total	567	100.0	

Residence type (other): Residing in a relative's home.

Smoking type (other smoker): Smoking college students who used to smoke the electronic cigarette and who currently smoke the regular cigarette.

those who perceived that there were adverse effects of secondhand smoking (54.9%) (Table 2).

### 3.3. Factors determining of smoking cessation attitude

Model 1 was used to analyze the perceptions of electronic cigarettes among the factors determining of smoking intention.

**Table 2**  
**Intention to quit smoking relevance.**

Variable	Intention to quit smoking						$\chi^2$	P	
	It does not help.		It does help		Total				
	N	%	N	%	N	%			
General characteristics	Gender								
	Male	253	65.7	134	73.6	387	68.3	3.570	.036
	Female	132	34.3	48	26.4	180	31.7		
	Grade								
	Freshman	71	18.4	19	10.4	90	15.9	8.186	.042
	Sophomore	99	25.7	60	33.0	159	28.0		
	Junior	107	27.5	57	31.3	164	28.9		
	Senior	108	28.1	46	25.3	154	27.2		
	Residence type								
	Own	267	69.4	117	64.3	384	67.7	4.834	.184
	Living alone or boarding house	62	16.1	41	22.5	103	18.2		
	Dormitory	50	13.0	19	10.4	69	12.2		
	Others	6	1.6	5	2.7	11	1.9		
	Major								
	Arts or physical education	96	24.9	55	30.2	151	26.6	1.844	.398
	Natural sciences or engineering	251	65.2	109	59.9	360	63.5		
	Humanities or social sciences	38	9.9	18	9.9	56	9.9		
Smoking type	Smoking type								
	Nonsmoker	202	52.5	51	28.0	253	44.6	60.135	<.001
	Regular cigarette smoker	116	30.1	52	28.6	168	29.6		
	Electronic cigarette smoker	12	3.1	33	18.1	45	7.9		
	Other smoker	55	14.3	46	25.3	101	17.8		
Perception of the electronic cigarette	It is the same as tobacco								
	Yes	161	41.8	61	33.5	222	39.2	3.575	.036
	No	224	58.2	121	66.5	345	60.8		
	It is harmless to the human body								
	Yes	32	8.3	61	33.5	93	16.4	57.256	<.001
	No	353	91.7	121	66.5	474	83.6		
	It reduces the amount of smoking								
	Yes	72	18.7	146	80.2	218	38.4	197.626	<.001
	No	313	81.3	36	19.8	349	61.6		
	It is less harmful than tobacco								
	Yes	99	25.7	124	68.1	223	39.3	93.185	<.001
	No	286	74.3	58	31.9	344	60.7		
	It is more convenient than tobacco								
	Yes	225	58.4	112	61.5	337	59.4	0.492	.272
	No	160	41.6	70	38.5	230	40.6		
	It can be used at any place								
	Yes	140	36.4	94	51.6	234	41.3	11.912	<.001
	No	245	63.6	88	48.4	333	58.7		
	I have heard of the safety of it								
	Yes	78	20.3	85	46.7	163	28.7	42.188	<.001
	No	307	79.7	97	53.3	404	71.3		
	I have heard of the hazard of it								
	Yes	236	61.3	109	59.9	345	60.8	0.103	.409
	No	149	38.7	73	40.1	222	39.2		
	Secondhand smoking damage								
	Yes	274	71.2	100	54.9	374	66.0	14.487	<.001
	No	111	28.8	82	45.1	193	34.0		
Total		385	100.0	182	100.0	567	100.0		

The results showed that the perceptions were more likely to influence the intention to quit smoking of “ordinary tobacco smokers” (OR=1.776 [95% CI=1.134–2.781]), “electronic cigarette smokers” (OR=10.892 [95% CI=5.256–22.571]), and “other smokers” (OR=3.313 [95% CI=2.014–5.449]) than those of “nonsmokers,” and all the differences were significant.

The results of Model 2, which was used to analyze the perceptions about electronic cigarettes among the determinants

of smoking intention, showed that electronic cigarettes were more likely to affect intention to quit smoking when they were perceived as “harmless to the human body” than when they were not (OR=2.657 [95% CI=1.419–4.976]); when they were perceived as “reducing the amount of smoking” than when they were not (OR=12.886 [95% CI=7.942–20.908]); and when they were perceived as “less harmful than tobacco” than when they were not (OR=3.778 [95% CI=2.299–6.209]). The



perceptions of harmless to the human body ( $P < .01$ ), capable of reducing the frequency of smoking ( $P < .001$ ), and less harmful than tobacco ( $P < .001$ ) were significantly different across participant groups.

The results of Model 3, which analyzed the general characteristics, smoking preferences, and perceptions of electronic cigarettes among the determinants of intention to quit smoking showed that ordinary tobacco smokers (OR = 2.032 [95% CI = 1.060–3.894]), electronic cigarette smokers (OR = 6.469 [95% CI = 2.313–18.091]), and other smokers (OR = 3.360 [95% CI = 1.638–6.893]) were more likely to perceive than “nonsmokers”. Intention to quit smoking were more likely when electronic cigarettes were perceived as “harmful to the human body” (OR = 2.970 [95% CI = 1.549–5.695]) or “not harmful to the human body”; when they were believed “to reduce the frequency of smoking” than when they were not (OR = 11.694 [95% CI = 7.005–19.519]); and when they were perceived as “not less harmful than tobacco” than when they were perceived as “less harmful than tobacco” (OR = 3.331 [95% CI = 1.942–5.715]). Ordinary cigarette smokers ( $P < .05$ ), electronic cigarette smokers ( $P < .001$ ), and other smokers ( $P < .001$ ) were likely to have smoking intention. Likewise, being harmless to the human body ( $P < .01$ ), capable of reducing the amount of smoking ( $P < .001$ ), and being less harmful than tobacco ( $P < .001$ ) were associated with intention to quit smoking (Table 3).

#### 4. Discussion

This study involved healthy university students and analyzed the relationship between intention to quit smoking and characteristics. The results of this study showed that sex, education, smoking attitude, and perceptions of “smoking cessation”, “same as tobacco”, “harmless to the human body”, “reduction in the amount of smoking”, “less harmful than tobacco”, “possible to smoke everywhere”, “heard about safety”, and “adverse effects of secondhand smoking” were related to smoking intention. This study aimed to provide basic data for health policies related to college students’ smoking and electronic cigarette by analyzing the smoking cessation attitude according to the smoking experience and perception about electronic cigarette using university students. This study used a survey method that was filled out by the respondents directly, and this study conducted logistic regression analysis using 567 copies of questionnaires after excluding missing values.

The results of the analysis of the determinants of intention to quit smoking using Model 1 showed that ordinary cigarette smokers, electronic cigarette smokers, and smokers who previously used electronic cigarettes instead of ordinary cigarettes and reverted to using ordinary cigarettes were 1.776 ( $P < .05$ ), 10.892 ( $P < .001$ ), and 3.971 ( $P < .001$ ) times more likely to have intention to quit smoking than nonsmokers, respectively. The results indicated that the university students used electronic cigarettes by choice; they knew that the ordinary cigarettes were cheaper but they chose the electronic cigarettes to help them quit smoking. The frequency of electronic cigarette use was 9.2% higher when the participants had a smoking cessation plan (24.8%) than when they did not (15.6%), indicating that the frequency of use of electronic cigarettes depended on having a smoking cessation plan.<sup>[24,25]</sup> In contrast, the results of this study revealed that electronic cigarette smoking affected the university students’ smoking intention. The use of electronic cigarettes was more associated with smoking cessation than the use of ordinary

cigarettes<sup>[12]</sup> and companies selling electronic cigarettes advertise it as a smoking cessation aid online.<sup>[23]</sup> The younger students tended to use the electronic cigarettes more.<sup>[24,25]</sup>

For Model 2, the “It is harmless to the human body”; “It reduces the amount of smoking”; and “It is less harmful than tobacco” perceptions were 2.213, 2.461, 10.901, and 2.799 times more likely to influence the decision to stop smoking, respectively. These results were consistent with those of previous studies that reported that electronic cigarettes were perceived to help smokers to quit smoking,<sup>[26,27]</sup> as not harmful for the human body or less harmful than tobacco,<sup>[28,29]</sup> and as helpful in reducing the frequency of smoking.<sup>[30]</sup> University students’ intention to quit smoking and the utilitarian and positive perceptions about electronic cigarettes increase their use and elevate smoking behavior. Moreover, it is not desirable, from the viewpoint of public health, to advocate for and promote the use of electronic cigarettes while emphasizing only the risks of ordinary cigarettes despite the lack of objective and reliable evidence on the safety of electronic cigarettes.

The results of this study revealed that those who used electronic cigarettes, those who perceived them as harmless to the human body, those who believed that they could help reduce the frequency of smoking, and those who perceived them as less harmful than tobacco were significantly likely to have smoking intention. It was confirmed that they did not know the facts about electronic cigarettes, and they perceived them as helpful in quitting smoking because of distorted information. While carcinogens such as formaldehyde and benzene have been detected in electronic cigarettes just like ordinary cigarettes, we shall not let electronic cigarettes harm the health of university students simply based on some advertisement arguing that it is easier to quit.

This study has several limitations. Since it randomly sampled students attending a 4-year college in a specific area, the generalization and extrapolation of the results should be done very carefully. Moreover, this study did not evaluate factors related to smoking behavior such as the timing and period of smoking ordinary cigarettes and electronic cigarettes. The questionnaire used in our study passed the deliberation of the Institutional Review Board before the study conducted. And also, the contents of the questionnaire were reviewed at the time of deliberation. In addition, data cannot be provided inevitably because the researchers informed the subjects that they would shred all research documents after the end of this study, when the survey was conducted.

Nevertheless, the results of this study provided evidence that will serve as the foundation for mitigating social problems caused by smoking in the future by analyzing the relationship between smoking and intention to quit smoking associated with the perceptions about electronic cigarettes by university students.

#### 5. Conclusion

We propose the following based on the results of this study. First, the regulatory system needs to be improved so that written warnings and pictorial warning labels can be printed on electronic cigarettes to indicate that they are not objectively proven as smoking cessation aids, they have not been objectively tested for their harmlessness to the human body, and they have been found to contain various harmful substances. Second, regular health education should be provided and constant public advertisements should be broadcasted to spread awareness on

**Table 3****Determinants of intention to quit smoking.**

Variables	Model 1 OR	Model 2 OR	Model 3 OR
General characteristics			
Gender			
Male			1
Female			1.209 0.662–2.208
Grade			
Freshman			1
Sophomore			2.023 0.876–4.669
Junior			1.468 0.633–3.404
Senior			1.001 0.407–2.464
Residence type			
Own			1
Living alone or boarding house			1.007 0.511–1.986
Dormitory			1.292 0.577–2.892
Others			1.392 0.261–7.425
Major			
Arts or physical education			1
Natural sciences or engineering			1.005 0.565–1.787
Humanities or social sciences			0.749 0.298–1.884
Smoking type			
Smoking type			
Nonsmoker	1		1
Regular cigarette smoker	1.776*		2.032*
Electronic cigarette smoker	1.134–2.781 10.892***		1.060–3.894 6.469***
Other smoker	5.256–22.571 3.313***		2.313–18.091 3.360***
	2.014–5.449		1.638–6.893
Perception of the Electronic Cigarette			
It is the same as tobacco			
Yes		0.887 0.536–1.468	0.835 0.488–1.429
No		1	1
It is harmless to the human body			
Yes		2.657** 1.419–4.976	2.970** 1.549–5.695
No		1	1
It reduces the amount of smoking			
Yes		12.886*** 7.942–20.908	11.694*** 7.005–19.519
No		1	1
It is less harmful than tobacco			
Yes		3.778*** 2.299–6.209	3.331*** 1.942–5.715
No		1	1
It is more convenient than tobacco			
Yes		0.915 0.559–1.498	0.763 0.453–1.286
No		1	1
It can be used at any place			
Yes		1.187 0.726–1.941	1.193 0.701–2.029
No		1	1
I have heard of the safety of it			
Yes		1.462 0.845–2.529	1.238 0.698–2.197

*(continued)*

**Table 3**  
(continued).

Variables	Model 1 OR	Model 2 OR	Model 3 OR
No		1	1
I have heard of the hazard of it			
Yes		0.813	0.808
		0.482–1.371	0.468–1.395
No		1	1
Secondhand smoking damage			
Yes		0.717	0.765
		0.437–1.177	0.455–1.288
No		1	1
Wald $\chi^2$	58.108***	267.863***	300.204***
–2LogL	653.603	443.849	411.507

\*  $P < .05$ .\*\*  $P < .01$ .\*\*\*  $P < .001$ .

smoking, especially electronic cigarettes, through various on- and off-campus activities and educational channels for university students. Third, health policies should be developed and public health science-oriented approaches should be implemented to allow university students, as well as adults, to receive smoking cessation support services and information on proven smoking cessation aids.

### Author contributions

**Conceptualization:** Ryoung Choi, Hyun Goo Kang.

**Data curation:** Ryoung Choi.

**Formal analysis:** Ryoung Choi, Hyun Goo Kang.

**Investigation:** Ryoung Choi, Hyun Goo Kang.

**Methodology:** Ryoung Choi.

**Resources:** Ryoung Choi, Hyun Goo Kang.

**Supervision:** Hyun Goo Kang.

**Validation:** Hyun Goo Kang.

**Visualization:** Ryoung Choi.

**Writing – original draft:** Ryoung Choi.

**Writing – review & editing:** Hyun Goo Kang.

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