

# Factors associated with electronic cigarettes use among adolescents in Jakarta, Indonesia

Electronic  
cigarettes use  
among  
adolescents

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## Abstract

**Purpose** – This study aimed to examine factors associated with electronic cigarette use among adolescents aged 15–19 in Jakarta, Indonesia.

**Design/methodology/approach** – The study was a school-based survey involving 1,318 students from 14 high schools in Jakarta. A multistage cluster sampling methodology was used. The authors used the chi-square test and multiple logistic regression to examine the association between electronic cigarette use and sociodemographic, social influences, health risk perceptions, availability, affordability and conventional cigarette smoking status.

**Findings** – Overall, 6.3% of females and 29% of males reported ever having used electronic cigarettes. Electronic cigarette use was independently associated with sex, school locations, conventional cigarette smoking status, peer use, availability and perceptions that electronic cigarettes aid conventional cigarette smoking cessation. Compared with non-smokers, lifetime (AOR: 8.740, 95% CI: 5.126–14.901) and current conventional cigarette smokers (AOR: 18.380, 95% CI: 10.577–31.938) were more likely to use electronic cigarettes.

**Social implications** – The use of electronic cigarettes among adolescents was considerably high in this study. Therefore, the tobacco control policy should be extended to regulate the marketing and use of all types of tobacco products and not just conventional cigarettes.

**Originality/value** – The study explored beyond individual lifestyle factors that contributed to electronic cigarette use in Indonesia such as affordability, school locations and availability of electronic cigarettes. These issues have not been specifically discussed in previous studies.

**Keywords** Adolescents, Electronic cigarettes, Tobacco products, Vaping, Smoking cessation

**Paper type** Research paper

## Introduction

The electronic nicotine delivery system (ENDS) or electronic cigarette is a major public health issue in many parts of the world [1]. The prevalence of electronic cigarette smoking varies across the WHO member countries ranging from 0.7% to 23.4% [2]. Nevertheless, studies found that electronic cigarette smoking has been increasing rapidly in recent years [3,4]. Basic health research 2018 reported that the prevalence of current electronic cigarette use is 2.8%, which consists of 2.8% in males and 2.7% in females [5]. The prevalence may still be lower than the US or European countries, but the government should be aware of the vaping trend, particularly among youth.

Electronic cigarettes have raised the attention of medical and public health professionals due to its potential benefit and harm [6]. The industry passionately advertises electronic cigarettes as an aid to conventional cigarette cessation [7]. However, the evidence is still

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lacking regarding the effectiveness of electronic cigarettes as a cessation tool [8]. In addition, the safety and long-term health effects of electronic cigarettes used are not yet apparent [9,10]. Prior studies reported that electronic cigarette aerosols contain similar hazardous components as found in conventional cigarettes such as nickel, chromium, cadmium, tin, carbonyl compounds, volatile organic compounds and aluminum [11–13]. A study in Surabaya, a city in Indonesia, found high formaldehyde concentrations in electronic cigarette users' vapors [14]. This chemical compound is carcinogenous and leads to a fatal health condition in the long-term [11]. Besides, the particulate meter (PM<sub>2.5</sub>) concentration in electronic cigarette user's homes were higher compared to smoke-free homes [15]. Therefore, the emission from electronic cigarettes has a potentially adverse effect on second-hand smokers.

Electronic cigarette industries expend a wide variety of marketing channels to promote their products including magazines and print media ads, online marketplaces, points of sales ads, television commercials, sponsorship and social media [11]. The marketing techniques and themes are similar to those that have been found in conventional cigarettes [11]. In Indonesia, electronic cigarettes are mainly traded in the online platform (35.3%) and vape stores (64.7%) [16]. Vape shops and electronic cigarette ambassadors also use Instagram, the most popular visual social media platform in Indonesia, that may appeal to the youth [17]. A recent study revealed that Indonesia shared the second-largest Instagram post on e-liquid marketing of any country [18].

The evidence showed that the demand for electronic cigarettes is excessively sensitive to the owned price change [19]. The price of electronic cigarettes may be substantially higher than conventional cigarettes in Indonesia. For instance, a pack of A Mild, the most popular cigarette brand, cost around 1.6 USD, while a device kit of a popular electronic cigarette brand sold on [Blibli.com](https://www.blibli.com) was approximately 12.65 USD [20,21]. The electronic cigarettes tax and pricing policies are also not well regulated [16]. Thus, the industry is able to develop a pricing and promotional strategy to make the product more affordable and accessible to the youth.

Indonesian Food and Drug Administration (FDA) has declared electronic cigarettes as a dangerous product [17]. Nevertheless, the trend of electronic cigarette use among adolescents continues to steadily increase in Indonesia [22]. In addition, the multinational electronic cigarette industry has expanded quite prominently into Indonesia's market recently [16]. Until now, there was no specific regulation about electronic cigarette marketing and use [17]. Overall, the literature on electronic cigarettes remains scarce in Indonesia. Therefore, this study aimed to investigate factors associated with electronic cigarette use among adolescents aged 15–19 years old in Jakarta. The findings would provide a framework to develop an effective intervention program to prevent youth from the damaging uptake of electronic cigarettes.

## Materials and methods

The study was a school-based survey conducted between April and May 2015. The study area was Jakarta Province, the capital city of Indonesia. There are approximately 377,216 students from 1,263 high schools across Jakarta Province [23]. The minimum sample size was 768 students determined by sample size formula to estimate proportion with 0.05 level of significance and a 0.05 acceptable error. We only included general public schools as our study sites. The study used a multistage cluster sample of high school students in Jakarta. First, we randomly selected eight schools from the suburban area and six schools from the downtown area. Second, we randomly selected three classes from grades ten and eleven from each school. Finally, all students from the selected classes were recruited as study participants. The researcher explained the study objectives and informed consent process before data collection. The students who were willing to participate were required to sign a consent form.

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The data were obtained by a self-administered questionnaire that took approximately 15 min to complete.

Three tobacco control experts from Thailand assessed the validity of the questionnaire. The total item objective congruence (IOC) score was 0.858. Sociodemographic characteristics of study participants included age, sex, school location (suburban vs downtown) and parents' education attainment (primary vs secondary vs higher). Electronic cigarette smoking status was measured by asking two questions: (1) "Have you ever tried or experimented with smoking an electronic cigarette, even one or two puffs?" (2) "During the past 30 days, did you smoke electronic cigarettes?". The responses included "no" and "yes" options. Study participants who answered "yes" to both questions were defined as current smokers. We measured the social influences by inquiring about the electronic cigarette smoking behaviors of family members and peers.

The health risk perceptions were measured by five positively framed questions; (1) electronic cigarettes help cut down the number of cigarettes smoked; (2) aids in quitting cigarette smoking; (3) doesn't contain toxic chemicals that have been found in combustible cigarettes; (4) less harmful and (5) less addictive. Three options were used to measure health risk perception namely "yes", "no", and "don't know". The Cronbach's alpha score for the health risk perception variable was 0.794. Conventional cigarette-related questions were "Have you ever tried or experimented with cigarette smoking, even one or two puffs?" (yes/no) and "During the past 30 days, did you smoke a cigarette?" (yes/no). For assessing conventional cigarette smoking status, two questions were asked: (1) "Have you ever tried or experimented with conventional cigarette smoking, even one or two puffs?" and (2) "During the past 30 days, did you smoke conventional cigarettes?". The participants who had smoked one or more cigarettes before but not in the past 30 days were considered to be lifetime smokers. The last part of the questionnaire measured participants' perceptions about the availability and affordability of electronic cigarettes. The availability was explored by participants' perception of difficulty getting electronic cigarettes. The affordability was assessed by inquiring whether electronic cigarette prices were affordable according to the study participant's perspective.

Descriptive statistics were used to summarize the general characteristics of the participants. Electronic cigarette use variables were transformed into binary classification, namely users and non-users. Users of electronic cigarettes consisted of historic lifetime and current smokers. A chi-square test was performed for bivariate analysis. Independent variables' significance at  $p < 0.25$  in bivariate analysis was included in the multivariate model. Multiple logistic regressions estimated an adjusted odds ratio (AOR) and 95% confidence interval (CI). Statistical significance was considered at  $p$ -value  $< 0.05$ . All statistical analyses were performed by SPSS statistics version 22.0 (IBM Corp, Armonk, NY, USA).

The protocol was approved by the Institutional Review Board, Atma Jaya Catholic University of Indonesia, number 404/III/LPPM-PM.10. 05/04/2015.

## Results

**Table 1** shows the general characteristics of the study participants by sex. Of the 1,318 participants, about 62.8% were female. The average age was 16 years old among both males and females ( $16.08 \pm 0.71$  vs  $16.21 \pm 0.72$ ). The current conventional cigarette smokers were approximately 8.5% female and 29.2% male. We estimated that the current electronic cigarette smokers among females and males were 0.6% and 8.2%. The rate of the current use of electronic cigarettes of the family members was low among both males and females at 3.1% and 2.8%. About one-fifth (20%) of the males had at least one close friend who currently smoked electronic cigarettes. A total of 38% of the participants reported that they easily

Characteristics <i>n</i> (%) or mean $\pm$ SD	Female <i>n</i> = 828	Male <i>n</i> = 490
Age	16.08 $\pm$ 0.71	16.21 $\pm$ 0.72
<i>School location</i>		
Suburban	491 (59.3)	287 (58.6)
Downtown	337 (40.7)	203 (41.4)
<i>Parents' education</i>		
Completed primary or less	33 (4.0)	12 (2.4)
Secondary	437 (52.8)	234 (47.8)
Higher	358 (43.2)	244 (49.8)
<i>Conventional cigarettes smoking</i>		
None	643 (77.7)	179 (36.5)
Lifetime	115 (13.9)	168 (34.4)
Current	70 (8.5)	143 (29.2)
<i>Electronic cigarettes smoking</i>		
None	776 (93.7)	348 (71.0)
Lifetime	47 (5.7)	102 (20.8)
Current	5 (0.6)	40 (8.2)
<i>Family use</i>		
No	805 (97.2)	475 (96.9)
Yes	23 (2.8)	15 (3.1)
<i>Peer use</i>		
No	695 (83.9)	392 (80)
Yes	133 (16.1)	98 (20)
<i>Availability</i>		
Difficult	506 (61.1)	300 (61.2)
Easy	322 (38.9)	190 (38.8)
<i>Affordability</i>		
No	608 (73.4)	347 (70.8)
Yes	220 (26.6)	143 (29.2)

**Table 1.**  
Characteristics of  
study participants  
by sex

found electronic cigarettes. More than a quarter (29.2%) of the males perceived that electronic cigarette prices were affordable.

A total of 27.3% of electronic cigarette users believed that electronic cigarettes were a smoking cessation aid, 30.1% reported they could help cut down the number of cigarettes smoked and 19.7% reported they were less addictive. More electronic cigarette users reported that electronic cigarettes were less harmful (20.2%) than non-users (9.1%). Health risk perceptions were significantly associated with ever having smoked electronic cigarettes at  $p < 0.001$  (Table 2).

Table 3 indicates the bivariate analysis of ever having used electronic cigarettes. Of electronic cigarette users, 3% had never used conventional cigarettes. Age was the only variable that did not significantly associate with ever having used electronic cigarettes in the bivariate analysis. However, the  $p$ -value was still less than 0.25. Thereby, all variables were included in the multivariate analysis.

Table 4 presents multiple logistic regression results. Having ever used electronic cigarettes were independently associated with the male sex (AOR: 3.522, 95% CI: 2.316–5.757), downtown school locations (AOR: 1.711, 95% CI: 1.153–2.538), having peers who

currently used electronic cigarettes (AOR: 2.073, 95% CI: 1.311–3.277), easy access to get electronic cigarettes (AOR: 2.370, 95% CI: 1.526–3.679) and the perception that electronic cigarettes were an aid to conventional cigarettes cessation (AOR: 5.197, 95% CI: 2.099–13.106). Compared with non-smokers, both lifetime smokers (AOR: 8.740, 95% CI: 5.126–14.901) and current conventional cigarette smokers (AOR: 18.380, 95% CI: 10.577–31.938) were more likely to ever use electronic cigarettes.

## Electronic cigarettes use among adolescents

Health risk perceptions of electronic cigarettes	Electronic cigarettes use status	
	User ( <i>n</i> = 193) <i>n</i> (%)	Non-user ( <i>n</i> = 1,125) <i>n</i> (%)
Help cut down number of cigarettes*	58 (30.1)	105 (9.3)
Aid quit cigarette smoking*	53 (27.5)	72 (6.4)
Does not contain toxic chemical*	30 (15.5)	82 (7.3)
Less harmful*	39 (20.2)	102 (9.1)
Less addictive*	38 (19.7)	104 (9.2)

**Note(s):** \**p* < 0.001

**Table 2.** Health risk perceptions of electronic cigarettes by electronic cigarettes smoking status

Independent variables	Electronic cigarettes use		<i>p</i> -value
	User ( <i>n</i> = 193) <i>n</i> (%)	Non-user ( <i>n</i> = 1,125) <i>n</i> (%)	
<i>Age (years)</i>			0.05
15–16	70 (17.5)	329 (82.5)	
17–19	123 (13.4)	796 (86.6)	
<i>Sex</i>			<0.001
Male	142 (29.0)	348 (71.0)	
Female	52 (6.2)	777 (93.8)	
<i>School locations</i>			<0.001
Downtown	104 (19.3)	436 (80.7)	
Suburban	89 (11.4)	689 (88.6)	
<i>Parents' education</i>			0.002
≤ Primary	44 (97.8)	1 (2.2)	
Secondary	85 (12.7)	586 (87.3)	
College degree	107 (17.8)	495 (82.5)	
<i>Cigarette use</i>			<0.001
None	25 (3.0)	797 (97.0)	
Lifetime	74 (26.1)	209 (73.9)	
Current	94 (44.1)	119 (55.9)	
<i>Family use</i>			0.001
No	1,100 (85.9)	180 (14.1)	
Yes	13 (34.2)	25 (64.8)	
<i>Peer use</i>			<0.001
No	139 (12.8)	948 (87.2)	
Yes	54 (23.4)	177 (76.6)	
<i>Availability</i>			<0.001
Difficult	78 (9.7)	728 (90.3)	
Easy	115 (22.5)	397 (77.5)	
<i>Affordability</i>			<0.001
No	111 (11.6)	844 (88.4)	
Yes	82 (22.6)	281 (77.4)	

**Table 3.** Bivariate analysis of ever using electronic cigarettes

## Discussion

The electronic cigarette smoking prevalence among male adolescents who had ever used them was about 29%, and 8.2% included current users according to this study. The findings are slightly higher than the rate reported from other studies in Poland (21.8% of users), Ontario (18.6% of users) and South Korea (7.8% current use) [24–26]. The fact is unsurprising because those areas have strong regulations on the restriction of electronic cigarette marketing and use [27]. Presently, there is no specific regulation in Indonesia on electronic cigarette control at the national and sub-national levels [17].

The Global Adult Tobacco Survey 2011 reported that the prevalence of electronic cigarettes is about 0.5% in males and less than 0.1% in females [28]. The rate markedly increased by more than ten times based on our study in 2015. The soaring prevalence of electronic cigarette smoking may also relate to the expansion of multinational companies to Indonesia [16,29]. Indonesia has poor tobacco control regulations compared to other ASEAN countries [21]. Besides, the country has a large young population that is a promising market for the tobacco industry [30]. China vape manufacturers pave the way for creating electronic cigarette demand in Indonesia [31]. Nevertheless, US and local products have also started to compete in the market [16,17,31]. Recently, the Minister of Industry announced that Phillip Morris was planning to invest a billion US\$ in electronic cigarettes [32]. The estimates of electronic cigarette sales are forecast to reach US\$419.6 million by 2022 [16].

The study revealed that electronic cigarette smoking was associated with the perception of electronic cigarettes as a smoking cessation aid. This may relate to the campaign from the electronic cigarettes industry that the device could support people to quit cigarette smoking dependence [33]. In 2017, the Indonesian FDA monitored the marketing activities of electronic cigarette sellers in online marketplaces, social media, video marketing and vape shops. The results found that most of the sellers used health claims, specifically claiming that they promoted electronic cigarettes as a quit smoking device, were a healthy alternative to using tobacco and were environmentally friendly [17]. This result suggests that adolescents were susceptible to promotional activities.

More than one-third of adolescents perceived that electronic cigarettes were easily found. Multivariate analysis revealed that school locations and availability were important predictors of ever having used electronic cigarettes. Electronic cigarette products are easily accessed through the online marketplace, social media and vape shops [17]. Downtown school locations may further ease access to vape stores. Based on the brief observation in Vapemagz's websites, the vape store locations are more concentrated in city centers than in suburban areas [34]. The use of zoning to restrict the density and location of electronic cigarette retailers may be effective in reducing the availability of electronic cigarettes. Zoning laws have been widely used to restrict the operations of alcohol and fast food retailers [35,36]. A study in the US found that zoning laws successfully reduced alcohol availability and alcohol-related problems such as liver cirrhosis and motor vehicle crashes [35]. The government should consider how the land use restriction model could be extended to vape stores.

Predictors	AOR (95% CI)	<i>p</i> -value
Male sex	3.522 (2.316–5.357)	<0.001
Downtown school location	1.711 (1.153–2.538)	0.008
Lifetime cigarette smoker	8.740 (5.126–14.901)	<0.001
Current cigarette smoker	18.380 (10.577–31.938)	<0.001
Peer use	2.073 (1.311–3.277)	0.002
Availability	2.370 (1.526–3.679)	<0.001
Aid to quit cigarettes	5.197 (2.099–13.106)	<0.001

**Table 4.**  
Predictors of ever  
using electronic  
cigarettes

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The participants who had a peer using electronic cigarettes were more likely to use electronic cigarettes. The result is in line with prior studies in Poland, South Carolina, and Hong Kong [24,37,38]. The previous meta-analysis showed that the association with peer smoking was greater compared to family members [39]. A laboratory-based behavioral study found that the risky decisions of adolescents was influenced by the choices of their peers [40]. Furthermore, adolescents tended to imitate conventional cigarette smoking behaviors of others that were associated with their social context and shared a common normative belief [41]. It is noteworthy that the evidence of peer influence on tobacco product use behavior was extended to electronic cigarette use in this study.

Consistent with previous studies [42,43], we found that electronic cigarette use was associated with current conventional cigarette smoking status. There may be some reasons why combustible cigarette smokers take up electronic cigarettes. First, some electronic cigarettes' mold resembles traditional cigarettes [5]. This will ease current conventional cigarette smokers to experiment with electronic cigarettes. Second, most electronic cigarette industries promote the product as a smoking cessation aid or a healthier alternative. Thus, conventional smokers may exert electronic cigarettes to reduce the number of conventional cigarettes smoked. Third, electronic cigarettes are generally more accepted by the public than conventional cigarettes [44]. A prior study in a Swiss-Italian Middle school found that approval from other people was associated with tobacco use among adolescents [41].

This study has some limitations. First, it was based on a cross-sectional design, so we are not able to infer whether independent variables caused electronic cigarette use or otherwise. Second, private and vocational high school students were excluded from the study. The provincial education office also did not allow data collection from 12<sup>th</sup>-grade students. Hence, the findings may not be generalized to those groups. Finally, we used the multistage cluster sampling method and thus may have some cluster effect.

## Conclusion

The research has some implications for public health research and policy in Indonesia. First, electronic cigarette use among males is increasing rapidly in a relatively short period, from less than 1% in 2011 to 8.2% in 2015. Therefore, the government should extend the tobacco control measures such as introducing smoke-free area enforcements, imposing pictorial health warnings, tobacco advertisement and sponsorship bans and prohibit sales to minors on all types of tobacco products and not just conventional cigarettes. Second, it is worth noting that about 3% of participants who used electronic cigarettes had never smoked conventional cigarettes before. Therefore, further study is necessary to investigate the role of electronic cigarettes in inducing adolescents to take up conventional cigarettes. Third, we found school locations and availability were significantly associated with having ever used electronic cigarettes. Accessibility may induce electronic cigarette use among adolescents. Hence, we suggest that the government introduces zoning laws to restrict vape store locations near schools and residential areas. Ultimately, multivariate analysis revealed that affordability was not significantly associated with electronic cigarette use. Hereinafter, more than a quarter of participants perceived that electronic cigarette prices were affordable. These facts may suggest that the price of electronic cigarettes is relatively cheap in Indonesia. Thus, we recommend the government to charge maximum tax rates for electronic cigarette products.

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