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## Electronic Cigarette Use Patterns And Its Determinants Among Adolescents In Yogyakarta City-Indonesia

Heni Trisnowati<sup>1\*</sup>, Hesti Yuningrum<sup>2</sup>, Naomi Nisari Rosdewi<sup>3</sup>, Enge Surabina Ketaren<sup>4</sup>

<sup>1,2,3</sup> Study Program of Public Health, Faculty of Health Sciences, Universitas Respati Yogyakarta

<sup>4</sup> Study Program of Public Health, Universitas Sebelas Maret

\*Email:heni\_trisnowati@respati.ac.id

Correspondence: JL. Raya Tajem KM 1.5 Sleman, Yogyakarta, 55282

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### ABSTRACT

Globally, the use of electronic cigarettes (e-cigarettes) among adolescents remains to increase. E-cigarette use in Yogyakarta City is the highest in Indonesia. Research needs to be conducted as a database for policymaking on tobacco control, especially the use of e-cigarettes in the community.

This study aimed to describe the pattern of e-cigarette uses among adolescents. Furthermore, analyzing the relationship between age, sex, and knowledge about the dangers of e-cigarettes with e-cigarette use among adolescents. This research used a quantitative method with a cross-sectional design in Yogyakarta city. There were 210 adolescents as the sample by stratified cluster sampling strategy. Seven equivalent high schools were selected as research locations. The selection of schools performed with the lottery. The variables included age, sex, and knowledge. Data is collected through Whatsapp media using google Forms by the class teacher coordinator. Data analysis was carried out by univariate and bivariate using SPSS 22 applications. The number of adolescents who smoked was 85 (40,5%), and the use of e-cigarettes was 51 (24,3%).

The pattern of e-cigarettes use among adolescents is divided into four: using conventional cigarettes 34 (16,2%), using e-cigarettes 18 (4,3%) ; using e-cigarettes and conventional 33 (15,7%), and never using both 125 (59,5%). The majority of respondents received information about e-cigarettes from their peers 150 (71,4%). The results of the bivariate analysis showed that age and sex were related to e-cigarette use among respondents with a p-value of 0,000.

The number of cigarette use among adolescents continues to increase both conventional cigarettes and e-cigarettes, and the age of starting smoking is getting younger. This phenomenon should be a driving force for policymakers to be more intense in carrying out various tobacco control efforts.

## BACKGROUND

E-cigarettes are becoming popular all over the world, including in Indonesia (1). Firstly, the e-cigarette was developed in 2003 in China and it is also called vapes, which are gaining attention among smokers as a potential smoking cessation tool (2). Electronic-cigarette is a battery-operated device, used to vaporize a liquid that may or may not contain nicotine. The main ingredients of the liquid are propylene glycol, glycerol, and some flavorings (3). E-cigarettes, also known as e-cigarettes, are “e-cigs,” “e-hookahs,” “mods,” “vape pens,” “vapes,” “tank systems,” or “electronic nicotine delivery systems (ENDS). ENDS is a type of cigarette that utilizes electricity from battery power to deliver nicotine in the form of vapor. E-cigarettes do not contain tobacco but it is harmful to health and unsafe (4).

Electronic cigarettes use among adolescents remind increased recently (5,6). One of the causes of the increasing prevalence of e-cigarette use among adolescents in Indonesia is its easy availability, attractive advertisements, cigarette sponsorships that are still allowed, various flavors of e-liquid, and the belief that they are safer (6). This increase correlates with their lack of knowledge about e-cigarettes and the perception that e-cigarettes are safer than conventional cigarettes (5). Sources of information that are widely circulated among students about e-cigarettes are from the internet (15.7%) and peers (41.5%). cigarettes have not been scientifically proven safe (7).

Electronic cigarettes were initially considered a safe product for health because the solution did not contain TAR and other toxic substances contained in tobacco cigarettes (8). Teenagers who use conventional cigarettes tend to be interested in using e-cigarettes (9). America conducted research related to e-cigarettes and the results found that e-cigarettes contain toxins, Tobacco Specific Nitrosamines (TSNA) and Diethyl Glycol (DEG), which are known carcinogens (5).

Awareness among 818,500 current e-cigarette users in four countries is 2.5% of adults in Indonesia, 3.9% of adults in Malaysia, 1.8% of adults in Qatar, and 2.2% of adults. in Greece. In all four countries, awareness is higher among respondents who are male, younger, more educated, and wealthier (10). A systematic review found that e-cigarettes are perceived as less harmful and addictive than tobacco cigarettes among e-cigarette users than non-users (11).

Factors that influence electronic cigarette use among adolescents are divided into two, namely internal factors and external factors (12). Internal factors are motivation to try or experiment with new things, there is a desire for adolescents to stop smoking, and there is a perception that using electronic cigarettes will look cool. While the external factor is the existence of ideas from the adolescent environment that electronic cigarettes are safer than conventional cigarettes. The most common reasons why teenagers use electronic cigarettes are internal factors, namely wanting to stop smoking, trying something new or experimenting with new things, looking cool, and feeling that electronic cigarettes are safer than conventional cigarettes (12).

Data on e-cigarette users in Yogyakarta is the highest in Indonesia, which is around 7.4% (13). Yogyakarta is known as the city of students, with a total of around 198,063 students in 2021 (14). Therefore, this city is very profitable for e-cigarette business players to market and develop

their business. The number of e-cigarette shops in the city of Yogyakarta makes it easier for adolescents to access them. Furthermore. The number of e-cigarette use in high school students is increasing Based on research, e-cigarettes have the same effect as conventional cigarettes, such as causing addiction, dangerous diseases, and disrupting brain development (15). In addition, the use of cigarettes is a risk factor for non-communicable diseases in adolescents in the city of Yogyakarta (16).

This study aims to describe the use of e-cigarettes and the factors that influence adolescents in the city of Yogyakarta. This paper also analyzes the relationship between age at first smoking, and gender with the use of e-cigarettes in adolescents in the city of Yogyakarta. The results of the study can be used as a basis for making policies regarding tobacco control, especially the use of e-cigarettes in the community introduction consists of a background of the study, literature review used as the theoretical and conceptual description, problems of the study, and purposes of the study.

## METHOD

This study used a quantitative method with a cross-sectional design. There were seven high school equivalents in Yogyakarta city were selected randomly as the research location. The sampling technique used a 99% confidence level, 10% precision, and a population proportion of 0.50 to obtain a sample of 167 adolescents (16). Then to increase the validity of the data, the number of samples was added by 25% from the minimum number of samples so that the total sample was 209 adolescents. The average number of students per school is 30 people so seven schools are needed to meet the number of samples. Taking into account the number of schools, there are 1 SMAN, 3 SMAS, 1 SMK, and 2 SMKS. The selection of schools is done by lottery. The number of samples as many as 210 people were taken by cluster random sampling.

Data collection was conducted via WhatsApp by sharing a google form link to the teacher in charge then the teacher forwards it to the student group for two weeks (1-15 Juni 2020) Respondents were given incentives such as pulses and bags. Data were analyzed by application of Statistical Package for the Social Science (SPSS) 22.

## HASIL

### Result

#### Characteristics of Respondents

The number of respondents in this study was 210 people from six high schools or vocational schools in the city of Yogyakarta. Most of the respondents came from class 12 as many as 132 (62.9%). The proportion of respondents' gender is almost equal, namely 106 men (50.5%) and 104 women (49.5%).

#### Smoking behavior pattern

The number of respondents who smoked as many as 85 people (40.5%). Respondents started smoking at the age of 10 years, and the proportion of smoking increased frequently with increasing age, wherein the age range 15-16 years the highest proportion was found to be 28.6%. The number

of regular or daily smokers is 14.8%. There are 51 (24.3%) respondents who have used e-cigarettes. Furthermore, the use of e-cigarettes is divided into four, namely using e-cigarettes only as many as 16 (8.6%); using e-cigarettes and conventional as many as 33 (15.7%); only using conventional cigarettes as many as 34 (16.2%), and do not use electric cigarettes or conventional cigarettes as many as 125 respondents (59.5%). The majority of respondents obtained information on e-cigarettes from their peers as many as 150 respondents (71.4%), then from the internet 43 respondents (20.5%). The description of the respondent's smoking pattern is shown in Table.1

Tabel 1. Smoking behavior pattern among respondents (N = 210)

No	Smoking behavior pattern	(n)	(%)
<b>1</b>	<b>Smoking behavior</b>		
	Yes	85	40.5
	No	125	59.5
<b>2</b>	<b>Age at first smoking</b>		
	Not smoking	125	59.5
	10 -11 years	9	4.3
	12 -13 years	15	7.1
	14-15 years	38	18.1
	16-17 years	22	10.5
	≥18 years	1	0.5
<b>3</b>	<b>Smoking frequency</b>		
	Not smoking	125	59.5
	1-2 days	25	11.9
	3-5 days	29	13.8
	Every day	31	14.8
<b>4</b>	<b>E-cigarette use</b>		
	Yes	51	24.3
	No	159	75.7
<b>5</b>	<b>E-cigarette use pattern</b>		
	Only e-cigarette use	18	8.6
	Conventional and e-cigarette use	33	15.7
	Only conventional cigarette use	34	16.2
	Never both	125	59.5
<b>6</b>	<b>Source of information on e-cigarettes</b>		
	Parents	1	0.5
	Peers	150	71.4
	Mass media (TV, newspaper, magazines)	6	2.9
	Internet (social media)	43	20.5
	Others	9	4.3

### Relationship between age, gender, and knowledge with the use of e-cigarettes

The results showed that respondents aged less than 15 years were more dominant in using e-cigarettes. Respondents who use e-cigarettes are 51 (24.3%) while those who do not use e-cigarettes are 159 (75.7%). There is a relationship between age and the use of e-cigarettes with a p-value <0.005. Based on gender, male adolescents are more likely to use e-cigarettes than female adolescents, namely 42.5%. The results of statistical tests showed that there was a relationship between gender and the use of e-cigarettes with a P-value < 0.005.

Meanwhile, the results of the chi-square test between knowledge of e-cigarettes and knowledge of the impact of e-cigarettes with the use of e-cigarettes were not related because the p-value was  $> 0.005$ . The variable of knowledge about e-cigarettes that were asked to respondents was "have you ever heard of e-cigarettes" then further asked, "whether e-cigarettes have a bad impact on health". In this study, most of the respondents had heard of e-cigarettes and knew that e-cigarettes harmed health. While the use of e-cigarettes in respondents who know the impact of e-cigarettes on health is less than those who do not use e-cigarettes. As shown in Table 2. below.

Tabel 2. The results of the chi-square test of age, gender, and knowledge with the use of e-cigarettes (N=210)

Variable	E-cigarette use		P-value
	Yes n %	No n %	
<b>Age</b>			
≤ 15 years	39 (62.9)	23 (37.1)	0.000
> 15 years	12 (52.2)	11 (47.8)	
Total	51 (60.0)	34 (40.0)	
<b>Gender</b>			
Male	45 (42.5)	61 (57.5)	0.000
Female	6 (5.8)	98 (94.2)	
Total	51 (24.3)	159 (75.7)	
<b>Knowledge toward e-cigarette</b>			
Yes	46 (26.1)	130 (73.9)	0.155
Now	5 (14.7)	29 (85.3)	
Total	51 (24.3)	159 (75.7)	
<b>Knowledge of the impact of e-cigarettes on health</b>			
Yes	45 (25,6)	131 (74,4)	0,972
No	6 (24,3)	28 (82,4)	
Total	51 (24,3)	159 (75,7)	

## DISCUSSION

The number of adolescents who smoked was 85 (40,5%), and the use of e-cigarettes was 51 (24,3%). The pattern of e-cigarettes use among adolescents is divided into four: using conventional cigarettes 34 (16,2%), using e-cigarettes 18 (4,3%) ; using e-cigarettes and conventional 33 (15,7%), and never using both 125 (59,5%). The majority of respondents received information about e-cigarettes from their peers 150 (71,4%). The results of the bivariate analysis showed that age and sex were related to e-cigarette use among respondents with a p-value of 0,000.

Smoking behavior at a young age is associated with low socioeconomic status, use and acceptance of cigarettes among siblings and peer groups, perceptions that smoking is normative, low academic achievement and low skills in resisting social influences for smoking, low self-esteem or self-image, the confidence the benefits of smoking and low self-efficacy (17). Age is associated with the initiation and prevalence of smoking among adolescents. The younger a person starts smoking, the more likely he is to become a regular smoker and the less likely he is to quit smoking. Therefore, many argue that it is better to prevent smoking initiation for the first time (18).



This study is in line with the results of a study in California, United States which showed that among non-daily smokers, adolescents/youth who use e-cigarettes tend to consume more conventional cigarettes so that these adolescents are at greater risk for long-term tobacco use and cigarette dependence (19). Currently, smokers not only use e-cigarettes but they use conventional cigarettes. These patterns may reflect the potential impact of intermittent e-cigarette use among adults, including prolonged dual use of both e-cigarettes and conventional cigarettes. In contrast, the use of e-cigarettes every day is generally done by former smokers. These findings highlight the importance of surveillance and further research to inform public health practice, particularly concerning the frequency of use of various types of e-cigarette products and their impact on smoking cessation programs (20).

Meanwhile, the prevalence of e-cigarette users in the United States is 22.4%. Current smoking and past use of alternative tobacco products are strong predictors of use. Other predictors of e-cigarette use were age, race/ethnicity, and educational attainment. The majority of US adults (83.6%) are aware of the existence of e-cigarettes. Among those who were aware, more than half (54.7%) considered e-cigarettes to be completely harmless or moderately harmful and nearly a quarter (22.4%) had tried it at least once (21).

The results showed that the majority of respondents obtained information on e-cigarettes from their peers as many as 150 respondents (71.4%), then the internet 43 respondents (20.5%). As stated by previous researchers, peer environment significantly influences initiation and regular use of e-cigarettes and affiliation with friends who use e-cigarettes among adolescents and young adult women (22–24) The most widely used tobacco product by adolescents is cigarettes, followed by e-cigarettes (25). Smoking status of parents or close friends, and access to cigarettes were all identified as important factors associated with cigarette and e-cigarette use (25). Research in Medan City shows that most respondents (88%) use e-cigarettes because they see the people around them (26).

This study is reinforced by previous researchers who showed that adolescents are routinely exposed to e-cigarette marketing and user-generated e-cigarette-related content on internet social media, especially Facebook, Instagram, and Twitter. Exposure to e-cigarette content on social media was most likely associated with a greater likelihood of e-cigarette use, even after adjusting for the effect of potential more direct influence of e-cigarette users on one's social network and smoking history. This relationship could be mediated by the expectation of positive outcomes associated with e-cigarette use, particularly expectations rooted in the belief that e-cigarettes provide a "smoking" alternative that is safer, more socially acceptable, more comfortable, and more enjoyable. Regulating the marketing of e-cigarettes on internet social media may need to be prioritized in tobacco control efforts (27).

The results of this study indicate that the male gender dominates the use of conventional and e-cigarettes. This is in line with the previous one. Research in Jakarta explained that the number of male adolescent respondents contributed more to using e-cigarettes than girls, namely 65%. As many as 80% are 16 years old and 4 people (20%) are 17 years old (28). This information

strengthens the results of research conducted by researchers. The factors that had the highest influence on teenagers consuming e-cigarettes were the friend factor, then the Internet factor, and parents. While other factors such as television media, books, and other factors did not affect the students' interest in choosing e-cigarettes (28).

Furthermore, the results of research in China stated that 48.5% of Chinese adults had heard of e-cigarettes. The proportions of Chinese adults who have used, have used in the past 12 months, and currently use e-cigarettes are 5.0%, 2.2%, and 0.9%, respectively. Among men, higher use of e-cigarettes was associated with age group 15-24 years, college/university or above education, and daily use of flammable cigarettes. The most common reason for e-cigarette use was smoking cessation (46.2%) while among former smokers, 9.5% of e-cigarette users had ever quit smoking and 21.8% of e-cigarette users never quit smoking. The prevalence of e-cigarettes among Chinese adults has increased since 2015, especially among young people aged 15-24. The high rates of multiple-use and lower quit rates among e-cigarette users suggest that e-cigarettes are showing no benefit as a smoking cessation tool at the population level in China. E-cigarette regulation is needed to protect young people and minimize health risks (29).

Somewhat in contrast to research in Greece showing that e-cigarette use is associated with male gender, older age, current use of combustible tobacco products, and family use of e-cigarettes (29). The emphasis of the older age is more using e-cigarettes, while in this study the younger age used more e-cigarettes. This is because young people are bigger because of curiosity and experimentation. Furthermore, it was shown that respondents who had used e-cigarettes, were older, female gender, and had higher pocket money was associated with increased susceptibility to tobacco smoking (29).

Research in Thailand found that current smoking, use of e-cigarettes by parents, peer use of e-cigarettes, peer consent to smoking, and did not know the risk of smoking e-cigarettes were significantly associated with current e-cigarette use (30). Male gender, poor academic achievement, and poor life assets were significantly associated with e-cigarette use (30). So, teenagers who currently smoke have a greater chance of becoming users of e-cigarettes than teenagers who don't smoke (22,29).

Research in Jakarta showed that overall, 6.3% of women and 29% of men reported having used e-cigarettes. E-cigarette use was independently related to gender, school location, conventional smoking status, peer use of e-cigarettes, availability, and the perception that e-cigarettes aided conventional smoking cessation (23). Meanwhile, a study in the United States showed that the majority of adolescents who reported using e-cigarettes also used flammable tobacco (29). Early and comprehensive prevention efforts to reduce e-cigarettes and other substance use can have a substantial beneficial impact on public health over time (31).

Furthermore, research in Western Ireland shows that among 4,422 adolescents 22.1% are current users of nicotine products, consisting of 5.1% e-cigarette-only users, 7.7% conventional cigarette users, and 9.3% multiple users. For risk factors, the possible associations were weaker for e-cigarette use alone compared to conventional cigarettes and multiple uses (32). Participating in

team sports four times/week or more significantly reduced the likelihood of conventional smoking and dual-use but had no association with e-cigarette-only use. Similarly, having higher scores for social norms reduced the likelihood of conventional cigarettes and multiple uses but not only use e-cigarettes. This is the first study to show that multiple uses are the most common behavior among adolescent nicotine product users in Ireland (32).

Research in Thailand revealed that the use of e-cigarettes in students was associated with knowledge about e-cigarettes. Students with less knowledge about the harmful effects of e-cigarettes were more likely to use them. In addition, students who are users of e-cigarettes have a more positive attitude towards the use of e-cigarettes than those who are not users of e-cigarettes. The results also revealed that male students, students who had also smoked tobacco, and students with friends who smoked tobacco were more likely to use e-cigarettes (33). Therefore, the use of e-cigarettes among students can significantly increase the overall use of e-cigarettes.

Older age, male gender, conventional smoking, peer influence, daily smoking, and heavy smoking were the most common characteristics of adolescent e-cigarette users. As e-cigarette use increases and given that long-term health effects are still under investigation, interventions targeted at more vulnerable individuals may be an effective prevention strategy (34). This study suggests that future tobacco control strategies should be strengthened in preventing the initiation of nicotine addiction among the non-smoking population (35,36).

The limitation of this study only focuses on variables of age, gender, and knowledge related to e-cigarettes and their impact on health. There are still many other variables that need to be studied for further research related to the use of e-cigarettes in adolescents such as cigarette advertising, peer environment, family environment, etc.

## CONCLUSION

The pattern of smoking behavior among adolescents is not only the use of conventional cigarettes but also e-cigarettes. The pattern e-cigarettes use among adolescents is divided into three, such as: using e-cigarettes, using electric and conventional cigarettes, never using both. The youngest age for first smoking is ten years. The majority of respondents received information about e-cigarettes from their peers. Age and gender are related to e-cigarette use among adolescents. The government of Yogyakarta city needs to make regulations for controlling e-cigarettes immediately.

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