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- Tahap 2 : Review Editor : 29 Mei 2024
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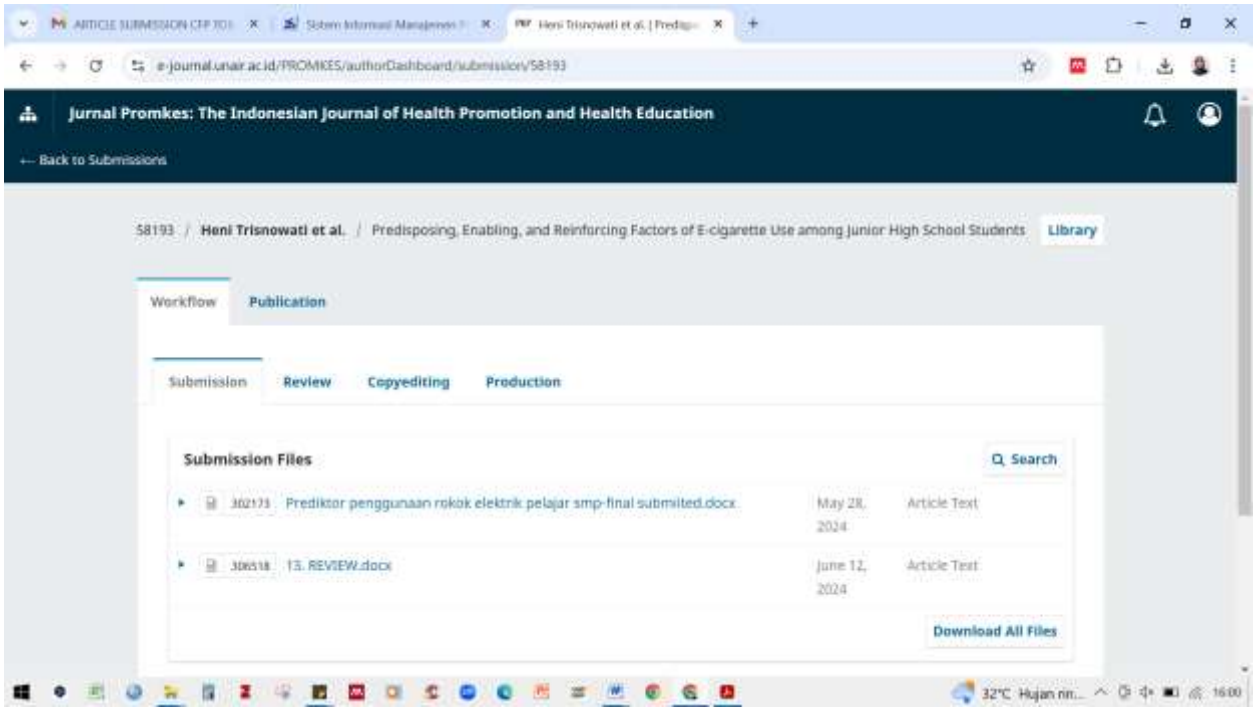

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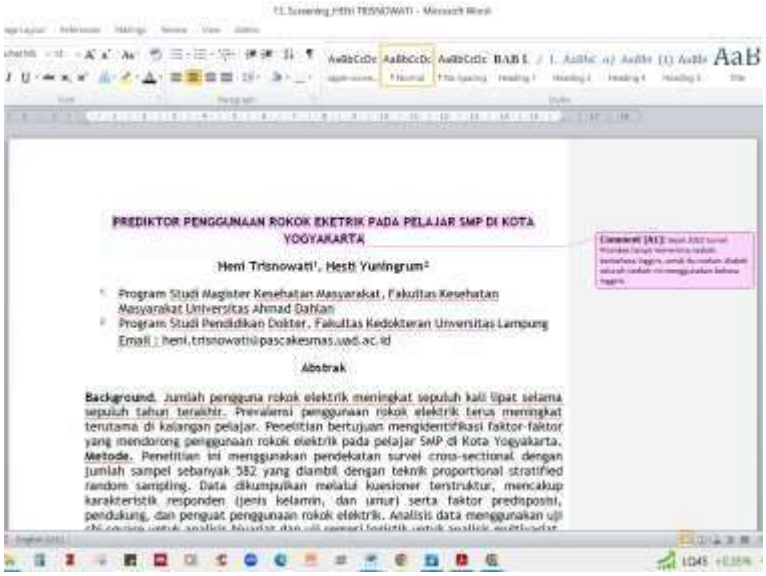

PREDIKTOR PENGGUNAAN ROKOK EKETRIK PADA PELAJAR SMP DI KOTA YOGYAKARTA

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Abstrak

Background. Jumlah pengguna rokok elektrik meningkat sepuluh kali lipat selama sepuluh tahun terakhir. Prevalensi penggunaan rokok elektrik terus meningkat terutama di kalangan pelajar. Penelitian bertujuan mengidentifikasi faktor-faktor yang mendorong penggunaan rokok elektrik pada pelajar SMP di Kota Yogyakarta. **Metode.** Penelitian ini menggunakan pendekatan survei cross-sectional dengan jumlah sampel sebanyak 582 yang diambil dengan teknik proportional stratified random sampling. Data dikumpulkan melalui kuesioner terstruktur, mencakup karakteristik responden (jenis kelamin, dan umur) serta faktor predisposisi, pendukung, dan penguat penggunaan rokok elektrik. Analisis data menggunakan uji

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Predisposing, Enabling, and Reinforcing Factors of E-cigarette Use among Junior High School Students in Yogyakarta, Indonesia

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Abstract

Background. The number of e-cigarette users has increased tenfold over the past ten years. The prevalence of e-cigarette use continues to increase, especially among students. **Aims.** This study aims to identify factors that encourage the use of e-cigarettes among junior high school students in Yogyakarta City. **Methods**. This study used a cross-sectional survey approach with a sample size of 582 taken using a proportional stratified random sampling technique. Data were collected through a structured questionnaire, including respondent characteristics (gender, and age) as well as predisposing, enabling, and reinforcing factors for e-cigarette use. Data were analyzed using a chi-square test for bivariate analysis and a logistic regression test for multivariate analysis. **Results.** The results showed that knowledge (RP=4.06, CI 95%=1.60-10.3, p<0.05), affordability (RP=2.46, CI 95%=1.37-4.39, p<0.05), family members smoking (RP=3.14, CI 95%=1.62-6.09, p<0.05), peers smoking (RP=8.14, CI 95%=3.92-16.9, p<0.05) were associated with the use of e-cigarettes in students. Meanwhile, the availability of cigarettes is not significant with the use of e-cigarettes in students (RP=1.98, CI 95%=0.96-4.09, p>0.05). The results of multivariate analysis showed that the most influential factor in the use of e-cigarettes was peer smoking behavior. **Conclusion.** There is a relationship between knowledge, affordability, smoking family members, and smoking peers with the use of e-cigarettes in students. **Recommendation**. Health promotion programs on the dangers of e-cigarettes use and how to avoid them should be implemented, as well as restrictions on access to e-cigarettes through the implementation of smoke-free areas in schools.
Keywords: predictors, e-cigarette use, junior high school students

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Introduction

E-cigarettes or vapes are considered a modern alternative to traditional cigarettes, yet their use still carries significant health risks as they rely on batteries to produce vapor containing liquid nicotine and other chemicals (Hutzler et al., 2014; Daniluk et al., 2018; Visser et al., 2019). Smoking prevalence has decreased globally, from 22.7% in 2007 to 17% in 2021, yet the number of smokers remains high due to population growth (The Tobacco Atlas, 2023). In 2021, approximately 4.5% of adults in the United States used e-cigarettes, with the highest rate of use occurring in the 18-24 age group, reaching 11.0% (Centers for Disease Control and Prevention, 2023).

The latest data from the Global Youth Tobacco Survey (GYTS) in 2019 shows that 40.6% of students in Indonesia (aged 13-15 years) have used tobacco products, with the number of students who smoke currently reaching 19.2% (WHO Indonesia, 2020). In addition, the prevalence of e-cigarette use in Indonesia is also recorded to be increasing, reaching 3% in 2021. This figure has increased significantly compared to 2011 which was only 0.3% (CDC, WHO and Kemenkes RI, 2022). In terms of gender, the prevalence of e-cigarette use among men was recorded to be higher, at 5.8%, while among women it was only 0.3%. The percentage of smoking in the population aged ≥ 15 years in Yogyakarta Province shows an increasing trend from year to year. In 2022, the figure reached 23.97% and increased to 24.82% in 2023 (BPS, 2024).

E-cigarettes are believed to be an option for smoking cessation as they were considered an effective form of nicotine replacement when first introduced (Cobb et al., 2010). However, research results from BPOM in 2015 showed that the liquid or aerosol used in e-cigarettes contains addictive compounds, carcinogenic and cancer-causing components. Nicotine, an addictive substance, is also present in e-cigarettes (Indonesian Ministry of Health, 2020). Despite this, school students continue to use e-cigarettes despite a lack of awareness and understanding of the risks and impacts. Previous research found that the level of e-cigarette use is almost equivalent to conventional cigarette use among students. (Artanti et al., 2017; Kim and Selya, 2020). Some factors that contribute to the use of e-cigarettes and traditional cigarettes include conventional

smoking habits, the belief that e-cigarettes are less addictive than conventional cigarettes, the belief that e-cigarettes do not cause cancer, parental acceptance of e-cigarettes, parental attitudes towards e-cigarettes, and the availability of funds to buy e-cigarettes (Bigwanto et al., 2022).

Adollescent-centered tobacco control efforts are relevant and important today. Health promotion for smoking prevention and cessation includes three approaches: 1) through mass public such as social marketing, mass media interventions; 2) through individuals such as motivational intervening, peer education and 3) through community approaches namely community mobilization, and environmental change through media advocacy and setting-based interventions (Golechha, 2016). Efforts to prevent and control cigarette use require an understanding of the causes of cigarette use behavior so that the purpose of this study is very relevant to support these efforts. This study aims to determine the predisposing, enabling and reinforcing factors that encourage the use of e-cigarettes in junior high school students in Yogyakarta city. This research is important as a basis for determining appropriate health promotion programs and for strengthening advocacy for e-cigarette control in Yogyakarta and in Indonesia in general.

Methods

Comment [A4]: why choose this method? explain and relate to research explain the method more detailed

This type of research uses a cross-sectional survey approach (Heni, Amila and Juneris, 2021). The choice of this design was motivated by the aim of finding and analyzing determinant factors associated with e-cigarette use. In addition, the method was chosen for its ability to collect data on several variables simultaneously. This not only saves time and money in data collection, but also makes it possible to compare and contrast different types of data within the same group of respondents.The research location involved public junior high schools (SMPN) and private junior high schools in Yogyakarta City. The sampling technique used was proportional stratified random sampling (Sugiyono, 2021). The minimum sample size was determined using the hypothesis testing formula for the proportion of two populations, 5% level of significance, and 90% power level (Lemeshow et al, 1997). The determination of schools was done by lottery. There are 3 public and 4 private junior high schools with a total sample size of 582 students.

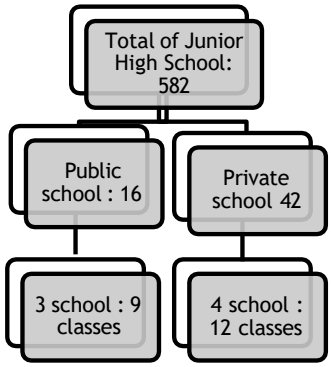

Figure. 1 Research Sample Details

The grouping of schools is distinguished based on strata, namely public and private schools, using the stratified random sampling method. The stratified random sampling method is a sampling method carried out by grouping the population based on strata or levels, selecting samples

randomly and simply from each stratum, and then combining them into research samples (Masturoh and Anggita, 2018). The sampling technique is proportional stratified random sampling used to obtain a representative sample by looking at the population in Yogyakarta City.

Data collection uses a structured questionnaire and respondents have been explained before filling out. The questionnaire instrument was adopted from previous research (Kurniasih, 2008; Trisnowati, 2012). Variables that became the focus of the study included respondent characteristics (gender, and age). In addition, the independent variables measured involved predisposing factors (level of knowledge about the health effects of smoking), supporting factors (availability and affordability of cigarettes), and reinforcing factors (smoking behavior of family members and smoking behavior of peers), which are related to the use of e-cigarettes. Data analysis was conducted using the chi-square test for bivariate analysis and the logistic regression test for multivariate analysis (Lestari and Yudhanegara, 2017). This study has obtained permission from the Research Ethics Commission of the University in Yogyakarta with number 134.3/FIKES/PL/IX/2022.

Result and Discussion

Overview of Predisposing, Enabling, and Reinforcing Factors for the Use of E-cigarettes by Junior High School Students

The results showed that most of the respondents were 14 years old as many as 280 (48.1%), came from grade 8 as many as 277 (47.6%), and were mostly female as many as 323 (55.5%). In predisposing factors, most respondents had good knowledge, as many as 520 (89.3%). In addition, in supporting factors, most respondents did not encounter cigarette sellers inside the school, reaching 543 (93.3%), while around 320 (55%) respondents reported the presence of cigarette sellers around the school. Students' daily pocket money was mostly in the range of Rp11,000 - Rp15,000, as many as 230 (39.5%). Access to e-cigarettes was obtained by 43 (7.3%) respondents. Most respondents (54.1%) thought the price of e-cigarettes was expensive. Respondents were of the view that the price of cigarettes could not be bought by students if the price was greater than 80,000, reaching 270 (46.4%).

Most respondents had family members who smoked, 346 (59.5%), and the majority of them reported their father as a smoker, 244 (42%) In terms of reinforcing factors. The number of respondents who reported having no close friends or peers who smoke was 335 (57.6%). The people who most influenced students' smoking behavior were peers, 97 (16.7%). The most commonly chosen smoking location was at a friend's house, reaching 57 (9.8%). The majority of respondents (7.2%) reported that they smoked during leisure time or on a whim. Finally, 23 (4%) respondents had smoked with family.

Regarding cigarette consumption patterns, it was found that some respondents, 56 (9.6%), used e-cigarettes. Meanwhile, the majority of respondents currently use a combination of e-cigarettes and conventional cigarettes, 30 (5.2%). The majority of current e-cigarette smoking habits were reported as sometimes, reaching 48 (8.2%). The main source of information about e-cigarettes was from neighbors or peers, 38 (6.5%). The main reason respondents used e-cigarettes was out of curiosity or wanting to try, recorded as 34 (5.9%). An overview of predisposing, supporting, and reinforcing factors for the use of e-cigarettes in students is presented in Table 1. Below

Tabel 1. Univariate Analysis (N=582)

Variabel	n	%
Predisposing factor		
Knowledge		
Less	8	1.4
Simply	54	9.3
Good	520	89.3
Enabling factors		
There is a cigarette seller in the scl ool		
Yes	39	6.7
No	543	93.3
There is a cigarette seller around the school		
Yes	320	55.0
No	262	45.0

Variabel	n	%
Pocket money per day		
Rp1.000 – Rp5.000	50	8.6
Rp6.000 – Rp10.000	176	30.2
Rp11.000 – Rp15.000	230	39.5
>Rp16.000	126	21.6
Access to E-cigarette		
Dari keluarga	16	2.7
Ditawari teman	23	4.0
Membeli sendiri	43	7.3
Tidak merokok elektrik	526	90.4
Opinion on E-cigarrete prices		
Biasa saja	129	22.2
Mahal	315	54.1
Sangat mahal	138	23.7
Opinion to keep E-cigarette out of reach of studen t		
Rp20.000 – Rp30.000	94	16.2
Rp31.000 – Rp50.000	100	17.2
Rp51.000 – Rp80.000	118	20.3
>80.000	270	46.4
Reinforcing Factors		
Family members smoking		
Yes	346	59.5
No	236	40.5
Family members who smoke		
No smoking	236	40.5
Father	244	42.0
Father and older brother	11	1.9
Father and grandfather	3	0.5
Dad and uncle	3	0.5
Older brother	40	6.9
Cousin	1	0.2
Brother, father, grandfather, uncle	6	1.1
Grandfather	17	2.9
uncle	5	0.9
Brother	17	3.8
Number of peers		
None	335	57.6
One	44	7.6
Two	40	6.9
Three	38	6.5
More than four	99	17.0
People who influence smoking		
Father	13	2.2
Religious leader	1	0.2
Cigarette advertisement	12	2.0
Brother	5	0.9
Idol figure	1	0.2
Friends	97	16.7
No smoking	453	77.9
Usual smoking places		
Green bean porridge stall	6	1.0
Badminton court	1	0.2
Home	34	5.8
Desert places	12	2.1
Friend"s house	57	9.8
Anywhere	1	0.2
Cafe	1	0.2
Garden	2	0.3
Field	1	0.2
Hangout spot	2	0.3
Ronda post	1	0.2

Variabel	n	%
House, shop, friend"s house	1	0.2
Stall	4	0.7
River	1	0.2
Out of the house	2	0.3
School	1	0.2
Tidak merokok	453	77.9
Situations that lead to smoking		
Family issues	1	0.2
When I see people smoking	8	1.4
When I bored	21	3.6
When I am feeling nervous	10	1.7
When the mouth feels bad	6	1.0
When I have nothing to do	42	7.2
When stressed/upset/angry	41	7.1
No smoking	453	77.9
Ever smoked with family		
Ever	23	4.0
Never	559	96.0
The pattern of cigarette use		
Using E-cigarette		
No	526	90.4
Yes	56	9.6
Current use of E-cigarrete		
No smoking	526	90.4
Using E-cigarette only	26	4.5
Using E-cigarettes and conventional	30	5.2
How often to use an e-cigarette		
No smoking	526	90.4
sometimes	48	8.2
everyday	5	0.9
Never	3	0.5
Media information on e-cigarrete		
No smoking	526	90.4
Internet (social media)	15	2.6
Environment/peers	38	6.5
Parents	3	0.5
Reason to use e-cigarrete		
No smoking	526	90.4
Invited by friends	5	0.9
Idle	15	2.6
Addicted	2	0.3
Curious	34	5.9

Predictors of e-cigarette use among junior high school students

In the bivariate analysis test, the categories in each category were simplified into two categories to avoid empty cells and to bring up the PR and CI values.

Table 2. Bivariate Analysis (N=582)

Variables	E-cigarrete use				*p-value*	RP	CI 95%	
	Ya	%	Tidak	%			*Lower*	*Upper*
Knowledge								
Less	3	0,5	5	0,9	**0,033**	4,06	1,60	10,3
Good	53	9,1	521	89,5				
Affordability								
Yes	42	7,2	278	47,8	**0,002**	2,46	1,37	4,39
No	14	2,4	248	42,6				
Availability								
Yes	7	1,2	32	5,5	**0,086**	1,98	0,96	4,09

No	49	8,4	494	84,9				
Family member smoking								
Yes	46	7,9	300	51,5	**0,000**	3,14	1,62	6,09
No	10	1,7	226	38,8				
Peers smoking								
Yes	48	8,2	199	34,2	**0,000**	8,14	3,92	16,9
No	8	1,4	327	56,2				

Based on Table 2, it is known that respondents who have less knowledge and use e-cigarettes are 3 people (0.5%). The results of bivariate analysis between knowledge and use of e-cigarettes obtained a value of RP = 4.06, CI (confidence interval) 95% = 1.60-10.3, and p-value = 0.033. The results of the analysis show that people who have less knowledge have a 4.06 times greater risk of using e-cigarettes compared to people who have good knowledge. Knowledge has a significant relationship with e-cigarette use (p-value <0.05).

Respondents who had tried smoking and stated the affordability of cigarettes were 42 people (7.2%). The results of bivariate analysis between cigarette affordability and e-cigarette use obtained an RP value = 2.46, 95% CI = 1.37-4.39, and p-value = 0.002. The results of this analysis indicate that the presence of cigarette affordability has a 2.46 times greater risk of using e-cigarettes compared to the absence of cigarette affordability. Cigarette affordability had a significant relationship with e-cigarette use (p-value <0.05).

Respondents who had tried smoking and stated the availability of cigarettes were 7 people (1.2%). The results of bivariate analysis between cigarette availability and e-cigarette use obtained an RP = 1.98, 95% CI = 0.96-4.09, and p-value = 0.086. The results of this analysis can conclude that the availability of cigarettes has a 1.98 times greater risk of using e-cigarettes compared to the absence of cigarette availability. Cigarette availability had no association with e-cigarette use (p-value > 0.05).

Respondents who had tried smoking and stated that there were family members who smoked were 46 people (7.9%). The results of bivariate analysis between family members who smoke and the use of e-cigarettes obtained RP = 3.14, 95% CI = 1.62-6.09, and p-value = 0.000. The results of this analysis can conclude that the presence of family members who smoke has a 3.14 times greater risk of using e-cigarettes compared to the absence of family members who smoke. The behavior of family members who smoke has a significant relationship with the use of e-cigarettes (p-value <0.05).

Respondents who had tried smoking and stated that there were peers who smoked were 48 people (8.2%). The results of bivariate analysis between peers who smoke and use e-cigarettes obtained RP = 8.14, 95% CI = 3.92-16.9, and p-value = 0.000. The results of the analysis can be concluded that the presence of peers who smoke has a risk of 8.14 times greater to use e-cigarettes compared to the absence of peers who smoke. The behavior of peers who smoke has a significant relationship with the use of e-cigarettes (p-value <0.05).

The Most Influential Factor on the Use of E-Cigarettes among School Children

Based on Table 3, it is known that there are 4 models in the multivariate analysis, namely model 1 which includes all variables, model 2 the variable of cigarette availability is omitted, model 3 the variable of cigarette affordability is omitted, model 4 the variable of knowledge is omitted. It can be concluded that the logistic regression equation model 4 is statistically robust to predict the incidence of e-cigarette use. The equation contains the variables of the smoking behavior of family members and the smoking behavior of peers. The final model, model 4, showed that people who had smoking peers had an 8.54 times greater risk of using e-cigarettes compared to people who did not have smoking peers.

Table 3. Multivariate analysis of e-cigarette use

Variable	Model 1 RP CI 95%	Model 2 RP CI 95%	Model 3 RP CI 95%	Model 4 RP CI 95%

	p-value	*p-value*	*p-value*	*p-value*
Knowledge level				
Less	4,92 (0,92-26,32) 0,063	5,02 (0,94-26,86) 0,059	5,06 (0,97-26,45) 0,055	
Affordability of cigarette				
Yes	1,39 (0,69-2,77) 0,353	1,41 (0,72-2,78) 0,318		
Availability of cigarette				
Yes	1,14 (0,45-2,93) 0,780			
Smoking behavior of family members				
Yes	2,31 (1,10-4,83) 0,026*	2,32 (1,11-4,84) 0,025*	2,41 (1,16-5,01) 0,019*	2,41 (1,16-4,99) 0,018*
Peers smoking behavior				
Ada	7,58 (3,40-16,88) 0,000*	7,59 (3,41-16,91) 0.000*	8,39 (3,85-18,27) 0,000*	8,54 (3,93-18,56) 0,000*

*= signifikan

The results of research by Wahidin et al. (2021), found that there was a significant relationship between knowledge and e-cigarette consumption (p=0.001). These findings indicate that individuals with less understanding are 13.5 times more likely to use electronic cigarettes compared to individuals who have very good knowledge (Wahidin, Handayani, and Ayu, 2021). In contrast, research by Palmes et al. (2021) found that there was no relationship between knowledge and attitude towards e-cigarette smoking (Palmes, Trajera, and Sajnani, 2021). Individual knowledge about e-cigarettes plays an important role in controlling health behaviors. Individuals who have a good understanding of electronic cigarettes tend to have internal control, while individuals who lack knowledge tend to rely on external control (Hasna, Cahyo and Laksmono, 2017). Environmental, family, residential, and social factors all have an impact on people's understanding of the dangers of e-cigarettes. The environment is an important non-formal source of information; a lack of information from the environment can lead to students being unaware of the dangers of smoking (Delpian, 2019).

Meanwhile, Hasna et al. (2017) found a relationship between the price of e-cigarettes and their use among novice smokers in Bekasi City (p-value=0.000). Similar findings were also obtained from research by Hamzah (2021) which revealed a correlation between the price of e-cigarettes and their use among students (Hamzah, 2021). Research by Fauzi et al. (2022) also found a relationship between the affordability of e-cigarettes and the level of use. E-cigarettes are increasingly favored by students due to various factors, including ease of access and use, and the influence of social media (Sapru et al., 2020). Sales of e-cigarettes are on the rise, especially among students. This is due to specialty stores, internet access, discounts, and community support. Lack of government oversight impacts availability and affordability. In addition, the accessibility of e-cigarette juice sharing helps students who run out of supplies to continue smoking e-cigarettes (B. Hamzah, 2021).

Bigwanto and Nurmansyah (2018) found that the availability and accessibility of e-cigarettes were strongly correlated with vaping activity among students. Students who had high availability and access to e-cigarettes were 2.26 times more likely to use them (OR, 2.26; 95% CI= 1.411-3.621) (Bigwanto and Nurmansyah, 2018). However, research conducted by Arman (2018) did not find a significant relationship (p=0.407) between the availability of electronic cigarettes and their use behavior. This is due to the limited availability of electronic cigarettes around schools, as most are available online or in locations far from the school environment (Arman, 2018).

Furthermore, Devhy & Yundari (2017), showed there was a significant influence between parental role models on e-cigarette smoking behaviour in male students at Saraswati 1 Denpasar Senior High School. Students who have smoking families are 2.5 times more likely to smoke e-cigarettes actively than those who do not have smoking families (Devhy and Yundari, 2017). The family has an important role in shaping a person's behavior patterns and attitudes. The likelihood of

using electronic cigarettes is higher in families whose members use electronic cigarettes (Damayanti, 2017). Positive parent-child relationships, spending more time with family, and anti-smoking expectations from parents are associated with lower rates of student smoking (Weemer, Ketner and Crecelius, 2021).

Research conducted by Devhy & Yundari (2017) found that students who have smoking friends are 2.6 times more likely to smoke e-cigarettes actively than those who do not have smoking friends. The results showed that there was a significant influence between peers on smoking behavior in male students (Devhy and Yundari, 2017). In addition, another study stated a significant relationship between peer influence and smoking behavior (Aisyiah, Nurani and Husaeyni, 2022). Students reported peer influence as one of the reasons they started using e-cigarettes, in addition to low perceived harm and social acceptance (Feliu et al., 2023). Peer effects increased students„ probability of smoking by 14.5%, suggesting a potential peer influence on students" smoking behavior (Hasna, Cahyo and Laksmono, 2017). Emotional changes in students, such as a sense of disobedience to parents make them prefer to be with friends outside the home. In addition, students' curiosity about new things often encourages them to try new things, including consuming electronic cigarettes (vaping) (Sitinjak and Susihar, 2020).

The best way to protect young people from the dangers of tobacco use, including e-cigarettes, is to discourage the use of these products through strong public policies that make it easy for young people to abstain from tobacco use (Hazard et al., 2022). In addition, school-based programs that teach students about the risks of e-cigarettes and address the main factors that drive students to use e-cigarettes, such as misperceptions, taste, nicotine content, addiction, and marketing, can also be effective in preventing student e-cigarette use (Liu, Gaiha and Halpern-Felsher, 2022).

Based on the results of the above research, it is recommended that schools provide health education about the dangers of e-cigarettes to students by including the material in school lessons. Schools can also collaborate with health centers for health promotion activities related to the impact of smoking on health, especially e-cigarettes. The results of the study can be used as advocacy material to include material on the impact of smoking on health and the economy in the school curriculum. The Yogyakarta City Government should be more assertive in regulating the advertisement, sale and sponsorship of e-cigarettes, especially those close to the school environment.

Limitations

This study provides an understanding of the factors associated with e-cigarette use among students in grades 1-3 at public and private schools in Yogyakarta City. However, the results may not be directly applicable to the wider population as they are limited to a specific area. The cross-sectional research method does not allow observation of changes over time, so it cannot identify developing trends or patterns. The variables studied mainly focused on respondent characteristics and factors related to e-cigarette use, thus not covering all factors that may influence the phenomenon. The analytical methods used also have limitations in illustrating the complexity of the relationships between the variables observed in this study. Therefore, the interpretation of the results should carefully consider these limitations.

Conclusion

Factors such as knowledge about e-cigarettes, affordability of cigarettes, smoking behavior of family members, and smoking behavior of peers have a significant association with e-cigarette use among junior high school students in grades 1-3 in Yogyakarta City. The multivariate analysis model showed that the smoking behavior of family members and peers was the strongest factor in predicting e-cigarette use. Recommendation. Health Promotion throuhgt intensive health education about the dangers of e-cigarettes and how to avoid them is needed, as implementing restrictions on access to e-cigarettes around schools with strict regulations and policies, and involving family and peers in fostering healthy behavior and socializing the risks of e-cigarettes.

Comment [A5]: provide recommendations and follow-up

Comment [R6]: thank you for your valuable feedback, we have added revisions in yellow block

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Dear Tim editor Jurnal Promkes,

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Terima kasih,
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[Kutipan teks disembunyikan]

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Predisposing, Enabling, and Reinforcing Factors of E-cigarette Use among Junior High School Students in Yogyakarta, Indonesia

Comment [R7]: It is the new title

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Abstract

Background. The number of e-cigarette users has increased tenfold over the past ten years. The prevalence of e-cigarette use continues to increase, especially among students. **Aims.** This study aims to identify factors that encourage the use of e-cigarettes among junior high school students in Yogyakarta City. **Methods**. This study used a cross-sectional survey approach with a sample size of 582 taken using a proportional stratified random sampling technique. Data were collected through a structured questionnaire, including respondent characteristics (gender, and age) as well as predisposing, enabling, and reinforcing factors for e-cigarette use. Data were analyzed using a chi-square test for bivariate analysis and a logistic regression test for multivariate analysis. **Results.** The results showed that knowledge (RP=4.06, CI 95%=1.60-10.3, p<0.05), affordability (RP=2.46, CI 95%=1.37-4.39, p<0.05), family members smoking (RP=3.14, CI 95%=1.62-6.09, p<0.05), peers smoking (RP=8.14, CI 95%=3.92-16.9, p<0.05) were associated with the use of e-cigarettes in students. Meanwhile, the availability of cigarettes is not significant with the use of e-cigarettes in students (RP=1.98, CI 95%=0.96-4.09, p>0.05). The results of multivariate analysis showed that the most influential factor in the use of e-cigarettes was peer smoking behavior. **Conclusion.** There is a relationship between knowledge, affordability, smoking family members, and smoking peers with the use of e-cigarettes in students. **Recommendation**. Health promotion programs on the dangers of e-cigarettes use and how to avoid them should be implemented, as well as restrictions on access to e-cigarettes through the implementation of smoke-free areas in schools.
Keywords: predictors, e-cigarette use, junior high school students

Comment [A8]: Add sub-bab aims h

Comment [R9]: We have revised in yellow highlight

Introduction

E-cigarettes or vapes are considered a modern alternative to traditional cigarettes, yet their use still carries significant health risks as they rely on batteries to produce vapor containing liquid nicotine and other chemicals (Hutzler et al., 2014; Daniluk et al., 2018; Visser et al., 2019). Smoking prevalence has decreased globally, from 22.7% in 2007 to 17% in 2021, yet the number of smokers remains high due to population growth (The Tobacco Atlas, 2023). In 2021, approximately 4.5% of adults in the United States used e-cigarettes, with the highest rate of use occurring in the 18-24 age group, reaching 11.0% (Centers for Disease Control and Prevention, 2023).

The latest data from the Global Youth Tobacco Survey (GYTS) in 2019 shows that 40.6% of students in Indonesia (aged 13-15 years) have used tobacco products, with the number of students who smoke currently reaching 19.2% (WHO Indonesia, 2020). In addition, the prevalence of e-cigarette use in Indonesia is also recorded to be increasing, reaching 3% in 2021. This figure has increased significantly compared to 2011 which was only 0.3% (CDC, WHO and Kemenkes RI, 2022). In terms of gender, the prevalence of e-cigarette use among men was recorded to be higher, at 5.8%, while among women it was only 0.3%. The percentage of smoking in the population aged ≥ 15 years in Yogyakarta Province shows an increasing trend from year to year. In 2022, the figure reached 23.97% and increased to 24.82% in 2023 (BPS, 2024).

E-cigarettes are believed to be an option for smoking cessation as they were considered an effective form of nicotine replacement when first introduced (Cobb et al., 2010). However, research results from BPOM in 2015 showed that the liquid or aerosol used in e-cigarettes contains addictive compounds, carcinogenic and cancer-causing components. Nicotine, an addictive substance, is also present in e-cigarettes (Indonesian Ministry of Health, 2020). Despite this, school students continue to use e-cigarettes despite a lack of awareness and understanding of the risks and impacts. Previous research found that the level of e-cigarette use is almost equivalent to conventional cigarette use among students. (Artanti et al., 2017; Kim and Selya, 2020). Some factors that contribute to the use of e-cigarettes and traditional cigarettes include conventional smoking habits, the belief that e-cigarettes are less addictive than conventional cigarettes, the belief that e-cigarettes do not cause cancer, parental acceptance of e-cigarettes, parental attitudes towards e-cigarettes, and the availability of funds to buy e-cigarettes (Bigwanto et al., 2022).

Adollescent-centered tobacco control efforts are relevant and important today. Health promotion for smoking prevention and cessation includes three approaches: 1) through mass public such as social marketing, mass media interventions; 2) through individuals such as motivational intervening, peer education and 3) through community approaches namely community mobilization, and environmental change through media advocacy and setting-based interventions (Golechha, 2016). Efforts to prevent and control cigarette use require an understanding of the causes of cigarette use behavior so that the purpose of this study is very relevant to support these efforts. This study aims to determine the predisposing, enabling and reinforcing factors that encourage the use of e-cigarettes in junior high school students in Yogyakarta city. This research is important as a basis for determining appropriate health promotion programs and for strengthening advocacy for e-cigarette control in Yogyakarta and in Indonesia in general.

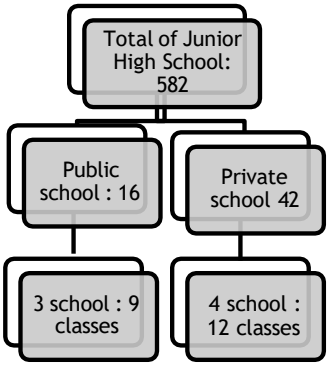
Methods

Comment [A10]: why choose this method? explain and relate to research explain the method more detailed

This type of research uses a cross-sectional survey approach (Heni, Amila and Juneris, 2021). The choice of this design was motivated by the aim of finding and analyzing determinant factors associated with e-cigarette use. In addition, the method was chosen for its ability to collect data on several variables simultaneously. This not only saves time and money in data collection, but also makes it possible to compare and contrast different types of data within the same group of respondents.The research location involved public junior high schools (SMPN) and private junior high schools in Yogyakarta City. The sampling technique used was proportional stratified random sampling (Sugiyono, 2021). The minimum sample size was determined using the hypothesis testing formula for the proportion of two populations, 5% level of significance, and 90% power level (Lemeshow et al, 1997). The determination of schools was done by lottery. There are 3 public and 4 private junior high schools with a total sample size of 582 students.

Figure. 1 Research Sample Details

The grouping of schools is distinguished based on strata, namely public and private schools, using the stratified random sampling method. The stratified random sampling method is a sampling method carried out by grouping the population based on strata or levels, selecting samples randomly and simply from each stratum, and then combining them into research samples (Masturoh and Anggita, 2018). The sampling technique is proportional stratified random sampling used to



obtain a representative sample by looking at the population in Yogyakarta City.

Data collection uses a structured questionnaire and respondents have been explained before filling out. The questionnaire instrument was adopted from previous research (Kurniasih, 2008; Trisnowati, 2012). Variables that became the focus of the study included respondent characteristics (gender, and age). In addition, the independent variables measured involved predisposing factors (level of knowledge about the health effects of smoking), supporting factors (availability and affordability of cigarettes), and reinforcing factors (smoking behavior of family members and smoking behavior of peers), which are related to the use of e-cigarettes. Data analysis was conducted using the chi-square test for bivariate analysis and the logistic regression test for multivariate analysis (Lestari and Yudhanegara, 2017). This study has obtained permission from the Research Ethics Commission of the University in Yogyakarta with number 134.3/FIKES/PL/IX/2022.

Result and Discussion

Overview of Predisposing, Enabling, and Reinforcing Factors for the Use of E-cigarettes by Junior High School Students

The results showed that most of the respondents were 14 years old as many as 280 (48.1%), came from grade 8 as many as 277 (47.6%), and were mostly female as many as 323 (55.5%). In predisposing factors, most respondents had good knowledge, as many as 520 (89.3%). In addition, in supporting factors, most respondents did not encounter cigarette sellers inside the school, reaching 543 (93.3%), while around 320 (55%) respondents reported the presence of cigarette sellers around the school. Students' daily pocket money was mostly in the range of Rp11,000 - Rp15,000, as many as 230 (39.5%). Access to e-cigarettes was obtained by 43 (7.3%) respondents. Most respondents (54.1%) thought the price of e-cigarettes was expensive. Respondents were of the view that the price of cigarettes could not be bought by students if the price was greater than 80,000, reaching 270 (46.4%).

Most respondents had family members who smoked, 346 (59.5%), and the majority of them reported their father as a smoker, 244 (42%) In terms of reinforcing factors. The number of respondents who reported having no close friends or peers who smoke was 335 (57.6%). The people who most influenced students' smoking behavior were peers, 97 (16.7%). The most commonly chosen smoking location was at a friend's house, reaching 57 (9.8%). The majority of respondents (7.2%) reported that they smoked during leisure time or on a whim. Finally, 23 (4%) respondents had smoked with family.

Regarding cigarette consumption patterns, it was found that some respondents, 56 (9.6%), used e-cigarettes. Meanwhile, the majority of respondents currently use a combination of e-

cigarettes and conventional cigarettes, 30 (5.2%). The majority of current e-cigarette smoking habits were reported as sometimes, reaching 48 (8.2%). The main source of information about e-cigarettes was from neighbors or peers, 38 (6.5%). The main reason respondents used e-cigarettes was out of curiosity or wanting to try, recorded as 34 (5.9%). An overview of predisposing, supporting, and reinforcing factors for the use of e-cigarettes in students is presented in Table 1. Below

Tabel 1. Univariate Analysis (N=582)

Variabel	n	%
Predisposing factor		
Knowledge		
Less	8	1.4
Simply	54	9.3
Good	520	89.3
Enabling factors		
There is a cigarette seller in the school		
Yes	39	6.7
No	543	93.3
There is a cigarette seller around the school		
Yes	320	55.0
No	262	45.0
Pocket money per day		
Rp1.000 – Rp5.000	50	8.6
Rp6.000 – Rp10.000	176	30.2
Rp11.000 – Rp15.000	230	39.5
>Rp16.000	126	21.6
Access to E-cigarette		
Dari keluarga	16	2.7
Ditawari teman	23	4.0
Membeli sendiri	43	7.3
Tidak merokok elektrik	526	90.4
Opinion on E-cigarrete prices		
Biasa saja	129	22.2
Mahal	315	54.1
Sangat mahal	138	23.7
Opinion to keep E-cigarette out of reach of studen t		
Rp20.000 – Rp30.000	94	16.2
Rp31.000 – Rp50.000	100	17.2
Rp51.000 – Rp80.000	118	20.3
>80.000	270	46.4
Reinforcing Factors		
Family members smoking		
Yes	346	59.5
No	236	40.5
Family members who smoke		
No smoking	236	40.5
Father	244	42.0
Father and older brother	11	1.9
Father and grandfather	3	0.5
Dad and uncle	3	0.5
Older brother	40	6.9
Cousin	1	0.2
Brother, father, grandfather, uncle	6	1.1
Grandfather	17	2.9
uncle	5	0.9
Brother	17	3.8
Number of peers		
None	335	57.6
One	44	7.6

Variabel	n	%
Two	40	6.9
Three	38	6.5
More than four	99	17.0
People who influence smoking		
Father	13	2.2
Religious leader	1	0.2
Cigarette advertisement	12	2.0
Brother	5	0.9
Idol figure	1	0.2
Friends	97	16.7
No smoking	453	77.9
Usual smoking places		
Green bean porridge stall	6	1.0
Badminton court	1	0.2
Home	34	5.8
Desert places	12	2.1
Friend" s house	57	9.8
Anywhere	1	0.2
Cafe	1	0.2
Garden	2	0.3
Field	1	0.2
Hangout spot	2	0.3
Ronda post	1	0.2
House, shop, friend" s house	1	0.2
Stall	4	0.7
River	1	0.2
Out of the house	2	0.3
School	1	0.2
Tidak merokok	453	77.9
Situations that lead to smoking		
Family issues	1	0.2
When I see people smoking	8	1.4
When I bored	21	3.6
When I am feeling nervous	10	1.7
When the mouth feels bad	6	1.0
When I have nothing to do	42	7.2
When stressed/upset/angry	41	7.1
No smoking	453	77.9
Ever smoked with family		
Ever	23	4.0
Never	559	96.0
The pattern of cigarette use		
Using E-cigarette		
No	526	90.4
Yes	56	9.6
Current use of E-cigarrete		
No smoking	526	90.4
Using E-cigarette only	26	4.5
Using E-cigarettes and conventional	30	5.2
How often to use an e-cigarette		
No smoking	526	90.4
sometimes	48	8.2
everyday	5	0.9
Never	3	0.5
Media information on e-cigarrete		
No smoking	526	90.4
Internet (social media)	15	2.6
Environment/peers	38	6.5
Parents	3	0.5
Reason to use e-cigarrete		

Variabel	n	%
No smoking	526	90.4
Invited by friends	5	0.9
Idle	15	2.6
Addicted	2	0.3
Curious	34	5.9

Predictors of e-cigarette use among junior high school students

In the bivariate analysis test, the categories in each category were simplified into two categories to avoid empty cells and to bring up the PR and CI values.

Table 2. Bivariate Analysis (N=582)

Variables	E-cigarrete use				p-value	RP	CI 95%	
	Ya	%	Tidak	%			*Lower*	*Upper*
Knowledge								
Less	3	0,5	5	0,9	**0,033**	4,06	1,60	10,3
Good	53	9,1	521	89,5				
Affordability								
Yes	42	7,2	278	47,8	**0,002**	2,46	1,37	4,39
No	14	2,4	248	42,6				
Availability								
Yes	7	1,2	32	5,5	**0,086**	1,98	0,96	4,09
No	49	8,4	494	84,9				
Family member smoking								
Yes	46	7,9	300	51,5	**0,000**	3,14	1,62	6,09
No	10	1,7	226	38,8				
Peers smoking								
Yes	48	8,2	199	34,2	**0,000**	8,14	3,92	16,9
No	8	1,4	327	56,2				

Based on Table 2, it is known that respondents who have less knowledge and use e-cigarettes are 3 people (0.5%). The results of bivariate analysis between knowledge and use of e-cigarettes obtained a value of RP = 4.06, CI (confidence interval) 95% = 1.60-10.3, and p-value = 0.033. The results of the analysis show that people who have less knowledge have a 4.06 times greater risk of using e-cigarettes compared to people who have good knowledge. Knowledge has a significant relationship with e-cigarette use (p-value <0.05).

Respondents who had tried smoking and stated the affordability of cigarettes were 42 people (7.2%). The results of bivariate analysis between cigarette affordability and e-cigarette use obtained an RP value = 2.46, 95% CI = 1.37-4.39, and p-value = 0.002. The results of this analysis indicate that the presence of cigarette affordability has a 2.46 times greater risk of using e-cigarettes compared to the absence of cigarette affordability. Cigarette affordability had a significant relationship with e-cigarette use (p-value <0.05).

Respondents who had tried smoking and stated the availability of cigarettes were 7 people (1.2%). The results of bivariate analysis between cigarette availability and e-cigarette use obtained an RP = 1.98, 95% CI = 0.96-4.09, and p-value = 0.086. The results of this analysis can conclude that the availability of cigarettes has a 1.98 times greater risk of using e-cigarettes compared to the absence of cigarette availability. Cigarette availability had no association with e-cigarette use (p-value > 0.05).

Respondents who had tried smoking and stated that there were family members who smoked were 46 people (7.9%). The results of bivariate analysis between family members who smoke and the use of e-cigarettes obtained RP = 3.14, 95% CI = 1.62-6.09, and p-value = 0.000. The results of this analysis can conclude that the presence of family members who smoke has a 3.14 times greater risk of using e-cigarettes compared to the absence of family members who smoke. The behavior of

family members who smoke has a significant relationship with the use of e-cigarettes (p-value <0.05).

Respondents who had tried smoking and stated that there were peers who smoked were 48 people (8.2%). The results of bivariate analysis between peers who smoke and use e-cigarettes obtained RP = 8.14, 95% CI = 3.92-16.9, and p-value = 0.000. The results of the analysis can be concluded that the presence of peers who smoke has a risk of 8.14 times greater to use e-cigarettes compared to the absence of peers who smoke. The behavior of peers who smoke has a significant relationship with the use of e-cigarettes (p-value <0.05).

The Most Influential Factor on the Use of E-Cigarettes among School Children

Based on Table 3, it is known that there are 4 models in the multivariate analysis, namely model 1 which includes all variables, model 2 the variable of cigarette availability is omitted, model 3 the variable of cigarette affordability is omitted, model 4 the variable of knowledge is omitted. It can be concluded that the logistic regression equation model 4 is statistically robust to predict the incidence of e-cigarette use. The equation contains the variables of the smoking behavior of family members and the smoking behavior of peers. The final model, model 4, showed that people who had smoking peers had an 8.54 times greater risk of using e-cigarettes compared to people who did not have smoking peers.

Table 3. Multivariate analysis of e-cigarette use

Variable	Model 1 RP CI 95% *p-value*	Model 2 RP CI 95% *p-value*	Model 3 RP CI 95% *p-value*	Model 4 RP CI 95% *p-value*
Knowledge level				
Less	4,92 (0,92-26,32) 0,063	5,02 (0,94-26,86) 0,059	5,06 (0,97-26,45) 0,055	
Affordability of cigarette				
Yes	1,39 (0,69-2,77) 0,353	1,41 (0,72-2,78) 0,318		
Availability of cigarette				
Yes	1,14 (0,45-2,93) 0,780			
Smoking behavior of family members				
Yes	2,31 (1,10-4,83) 0,026*	2,32 (1,11-4,84) 0,025*	2,41 (1,16-5,01) 0,019*	2,41 (1,16-4,99) 0,018*
Peers smoking behavior				
Ada	7,58 (3,40-16,88) 0,000*	7,59 (3,41-16,91) 0.000*	8,39 (3,85-18,27) 0,000*	8,54 (3,93-18,56) 0,000*

*= signifikan

The results of research by Wahidin et al. (2021), found that there was a significant relationship between knowledge and e-cigarette consumption (p=0.001). These findings indicate that individuals with less understanding are 13.5 times more likely to use electronic cigarettes compared to individuals who have very good knowledge (Wahidin, Handayani, and Ayu, 2021). In contrast, research by Palmes et al. (2021) found that there was no relationship between knowledge and attitude towards e-cigarette smoking (Palmes, Trajera, and Sajnani, 2021). Individual knowledge about e-cigarettes plays an important role in controlling health behaviors. Individuals who have a good understanding of electronic cigarettes tend to have internal control, while individuals who lack knowledge tend to rely on external control (Hasna, Cahyo and Laksmono, 2017). Environmental, family, residential, and social factors all have an impact on people's understanding of the dangers of e-cigarettes. The environment is an important non-formal source of

information; a lack of information from the environment can lead to students being unaware of the dangers of smoking (Delpian, 2019).

Meanwhile, Hasna et al. (2017) found a relationship between the price of e-cigarettes and their use among novice smokers in Bekasi City (p-value=0.000). Similar findings were also obtained from research by Hamzah (2021) which revealed a correlation between the price of e-cigarettes and their use among students (Hamzah, 2021). Research by Fauzi et al. (2022) also found a relationship between the affordability of e-cigarettes and the level of use. E-cigarettes are increasingly favored by students due to various factors, including ease of access and use, and the influence of social media (Sapru et al., 2020). Sales of e-cigarettes are on the rise, especially among students. This is due to specialty stores, internet access, discounts, and community support. Lack of government oversight impacts availability and affordability. In addition, the accessibility of e-cigarette juice sharing helps students who run out of supplies to continue smoking e-cigarettes (B. Hamzah, 2021).

Bigwanto and Nurmansyah (2018) found that the availability and accessibility of e-cigarettes were strongly correlated with vaping activity among students. Students who had high availability and access to e-cigarettes were 2.26 times more likely to use them (OR, 2.26; 95% CI= 1.411-3.621) (Bigwanto and Nurmansyah, 2018). However, research conducted by Arman (2018) did not find a significant relationship (p=0.407) between the availability of electronic cigarettes and their use behavior. This is due to the limited availability of electronic cigarettes around schools, as most are available online or in locations far from the school environment (Arman, 2018).

Furthermore, Devhy & Yundari (2017), showed there was a significant influence between parental role models on e-cigarette smoking behaviour in male students at Saraswati 1 Denpasar Senior High School. Students who have smoking families are 2.5 times more likely to smoke e-cigarettes actively than those who do not have smoking families (Devhy and Yundari, 2017). The family has an important role in shaping a person's behavior patterns and attitudes. The likelihood of using electronic cigarettes is higher in families whose members use electronic cigarettes (Damayanti, 2017). Positive parent-child relationships, spending more time with family, and anti-smoking expectations from parents are associated with lower rates of student smoking (Weemer, Ketner and Crecelius, 2021).

Research conducted by Devhy & Yundari (2017) found that students who have smoking friends are 2.6 times more likely to smoke e-cigarettes actively than those who do not have smoking friends. The results showed that there was a significant influence between peers on smoking behavior in male students (Devhy and Yundari, 2017). In addition, another study stated a significant relationship between peer influence and smoking behavior (Aisyiah, Nurani and Husaeyni, 2022). Students reported peer influence as one of the reasons they started using e-cigarettes, in addition to low perceived harm and social acceptance (Feliu et al., 2023). Peer effects increased students„ probability of smoking by 14.5%, suggesting a potential peer influence on students" smoking behavior (Hasna, Cahyo and Laksmono, 2017). Emotional changes in students, such as a sense of disobedience to parents make them prefer to be with friends outside the home. In addition, students' curiosity about new things often encourages them to try new things, including consuming electronic cigarettes (vaping) (Sitinjak and Susihar, 2020).

The best way to protect young people from the dangers of tobacco use, including e-cigarettes, is to discourage the use of these products through strong public policies that make it easy for young people to abstain from tobacco use (Hazard et al., 2022). In addition, school-based programs that teach students about the risks of e-cigarettes and address the main factors that drive students to use e-cigarettes, such as misperceptions, taste, nicotine content, addiction, and marketing, can also be effective in preventing student e-cigarette use (Liu, Gaiha and Halpern-Felsher, 2022).

Based on the results of the above research, it is recommended that schools provide health education about the dangers of e-cigarettes to students by including the material in school lessons. Schools can also collaborate with health centers for health promotion activities related to the impact of smoking on health, especially e-cigarettes. The results of the study can be used as advocacy material to include material on the impact of smoking on health and the economy in the school curriculum. The Yogyakarta City Government should be more assertive in regulating the advertisement, sale and sponsorship of e-cigarettes, especially those close to the school environment.

Limitations

This study provides an understanding of the factors associated with e-cigarette use among students in grades 1-3 at public and private schools in Yogyakarta City. However, the results may not be directly applicable to the wider population as they are limited to a specific area. The cross-sectional research method does not allow observation of changes over time, so it cannot identify developing trends or patterns. The variables studied mainly focused on respondent characteristics and factors related to e-cigarette use, thus not covering all factors that may influence the phenomenon. The analytical methods used also have limitations in illustrating the complexity of the relationships between the variables observed in this study. Therefore, the interpretation of the results should carefully consider these limitations.

Conclusion

Comment [A11]: provide recommendations and follow-up

Comment [R12]: thank you for you valuable feedback, we have added revisions in yellow block

Factors such as knowledge about e-cigarettes, affordability of cigarettes, smoking behavior of family members, and smoking behavior of peers have a significant association with e-cigarette use among junior high school students in grades 1-3 in Yogyakarta City. The multivariate analysis model showed that the smoking behavior of family members and peers was the strongest factor in predicting e-cigarette use. Recommendation. Health Promotion throuhgt intensive health education about the dangers of e-cigarettes and how to avoid them is needed, as implementing restrictions on access to e-cigarettes around schools with strict regulations and policies, and involving family and peers in fostering healthy behavior and socializing the risks of e-cigarettes.

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Tahap 4. Artikel diterima : 19 Juni 2024

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Terima kasih.

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Salam Sehat

Dr. Heni Trisnowati, SKM., MPH
Postgraduate Program of Public Health
Faculty of Public Health Universitas Ahmad Dahlan (UAD)
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Berikut kami lampirkan Letter of Acceptance

Semoga dapat digunakan sebagaimana mestinya

Terima kasih atas kontribusinya

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Nama penulis : **Heni Trisnowati*, Hesti Yuningrum**

telah **diterima** sebagai salah satu artikel yang akan dimuat dalam **Jurnal Promkes: The Indonesian Journal of Health Promotion and Health Education Volume 12 Special Issue 2 Agustus tahun 2024**.

Surabaya, 21 Juni 2024
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Melalui surel ini, kami kirimkan galley proof atas naskah Anda yang akan dipublikasikan di bulan Agustus 2024 mendatang.

Harap melakukan pengecekan terhadap naskah yang kami lampirkan **(khususnya pada bagian nama & afiliasi)**

Proses pengecekan kami tunggu maksimal hingga hari **Rabu, 17 Juli 2024 jam 12.00.**

Jika setelah waktu tersebut tidak ada balasan, maka kami anggap galley proof yang dikirimkan telah sesuai.

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Ada sedikit perubahan pada afiliasi Heni Trisnowati, nama prodinya : Master of Public Health Study Program
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Faculty of Public Health Universitas Ahmad Dahlan (UAD)
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Terima kasih

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Predisposing, Enabling, and Reinforcing Factors of E-cigarette Use among Junior High School Students in Yogyakarta, Indonesia

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Abstract

Background. The number of e-cigarette users has increased tenfold over the past ten years. The prevalence of e-cigarette use continues to increase, especially among students. **Aims.** This study aims to identify factors that encourage the use of e-cigarettes among junior high school students in Yogyakarta City. **Methods.** This study used a cross-sectional survey approach with a sample size of 582 taken using a proportional stratified random sampling technique. Data were collected through a structured questionnaire, including respondent characteristics (gender, and age) as well as predisposing, enabling, and reinforcing factors for e-cigarette use. Data were analyzed using a chi-square test for bivariate analysis and a logistic regression test for multivariate analysis. **Results.** The results showed that knowledge (RP=4.06, CI 95%=1.60-10.3, p<0.05), affordability (RP=2.46, CI

95%=1.37-4.39, p<0.05), family members smoking (RP=3.14, CI 95%=1.62-6.09, p<0.05), peers smoking (RP=8.14, CI 95%=3.92-16.9, p<0.05) were associated with the use of e-cigarettes in students. Meanwhile, the availability of cigarettes is not significant with the use of e-cigarettes in students (RP=1.98, CI 95%=0.96-4.09, p>0.05). The results of multivariate analysis showed that the most influential factor in the use of e-cigarettes was peer smoking behavior. **Conclusion.** There is a relationship between knowledge, affordability, smoking family members, and smoking peers with the use of e-cigarettes in students. **Recommendation**. Health promotion programs on the dangers of e-cigarettes use and how to avoid them should be implemented, as well as restrictions on access to e-cigarettes through the implementation of smoke-free areas in schools.
Keywords: predictors, e-cigarette use, junior high school students

Introduction

E-cigarettes or vapes are considered a modern alternative to traditional cigarettes, yet their use still carries significant health risks as they rely on batteries to produce vapor containing liquid nicotine and other chemicals (Hutzler et al., 2014; Daniluk et al., 2018; Visser et al., 2019). Smoking prevalence has decreased globally, from 22.7% in 2007 to 17% in 2021, yet the number of smokers remains high due to population growth (The Tobacco Atlas, 2023). In 2021, approximately 4.5% of adults in the United States used e-cigarettes, with the highest rate of use occurring in the 18-24 age group, reaching 11.0% (Centers for Disease Control and Prevention, 2023).

The latest data from the Global Youth Tobacco Survey (GYTS) in 2019 shows that 40.6% of students in Indonesia (aged 13-15 years) have used tobacco products, with the number of students who smoke currently reaching 19.2% (WHO Indonesia, 2020). In addition, the prevalence of e-cigarette use in Indonesia is also recorded to be increasing, reaching 3% in 2021. This figure has increased significantly compared to 2011 which was only 0.3% (CDC, WHO and Kemenkes RI, 2022). In terms of gender, the prevalence of e-cigarette use among men was recorded to be higher, at 5.8%, while among women it was only 0.3%. The percentage of smoking in the population aged ≥ 15 years in Yogyakarta Province shows an increasing trend from year to year. In 2022, the figure reached 23.97% and increased to 24.82% in 2023 (BPS, 2024).

E-cigarettes are believed to be an option for smoking cessation as they were considered an effective form of nicotine replacement when first introduced (Cobb et al., 2010). However, research results from BPOM in 2015 showed that the liquid or aerosol used in e-cigarettes contains addictive compounds, carcinogenic and cancer-causing components. Nicotine, an addictive substance, is also present in e-cigarettes (Indonesian Ministry of Health, 2020). Despite this, school students continue to use e-cigarettes despite a lack of awareness and understanding of the risks and impacts. Previous research found that the level of e-cigarette use is almost equivalent to conventional cigarette use among students. (Artanti et al., 2017; Kim and Selya, 2020). Some factors that contribute to the use of e-cigarettes and traditional cigarettes include conventional smoking habits, the belief that e-cigarettes are less addictive than conventional cigarettes, the belief that e-cigarettes do not cause cancer, parental acceptance of e-cigarettes, parental attitudes towards e-cigarettes, and the availability of funds to buy e-cigarettes (Bigwanto et al., 2022).

Adollescent-centered tobacco control efforts are relevant and important today. Health promotion for smoking prevention and cessation includes three approaches: 1) through mass public such as social marketing, mass media interventions; 2) through individuals such as motivational intervening, peer education and 3) through community approaches namely community mobilization, and environmental change through media advocacy and setting-based interventions (Golechha, 2016). Efforts to prevent and control cigarette use require an understanding of the causes of cigarette use behavior so that the purpose of this study is very relevant to support these efforts. This study aims to determine the predisposing, enabling and reinforcing factors that encourage the use of e-cigarettes in junior high school students in Yogyakarta city. This research is important as a basis for determining appropriate health promotion programs and for strengthening advocacy for e-cigarette control in Yogyakarta and in Indonesia in general.

Methods

This type of research uses a cross-sectional survey approach (Heni, Amila and Juneris, 2021). The choice of this design was motivated by the aim of finding and analyzing determinant factors associated with e-cigarette use. In addition, the method was chosen for its ability to collect data on

several variables simultaneously. This not only saves time and money in data collection, but also makes it possible to compare and contrast different types of data within the same group of respondents.The research location involved public junior high schools (SMPN) and private junior high schools in Yogyakarta City. The sampling technique used was proportional stratified random sampling (Sugiyono, 2021). The minimum sample size was determined using the hypothesis testing formula for the proportion of two populations, 5% level of significance, and 90% power level (Lemeshow et al, 1997). The determination of schools was done by lottery. There are 3 public and 4 private junior high schools with a total sample size of 582 students.

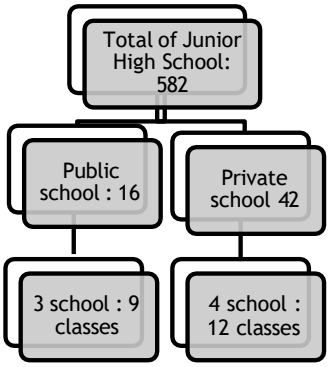

Figure. 1 Research Sample Details

The grouping of schools is distinguished based on strata, namely public and private schools, using the stratified random sampling method. The stratified random sampling method is a sampling method carried out by grouping the population based on strata or levels, selecting samples randomly and simply from each stratum, and then combining them into research samples (Masturoh and Anggita, 2018). The sampling technique is proportional stratified random sampling used to obtain a representative sample by looking at the population in Yogyakarta City.

Data collection uses a structured questionnaire and respondents have been explained before filling out. The questionnaire instrument was adopted from previous research (Kurniasih, 2008; Trisnowati, 2012). Variables that became the focus of the study included respondent characteristics (gender, and age). In addition, the independent variables measured involved predisposing factors (level of knowledge about the health effects of smoking), supporting factors (availability and affordability of cigarettes), and reinforcing factors (smoking behavior of family members and smoking behavior of peers), which are related to the use of e-cigarettes. Data analysis was conducted using the chi-square test for bivariate analysis and the logistic regression test for multivariate analysis (Lestari and Yudhanegara, 2017). This study has obtained permission from the Research Ethics Commission of the University in Yogyakarta with number 134.3/FIKES/PL/IX/2022.

Result and Discussion

Overview of Predisposing, Enabling, and Reinforcing Factors for the Use of E-cigarettes by Junior High School Students

The results showed that most of the respondents were 14 years old as many as 280 (48.1%), came from grade 8 as many as 277 (47.6%), and were mostly female as many as 323 (55.5%). In predisposing factors, most respondents had good knowledge, as many as 520 (89.3%). In addition, in supporting factors, most respondents did not encounter cigarette sellers inside the school,

reaching 543 (93.3%), while around 320 (55%) respondents reported the presence of cigarette sellers around the school. Students' daily pocket money was mostly in the range of Rp11,000 - Rp15,000, as many as 230 (39.5%). Access to e-cigarettes was obtained by 43 (7.3%) respondents. Most respondents (54.1%) thought the price of e-cigarettes was expensive. Respondents were of the view that the price of cigarettes could not be bought by students if the price was greater than 80,000, reaching 270 (46.4%).

Most respondents had family members who smoked, 346 (59.5%), and the majority of them reported their father as a smoker, 244 (42%) In terms of reinforcing factors. The number of respondents who reported having no close friends or peers who smoke was 335 (57.6%). The people who most influenced students' smoking behavior were peers, 97 (16.7%). The most commonly chosen smoking location was at a friend's house, reaching 57 (9.8%). The majority of respondents (7.2%) reported that they smoked during leisure time or on a whim. Finally, 23 (4%) respondents had smoked with family.

Regarding cigarette consumption patterns, it was found that some respondents, 56 (9.6%), used e-cigarettes. Meanwhile, the majority of respondents currently use a combination of e-cigarettes and conventional cigarettes, 30 (5.2%). The majority of current e-cigarette smoking habits were reported as sometimes, reaching 48 (8.2%). The main source of information about e-cigarettes was from neighbors or peers, 38 (6.5%). The main reason respondents used e-cigarettes was out of curiosity or wanting to try, recorded as 34 (5.9%). An overview of predisposing, supporting, and reinforcing factors for the use of e-cigarettes in students is presented in Table 1. Below

Tabel 1. Univariate Analysis (N=582)

Variabel	n	%
Predisposing factor		
Knowledge		
Less	8	1.4
Simply	54	9.3
Good	520	89.3
Enabling factors		
There is a cigarette seller in the school		
Yes	39	6.7
No	543	93.3
There is a cigarette seller around the school		
Yes	320	55.0
No	262	45.0
Pocket money per day		
Rp1.000 – Rp5.000	50	8.6
Rp6.000 – Rp10.000	176	30.2
Rp11.000 – Rp15.000	230	39.5
>Rp16.000	126	21.6
Access to E-cigarette		
Dari keluarga	16	2.7
Ditawari teman	23	4.0
Membeli sendiri	43	7.3
Tidak merokok elektrik	526	90.4
Opinion on E-cigarrete prices		
Biasa saja	129	22.2
Mahal	315	54.1
Sangat mahal	138	23.7
Opinion to keep E-cigarette out of reach of student		
Rp20.000 – Rp30.000	94	16.2
Rp31.000 – Rp50.000	100	17.2
Rp51.000 – Rp80.000	118	20.3
>80.000	270	46.4
Reinforcing Factors		
Family members smoking		
Yes	346	59.5
No	236	40.5

Variabel	n	%
Family members who smoke		
No smoking	236	40.5
Father	244	42.0
Father and older brother	11	1.9
Father and grandfather	3	0.5
Dad and uncle	3	0.5
Older brother	40	6.9
Cousin	1	0.2
Brother, father, grandfather, uncle	6	1.1
Grandfather	17	2.9
uncle	5	0.9
Brother	17	3.8
Number of peers		
None	335	57.6
One	44	7.6
Two	40	6.9
Three	38	6.5
More than four	99	17.0
People who influence smoking		
Father	13	2.2
Religious leader	1	0.2
Cigarette advertisement	12	2.0
Brother	5	0.9
Idol figure	1	0.2
Friends	97	16.7
No smoking	453	77.9
Usual smoking places		
Green bean porridge stall	6	1.0
Badminton court	1	0.2
Home	34	5.8
Desert places	12	2.1
Friend"s house	57	9.8
Anywhere	1	0.2
Cafe	1	0.2
Garden	2	0.3
Field	1	0.2
Hangout spot	2	0.3
Ronda post	1	0.2
House, shop, friend"s house	1	0.2
Stall	4	0.7
River	1	0.2
Out of the house	2	0.3
School	1	0.2
Tidak merokok	453	77.9
Situations that lead to smoking		
Family issues	1	0.2
When I see people smoking	8	1.4
When I bored	21	3.6
When I am feeling nervous	10	1.7
When the mouth feels bad	6	1.0
When I have nothing to do	42	7.2
When stressed/upset/angry	41	7.1
No smoking	453	77.9
Ever smoked with family		
Ever	23	4.0
Never	559	96.0
The pattern of cigarette use		
Using E-cigarette		
No	526	90.4
Yes	56	9.6
Current use of E-cigarrete		

Variabel	n	%
No smoking	526	90.4
Using E-cigarette only	26	4.5
Using E-cigarettes and conventional	30	5.2
How often to use an e-cigarette		
No smoking	526	90.4
sometimes	48	8.2
everyday	5	0.9
Never	3	0.5
Media information on e-cigarrete		
No smoking	526	90.4
Internet (social media)	15	2.6
Environment/peers	38	6.5
Parents	3	0.5
Reason to use e-cigarrete		
No smoking	526	90.4
Invited by friends	5	0.9
Idle	15	2.6
Addicted	2	0.3
Curious	34	5.9

Predictors of e-cigarette use among junior high school students

In the bivariate analysis test, the categories in each category were simplified into two categories to avoid empty cells and to bring up the PR and CI values.

Table 2. Bivariate Analysis (N=582)

Variables	E-cigarrete use				p-value	RP	CI 95%	
	Ya	%	Tidak	%			*Lower*	*Upper*
Knowledge								
Less	3	0,5	5	0,9	**0,033**	4,06	1,60	10,3
Good	53	9,1	521	89,5				
Affordability								
Yes	42	7,2	278	47,8	**0,002**	2,46	1,37	4,39
No	14	2,4	248	42,6				
Availability								
Yes	7	1,2	32	5,5	**0,086**	1,98	0,96	4,09
No	49	8,4	494	84,9				
Family member smoking								
Yes	46	7,9	300	51,5	**0,000**	3,14	1,62	6,09
No	10	1,7	226	38,8				
Peers smoking								
Yes	48	8,2	199	34,2	**0,000**	8,14	3,92	16,9
No	8	1,4	327	56,2				

Based on Table 2, it is known that respondents who have less knowledge and use e-cigarettes are 3 people (0.5%). The results of bivariate analysis between knowledge and use of e-cigarettes obtained a value of RP = 4.06, CI (confidence interval) 95% = 1.60-10.3, and p-value = 0.033. The results of the analysis show that people who have less knowledge have a 4.06 times greater risk of using e-cigarettes compared to people who have good knowledge. Knowledge has a significant relationship with e-cigarette use (p-value <0.05).

Respondents who had tried smoking and stated the affordability of cigarettes were 42 people (7.2%). The results of bivariate analysis between cigarette affordability and e-cigarette use obtained an RP value = 2.46, 95% CI = 1.37-4.39, and p-value = 0.002. The results of this analysis indicate that the presence of cigarette affordability has a 2.46 times greater risk of using e-cigarettes compared to the absence of cigarette affordability. Cigarette affordability had a significant relationship with e-cigarette use (p-value <0.05).

Respondents who had tried smoking and stated the availability of cigarettes were 7 people (1.2%). The results of bivariate analysis between cigarette availability and e-cigarette use obtained an RP = 1.98, 95% CI = 0.96-4.09, and p-value = 0.086. The results of this analysis can conclude that the availability of cigarettes has a 1.98 times greater risk of using e-cigarettes compared to the absence of cigarette availability. Cigarette availability had no association with e-cigarette use (p-value > 0.05).

Respondents who had tried smoking and stated that there were family members who smoked were 46 people (7.9%). The results of bivariate analysis between family members who smoke and the use of e-cigarettes obtained RP = 3.14, 95% CI = 1.62-6.09, and p-value = 0.000. The results of this analysis can conclude that the presence of family members who smoke has a 3.14 times greater risk of using e-cigarettes compared to the absence of family members who smoke. The behavior of family members who smoke has a significant relationship with the use of e-cigarettes (p-value <0.05).

Respondents who had tried smoking and stated that there were peers who smoked were 48 people (8.2%). The results of bivariate analysis between peers who smoke and use e-cigarettes obtained RP = 8.14, 95% CI = 3.92-16.9, and p-value = 0.000. The results of the analysis can be concluded that the presence of peers who smoke has a risk of 8.14 times greater to use e-cigarettes compared to the absence of peers who smoke. The behavior of peers who smoke has a significant relationship with the use of e-cigarettes (p-value <0.05).

The Most Influential Factor on the Use of E-Cigarettes among School Children

Based on Table 3, it is known that there are 4 models in the multivariate analysis, namely model 1 which includes all variables, model 2 the variable of cigarette availability is omitted, model 3 the variable of cigarette affordability is omitted, model 4 the variable of knowledge is omitted. It can be concluded that the logistic regression equation model 4 is statistically robust to predict the incidence of e-cigarette use. The equation contains the variables of the smoking behavior of family members and the smoking behavior of peers. The final model, model 4, showed that people who had smoking peers had an 8.54 times greater risk of using e-cigarettes compared to people who did not have smoking peers.

Table 3. Multivariate analysis of e-cigarette use

Variable	Model 1 RP CI 95% *p-value*	Model 2 RP CI 95% *p-value*	Model 3 RP CI 95% *p-value*	Model 4 RP CI 95% *p-value*
Knowledge level				
Less	4,92 (0,92-26,32) 0,063	5,02 (0,94-26,86) 0,059	5,06 (0,97-26,45) 0,055	
Affordability of cigarette				
Yes	1,39 (0,69-2,77) 0,353	1,41 (0,72-2,78) 0,318		
Availability of cigarette				
Yes	1,14 (0,45-2,93) 0,780			
Smoking behavior of family members				
Yes	2,31 (1,10-4,83) 0,026*	2,32 (1,11-4,84) 0,025*	2,41 (1,16-5,01) 0,019*	2,41 (1,16-4,99) 0,018*
Peers smoking behavior				

Ada	7,58 (3,40-16,88) 0,000*	7,59 (3,41-16,91) 0.000*	8,39 (3,85-18,27) 0,000*	8,54 (3,93-18,56) 0,000*

*= signifikan

The results of research by Wahidin et al. (2021), found that there was a significant relationship between knowledge and e-cigarette consumption (p=0.001). These findings indicate that individuals with less understanding are 13.5 times more likely to use electronic cigarettes compared to individuals who have very good knowledge (Wahidin, Handayani, and Ayu, 2021). In contrast, research by Palmes et al. (2021) found that there was no relationship between knowledge and attitude towards e-cigarette smoking (Palmes, Trajera, and Sajnani, 2021). Individual knowledge about e-cigarettes plays an important role in controlling health behaviors. Individuals who have a good understanding of electronic cigarettes tend to have internal control, while individuals who lack knowledge tend to rely on external control (Hasna, Cahyo and Laksmono, 2017). Environmental, family, residential, and social factors all have an impact on people's understanding of the dangers of e-cigarettes. The environment is an important non-formal source of information; a lack of information from the environment can lead to students being unaware of the dangers of smoking (Delpian, 2019).

Meanwhile, Hasna et al. (2017) found a relationship between the price of e-cigarettes and their use among novice smokers in Bekasi City (p-value=0.000). Similar findings were also obtained from research by Hamzah (2021) which revealed a correlation between the price of e-cigarettes and their use among students (Hamzah, 2021). Research by Fauzi et al. (2022) also found a relationship between the affordability of e-cigarettes and the level of use. E-cigarettes are increasingly favored by students due to various factors, including ease of access and use, and the influence of social media (Sapru et al., 2020). Sales of e-cigarettes are on the rise, especially among students. This is due to specialty stores, internet access, discounts, and community support. Lack of government oversight impacts availability and affordability. In addition, the accessibility of e-cigarette juice sharing helps students who run out of supplies to continue smoking e-cigarettes (B. Hamzah, 2021).

Bigwanto and Nurmansyah (2018) found that the availability and accessibility of e-cigarettes were strongly correlated with vaping activity among students. Students who had high availability and access to e-cigarettes were 2.26 times more likely to use them (OR, 2.26; 95% CI= 1.411-3.621) (Bigwanto and Nurmansyah, 2018). However, research conducted by Arman (2018) did not find a significant relationship (p=0.407) between the availability of electronic cigarettes and their use behavior. This is due to the limited availability of electronic cigarettes around schools, as most are available online or in locations far from the school environment (Arman, 2018).

Furthermore, Devhy & Yundari (2017), showed there was a significant influence between parental role models on e-cigarette smoking behaviour in male students at Saraswati 1 Denpasar Senior High School. Students who have smoking families are 2.5 times more likely to smoke e-cigarettes actively than those who do not have smoking families (Devhy and Yundari, 2017). The family has an important role in shaping a person's behavior patterns and attitudes. The likelihood of using electronic cigarettes is higher in families whose members use electronic cigarettes (Damayanti, 2017). Positive parent-child relationships, spending more time with family, and anti-smoking expectations from parents are associated with lower rates of student smoking (Weemer, Ketner and Crecelius, 2021).

Research conducted by Devhy & Yundari (2017) found that students who have smoking friends are 2.6 times more likely to smoke e-cigarettes actively than those who do not have smoking friends. The results showed that there was a significant influence between peers on smoking behavior in male students (Devhy and Yundari, 2017). In addition, another study stated a significant relationship between peer influence and smoking behavior (Aisyiah, Nurani and Husaeyni, 2022). Students reported peer influence as one of the reasons they started using e-cigarettes, in addition to low perceived harm and social acceptance (Feliu et al., 2023). Peer effects increased students„ probability of smoking by 14.5%, suggesting a potential peer influence on students" smoking behavior (Hasna, Cahyo and Laksmono, 2017). Emotional changes in students, such as a sense of disobedience to parents make them prefer to be with friends outside the home. In addition, students' curiosity about new things often encourages them to try new things, including consuming electronic cigarettes (vaping) (Sitinjak and Susihar, 2020).

The best way to protect young people from the dangers of tobacco use, including e-cigarettes, is to discourage the use of these products through strong public policies that make it easy for young people to abstain from tobacco use (Hazard et al., 2022). In addition, school-based programs that teach students about the risks of e-cigarettes and address the main factors that drive students to use e-cigarettes, such as misperceptions, taste, nicotine content, addiction, and marketing, can also be effective in preventing student e-cigarette use (Liu, Gaiha and Halpern-Felsher, 2022).

Based on the results of the above research, it is recommended that schools provide health education about the dangers of e-cigarettes to students by including the material in school lessons. Schools can also collaborate with health centers for health promotion activities related to the impact of smoking on health, especially e-cigarettes. The results of the study can be used as advocacy material to include material on the impact of smoking on health and the economy in the school curriculum. The Yogyakarta City Government should be more assertive in regulating the advertisement, sale and sponsorship of e-cigarettes, especially those close to the school environment.

Limitations

This study provides an understanding of the factors associated with e-cigarette use among students in grades 1-3 at public and private schools in Yogyakarta City. However, the results may not be directly applicable to the wider population as they are limited to a specific area. The cross-sectional research method does not allow observation of changes over time, so it cannot identify developing trends or patterns. The variables studied mainly focused on respondent characteristics and factors related to e-cigarette use, thus not covering all factors that may influence the phenomenon. The analytical methods used also have limitations in illustrating the complexity of the relationships between the variables observed in this study. Therefore, the interpretation of the results should carefully consider these limitations.

Conclusion

Factors such as knowledge about e-cigarettes, affordability of cigarettes, smoking behavior of family members, and smoking behavior of peers have a significant association with e-cigarette use among junior high school students in grades 1-3 in Yogyakarta City. The multivariate analysis model showed that the smoking behavior of family members and peers was the strongest factor in predicting e-cigarette use. Recommendation. Health Promotion throuhgt intensive health education about the dangers of e-cigarettes and how to avoid them is needed, as implementing restrictions on access to e-cigarettes around schools with strict regulations and policies, and involving family and peers in fostering healthy behavior and socializing the risks of e-cigarettes.

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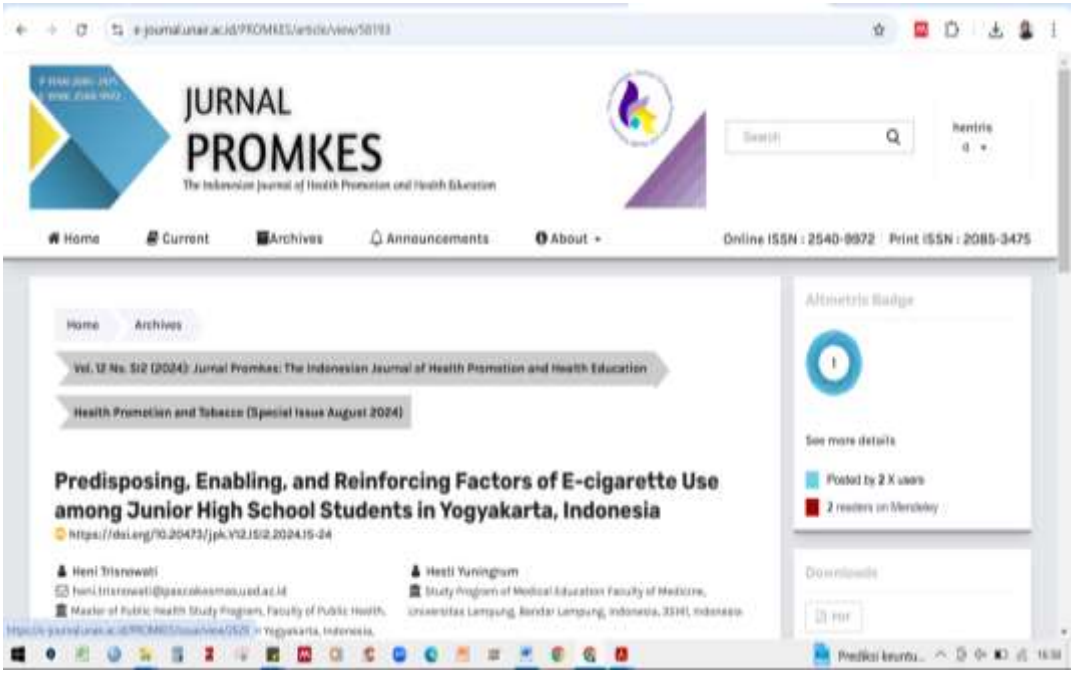

Predisposing, Enabling, and Reinforcing Factors of E-cigarette Use among Junior High School Students in Yogyakarta, Indonesia

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ABSTRACT

***Background**: The number of e-cigarette users has increased tenfold over the past ten years. The prevalence of e-cigarette use continues to increase, especially among students. **Objective**: This study aims to identify factors that encourage the use of e-cigarettes among junior high school students in Yogyakarta City. **Methods**: This study used a cross-sectional survey approach with a sample size of 582 taken using a proportional stratified random sampling technique. Data were collected through a structured questionnaire, including respondent characteristics (gender, and age) as well as predisposing, enabling, and reinforcing factors for e-cigarette use. Data were analyzed using a chi-square test for bivariate analysis and a logistic regression test for multivariate analysis. **Results**: The results showed that knowledge (RP=4.06, CI 95%=1.60-10.3, p<0.05), affordability (RP=2.46, CI 95%=1.37-4.39, p<0.05), family members smoking (RP=3.14, CI 95%=1.62-6.09, p<0.05), peers smoking (RP=8.14, CI 95%=3.92-16.9, p<0.05) were associated with the use of e-cigarettes in students. Meanwhile, the availability of cigarettes is not significant with the use of e-cigarettes in students (RP=1.98, CI 95%=0.96-4.09, p>0.05). The results of multivariate analysis showed that the most influential factor in the use of e-cigarettes was peer smoking behavior. **Conclusion**: There is a relationship between knowledge, affordability, smoking family members, and smoking peers with the use of e-cigarettes in students. Health promotion programs on the dangers of e-cigarette use and how to avoid them should be implemented, as well as restrictions on access to e-cigarettes through the implementation of smoke-free areas in schools.*

***Keywords**: E-cigarette use, Junior high school students, Predictors.*