

Exposure to Electronic Cigarette Advertisements on the Internet and Smoking Behavior in Adolescents

Diah Wijayanti Sutha^{1*}, Nathratul Ayes Shah Binti Zulkifli², Christine³, Eka Wilda Faida¹,
Serlly Frida Drastyana¹, Siti Novianti⁴

¹STIKES Yayasan RS Dr. Soetomo

²Faculty of Medicine and Health Science, Universiti Sains Islam

³Poltekkes Kemenkes Palu

⁴Faculty of Health Science, Study Program of Public Health, Universitas Siliwangi

ABSTRACT

Background: E-cigarettes are increasingly popular among adolescents, driven by massive advertising on the internet, especially through social media. These advertisements often display modern and attractive images without including sufficient information about health risks. Social media influencers also play a role in strengthening the appeal of e-cigarettes to adolescents. The purpose of this study is to analyze the relationship between exposure to e-cigarette advertising on the internet and smoking behavior among adolescents in Indonesia.

Method: This study used a cross-sectional design with an online survey conducted over three months, from March to June 2024. A total of 625 adolescents aged 14–19 years participated in this study. Respondents reported exposure to e-cigarette advertising on the internet, which was analyzed by age, gender, social media used, and smoking status. Data were analyzed using logistic regression to see the relationship between advertising exposure and smoking behavior.

Result The results showed that adolescents who were more frequently exposed to e-cigarette advertising were 2.3 times more likely to try e-cigarettes than those who rarely saw these advertisements. Instagram and YouTube were the main platforms where adolescents were exposed to e-cigarette advertisements. In addition, 50% of respondents reported seeing influencers using e-cigarettes, and 40.2% of them were interested in trying them. Most e-cigarette advertisements were also found not to include clear health warnings. This study confirms that exposure to e-cigarette advertisements on social media plays a significant role in increasing smoking interest and behavior in adolescents. Therefore, stricter regulations are needed for e-cigarette marketing on the internet, including supervision of the role of influencers and the obligation to include health warnings in every advertisement. In addition, broader health education is needed to increase adolescent awareness of the risks of e-cigarettes.

*Correspondence

diahwsutha@gmail.com

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INTRODUCTION

The development of digital technology has driven significant changes in the marketing strategies of various products, including electronic cigarettes. Electronic cigarette advertisements are increasingly massive on various digital platforms, such as social media, websites, and streaming services, which allow information about these products to be easily accessed by the public, including the teenagers. This aggressive marketing often presents electronic cigarettes as a safer alternative to conventional cigarettes, although various studies have shown that these products pose health risks that cannot be ignored. (1,2) The use of vapes or e-cigarettes among Indonesian teenagers has increased significantly in recent years. Data from the Ministry of Health of the Republic of

Indonesia (2020) shows that the prevalence of vaping among teenagers aged 15–19 years increased from 1.2% in 2016 to 10.9% in 2020. (3) Based on age group, the highest prevalence was among those aged 10–14 years old (10.6%) and 15–19 years old (10.5%). (4) These findings indicate the urgency of public health measures targeting youth exposure.

Electronic cigarettes come in various forms, such as pod systems, mods, disposable vapes, and pen-style vapes, with a variety of flavors that appeal to users. Among teenagers, these products are increasingly popular because they are considered more modern, practical, and have a more acceptable aroma compared to traditional tobacco cigarettes. (5,6) Studies show that the trend of e-

cigarette use among teenagers has increased significantly in recent years, especially in countries with loose

Increased exposure to e-cigarette advertising raises concerns about the potential for increased prevalence of use among adolescents, increasing the risk of nicotine dependence at an early age. As a generation that is highly connected to the digital world, adolescents tend to be influenced by the content they see on social media. Platform algorithms also play a role in expanding the reach of e-cigarette advertising by recommending similar content based on user interests. This creates an environment where e-cigarettes have become normalized and even considered the new norm in adolescent relationships. In Indonesia, regulation on marketing and sale of e-cigarettes is still relatively weak compared to other countries such as Australia or Singapore, which have strict bans on promotion and distribution. In contrast, in Indonesia, e-cigarette advertisements continue to circulate freely on social media platforms without clear enforcement mechanisms.(9,10) According to data from the Indonesian Ministry of Health (2023), over 30% of adolescent internet users reported seeing e-cigarette advertisements in the past three months, and 15% expressed interest in trying them after viewing such content.(11)

In recent years, social media has become one of the most effective marketing tools for the e-cigarette industry.(12,13) Many influencers on platforms such as Instagram, TikTok, and YouTube openly use and promote e-cigarettes to their millions of followers. With their laid-back style and eye-catching visuals, these influencers often portray e-cigarettes as part of a modern, cool, and trendy lifestyle.(12,14,15) This further strengthens the appeal of the product, especially among teenagers who are the main consumers of social media.

E-cigarette advertising on the internet, especially through social media and digital platforms, plays a significant role in attracting the attention of teenagers. Unlike conventional cigarettes, e-cigarettes are often promoted as a safer and more modern alternative, with a variety of flavors that appeal to the younger generation. However, various studies have shown that exposure to e-cigarette advertising can increase the likelihood of teenagers trying and continuing to use these products. Several studies have also shown that exposure to e-cigarette advertising and promotions on social media is correlated with increased rates of use of these products among adolescents.(16,17) In addition, the lack of strict regulation of e-cigarette promotional content on social media allows the information conveyed to highlight its benefits or appeal more, without showing the accompanying health risks. Therefore, a stricter

regulations regarding the distribution and promotion of these products.(7,8)

monitoring and regulation strategy is needed for this marketing practice to prevent an increase in the prevalence of e-cigarette use, especially among young age groups. Research also suggests that exposure to e-cigarette advertising in digital media can influence adolescents psychologically. A study by WHO (2021) found that adolescents exposed to such advertisements are 1.9 times more likely to try e-cigarettes compared to those who are not. This exposure shapes their risk perceptions, often underestimating the potential harms due to the persuasive nature of the advertisements.(18)

The massive advertising of e-cigarettes on various digital platforms and the increasing trend of their use among teenagers has created an urgency to conduct comprehensive research on this phenomenon. This research is important to understand how the distribution of e-cigarette advertising on the internet affects adolescent smoking behavior, as well as factors that contribute to the increasing use of e-cigarettes in this age group.

This study examined the distribution patterns of e-cigarette advertisements on various social media, such as X (formerly Twitter), Instagram, Facebook, and YouTube, which have a significant number of adolescent users. In addition, this study analyzed how exposure to these advertisements could influence adolescents' perceptions and decisions to try or use e-cigarettes regularly. Theories such as social learning theory (SLT) and the health belief model (HBM) are useful frameworks to understand adolescent smoking behavior. SLT posits that individuals, especially youth, learn behaviors by observing and imitating influential models, such as celebrities or social media influencers. Meanwhile, HBM explains that health behavior is influenced by perceived susceptibility, severity, benefits, and barriers.(19–21) These theories help explain why adolescents may choose to engage in e-cigarette use despite known risks.

To reach more respondents and obtain broader data, an online survey method was used. The survey was conducted through social media and other online platforms that were often used by teenagers. This approach allowed the collection of data from a wider range of backgrounds and regions, thus providing a more accurate picture of the relationship between exposure to e-cigarette advertising and smoking behavior in teenagers. The results of this study are expected to provide a basis for policy makers and stakeholders in designing stricter regulations on the marketing of e-cigarettes on social media and increasing education about the health risks of this product for adolescents. Therefore, the purpose of this study is to

analyze the relationship between exposure to e-cigarette advertising on the internet and smoking behavior among adolescents in Indonesia, as well as to identify which social media platforms are most frequently used to display such advertisements.

METHOD

This study employed a cross-sectional design utilizing an online survey to examine the association between exposure to e-cigarette advertising on the internet and smoking behavior among adolescents. The research was conducted over a three-month period, from March to June 2024, with data collected through a digital questionnaire. The online nature of the study enabled the recruitment of adolescent respondents from various regions across Indonesia. Because the questionnaire was disseminated widely via social media platforms, the geographical scope of the study was national.

The questionnaire was developed based on previous validated instruments and adapted to the context of Indonesian adolescents. The content validity of the questionnaire was assessed by a panel of three public health experts, who evaluated the relevance, clarity, and completeness of each item. The results showed that all items had a content validity index (CVI) of above 0.80. To test the reliability of the questionnaire, a pilot study involving 30 adolescents was conducted. The internal consistency reliability was assessed using Cronbach's alpha, and the overall score was 0.86, indicating high reliability.

Data collection was conducted using a digital questionnaire distributed via Google Forms. The link to the survey was shared through popular social media platforms such as Instagram, WhatsApp, and Facebook, targeting adolescent user groups. A pilot test of the questionnaire was performed to identify technical issues and ensure question clarity. During the data collection period, we monitored response rates and conducted periodic checks to prevent duplicate responses and ensure data completeness. The population in this study were teenagers aged 14-19 years who actively used social media. The research sample consisted of 625 respondents selected using purposive sampling techniques, with the following inclusion criteria:

1. Aged 14-19 years at the time of the study
2. Had an active account on social media including X, Instagram, Facebook, TikTok, or YouTube
3. Willing to complete the research questionnaire
4. Willing to be a respondent

Data collection was conducted using a digital questionnaire containing structured questions related to

respondent characteristics, exposure to e-cigarette advertising, and adolescent smoking status. In this study, the variables measured included the level of respondent exposure to e-cigarette advertisements on the internet, which was assessed based on the frequency of respondents seeing the advertisements, the type of social media platform used, and the extent to which respondents were exposed to promotions from influencers who used or recommended e-cigarette products. In addition, smoking behavior in adolescents was measured through the status of e-cigarette use, namely whether or not respondents used it. Respondents' demographic characteristics, such as age, gender, and the type of social media most frequently used, were also collected to provide context in data analysis and to enrich the interpretation of research results.

The data obtained was analyzed using descriptive and inferential statistics. Descriptive analysis was used to see the distribution of respondent characteristics, exposure to e-cigarette advertising, and the prevalence of e-cigarette use among adolescents. The chi-square test was used to see the relationship between exposure to e-cigarette advertising and adolescent smoking status, as well as the influence of age, gender, and social media used. All statistical analyses were conducted using SPSS version 25. This study obtained ethics approval from the Ethics Committee of STIKES Yayasan RS Dr. Soetomo (number KEPK/YRSDS/001b/II/2024). All respondents were given an informed consent form to sign before filling out the questionnaire. The data collected was kept confidential and used only for the purposes of this study. The results of this study are expected to provide insight into the impact of e-cigarette advertising on the internet on adolescent smoking behavior and to become the basis for policies to control e-cigarette advertising on social media.

RESULT AND DISCUSSION

This study identified exposure to e-cigarette advertising on social media and its relationship to smoking behavior in adolescents. The respondents were 625 adolescents aged 14–19 years, who reported the frequency of exposure to advertising, the social media platform where they saw the advertisement, and their smoking status. In addition, this study also examined the influence of influencers in promoting e-cigarettes.

Table 1 shows that 60.0% of respondents were often exposed to e-cigarette advertisements, while 28.8% rarely saw them, and only 11.2% had never seen them. Instagram (32.3%) and YouTube (23.5%) were the main platforms where teenagers saw e-cigarette advertisements. In addition to advertising exposure, social media influencers also play a role in e-cigarette exposure, with

49.9% of respondents reporting seeing influencers using the product. Of those who did, 40.2% were interested in trying e-cigarettes, confirming that influencer promotion can increase adolescent interest in e-cigarettes.

Tabel 1. Respondents' characteristics based on exposure to e-cigarette advertising and smoking status

Category	f	%
Age		
14-16	245	39.2
16-17	380	60.8
Sex		
Male	312	49.9
Female	313	50.1
Most frequently used social media		
Instagram	260	41.6
YouTube	215	34.4
TikTok	78	12.5
X	60	9.6
Facebook	12	1.9
Exposure to electronic cigarette advertising		
Often	375	60.0
Seldom	180	28.8
Never	70	11.2
Social media where advertising was displayed		
Instagram	202	32.3
YouTube	147	23.5
TikTok	112	17.9
X	124	19.8
Facebook	40	6.4
Seeing influencers using e-cigarettes		
Ever	312	49.9
Never	313	50.1
Interested in trying after seeing influencers vaping		
Yes	251	40.2
No	374	59.8
Clarity of health warnings in advertising		
Clear	239	38.2
Unclear or not available	386	61.8
History of electronic cigarette use		
Ever used	289	46.2
Never used	336	53.8
Main reasons for using e-cigarettes		
Curious	142	49.1
Influence of friends	85	29.4
Attractive taste and aroma	42	14.5
Influenced by advertising	20	6.9

The majority of respondents (61.8%) also stated that health warnings in e-cigarette advertisements were

unclear or non-existent, which could lead to low awareness among teenagers of the health risks they pose. Nearly half of respondents (46.2%) admitted to having tried e-cigarettes, while 53.8% had never tried them. These results indicate a correlation between exposure to advertisements and the tendency of teenagers to try e-cigarettes.

From the results of the study, the majority of respondents were aged 17–19 years (60.8%), with an almost balanced gender distribution between males (49.9%) and females (50.1%). Instagram (41.6%) and YouTube (34.4%) were the social media platforms most frequently used by respondents, while Facebook and X had a lower percentage of users. In addition, respondents reported frequent exposure to e-cigarette advertisements, primarily on Instagram (32.3%) and YouTube (23.5%).

The percentage of adolescents admitted to having tried e-cigarettes was 46.2%, and their main reason was curiosity (49.1%), followed by peer influence (29.4%). A small number stated that they were interested because of the taste and aroma of e-cigarettes (14.5%) or because of the influence of the advertisements (6.9%). To test the relationship between exposure to e-cigarette advertising and smoking status, a chi-square test was conducted. The results of the analysis are presented in Table 2.

Table 2. Analysis of the relationship between exposure to e-cigarette advertising and smoking status

Exposure to electronic cigarette advertising	Smoking status				χ^2	p- value
	Ever smoked		Never smoked			
	f	%	f	%		
Often	210	56.0	165	44.0	18.21	0.002
Seldom	65	36.1	115	63.9		
Never	14	20.0	56	80.0		

The results of the analysis showed that there was a significant relationship between exposure to e-cigarette advertising and smoking status in adolescents ($\chi^2 = 18.21$, $p < 0.05$). Specifically, adolescents who were frequently exposed to the advertising were more likely to try e-cigarettes (56.0%) compared to those who were rarely (36.1%) or never exposed to the advertising (20.0%). This relationship was significant ($p < 0.05$), indicating that advertising exposure may influence adolescents' decision to try e-cigarettes.

In addition to the relationship between advertising exposure and smoking status, there were several additional interesting findings from this study.

1. Social Media Influencers as a Driving Factor

Almost half of the respondents (49.9%) admitted to having seen influencers using e-cigarettes, and 40.2%

of them felt interested in trying them after seeing them. This shows that promotions by influencers have a significant impact on teenagers' decisions to try e-cigarettes.

2. Health Warnings in Advertisements

Of all respondents, 61.8% stated that health warnings in e-cigarette advertisements were unclear or non-existent, which could result in a decreased awareness of the dangers of this product.

3. Influence of Friends and Taste or Aroma as Motivating Factors

Apart from advertising, the influence of friends (29.4%) and attractive tastes and aromas (14.5%) were also major factors in teenagers' decisions to try e-cigarettes.

The results of this study indicate that exposure to e-cigarette advertisements on the internet has a significant relationship with smoking behavior in adolescents. Most respondents admitted to often seeing e-cigarette advertisements, especially on social media platforms such as Instagram and YouTube. This finding is in line with the findings of previous studies showing that e-cigarette marketing on digital media has become the industry's main strategy to attract the attention of the younger generation.(7,12,13)

The study found that adolescents who were more frequently exposed to e-cigarette advertisements were 2.3 times more likely to try e-cigarettes than those who rarely saw the advertisements. This finding is consistent with that of Hammond's study which states that e-cigarette advertisements can increase interest in trying this product, especially because advertisements often display modern, trendy, and low-risk health images.(7) In addition, Chaffee's research shows that exposure to e-cigarette advertisements can strengthen the perception that these products are safer than conventional cigarettes despite ongoing debate about scientific evidence regarding their impact on health.(5)



Figure 1. Cigarette advertising on the internet

Figure 1 shows various forms of cigarette advertisements circulating online through social media and websites. We found that a cigarette marketing strategy was

packaged in an attractive, creative way, and had a tendency to target young age groups, including teenagers. The use of striking visuals, slogans such as "Let's Do It!", and a collaboration with influencers and public figures in advertising content indicate that cigarette manufacturers are actively utilizing digital platforms to create a positive image of their products. These advertisements also appeared to utilize narratives that promoted a healthy lifestyle or moral messages, such as the call to "Wash Your Hands", but they still displayed logos and images of cigarette products explicitly. This kind of strategy has the potential to obscure adolescents' perceptions of the health risks posed by tobacco products, especially when health hazard warning information is placed in a small or inconspicuous manner. This exposure can shape adolescents' perceptions that the use of e-cigarettes is part of a modern and safe lifestyle, despite their significant health risks. Therefore, regulations on cigarette advertisements on the internet need to be tightened, especially to protect young people from the influence of manipulative digital marketing.

Based on the social learning theory (22), individuals, especially adolescents, learn through observation and the models they see in their social environment. In the context of this study, influencers and advertisements on social media act as models that introduce and normalize the use of e-cigarettes among adolescents. This finding is also supported by the study of Liu et al., which found that adolescents who frequently see e-cigarette-related content on social media are more likely to have a positive attitude towards the product and are willing to try it.(23)

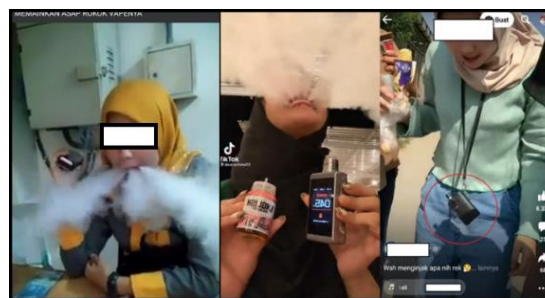


Figure 2. E-cigarette smoking activities of teenagers on social media

The results of this study showed that Instagram and YouTube were the main platforms where teenagers saw e-cigarette advertisements. This finding is in accordance with that of a study by the Pew Research Center, which revealed that these platforms are the most widely used social media by teenagers (24), thus becoming the main target for the e-cigarette industry to spread their

marketing strategies. In addition, research by Mira-Aladren revealed that social media has a major role in shaping the attitudes and consumption decisions of adolescents, including in terms of the use of e-cigarettes.(25,26)

The findings of this study also revealed that almost 50% of respondents had seen influencers or celebrities using e-cigarettes on social media, and 40.2% were interested in trying them. These findings support the cultivation theory, which states that continuous exposure to content in the media can shape a person's perception and behaviour.(27) In this context, exposure to influencers using e-cigarettes may create normalization of the product among adolescents, increasing their likelihood of trying it. Figure 2 and Figure 3 illustrate the activities of teenagers, influencers or celebrities using e-cigarettes on various digital media. They display a visual representation of how e-cigarette behavior is not only carried out in real life, but also disseminated through social media platforms such as Instagram, TikTok, or YouTube. This indicates the normalization of vaping behavior among teenagers who are active in the digital world.



Figure 3. Smoking activities by influencers on social media

The results of this study also showed that 61.8% of respondents stated that e-cigarette advertisements rarely or did not clearly include health hazard warnings. This finding is in line with that of the study by Kalaji, which found that many e-cigarette advertisements focus on aesthetic aspects, flavor variants, and ease of use, while information related to health risks is often ignored or poorly communicated.(28) This might be driven by the perception that e-cigarettes are safer than conventional cigarettes. Many individuals, especially young people, believe that the main dangers associated with tobacco consumption come from the combustion process that occurs in conventional cigarettes, leading them to conclude that using e-cigarettes does not pose similar health risks.(23,26) Figure 4 illustrates examples of disinformation about e-cigarettes that are widely circulated on social media. The messages shown in the image, such as “guaranteed to quit smoking in 7 days” or “doesn't bother others because it has no smell,” represent misleading claims that are not accompanied by adequate explanations of the associated health risks. Such

disinformation is highly dangerous, as it promotes the perception that e-cigarettes are a safe and even healthy alternative to conventional cigarettes.



Image translation one: The desire to quit smoking is a major motivation to switch to alternative tobacco products such as e-cigarettes and heated tobacco. After switching, smokers feel healthier (e.g., less coughing) and are no longer bothered by the smell of smoke, making social interactions more comfortable. Additionally, these products are claimed to effectively help users quit smoking within 7 days, with a money-back guarantee if unsuccessful.

Figure 4. Disinformation about e-cigarettes on social media

However, this assumption is contrary to growing scientific evidence. Various studies have shown that e-cigarettes still contain harmful substances, including nicotine, heavy metals, and other chemical compounds that can have negative impacts on health. Exposure to nicotine in adolescents, for example, can interfere with brain development, increase the risk of addiction, and contribute to various health problems, such as cardiovascular and respiratory disorders. In addition, the use of e-cigarettes has also been associated with e-cigarette or vaping use-associated lung injury (EVALI) (29,30), which is a serious condition of lung inflammation due to inhalation of dangerous chemicals contained in vape fluid.

In fact, based on the health belief model (HBM) (31), individuals tend to avoid a health risk if they have sufficient understanding of its dangers. Thus, the lack of information about health risks in e-cigarette advertisements can cause teenagers to have the wrong perception, making them more easily encouraged to try and use this product in the long term.

The results of this study provide important implications for policies to control e-cigarette advertising on the internet. Several countries, such as the United States and the United Kingdom, have begun to implement strict regulations on the marketing of e-cigarettes, including a ban on advertising targeting teenagers and the requirement to include health warnings in every product promotion.(32,33) However, in many developing countries, because regulations regarding the marketing of

e-cigarettes are still weak, advertisements for these products easily target teenagers through various digital platforms.(34,35)

While the relationship between advertising exposure and adolescent smoking behavior was statistically significant, it is important to note that this relationship may be moderated or confounded by other factors. Several studies have indicated that family environment, socioeconomic status, and peer group habits can significantly influence adolescent smoking behavior. Adolescents from families where smoking is common are more likely to perceive smoking as a normative behaviour.(36) Similarly, lower socioeconomic status has been associated with higher susceptibility to tobacco advertising and higher smoking initiation rates.(37) Peer influence, especially from close friends who smoke, is another well-documented factor that can amplify the effect of advertising on behaviour.(38,39) Although not directly measured in this study, these contextual variables should be considered in future research.

This study confirms the need for stronger policy interventions to reduce adolescent exposure to e-cigarette advertising. Some steps that can be taken include increasing regulation of e-cigarette advertising on social media, including a ban on promotions targeting adolescents, requiring health warnings to be included in every e-cigarette advertisement. As is the case with conventional cigarettes, increasing health education about the dangers of e-cigarettes for adolescents through digital campaigns and school programs is necessary. It is also important to strengthen the supervision of the role of influencers in promoting e-cigarette products to prevent them from indirectly becoming marketing agents for the e-cigarette industry. The results of this study are relevant to the regulatory situation in Indonesia, where supervision of e-cigarette advertising remains weak. Unlike countries such as Australia and Singapore that have banned advertising of this product on digital media, Indonesia currently lacks strict regulations to limit exposure to e-cigarette advertising to teenagers. Therefore, this finding highlights the urgency of updating national policies in controlling e-cigarette promotion, including the involvement of the Ministry of Health, Ministry of Communication and Information, and the National Agency of Drug and Food Control of Indonesia (BPOM) to conduct integrated monitoring on social media.

This study has several limitations that should be acknowledged. First, the use of self-reported data may introduce response bias, as some respondents may underreport or overreport their smoking behavior or advertising exposure. Second, the cross-sectional design

limits the ability to establish causality between exposure and smoking behavior. Third, the purposive sampling via online distribution may not be fully representative of the general adolescent population in Indonesia, particularly those without internet access. Lastly, other influencing factors such as family smoking history, socioeconomic background, and peer smoking behavior were not included in the model, which may confound the observed relationships.

CONCLUSION

The results of this study indicate that exposure to e-cigarette advertisements on social media has a significant relationship with smoking behavior in adolescents. Adolescents who are frequently exposed to advertisements are more likely to try e-cigarettes compared to those who are rarely or never exposed. In addition, social media influencers play a major role in increasing the appeal of e-cigarettes among adolescents. Strict policies on e-cigarette advertising on social media and more intensive education for teenagers about the negative impacts of e-cigarette use are needed. In addition, regulations governing the marketing of these products, including clarity of health warnings in advertisements, must be strengthened to protect teenagers from the health risks they pose. Future research should include a broader range of influencing variables such as parental smoking status, peer pressure, and socioeconomic background to provide a more comprehensive understanding of adolescent smoking behavior. Longitudinal studies are also recommended to explore the causal relationship between exposure to advertising and long-term smoking habits. Moreover, qualitative studies can provide deeper insight into how adolescents interpret and respond to e-cigarette advertising and influencer promotions.

Conflict of Interest

No potential conflicts of interest relevant to this article were reported

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