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Original research

Determinants of Electronic Smoking Behavior among Adolescents in Indonesia (Analysis of Global Youth Tobacco Survey 2019)

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Abstract

Background: E-cigarettes are a concerning issue since e-smoking has affected young people. This phenomenon will be influenced by how common e-cigarette use is among youth. Nevertheless, health experts have found that e-cigarettes have negative effects on health.
Objectives: The purpose of this study was to determine factors connected with electronic smoking habits among adolescents in Indonesia.
Methods: The 2019 Global Youth Tobacco Survey was used in this cross-sectional study employing a multistage cluster random sampling approach. A total of 7,758 samples were taken after selection based on inclusion criteria.
Results: According to this study, 21% of adolescents had tried e-cigarettes. Furthermore, multiple logistic regression analyses revealed that sex (POR: 5.834, 95% CI: 4.749—7.167), allowance (POR: 2.432, 95% CI: 1.874—3.157), obtaining e-cigarette information from friends, shopkeepers, and promotion events (POR: 2.422, 95% CI: 1.959—2.994), and knowledge and attitude (POR: 2.030, 95% CI: 1.683—2.449) were the most influential factors on electronic smoking habits among adolescents in Indonesia.
Conclusion: The results indicated that sex, allowance, access to information on e-cigarettes, and the knowledge and attitudes of adolescents strongly influence the likelihood of trying e-cigarettes. Strict policies regarding the use of e-cigarettes among adolescents need to be enforced, especially in regulating advertising and pricing to make them less affordable for adolescents.

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Background

Electronic cigarettes were first introduced by Hon Lik in China around 2003-2004, Since 2008, their sales have increased fourteen-fold. One of its consumers is adolescents (Endang et al., 2017; Qasim, Karim, Rivera, Khasawneh, & Alshbool, 2017). The sales of e-cigarettes continue to rise, albeit at a slower pace. It is advertised via the internet, television, and printed ads (Grana, Benowitz, & Glantz, 2014). Studies indicate that e-cigarettes often contain nicotine, flavoring chemicals, vegetable glycerin, and propylene glycol (Baldassarri, 2020; Ebersole et al., 2020; Etzel et al., 2015). People who smoke can have a nicotine addiction. At low doses, nicotine has an impact on

respiratory tract disorders. At large doses, it clogs blood circulation, which results in various diseases, such as heart attacks and strokes, that can lead to death (Rochka, Anwar, & Rahmadani, 2019). WHO has provided policy options to limit the widespread use of e-cigarettes including in products marketing (WHO, 2016). Indonesian Medical Association (IDI) and Indonesian National Agency of Drugs and Food Control (BPOM) have stated stated they strictly prohibits the use of e-cigarette (Bam et al., 2014; Ministry of Health Indonesia, 2023; Putra, Putra, Prayoga, & Astuti, 2018).

The present popularity of e-cigarette smoking in the Americas and Asia began to rise and then remained rather stable. Prevalence of e-cigarette users in the continent of America (10%), Europe (14%), Asia (11%), and Oceania (6%) (Tehrani, Rajabi, Ghelichi- Ghojogh, Nejatian, & Jafari, 2022). The prevalence of adolescent electronic smokers in Indonesia has also increased, from 2% in 2016 to 2.7% in 2018. In 2018, the proportions of electronic cigarette users by age were reported to be 10.6% (10-14 years), 10.5% (15-19 years), and 7%. (20-24 years) (National Health Research and Development, 2018). This trend started as e-cigarettes were promoted as a smoking cessation tool and had a lower risk of harm to health than conventional cigarettes. 59 retail websites for single-brand e-cigarettes in 2012 discovered that the most frequently stated claims were that the products were cheaper (93%), healthier (95%), and cleaner (95%) than traditional cigarettes (Grana et al., 2014).

The rampant use of electronic cigarettes among young people is due to the statement that the product can be a solution or alternative to quitting smoking and offers a variety of flavours. Most respondents' reason for using electronic cigarettes is to stop smoking and various flavour or aroma variants that attract them. Tobacco-flavoured electronic cigarettes were less favourable than alternative flavours such as fruit, chocolate, and mint (Clarke & Lusher, 2017; Lorensia, Yudiarso, & Herwansyah, 2017). However, health experts denied this and revealed that electronic cigarettes harm health and are not a solution to quitting smoking. Nicotine and other substances can interfere with the human brain's performance, especially in adolescence, because the brain is still developing at that age. This brain disorder causes addiction and triggers people to try other types of cigarettes (U.S. Department of Health and Human Services, 2023).

Several research on e-cigarettes have been conducted in Indonesia. The results showed that positive perception, social influence, and affordable price are the reasons why adolescents used e-cigarettes (Bigwanto, Nurmansyah, Orlan, Farradika, & Purnama, 2022; Cleopatra, Fitriangga, & Fahdi, 2018; Istiqomah, Cahyo, & Indraswari, 2016). Indeed, rather than seeking a way to quit smoking conventional cigarettes, most e-cigarette users combine the two. One further indication is that dual users of electronic cigarettes and other tobacco products had a 28% lower chance of stopping smoking than those who did not use e-cigarettes (Kalkhoran & Glantz, 2016).

One of the surveys on the consumption of tobacco products conducted in Indonesia is the Global Youth Tobacco Survey (GYTS), which was implemented in 2003, and the latest survey was conducted in 2019. The main result of GYTS Indonesia 2019 was the prevalence of students who know e-cigarettes from friends and the Internet is 41.5% and 15.7% . They can buy e-cigarettes from someone, online shop, offline shop (7.8%, 2%, 1.7% respectively). The purpose of this survey was to learn more about the factors of e-cigarette smoking behavior among Indonesian adolescents in 2019 based on this survey.

Method

Study design

This study used was observational study, a cross-sectional design. The choice of a cross-sectional study design was based on data from the secondary Global Youth Tobacco Survey (GYTS), whose data was collected simultaneously between the dependent and independent variables.

Setting

The samples were collected in 34 provinces in Indonesia in 2019. Nationwide representative school-based student survey.

Samples

This study analyzed data from the Ministry of Health of Indonesia. GYTS is supported by the World Health Organization and the US Centers for Disease Control and Prevention. Schools are chosen with a probability proportional to enrollment size in a two-stage sample design, as part of the global standardized technique used by GYTS. Each student in a chosen class is able to take part in the survey; the classes within the selected schools are picked at random. The population included all students aged 13-17 years, from grades 7-12. The survey was conducted in 75 junior high schools and 75 senior high schools across 34 provinces using a multistage cluster random sampling technique. The total sample was 9.992 eligible students. The response rate was 91% overall. The dropout criterion was that all respondents did not complete the questionnaire. Therefore, 7.758 samples were obtained after data cleaning.

Instrument

To monitor and track important tobacco control indicators, the survey employs a standard core questionnaire with a set of optional questions that individual nations can customize. The following subjects are included in the questionnaire: tobacco use (smoking and non-smoking), quitting, secondhand smoke (SHS), media and advertising that support and oppose tobacco use, accessibility to and availability of tobacco products, and attitudes and knowledge about tobacco use. The survey is self-administered and anonymous to maintain confidentiality. It is created using scannable paper-based bubble sheets.

Anonymous questionnaires were completed for every selected adolescent. It consisted of 76 multiple-choice questions. The dependent variable was students' electronic smoking behavior based on questionnaire question number 19, "*How old were you when you first tried e-cigarettes*?", One of the possible responses was, 1) "I have never tried an e-cigarette."; 2) 7 years old or younger; 3) 8 or 9 years old; 4) 10 or 11 years old; 5) 12 or 13 years old; 6) 14 or 15 years old; 7) 16 years old or older.

Respondents who answered zero days were categorized as non-e-cigarette smokers, and respondents who answered ≥1 day were categorized as e-cigarette smokers. The independent variables were age (questionnaire question No. 1), sex (questionnaire question No. 2), education level (questionnaire question No. 3), allowance (questionnaire question No. 4), second-hand smoke at home, public places, and school (questionnaire questions No. 33, 34, 35, 36), knowledge and attitudes about cigarettes (questionnaire questions No. 18, 24, 38, 39, 40, 48, 64,71-76), access to e-cigarettes (questionnaire question No. 20), advertisements (questionnaire questions No. 22, 50, 51, 54, 68), smoking status of teachers and parents (questionnaire questions No. 37, 69), and seller attitudes (questionnaire question No. 42). Each knowledge and attitude question was categorized as zero (0) or one (1), where students who indicated a risky smoking attitude received a lower score and vice versa. Finally, the respondents' scores were summed into a total score and, based on the mean, categorized into positive attitudes (≥9.8) and negative attitudes (<9.8).

Statistical analysis

The quantitative data analysis with IBM SPSS Statistics *version* 25 consists of descriptive analysis, bivariate analysis (Chi-Square and Simple Logistic Regression), and Multiple Logistic Regression to determine the factors affecting the dependent variable using the backward method. A level of $p<0,05$ was considered to indicate statistical significance.

Data collection

Data collected by National Health Research and Development (NHRD), Ministry of Health of Indonesia in 2019. All interviewers for the GYTS 2019 received training to understand every aspect of the survey, including its methodology and questionnaire content.

Ethical considerations

Ethical approval was obtained from the ethics committee of Universitas Pembangunan Nasional Veteran Jakarta number 113/V/2022/KEPK. The GYTS has a standardized core questionnaire, sample design, and data collection technique.

Results

The Global Youth Tobacco Survey sample in 2019 included 9.992 participants: 3.431 from the Java region, 3.550 from the Sumatra region, and 3.011 from other regions. A total of 7.758 participants from 34 provinces of Indonesia were included in the study, and 2.234 respondents were excluded. The proportion of adolescents in Indonesia in 2019 who smoked electronics was 21%. The majority of respondents were women (56%), aged 13-15 years (51%), and had completed junior high school (60%) (Table 1).

Table 1 Characteristics of the respondents

Variables	Percentage (%)	Frequency (n= 7.758)
E-smoking status		
Ever	21	1.625
Never	79	6.133
Sex		
Female	56	4.346
Male	44	3.412
Age (years)		
<13	17	1.335
13-15	51	3.982
>15	32	2.441
Education level		
Junior High School	60	4.631
Senior High School	40	3.127

Table 2 Descriptive analysis of knowledge and attitudes (n= 7.758)

Instrument	Frequency (n)	Percentage (%)
Ever heard of e-cigarette		
Yes	5.310	68
No	2.448	32
Want to use e-cigarette if offered by close friend		
No	6.531	84
Yes	1.227	16
Thought smoke from other people's cigarette is harmful		
Yes	411	6
No	7.347	94
Favor in banning smoking inside enclosed public places		
Yes	6.861	89
No	897	11
Favor in banning smoking at outdoor public places		
Yes	6.218	80
No	1.540	20
Thought the cigarette's price should be increased		
Yes	4.930	63
No	2.828	37
Thought of cigarette advertising should be banned		
Yes	5.121	66
No	2.637	34
Will consume cigarette in any form during the next 12 months		
No	7.260	94
Yes	498	6
Thought it would be difficult to quit once has started smoking		
Yes	6.102	79
No	1.656	21
Thought of smoking helps people more comfortable		
No	4.325	56
Yes	3.433	44
Agree with "I think I might enjoy smoking a cigarette."		
Disagree	1.183	15
Agree	6.575	85
Smoking cigarette is harmful to health		
Yes	7.197	93
No	561	7
Thought it is safe to smoke tobacco for only a year or two		
No	5.642	73
Yes	2.116	27

Table 3 Bivariate and multivariate analysis results for e-smoking behavior (n= 7.758).

Variables	E-smoking status		Bivariate	Odd ratio	Multivariate	Odd ratio
	Ever (%)	**Never (%)**	**p-value**	**(95% CI, Lower-Upper)**	**p-value**	**(95% CI, Lower-Upper)**
Age (years)						
<13	231 (17.3)	1104 (82.7)		1	-	-
13-15	798 (20)	3184 (80)	0.029*	1.198 (1.019−1.408)		
>15	596 (24.4)	1845 (75.6)	0.000*	1.544 (1.304−1.829)		
Sex						
Female	269 (6.2)	4077 (93.8)		1		1
Male	1356 (39.7)	2056 (60.3)	0.000*	9.996 (8.680−11.511)	0.000*	5.834 (4.749-7.167)
Education level						
Junior high school	881 (19)	3750 (81)		1		1
Senior high school	774 (23.8)	2383 (76.2)	0.000*	1.329 (1.190-1.484)	0.000*	1.459 (1.216-1.750)
Allowance (IDR)						
<11,000	338 (16.1)	1761 (83.9)		1		1
11,000-50,000	853 (22.1)	3015 (77.9)	0.000*	1.474 (1.283−1.694)	0.000*	1.676 (1.338-2.100)
>50,000	434 (24.2)	1357 (75.8)	0.000*	1.666 (1.422−1.953)	0.000*	2.432 (1.874-3.157)
Access to e-cigarette						
Other	51 (78.5)	14 (21.5)		1		1
Haven't consumed e-cigarettes	659 (9.8)	6060 (90.2)	0.000*	0.030 (0.016−0.054)	0.000*	0.031 (0.014-0.068)
Buy at the store, shop, beside street, online shop, someone	915 (93.9)	59 (6.1)	0.000*	4.257 (2.228−8.133)	0.123	1.925 (0.838-4.423)
Knowledge and attitudes						
Good	521 (10.4)	4488 (89.6)		1		1
Less	1104 (40.2)	1645 (59.8)	0.000*	5.781 (5.135−6.509)	0.000*	2.030 (1.683-2.449)
Second-hand smoke						
At home						
No	456 (13.4)	2956 (86.6)		1		1
Yes	1169 (26.9)	3177 (73.1)	0.000*	2.385 (2.170−2.687)	0.016*	1.266 (1.045-1.534)
At public enclosed places						
No	289 (11,1)	2321 (88,9)		1		1
Yes	1336 (26)	3812 (74)	0.000*	2.815 (2.454−3.229)	0.009*	1.336 (1.075-1.661)
At public outdoor places						
No	313 (12,2)	2260 (87.8)		1	-	-
Yes	1312 (25.3)	3873 (74.7)	0.000*	2.446 (2.140−2.796)		
At school						
No	555 (16.3)	2860 (83.7)		1	-	-
Yes	1070 (24.6)	3273 (75.4)	0.000*	1.685 (1.503−1.888)		

Advertisement						
Finding out e-cigarette info						
On streets and shops, television, internet	332 (19.3)	1388 (80.7)		1		1
Never smoke e-cigarette	56 (2.1)	2616 (97.9)	0.000*	0.089 (0.067−0.120)	0.000*	0.178 (0.123-0.258)
From a friend, shopkeeper, promotion event	1237 (36.7)	2129 (63.3)	0.000*	2.429 (2.114−2.791)	0.000*	2.422 (1.959-2.994)
Saw or heard any anti-cigarette media messages						
Yes	1220 (20.2)	4822 (79.8)		1		1
No	405 (23.6)	1311 (76.4)	0.002*	1.221 (1.074−1.388)	0.020*	1.285 (1.040-1.589)
Saw or heard any anti-cigarette messages at any events						
Yes	553 (24.3)	1723 (75.7)		1	-	-
Didn't go to any events	605 (17.4)	2869 (82.6)	0.000*	0.657 (0.577−0.748)		
No	467 (23.3)	1541 (76.7)	0.425	0.944 (0.820−1.087)		
Got free cigarette products or discount						
No						
Yes	1405 (19.2)	5904 (80.8)		1		1
	220 (49)	229 (51)	0.000*	4.037 (3.325-4.901)	0.012*	1.503 (1.094-2.065)
Education on the dangers of cigarettes in school						
Yes	941 (20)	3762 (80)		1		1
Don't know	250 (20.8)	953 (79.2)	0.551	1.049 (0.897−1.226)	0.027*	1.329 (1.033-1.709)
No	434 (23.4)	1418 (76.6)	0.002*	1.224 (1.075−1.392)	0.287	1.297 (1.049-1.581)
Social environment factors						
Smoking Teachers						
No	437 (16.3)	2246 (83.7)		1	-	-
Don't know	236 (16.5)	1194 (83.5)	0.859	1.016 (0.854−1.208)		
Yes	952 (26.1)	2693 (73.9)	0.000*	1.817 (1.601−2.062)		
Smoking Parents						
No	819 (20)	3278 (80)		1	-	-
Don't know	82 (20.6)	317 (79.4)	0.789	1.035 (0.803−1.336)		
Yes	724 (22.2)	2538 (77.8)	0.021	1.142 (1.020−1.278)		
Seller refused to sell products						
Yes	274 (41.2)	391 (58.8)		1		1
Didn't try to buy cigarettes	781 (12.7)	5350 (87.3)	0.000*	0.208 (0.175−0.247)	0.113	0.793 (0.596-1.057)
No	570 (59.3)	392 (40.7)	0.000*	2.075 (1.697−2.537)	0.130	1.282 (0.930-1.767)

*p-value <0.05 indicates significance; Negelkerke R Square 0.678.

Age, sex, allowance, access to e-cigarettes, knowledge and attitudes, second-hand smoke, advertisements, and smoking teachers were associated with e-smoking behavior (Table 3). The significant variables ($p<0.05$) were included in the multiple logistic regression analysis. The final results showed that sex was the most influential factor on e-cigarette smoking behavior, male respondents were 5.834 times more likely to try e-cigarettes than women. In addition, respondents whose allowance for more than an IDR of 50.000 are at 2.432 times greater risk of using e-cigarettes than those who receive an allowance less than an IDR of 11.000. Furthermore, finding e-cigarette information from friends, shopkeepers, and promotions are the factors that have the 3rd largest probability after sex and allowance. Moreover, seller refusal to sell products was not a significant factor in e-cigarette smoking behavior (Table 3).

After multiple logistic regression analyses, the Negelkerke R Square (R^2) shows 0.678. In conclusion, electronic smoking behaviour in Indonesia in 2019 was determined by approximately 68% of those factors.

Discussion

In this cross-sectional study, we examined factors influencing Indonesian adolescents' electronic smoking behavior. According to our research, male adolescents were more likely than female adolescents to smoke electronic cigarettes. Additionally, our findings indicated that there was a greater risk of adolescent e-smoking behaviour among those with an allowance greater than 50.000, who received information from friends, shopkeepers, and promotional events, and lacked knowledge and attitudes.

Our findings show that 1.625 (21%) respondents had tried electronic cigarettes. This percentage is greater than Greece (12.3%), (Maldives (17.1%), Philippines (14.1%), and Malaysia (19.1%) (Soteriades et al., 2020; Tobacco & E-Cigarette Survey Among Malaysian Adolescents (TECMA), 2016; WHO, 2019b, 2019a). Since the introduction of e-cigarettes in 2004, the prevalence of this condition has increased substantially worldwide. E-cigarettes are aggressively advertised, primarily through the internet, as an aid to smoking cessation or reduction as less expensive and more ecologically and socially acceptable, and as a healthy alternative to conventional cigarettes (Rom, Pecorelli, Valacchi, & Reznick, 2014).

The dominant sex used for e-cigarette use was male (39.7%), which is in line with the other study that males used e-cigarettes more often. The results of Indonesia Basic Health Research 2018 showed that the proportion of e-cigarette smokers among males (2.8%) was more significant than that among females (2.7%) (Cleopatra et al., 2018; National Health Research and Development, 2018), this result reinforces that men will be more prone to using e-smoking. Research on students in Malaysia shows that the majority of e-cigarette users are male students. Smoking among female students is an unacceptable culture, so it can confirm the low number of females who use e-cigarettes in this study (Puteh et al., 2018). The greater use of cigarettes by males is due to the social perception of smoking, which is generally more tolerant of smoking by males than females (Erinoso et al., 2021). One of the reasons for the large number of smokers in the male sex is that cigarettes are considered a symbol of masculinity (Hadisuyatmana, Kukuh, Indarwati, & Efendi, 2020; Putra et al., 2018).

The second more significant factor influencing e-smoking behavior is allowances. The greater the allowance earned, the more excellent the opportunity to buy e-cigarettes. Another study shows a relationship between allowance and electronic smoking behavior in adolescents (Puspitawati & Widyanthini, 2021). Allowance will affect a person's lifestyle, including the purchase of cigarettes (Istiqomah et al., 2016). In contrast to conventional cigarettes, e-cigarettes tend to be more expensive and can reach hundreds of thousands of rupiah. E-liquid costs from IDR 50.000 to IDR 200.000. Initially, it was more expensive to buy all the components. This indicates that consumers of e-cigarettes and vapes will be required to make fewer purchases of traditional cigarettes. The e-liquid may be used several times over two weeks, and when the costs of conventional and electronic cigarettes are compared overall, traditional cigarettes are significantly more expensive (Hutapea & Fasya, 2021; Zhu et al., 2014). Research by Rutter *et al.* (2017) found that adolescents thought that if tobacco became too expensive, 44% said they would consider trying an e-cigarette or would use one more frequently.

Compared to those who were informed by friends, shopkeepers, and promotional events, adolescents were at 2.442 times the risk of trying e-cigarettes. Most respondents who were students in Malaysia received information about e-cigarettes from other students (57.5%), friends (37.5%),

and the internet (36.6%) (Puteh et al., 2018). Further research revealed that the probability of ever using e-cigarettes increased by 2.86 (95% CI: 1.11-7.38) for each source of communication for respondents who were exposed to digital pro-e-cigarette messages through the internet or Facebook (Herrera et al., 2018). According to research by Istiqomah *et al* (2016), most respondents received support from the reference group because they were offered at least one electronic cigarette from friends. Similarly, in e-cigarette refills, respondents stated that they had received more than 5 e-cigarette refills. In addition, nonsmokers, who represent a majority of the adolescent population, may be susceptible to some negative impacts from e-cigarette promotion since those who saw the "cigalike" ads perceived smoking cigarettes as less harmful than those who received control messages. Some brands claim that their products are less harmful than conventional cigarettes. Aside from that, for smokers, e-cigarettes are marketed as an alternative way to stop smoking (United States Patent No. US8393331B2, 2013; Kim, Popova, Felsher, & Ling, 2019; Zhu et al., 2014).

The fourth factor influencing e-smoking behavior is a lack of knowledge and attitudes regarding electronic cigarettes and their dangers. 44% of respondents still assume that consuming cigarettes makes them comfortable at parties or other social gatherings. 27% of respondents answered it is still safe to smoke tobacco for only a year or two (Table 2). Students in Qatar revealed that the reason use electronic cigarettes is that they are safer for themselves (75%) and safer for others than conventional cigarettes (71,4%) (Kurdi et al., 2021). Knowledge of cigarettes is the extent to which a person knows and understands the dangers of cigarettes to make the person aware of healthy behaviour. On the other hand, if a person does not have sufficient knowledge and underestimates the consequences of cigarette use, then that person will consume cigarettes (Dawood, Rashan, Hassali, & Saleem, 2016).

The findings of this study match Lawrence Green's theory, which states that three factors: predisposing, enabling, and reinforcing factors have an impact on an individual's behavior (Notoatmodjo, 2014). The predisposing variables category includes the elements that most affect an individual's decision to use an electronic cigarette. The limitation of this study is that it only used secondary survey data for adolescents who were actively engaged in school; thus, it cannot explain the smoking habits of adolescents who do not attend school, and the questionnaire was used for all types of cigarettes not detailed for questioning adolescents using e-cigarettes.

Conclusion

The final results indicated that sex, allowance, access to information on e-cigarettes, knowledge, and attitudes of adolescents have a strong influence on their likelihood of trying e-cigarettes. Smoking, including e-cigarette use, is often considered a symbol of coolness or masculinity, which frequently motivates male students to try it. Allowances may be related to household income and the affordability for the student. Strict laws governing the use of e-cigarettes among adolescents must be enforced, particularly regarding advertising and pricing, to make them prohibitively expensive for adolescents. This is one way to prevent adolescents from being able to buy e-cigarettes at affordable prices.

Declaration Conflicting Interest

The authors declare that they have no conflicts of interest associated with the material presented in this paper.

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Author contributions
FH contributed to designing and creating the study, as well as collecting, analyzing, interpreting the data, and writing paper. A contributed to the literature search and interpretation data, as well as paper writing. CS helped develop the procedures as well as interpret the data. LH contributed to the data interpretation, as well as the drafting of the paper. All authors evaluated and approved the manuscript's final form as submitted.

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Data availability
Data is open access for the public on https://www.cdc.gov/tobacco/global/gtss/gtssdata/index.html

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