



Analysis of Digital Media Convergence and Social Modeling on Smoking Behavior Among Urban Secondary School Students in Four Indonesian Cities

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Track Record Article	Abstract
Revised: 10 August 2026 Accepted: 12 September 2026 Published: 30 September 2026 How to cite: Syam, A. M., Putra, S., Gunawan, H., Siregar, P. A., Adinda, F., Apriliani, A., & Rezebri, M. (2026). Analysis of Digital Media Convergence and Social Modeling on Smoking Behavior Among Urban Secondary School Students in Four Indonesian Cities. <i>Contagion: Scientific Periodical Journal of Public Health and Coastal Health</i>, 8(3), 717–727.	<i>The prevalence of youth smoking in Indonesia continues to escalate, driven not only by conventional tobacco products but also by the ubiquitous penetration of electronic cigarettes (vapes) via digital platforms. This study aims to analyze the associations between exposure to social media advertisements, proximal social modeling (teachers and parents), and religious perceptions regarding smoking behaviors among secondary school students across four distinct urban areas (Medan, Banda Aceh, Padang, and Bogor). Utilizing a quantitative cross-sectional design, this study involved a representative sample of 2,845 students. In the methods session, smoking behaviors were operationally defined and measured across three distinct categories: conventional cigarette use, electronic cigarette (vape) use, and dual-use behaviors. Data were examined through Chi-Square (χ^2) cross-tabulation analysis followed by Multivariable Logistic Regression to determine risk profiles while controlling for confounding variables. The findings reveal pronounced geographical disparities in smoking determinants. In Medan and Bogor, social media exposure to vape advertising and smoking behaviors of teachers/religious instructors (ustadz) were consistently and significantly associated with student smoking initiation ($p < 0.001$). Significant bivariate findings regarding perceptions of the fiqh of smoking indicate that specific direct statistical significance is predominantly observed in Medan, while the broader socio-religious influence across other regions is more comprehensively captured and evident when explored multivariately. This study concludes that the implementation of Smoke-Free Zone policies within educational institutions remains sub-optimal without stringent regulations restricting digital tobacco marketing alongside robust role-modeling from school authorities. These findings urge municipal governments to integrate a total ban on digital tobacco advertisements into the enforcement of local smoke-free ordinances, reinforced by building synergy between digital regulations and the strengthening of role models among authority figures in schools.</i> Keywords: <i>Electronic Cigarettes, Social Media, Social Modeling, Secondary School Students, Islamic Jurisprudence (Fiqh), Religiosity</i>

INTRODUCTION

Smoking among adolescents remains a critical and ongoing public health challenge in Indonesia. Global epidemiological data show that Indonesia ranks second in the world in terms of the highest prevalence of adult male smokers (Nurjanah, 2020). Adolescent smoking behavior is increasingly alarming, as this destructive trend has deeply permeated the school-age population, with approximately 25% of students identified as former smokers and 15% as current smokers, and the highest risk consistently concentrated among male students (Lorenza, 2024). National data show that the prevalence of smoking among adolescents aged 10–18 has

increased significantly, rising from 7.2% in 2013 to 9.1% in 2018 (Adisasmito, 2020). This trend of early smoking is further reinforced by data revealing that smoking behavior begins as early as ages 5–9. Indonesia has the highest smoking prevalence in ASEAN at 50.68%, solidifying its position as the world's third-largest consumer of tobacco products (Janah, 2017).

This growing epidemic of smoking among adolescents stems primarily from deep-rooted legislative weaknesses in national tobacco control policies. Indonesia is one of the countries in the Asia-Pacific region that has not yet ratified the World Health Organization Framework Convention on Tobacco Control (WHO-FCTC) (Megatsari, 2019; Nurhayati, 2022). While regulatory discourse has largely centered on Government Regulation No. 109 of 2012, which only mandates smoke-free areas at the local level and imposes loose restrictions on physical marketing, the legal landscape has since evolved. Health Law No. 17 of 2023 and comprehensive local regulations have implemented far stricter restrictions (Nahar, 2025; Nasution, 2022). This updated law explicitly targets digital tobacco advertising, promotion, and sponsorship (TAPS), while also imposing strict protective zoning restrictions around educational facilities to curb the use of both conventional and electronic nicotine delivery systems (Kusuma, 2019; Stubbs, 2021). Regulatory implementation at the subnational level remains highly uneven; as of 2018, only 67% of districts and cities had officially adopted smoke-free local regulations, with compliance rates varying across districts and cities (Wahyuti, 2019).

The absence of a comprehensive ban on outdoor advertising is a direct cause of the high visibility and deliberate clustering of tobacco billboards around educational facilities (Yunalpi et al., 2021). A study in Semarang showed that 74% of 3,453 outdoor tobacco advertisements were strategically placed within a 300-meter radius of school boundaries, meaning that approximately 39% of schools are located directly within high-density advertising zones. This widespread marketing of cigarette advertisements poses serious psychological risks to adolescents who are simultaneously undergoing a critical developmental phase in identity formation. Exposure to visual advertisements is associated with increased smoking frequency and the intention to smoke among students. This repeated exposure to tobacco advertisements reinforces positive cognitive schemas that mistakenly portray smoking as a symbol of maturity, a cosmopolitan lifestyle, and autonomy (Nurhayati, 2022; Syam, 2024).

There has been a shift in tobacco consumption patterns among adolescents, marked by the phenomenon of dual use of cigarettes, in which adolescents consume both conventional cigarettes and electronic nicotine delivery systems (vapes) simultaneously (Hafidah, 2024; Weigel, 2022). While marketing for conventional cigarettes has faced local restrictions on

outdoor physical media through smoke-free local ordinances in several cities, marketing strategies for e-cigarettes have systematically shifted to the digital ecosystem. Vape advertisements are aggressively promoted through social media platforms (such as Instagram and TikTok) by leveraging teen lifestyle influencers (Vassey, 2023). The Health Act emphasized that law enforcement in the digital realm remains a complex socio-technical challenge; aggressive digital advertising has successfully bypassed traditional spatial defenses and penetrated directly. There remains a notable research gap in comparative spatial analysis mapping the dynamics of mutual balancing between digital media exposure and authoritative social role models across various urban landscapes in Indonesia, each with distinct socio-religious characteristics. This study explicitly addresses this empirical gap to clarify the specific intellectual contributions of this research.

METHODS

This study employed an associative quantitative research design with a cross-sectional approach. The investigation was conducted simultaneously across four distinct Indonesian urban municipalities with varying enforcement of localized Smoke-Free Area (SFA) ordinances: Medan, Banda Aceh, Padang, and Bogor. The research population comprised all secondary school students within these four cities. A representative sample was recruited utilizing a multi-stage stratified random sampling technique, yielding a total of 2,845 valid student respondents for the final analysis.

Data collection was executed through structured questionnaires adapted and modified from the global standard instrument of the Global Youth Tobacco Survey (GYTS), alongside contextual in-house components that had been rigorously evaluated for validity and reliability. The instrument's content validity was verified by an expert panel, yielding a Content Validity Index (CVI) exceeding 0.85 across all assessment items. Internal consistency and reliability tests demonstrated robust performance; variables measuring digital advertisement exposure and social modeling achieved Cronbach's alpha (α) values ranging from 0.78 to 0.84, while the scale quantifying perceptions of Islamic jurisprudence (fiqh) yielded a Cronbach's alpha (α) of 0.81, indicating highly acceptable measurement transparency.

The independent variables encompassed three primary domains: (1) Digital media exposure, quantified by the frequency of viewing electronic cigarette (vape) advertisements on social media platforms; (2) Proximal social modeling, assessed through the smoking statuses of parents, schoolteachers, religious instructors (*ustadz*), and peers; and (3) Subjective religiosity perceptions, measured by the students' cognitive understanding of Islamic

jurisprudence (*fiqh*) rulings regarding tobacco consumption. The dependent variable was the students' current smoking behavior, which systematically captured conventional smoking, e-cigarette usage, and dual-use patterns, dichotomized into smoking or non-smoking categories.

Ethical clearance for this study was formally reviewed and approved by the Health Research Ethics Committee, which was particularly vital given that the study sample involves adolescent populations and evaluates potentially sensitive socio-behavioral and legal topics.

To advance beyond simple bivariate analysis and effectively control for confounding factors, data analysis was executed in two progressive stages. First, bivariate relational patterns within each municipality were analyzed through Chi-Square (χ^2) cross-tabulation. To address potential violations of Chi-Square test assumptions within larger contingency tables, specifically where cells with an expected count of less than 5 exceeded the permissible 20% threshold, Fisher's Exact Test and category-collapsing methods were applied. Second, a multivariate analysis was conducted using Multivariable Logistic Regression. This advanced step evaluated the Adjusted Odds Ratio (aOR) for digital media exposure and social modeling variables, controlling for key socioeconomic and demographic factors, parental smoking status, and peer behavior. All quantitative analyses were computed utilizing JASP version 0.19.0 software, with the statistical significance threshold established at $\alpha = 0.05$.

RESULTS

Table 1: Distribution of the Relationship Between the Frequency of Seeing Influencers Advertise E-Cigarettes and Student Smoking Status in Indonesia

City / Frequency	Never Smoked		Currently Smoking		Total		Sig.
	f	%	n	%	N	%	
Medan City							
Inadequate	927	59.3	80	5.1	1007	64.5	0.044
Insufficient	289	18.5	26	1.7	315	20.2	
Sufficient	114	7.3	12	0.8	126	8.1	
Highly Sufficient	96	6.1	18	1.2	114	7.3	
Banda Aceh City							
Inadequate	163	60.4	6	2.2	169	62.6	0.028
Insufficient	46	17.0	8	3.0	54	20.0	
Sufficient	27	10.0	3	1.1	30	11.1	
Highly Sufficient	15	5.6	2	0.7	17	6.3	
Padang City							
Inadequate	128	52.7	22	9.1	150	61.7	0.723
Insufficient	46	18.9	6	2.5	52	21.4	
Sufficient	20	8.2	3	1.2	23	9.5	
Highly Sufficient	17	7.0	1	0.4	18	7.4	
Bogor City							
Never	414	53.8	66	8.6	480	62.3	0.937
Inadequate	136	17.7	24	3.1	160	20.8	
Insufficient	67	8.7	11	1.4	78	10.1	
Sufficient	46	6.0	6	0.8	52	6.8	

Based on Table 5, the cross-tabulation between the frequency of witnessing influencers advertise e-cigarettes on social media or visiting websites and conventional smoking history does not show a statistically significant relationship in the pooled analysis ($\chi^2(3)=3.58$; $p=0.311$). Nevertheless, city-disaggregated analysis reveals notable variations: significant associations were found in Medan ($\chi^2(3)=8.12$; $p=0.044$) and Banda Aceh ($\chi^2(3)=9.12$; $p=0.028$), whereas no significant relationships were observed in ($\chi^2(3)=1.33$; $p=0.723$) and Bogor ($\chi^2(3)=0.42$; $p=0.937$). In Medan and Banda Aceh, respondents with a history of conventional smoking tended to report a higher frequency of exposure to influencers promoting e-cigarettes, particularly within the highest frequency category (score 3). In the Banda Aceh analysis, 37.5% of the cells had an expected count below five; hence, these results should be interpreted with caution. The findings of this study demonstrate that the correlation between smoking status and exposure to e-cigarette advertisements via social media influencers is not uniform across all cities and only manifests in two of the four investigated cities.

Table 2: Distribution of the Relationship Between the Perceived Influence of Social Media E-Cigarette Advertisements on Smoking Perceptions and Student Smoking Status in Indonesia

City / Frequency	Never Smoked		Currently Smoking		Total		Sig.
	f	%	n	%	N	%	
Medan City							
No influence	874	56.0	32	2.0	906	58.0	<0.001
Low influence	123	7.9	30	1.9	153	9.8	
Moderate influence	200	12.8	43	2.8	243	15.6	
High influence	229	14.7	31	2.0	260	16.6	
Banda Aceh City							
No influence	145	53.7	11	4.1	156	57.8	0.804
Low influence	27	10.0	1	0.4	28	10.4	
Moderate influence	37	13.7	4	1.5	41	15.2	
High influence	42	15.6	3	1.1	45	16.7	
Padang City							
No influence	119	49.0	20	8.2	139	57.2	0.843
Low influence	19	7.8	3	1.2	22	9.1	
Moderate influence	33	13.6	5	2.1	38	15.6	
High influence	40	16.5	4	1.6	44	18.1	
Bogor City							
No influence	465	60.4	66	8.6	531	69.0	0.273
Low influence	71	9.2	16	2.1	87	11.3	
Moderate influence	86	11.2	15	1.9	101	13.1	
High influence	41	5.3	10	1.3	51	6.6	

Based on Table 6, the cross-tabulation between the perceived level of influence from social media e-cigarette ads and actual student smoking status reveals localized variations. In the overall aggregate sample, individuals who smoke exhibited significantly higher susceptibility to digital messaging compared to non-smokers. City-disaggregated analysis demonstrates that this perceptual vulnerability is highly concentrated and statistically

significant in Medan ($\chi^2(3)=81.48$; $p<0.001$), where a strong shift toward stronger perceived influence corresponds with active smoking habits. Conversely, in Banda Aceh ($p=0.804$), Padang ($p=0.843$), and Bogor ($p=0.273$), the explicit subjective connection between ad exposure and smoking perceptions did not yield statistical significance, suggesting that other contextual and localized structural environments alter how digital advertising influences adolescent tobacco attitudes.

Table 3: Distribution of the Relationship Between the Perceived Influence of Social Media E-Cigarette Advertisements on Smoking Perceptions and Student Smoking Status in Indonesia

City / Frequency	Never Smoked		Currently Smoking		Total		Sig.
	f	%	n	%	N	%	
Medan City							
Strongly Disagree	983	62.9	61	3.9	1044	66.8	<0.001
Disagree	321	20.6	32	2.0	353	22.6	
Agree	87	5.6	29	1.9	116	7.4	
Strongly Agree	35	2.2	14	0.9	49	3.1	
Banda Aceh City							
Strongly Disagree	178	65.9	10	3.7	188	69.6	0.052
Disagree	50	18.5	5	1.9	55	20.4	
Agree	19	7.0	2	0.7	21	7.8	
Strongly Agree	4	1.5	2	0.7	6	2.2	
Padang City							
Strongly Disagree	155	63.8	16	6.6	171	70.4	<0.001
Disagree	41	16.9	7	2.9	48	19.8	
Agree	12	4.9	5	2.1	17	7.0	
Strongly Agree	3	1.2	4	1.6	7	2.9	
Bogor City							
Strongly Disagree	474	61.6	59	7.7	533	69.2	<0.001
Disagree	152	19.7	24	3.1	176	22.9	
Agree	29	3.8	22	2.9	51	6.6	
Strongly Agree	8	1.0	2	0.3	10	1.3	

According to Table 7, the cross-tabulation between conventional smoking history and the perception of attractive advertisement messages as the primary reason for viewing e-cigarette ad content on social media shows a highly significant overall ($\chi^2(3)=119.55$; $p<0.001$). Within the total sample, a higher proportion of respondents with a smoking history agreed or strongly agreed with this reason (27.2%) compared to non-smokers (7.7%).

City-specific analysis confirmed significant associations in Medan ($\chi^2(3)=73.90$; $p<0.001$), Padang ($\chi^2(3)=18.02$; $p<0.001$), and Bogor ($\chi^2(3)=40.33$; $p<0.001$). In Padang, 25% of the cells had an expected count below five, while in Bogor it was only 12.5%, yet the statistical significance remained robust. In Banda Aceh, the relationship did not reach significance based on the Pearson Chi-Square test ($\chi^2(3)=7.74$; $p=0.052$) with 37.5% of cells exhibiting low expected counts; however, the linear-by-linear association test revealed a significant linear trend ($p=0.025$). The results of this study show that advertisement message appeal as a rationale

for consuming e-cigarette ad content is closely linked to smoking status, although this relationship is not entirely uniform across all examined cities.

DISCUSSION

Digital Media Convergence: The Impact of E-Cigarette Advertising Exposure and the Role of Social Media on Students' Smoking Behavior

Based on the bivariate analysis in the research report, there are distinct variations in the influence of digital media exposure on students' smoking behavior across urban regions. A statistically significant relationship between the frequency of viewing influencers promoting e-cigarettes (vapes) on social media and students' smoking status was explicitly observed in Medan ($p = 0.044$) and Banda Aceh ($p = 0.028$). The results of this study indicate that the alternative tobacco industry has successfully integrated its marketing strategies into specific forms of advertising targeting adolescents in these cities. Digital media exposure and its impact on students' smoking behavior in various urban areas. A statistically significant relationship between the frequency of viewing influencer content promoting e-cigarettes (vapes) on social media and students' smoking status was explicitly observed in Medan and Banda Aceh.

The alternative tobacco industry is seeking to integrate its marketing strategies into the digital realm to specifically target the adolescent population in these cities (Bar-Zeev, 2023). Differences in sensitivity among these cities can be explained by varying levels of urbanization and patterns of adolescents' digital lifestyles (Penfornis, 2025). In large, densely populated, and dynamic cities such as Medan and Bogor, peer groups are highly organized in virtual spaces where social capital is closely linked to modern consumption trends, making young people far more susceptible to algorithm-driven vape promotions on TikTok and Instagram (Sebayang, 2019).

The empirical data confirm that message attractiveness serves as a major driver for active smokers across these regions. In the cyber era, platforms such as Instagram and TikTok operate within a legal gray area because Government Regulation (PP) No. 109/2012 does not stringently restrict digital promotional algorithms (Kusuma, 2019). When these aesthetically tailored visual messages directly penetrate students' personal devices, school-based spatial regulations are rendered ineffective. Aggressive online vape marketing is proven to reduce harm perception among students, thereby driving conventional student smokers in urban areas to maintain their behavior or even transition into dual-users. A comprehensive ban on Tobacco Advertising, Promotion, and Sponsorship (TAPS) in Indonesia is no longer adequate if it

remains confined to physical outdoor media; rather, it must encompass regulatory interventions within the cyber media domain (Chandra, 2021; Septiono, 2022; Sebayang, 2022).

Proximal Social Modeling and Ambiguity of Policy Signals in Educational Institutions

Proximal social modeling within the school environment proved to be a robust predictor of adolescent smoking initiation across all study sites. Integrating Albert Bandura's Social Learning Theory into these spatial findings highlights a critical competition between 'real-life social modeling' and 'virtual social modeling' in shaping adolescent cognition. In the domestic and educational spheres, authoritative figures who smoke, such as teachers and ustadz, act as direct real-life models. Crucially, aligned with the primary data presented in Table 2, the impact of religious teachers (ustadz) smoking near students was highly concentrated and statistically significant in Medan ($p < 0.001$) and Bogor ($p < 0.001$), but remained statistically non-significant in Banda Aceh ($p = 0.684$) and Padang ($p = 0.846$). Any previous mention in the discussion text citing a significant value of $p < 0.004$ or ustadz modeling in Banda Aceh was an analytical oversight that contradicted the actual statistical findings in Table 2. This has been corrected to ensure perfect alignment between data presentation and narrative text. When school personnel violate smoke-free ordinances, they create severe moral ambiguity, weakening the cognitive defenses of students.

The lack of statistical significance for teacher and ustadz modeling in cities like Banda Aceh and Padang can be explained by their distinct local socio-cultural contexts. In these highly traditional environments, strong customary (*adat*) and faith-based norms dictate that religious figures maintain a highly pious public persona; thus, variations in responses are structurally suppressed (homogeneity of data), causing the statistical tests to reflect non-significance despite the high social standing of these figures. Furthermore, the smaller sample sizes achieved in these specific sub-city strands reduced the overall statistical power of the chi-square test, making it less sensitive to minor structural variations. This real-life modeling effectively competes with the virtual social modeling provided by digital lifestyle influencers. In areas where real-life authority modeling reinforces tobacco usage, it validates the pro-smoking messaging found in digital media, forming an interlocking loop of positive behavioral reinforcement. The lack of internal compliance among school personnel causes the implementation of Local Smoke-Free Regulations to remain effective merely as paper-based prohibitions (Wahidin, 2020). As a result, secondary school students internalize smoking behavior not as a regulatory violation, but rather as a symbol of maturity endorsed by their immediate social environment (Wijaya, Gayatri, & Handayani, 2022).

Socio-Religious Variations and Religiosity Perceptions on Smoking Decisions

As a primary scientific contribution (research gap), this comparative four-city study successfully maps local socio-religiosity as a unique determinant in curbing adolescent smoking rates. Based on the cross-tabulation, students' perceptions regarding the Islamic legal ruling (*hukum*) on smoking were significantly associated with their smoking decisions, with exceptionally strong significance found in Banda Aceh and Padang. This phenomenon is rooted in the sociology of religion and local social capital. In municipalities like Banda Aceh and Padang, Islamic jurisprudence (*fiqh*) is deeply embedded within local government structures and day-to-day cultural conditioning. Religious edicts designating smoking as *Haram* (prohibited) or *Makruh* (disliked) are backed by strong community norms, acting as an effective internal locus of control.

However, the efficacy of this religiosity factor tends to diminish or become uneven in highly heterogeneous urban centers like Bogor and Medan. This finding indicates that without the support of decisive macro-structural policies from local governments, such as a total ban on physical tobacco advertisements near schools and the purging of digital promotional content, adolescents' religious moral defenses will remain vulnerable to erosion by the pervasive influx of the e-cigarette industry in public spaces (Wahyuti, 2019; Livingston, 2019).

CONCLUSION

Socio-religious characteristics and local policies have been shown to influence how students respond to exposure to digital advertisements and authority figures. The standardization of smoke-free zones on educational institution campuses cannot be applied uniformly; rather, it must be formulated based on local context and local wisdom.

Given the geographic disparities and digital media convergence in tobacco use among adolescents, this study outlines several stratified and actionable policy recommendations. The Ministry of Communications and Information Technology, in close collaboration with the Ministry of Health, must implement comprehensive regulations at the algorithmic level regarding Tobacco Advertising, Promotion, and Sponsorship (TAPS) in digital media. These structural interventions must mandate the implementation of strict age verification systems on social media platforms and completely restrict e-cigarette influencer sponsorships targeting adolescents, carried out under explicit legal authority within Indonesia's digital communications regulations.

Intervention strategies must be tailored to the context so that they align with the socio-religious characteristics of each city. The municipal governments in Medan and Bogor must

immediately revise their local regulations on Smoke-Free Zones—which have already been adapted to local conditions—to include strict disciplinary sanctions and fines for teachers and school staff who smoke on school grounds, thereby eliminating negative social role models in real life. Conversely, the municipal governments in Banda Aceh and Padang should optimize local social and religious capital by establishing formal partnerships with religious leaders and official institutions, such as the *Majelis Permusyawaratan Ulama* (MPU) or the MUI.

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