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Household Consumption, Inequality, and the Diffusion of E-Cigarettes in Indonesia

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Abstract

Tobacco use remains one of Indonesia's significant public health burdens, and the rapid growth of electronic cigarettes (e-cigarettes) introduces new regulatory challenges. Data from the 2018 Basic Health Research Survey (Riset Kesehatan Dasar; RISKESDAS) show that adolescent e-cigarette use increased sharply from 1.2% in 2016 to 10.9% in 2018. Drawing on consumer behaviour theory and the diffusion of innovations framework, this study examines how household consumption, income inequality, poverty, unemployment, and demographic factors influence e-cigarette uptake in Indonesia. Using nationally representative data from the 2023 National Socio-Economic Survey (Survei Sosial Ekonomi Nasional; SUSENAS), this study applies logistic regression and accounts for clustering at the provincial level. The results indicate that higher household consumption significantly increases the likelihood of e-cigarette use. Income inequality exhibits a strong positive association, suggesting diffusion driven by more affluent adopters, whereas unemployment and poverty show negative but statistically insignificant effects. E-cigarette adoption remains concentrated among men and urban residents. Overall, the findings indicate that the diffusion of e-cigarettes in Indonesia reflects underlying socioeconomic disparities. These results underscore the importance of policies addressing affordability and marketing practices—such as excise taxation, price floors, and integrated regulatory frameworks—to mitigate the expansion of nicotine-related inequalities and Indonesia's existing tobacco burden.

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INTRODUCTION

Tobacco use remains one of Indonesia's most persistent public health challenges. Smoking-related diseases account for more than 21% of chronic illness cases in the country (Holipah et al., 2020). Amid this public health concern, the use of electronic cigarettes (e-cigarettes or "vapes") has increased rapidly in recent years. It is often marketed as a safer and more modern alternative to conventional cigarettes. According to the Global Adult Tobacco Survey (GATS) Indonesia 2021, approximately 6.2 million Indonesian adults currently use e-cigarettes, and more than a quarter (27.1%) have tried e-cigarettes at least once (World Health Organization, 2021). The Ministry of Health of Indonesia reports that e-cigarette prevalence rose nearly tenfold between 2016 and 2018, indicating the rapid market penetration of vaping products (Kementerian Kesehatan RI, 2018).

The theoretical framework of this study draws on two complementary perspectives. Diffusion of Innovations theory, initially developed by Rogers (1995), posits that individuals' adoption decisions are shaped not only by the characteristics of an innovation but also by their position within the social system and their access to information. This framework categorizes adopters into groups such as early adopters and laggards, whose decisions are influenced by communication networks and social environments. In parallel, consumer behaviour theory assumes that individuals act rationally to maximize utility, subject to income constraints, treating consumption as a function of budget availability and preferences. Within this framework, e-cigarettes are regarded as normal goods, with uptake increasing alongside discretionary income. Together, these theoretical perspectives provide a structured explanation of how structural inequalities shape the diffusion of e-cigarette use in Indonesia.

Empirical evidence aligns with these theoretical expectations by identifying several factors influencing e-cigarette uptake. Numerous studies show that young adults often perceive e-cigarettes as less harmful than conventional cigarettes and frequently view them as cessation tools (Choi & Forster, 2014; Trumbo & Harper, 2015). However, other studies present a contrasting view. Research conducted in South Africa finds that social compatibility and observability significantly influence willingness to vape. At the same time, no association with quitting intentions is observed, suggesting that cessation is not the primary motivation (Muposhi & Dhurup, 2016). Moreover, such perceptions of reduced harm are frequently shaped by marketing narratives rather than robust scientific evidence. These findings indicate that adoption is driven not only by perceived harm reduction but also by the broader social construction of vaping as a "modern lifestyle product." Social networks and digital marketing further amplify these dynamics, with peer influence shown to significantly shape susceptibility among Indonesian youth (Bigwanto et al., 2025).

International evidence characterizes vaping as a lifestyle product that initially diffuses within cosmopolitan urban centres before spreading to smaller towns and peripheral areas (Noland et al., 2018). These diffusion patterns align with Rogers' Diffusion of Innovations theory, which posits that new technologies are first adopted by socially open networks comprising younger, urban, and wealthier groups before reaching broader populations. Recent evidence from Indonesia corroborates this pattern, showing that e-cigarette use is disproportionately concentrated among men, younger age groups, urban residents, and individuals from higher-income households (Paramashanti et al., 2025; Syawqie et al., 2025; Wibowo et al., 2025). Similar trends have been documented in other low- and middle-income countries. For instance, studies from China indicate that e-cigarette uptake is more prevalent among wealthier and urban residents (Huang et al., 2023; Wang et al., 2016). This urban–rural disparity also appears in high-income countries such as the United States, where early e-cigarette use among youth occurs more frequently in urban schools than in rural ones (Noland et al., 2018).

Economic conditions also play a central role in shaping the diffusion of e-cigarettes. Consumer behaviour theory conceptualizes e-cigarettes as normal goods, with adoption primarily determined by affordability and purchasing power. In the case of conventional cigarettes, extensive evidence shows that income and price are key determinants of consumption, with higher income levels often associated with greater smoking uptake (Hosseinpoor et al., 2011; Ng et al., 2014). E-cigarettes appear even more sensitive to disposable income, as their use requires upfront expenditures on devices and recurring costs for e-liquids. Empirical evidence from Indonesia confirms this pattern: individuals in the highest household wealth quintile are more than twice as likely to use e-cigarettes as those in the poorest quintile (Paramashanti et al., 2025). Similarly, Syawqie et al. (2025) report that most Indonesian vapers earn betwee1 and 5 million Rupiah per month, placing them in middle- to upper-income groups. Evidence from South Africa further supports this argument, showing that early adopters of e-cigarettes tend to be young consumers with internet access and sufficient disposable income (Muposhi & Dhurup, 2016). These findings suggest that in Indonesian provinces with higher household consumption, e-cigarette uptake is more economically feasible. Conversely, deeper levels of poverty substantially constrain adoption, as disadvantaged households prioritize essential needs over discretionary consumption.

Macroeconomic structures further complicate these dynamics. Income inequality plays a significant role in shaping consumption patterns, with evidence indicating that countries characterized by higher inequality exhibit greater vaping prevalence (Benny et al., 2023; Salmond, 2001). This pattern likely reflects segmented diffusion, whereby affluent early adopters embrace e-cigarettes as lifestyle and status markers while lower-income groups face participation barriers. Such dynamics are consistent with theories of conspicuous consumption in unequal societies, where vaping symbolizes modernity and social distinction. In the Indonesian context, this implies that provinces with higher income inequality may display more substantial e-cigarette uptake among wealthy subpopulations, reinforcing vaping as a "luxury good." Evidence on unemployment presents a more nuanced picture. While some studies suggest that joblessness increases smoking through stress-related mechanisms (Everding & Marcus, 2020; Wang et al., 2016), others find that unemployment reduces consumption due to affordability constraints (Kaiser et al., 2018; Savaş et al., 2025). These mixed findings underscore the importance of examining unemployment alongside complementary indicators such as household consumption and poverty when analysing e-cigarette diffusion.

Indonesia presents a particularly challenging context for tobacco and vaping control due to the absence of comprehensive regulation beyond excise taxation. This regulatory gap allows e-cigarettes to remain widely accessible and marketed with minimal restrictions (Kowitt et al., 2022; Bigwanto et al., 2025). Such policy inertia is driven by fragmented multilevel governance—including decentralization to 514 districts, vague national policies that require local implementation, and overlapping responsibilities among government agencies—as well as pervasive interference from the tobacco industry. Together, these factors have contributed to stalled progress in tobacco control efforts (Astuti, Assunta, and Freeman, 2020). Recent studies further indicate that e-cigarette uptake in Indonesia is concentrated among socioeconomically advantaged groups, with higher prevalence observed among men, urban residents, and individuals with greater economic resources. These patterns reflect stratified access and usage shaped by socioeconomic position (Bigwanto et al., 2025; Paramashanti et al., 2025; Syawqie et al., 2025; Wibowo et al., 2025).

Although several studies have examined individual-level determinants of e-cigarette use in Indonesia, limited attention has been given to the interaction between household consumption, income inequality, and broader socioeconomic conditions within the combined frameworks of

consumer behaviour and innovation diffusion. Existing research suggests that diffusion is influenced by product popularity, social influence, and affordability (Syahrawani Elsa and Nadjib, 2019; Bigwanto et al., 2025; Syawqie et al., 2025). However, the joint roles of household consumption, poverty, inequality, and unemployment remain underexplored in low- and middle-income country contexts. Analysing these factors is particularly important in Indonesia, where a high burden of conventional smoking coincides with a rapid rise in vaping, and policymakers continue to debate whether e-cigarettes function as cessation tools or instead expand overall nicotine use (Stubbs et al., 2023).

This study draws on consumer behaviour theory and Diffusion of Innovations theory to explain how economic conditions and social structures shape e-cigarette adoption in Indonesia. While existing studies have documented patterns of vaping uptake, they provide limited insight into how these theories operate in contexts characterized by unequal purchasing power, segmented market access, and uneven exposure to new technologies. Consumer behaviour theory suggests that the adoption of normal goods depends on disposable income, whereas diffusion theory posits that early adopters are typically wealthier and more socially connected. Empirical evidence, however, has not yet clarified whether these mechanisms hold in the Indonesian context, where income disparities and social stratification may modify—or even weaken—expected adoption pathways. This theoretical ambiguity constitutes the central research gap addressed in this study: the lack of clear evidence on whether consumer behaviour and innovation diffusion theories adequately explain patterns of e-cigarette adoption in Indonesia, or whether contextual factors generate systematic deviations from these theoretical expectations.

To address this gap, the study applies a multilevel modelling approach by nesting individuals within provinces, thereby capturing both micro-level characteristics (such as gender and place of residence) and macro-level indicators (including household consumption, income inequality, unemployment, and poverty). The analysis tests whether individuals residing in provinces with higher household consumption and income inequality are more likely to use e-cigarettes. At the same time, deeper poverty and unemployment constrain adoption. At the same time, adoption patterns are examined by gender and urban–rural residence, reflecting the role of men and urban residents as early adopters. By situating these expectations within the consumer behaviour and innovation diffusion frameworks, this study offers clearer insight into the socioeconomic drivers of e-cigarette use in Indonesia and provides evidence to inform more balanced, context-sensitive tobacco control strategies.

RESEARCH METHODS

This study uses secondary data from the 2023 National Socio-Economic Survey (Survei Sosial Ekonomi Nasional; Susenas), conducted by Statistics Indonesia (Badan Pusat Statistik; BPS). Susenas is a nationally representative survey designed to capture the demographic and socio-economic characteristics of the Indonesian population. The survey covers 1,223,377 individuals across 34 provinces and 79 districts or cities. After excluding observations with missing values for the main dependent and explanatory variables, the final analytic sample consists of 1,213,484 individuals.

The unit of analysis is individuals aged five years and older, in accordance with the survey questionnaire design. In practice, e-cigarette use among very young respondents is extremely rare, and these observations are retained solely to preserve the representativeness of household-level demographic structures. Consequently, all substantive interpretations of vaping behaviour are conceptually anchored in adolescent and adult populations.

The dependent variable is e-cigarette use, defined as a binary indicator coded as 1 if the respondent reports using e-cigarettes and 0 otherwise. Key demographic covariates include gender (1 = male; 2 = female) and area of residence (1 = urban; 2 = rural). To enrich the

individual-level data, Susenas microdata are merged with provincial-level macroeconomic indicators published by Statistics Indonesia (BPS).

Household consumption serves as a proxy for purchasing power and discretionary income, reflecting the role of e-cigarettes as a normal good whose uptake increases with greater economic capacity. Income inequality captures stratified diffusion environments in which early adopters are concentrated among wealthier and more socially connected groups. Poverty proxies material deprivation and resource constraints that limit access to new products, while unemployment reflects economic insecurity that may suppress discretionary spending or alter risk-related behaviours. This multilevel approach allows the analysis to account for both individual characteristics and the broader socio-economic context in which individuals reside. All macroeconomic indicators are matched to the Susenas microdata at the provincial level.

To account for contextual influences, provincial-level indicators are merged with each record based on the province of residence. This linkage enables the model to estimate e-cigarette use as a function of both individual characteristics and macroeconomic conditions. Accordingly, the interpretation of the estimated coefficients reflects how individuals residing in provinces with relatively higher or lower macroeconomic indicators differ in their likelihood of adopting e-cigarettes.

This study employs logistic regression to examine the determinants of e-cigarette use in Indonesia. Logistic regression estimates the probability of a behavioural outcome, specifically the likelihood that an individual reports using e-cigarettes, as influenced by socio-economic and demographic characteristics. Although logit and probit models both produce probability estimates under a similar latent-variable framework, the inverse logit link function, $\Lambda^{-1}(p_i)$, is directly interpretable in terms of log-odds, whereas the probit inverse link, $\Phi^{-1}(p_i)$, lacks a similarly straightforward interpretation (Wooldridge, 2001; Efron and Hastie, 2017).

This interpretability is particularly important in smoking-related research, where policy relevance depends on identifying population groups with a higher likelihood of use through odds ratios. Consistent with this rationale, recent empirical studies on smoking and vaping behaviours commonly employ logistic regression to estimate binary use probabilities (Benny et al., 2023; Khusaini et al., 2024; Paramashanti et al., 2025; Zahra and Rahani, 2025).

The general specification of the model is as follows:

$$\log \frac{P(Y_i=1)}{1-P(Y_i=1)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \sum_{j=1}^{k} \beta_j X_{ij} \quad (1)$$

In this model, $P(Y_i = 1)$ denotes the probability that individual i uses e-cigarettes. The variables X_{ij} denote the control variables, β_0 is the intercept, β_1 is the coefficient for household consumption (log-transformed), β_2 is the coefficient for inequality and β_j are the coefficients for control variables.

Given the complex survey design, we applied the provided survey sampling weights (pweight = fwt) so that results are representative of the national population. We also used robust standard errors clustered at the provincial level to correct for any within-province correlation among respondents. This adjustment corrects variance estimation in the presence of unobserved province-level heterogeneity and guarantees consistent inference (MacKinnon et al., 2023). We set a significance threshold of $\alpha = 0.05$ (5%) in accordance with standard practice in applied microeconometric studies.

RESULTS AND DISCUSSION

The analysis is based on 1,122,250 observations. The dependent variable is e-cigarette use, coded as 1 for users and 0 for non-users. Two individual-level demographic variables, gender and area of residence, are included to capture respondents' biological sex and residential location. Macroeconomic conditions are measured at the provincial level and matched to each respondent based on province of residence. These variables include household consumption, unemployment,

income inequality, and poverty. Table 1 presents the complete operational definitions and measurement scales for all variables, clearly distinguishing between individual-level and provincial-level indicators.

Table 1. Variables Description

Variables	Definition	Measurement	Level
E-cigarettes Consumption	Whether the respondent used e-cigarettes	1 = User 0 = non-user	Individual
Gender	Biological sex of the respondent	1 = Male 0 = Female	Individual
Living Area	Respondent's residence type	1 = Urban 0 = Rural	Individual
Household Consumption	Average per capita consumption	log value	Province
Unemployment	Open unemployment rate	% of labour force unemployed	Province
Income Inequality	Income inequality index	Gini Ratio	Province
Poverty	Poverty severity index	P2 Index	Province

Source: BPS-Statistics Indonesia (2023)

Table 2 presents summary statistics for all variables used in the analysis. The dependent variable, e-cigarette use, has a very low mean of 0.0109, indicating that approximately 1.1% of individuals in the sample report e-cigarette use. The individual-level demographic variables, gender and area of residence, are relatively balanced across observations, with mean values of 1.50 and 1.58, respectively, suggesting comparable representation of males and females and of urban and rural respondents.

The macroeconomic indicators display substantial variation across provinces. Logged household consumption has a mean of 14.8403 with a standard deviation of 0.2057, while the unemployment rate averages 4.8375% and shows wider dispersion (SD = 1.3734). Income inequality has a mean of 0.3499 and a standard deviation of 0.0430, whereas the poverty rate has a mean of 0.4871 and a standard deviation of 0.4483. These figures indicate meaningful cross-provincial variation, underscoring the heterogeneity of Indonesia's economic landscape.

This variation is analytically important because all macroeconomic variables are measured at the provincial level and serve as Level-2 predictors for individuals residing within the same province. The clear distinction between micro-level and macro-level variables aligns with the study's multilevel analytical framework, which requires both within-province individual variation and between-province macroeconomic variation. The descriptive statistics confirm that the dataset provides sufficient variation at both levels, enabling robust estimation of provincial-level effects on individual e-cigarette use.

To formally assess multicollinearity among the key independent variables, a Variance Inflation Factor (VIF) analysis is conducted. All VIF values fall well below the conventional threshold of 5, ranging from 1.00 to 1.24, with a mean VIF of 1.13. These results indicate minimal multicollinearity and support the statistical independence of the predictors.

A logistic regression model is then estimated to examine the probability of e-cigarette use as a function of individual-level demographic characteristics and provincial-level macroeconomic conditions. All macroeconomic variables are merged with individual-level observations by province of residence. Model coefficients and marginal effects are reported with robust standard errors.

Table 2. Summary Statistics

Variables	Obs	Mean	Std. Dev.
E-cigarettes Consumption	1,122,250	0.01088	0.10371
Gender	1,122,250	1.49765	0.49999
Living Area	1,122,250	1.58329	0.49301
Household Consumption	1,122,250	14.84032	0.20575
Unemployment	1,122,250	4.83745	1.37337
Income Inequality	1,122,250	0.34985	0.04298
Poverty	1,122,250	0.48707	0.44831

The results reported in Table 3 present the estimated coefficients and marginal effects derived from the logistic regression model. These estimates summarize the direction and statistical significance of each explanatory variable with respect to the probability of e-cigarette use. Overall, the results indicate that several individual-level and macroeconomic factors exhibit statistically meaningful associations with vaping adoption.

To facilitate interpretation of the magnitude of these relationships, Table 4 reports the corresponding odds ratios (ORs) along with their 95% confidence intervals. The ORs provide a more intuitive measure of effect size, illustrating how each explanatory variable influences the relative odds of e-cigarette use across different socioeconomic and demographic groups.

Table 3. Logistic Regression Result

Variables	Coefficient	Marginal Effect
Gender		
Male		
Female	-2.985***	-0.023***
	(0.088)	(0.001)
Living Area		
Urban		
Rural	-0.198***	-0.002***
	(0.048)	(0.001)
Household Consumption	0.278**	0.004**
	(0.140)	(0.002)
Unemployment	-0.049	-0.001
	(0.033)	(0.000)
Income Inequality	3.226***	0.041***
	(0.734)	(0.009)
Poverty	-0.211	-0.003
	(0.110)	(0.001)
Constant	-8.588***	
	(1.960)	
N	1122250	1122250
Standard Errors in Parentheses * p<0.10, ** p<0.05, *** p<0.01		

Source: Data Processed, 2025

Before interpreting the macro-level results, it is important to acknowledge the data's structural properties. All individuals within the same province share identical values for provincial-level variables, implying that the effective sample size for these Level-2 predictors corresponds to the number of provinces rather than the total number of individual observations.

Consequently, statistical power for detecting macro-level effects is relatively limited, and the estimated coefficients should be interpreted with appropriate caution. To ensure valid inference under this data structure, all regression models employ standard errors clustered at the provincial level.

Turning to household consumption, the coefficient is positive and statistically significant ($\beta = 0.278$, $p<0.05$). In marginal terms, higher household consumption is associated with a 0.4 percentage-point increase in the probability of e-cigarette use. This effect corresponds to an odds ratio of 1.32 (95% CI: 1.003–1.736), indicating that individuals residing in provinces with higher expenditure levels are significantly more likely to use e-cigarettes than those in lower-expenditure provinces. This result is consistent with economic intuition, as e-cigarette use requires discretionary income for both devices and refills, rendering these products more accessible to wealthier households. From an economic perspective, this pattern supports the characterization of e-cigarettes as normal goods, for which demand increases with rising income.

Table 4. Odds Ratios (OR)

Variables	OR	95% CI	p-value
Gender (2=Female)	0.051	(0.043 – 0.060)	0.000***
Living Area (2=Rural)	0.820	(0.746 – 0.902)	0.000***
Household Consumption	1.320	(1.003 – 1.736)	0.047**
Unemployment	0.952	(0.891 – 1.016)	0.141
Income Inequality	25.183	(5.975 – 106.135)	0.000***
Poverty	0.810	(0.652 – 1.005)	0.056

Standard Errors in Parentheses * p<0.10, ** p<0.05, *** p<0.01

Source: Data processed, 2025

Turning to income inequality, measured by the provincial Gini index, the results indicate the strongest effect among the macroeconomic variables. Income inequality is positive and highly statistically significant ($\beta = 3.226$, $p < 0.01$), with a marginal effect of 0.041. The corresponding odds ratio is notably large at 25.183 (95% CI: 5.975–106.135), suggesting that individuals residing in provinces with higher levels of inequality are substantially more likely to adopt e-cigarettes. This pattern reflects how income inequality shapes disparities in purchasing power. In provinces characterized by wider income gaps, wealthier groups more readily adopt new lifestyle goods such as e-cigarettes, while poorer groups face exclusion due to affordability constraints. The unusually large magnitude of the estimated effect may also capture unobserved provincial characteristics correlated with inequality (such as differences in educational attainment, urban infrastructure, or access to health services) that are not explicitly controlled for in the model.

In contrast, both poverty and unemployment exhibit negative but statistically non-significant coefficients (poverty: $\beta = -0.211$, $p = 0.056$; unemployment: $\beta = -0.049$, $p = 0.141$). These results indicate that neither poverty nor unemployment independently predicts e-cigarette use, even after controlling for other socioeconomic indicators. Although the negative signs of both coefficients align with theoretical expectations (suggesting that disadvantaged households face affordability constraints that limit discretionary consumption), the relationships do not reach conventional levels of statistical significance. This pattern implies that purchasing power in this context is more effectively captured by household consumption and income inequality, which display stronger and statistically significant associations with e-cigarette adoption.

Demographic characteristics remain highly influential. Rural residence is negatively associated with e-cigarette use ($\beta = -0.198$, $p < 0.01$), with a marginal effect of -0.002. The odds ratio of 0.82 (95% CI: 0.746–0.902) indicates that rural residents are significantly less likely to use e-cigarettes than their urban counterparts. This finding aligns with expectations that urban areas provide greater access to vape retailers and more substantial exposure to emerging consumption trends. In contrast, rural regions experience more limited availability and weaker diffusion of such lifestyle products.

Gender differences are even more pronounced. The coefficient for females is large and negative ($\beta = -2.985$, $p < 0.01$), corresponding to a marginal effect of -0.023. The odds ratio of 0.051 (95% CI: 0.043–0.060) indicates that women are approximately 95% less likely to use e-cigarettes than men. This pattern is consistent with Indonesia's tobacco consumption profile, where smoking prevalence is overwhelmingly male-dominated. Cultural norms, gendered perceptions of risk, and the limited targeting of women by tobacco and vaping marketing help explain why female e-cigarette use remains exceptionally low.

Overall, the findings indicate that both demographic and economic factors shape e-cigarette consumption in Indonesia in ways consistent with innovation diffusion and consumer behaviour theories. Individuals residing in provinces with higher household consumption and greater income inequality exhibit a higher likelihood of adopting e-cigarettes, whereas deeper poverty and unemployment constrain uptake. This pattern suggests that purchasing power plays a central role in enabling both access to and aspiration for e-cigarette use. At the same time, vaping remains disproportionately concentrated among men and urban residents, reinforcing the view that e-cigarettes function as normal goods that diffuse initially through socially open and economically advantaged groups.

The positive association between household consumption (a proxy for income) and e-cigarette use further confirms that these products behave as normal goods, with adoption increasing alongside disposable income. In practical terms, individuals living in provinces with higher consumption levels, indicative of wealthier households, display a greater likelihood of using e-cigarettes. This relationship reflects differences in affordability and lifestyle orientation. The findings align with prior evidence from Indonesia showing that individuals in the highest household wealth quintile have more than double the odds of vaping (adjusted odds ratio ≈ 2.6), particularly among employed individuals with monthly incomes exceeding IDR 5 million (Paramashanti et al., 2025; Syawqie et al., 2025). These results also mirror international evidence demonstrating that new nicotine products tend to diffuse first among wealthier populations with greater purchasing power (Harlow et al., 2019; Kock et al., 2019; Zavala-Arciniega et al., 2018). Evidence from the United States similarly shows that adolescents from higher-income families are more likely to experiment with e-cigarettes, even as conventional cigarette use declines (Cho et al., 2021).

International evidence similarly indicates that increases in per capita income significantly raise the likelihood of tobacco initiation. Li & Guindon (2013) report that a 10% increase in GDP per capita is associated with at least a 2.5% rise in youth smoking prevalence. Economic theory further suggests that e-cigarettes exhibit high price sensitivity, particularly among younger users with lower incomes, implying that wealthier adults are better able to afford the associated costs (Cotti et al., 2022). Taken together, these findings suggest that Indonesia may still be situated in an earlier stage of the tobacco epidemic curve, where smoking remains a normalized behaviour even among higher-income groups.

The strong positive association between income inequality and e-cigarette adoption further illustrates how disparities in purchasing power shape e-cigarette adoption. Income inequality not only constrains access for disadvantaged groups but also intensifies market segmentation, reinforcing e-cigarettes as lifestyle

or "luxury" goods from which poorer populations are excluded. In the Indonesian context, e-cigarette use among wealthier individuals increasingly functions as a lifestyle or status marker, a pattern supported by recent evidence indicating that vaping is often associated with a "modern lifestyle" (Bigwanto et al., 2025). Consistent with international research, wider income gaps are linked to higher odds of smoking and vaping, a relationship frequently explained through psychosocial stress and social comparison mechanisms (Mistry et al., 2011; Siahpush et al., 2006). Comparative evidence from Russia further demonstrates that greater cigarette affordability—used as a proxy for higher relative purchasing power—drives smoking prevalence, underscoring the importance of accounting for regional disparities in high-inequality contexts (Zasimova & Kolosnitsyna, 2025). This mechanism also resonates with broader literature linking income inequality to health-related behaviours (Benny et al., 2023). Collectively, these findings carry important implications for upstream policy debates concerning income inequality and public health.

Nevertheless, the magnitude of the income inequality coefficient warrants cautious interpretation. As a provincial-level indicator shared by all individuals within the same province, income inequality may capture unobserved contextual characteristics, such as the urban concentration of vaping markets, differential exposure to advertising, or clustering within social networks among higher-income groups. Moreover, the rare-event nature of e-cigarette use, combined with the relatively small effective sample size for Level-2 variables, may inflate the estimated odds ratio, even though the positive association remains theoretically consistent. Accordingly, the inequality effect identified in this study should be interpreted as reflecting broader structural conditions rather than a purely causal impact of income inequality alone.

Demographic factors exhibit clear and consistent effects. Being male and residing in urban areas significantly increases the odds of e-cigarette use. This pattern reflects Indonesia's well-documented tobacco disparity, in which men overwhelmingly dominate smoking behaviour (Bigwanto et al., 2025; Syawqie et al., 2025), and aligns with broader evidence showing that nicotine use remains strongly male-dominated in many Asian countries due to prevailing cultural norms (Kundu et al., 2023). The higher likelihood of vaping among urban residents is also consistent with previous studies linking urban residence to greater product availability, stronger marketing exposure, and intensified social influence (Syawqie et al., 2025; Wibowo et al., 2025). Taken together, these findings are consistent with diffusion of innovations theory, illustrating that e-cigarette use clusters among socially open groups, particularly urban men with greater purchasing power. Although this study does not explicitly include age or smoking status, prior evidence indicates that the majority of e-cigarette users in Indonesia are young, male, urban residents who are current or former smokers (Paramashanti et al., 2025). Accordingly, the demographic profile identified in this study reinforces the concentration of e-cigarette use among men living in urban areas.

By contrast, individuals residing in provinces with higher poverty levels tend to have lower odds of e-cigarette use, although this relationship does not reach statistical significance. From a consumer behaviour perspective, the negative direction of the coefficient remains theoretically meaningful, as it aligns with the argument that e-cigarette adoption is strongly shaped by purchasing power. This pattern contrasts with conventional cigarettes, which remain prevalent in poorer areas due to informal or illicit markets that lower prices (Barnett et al., 2009). Unlike conventional tobacco products, e-cigarettes in Indonesia are largely sold through formal retail channels, which maintain higher prices and restrict access. These conditions limit affordability for low-income households, making e-cigarette use less feasible among poorer populations. This interpretation is consistent with Indonesian evidence showing lower vaping prevalence in provinces with higher poverty levels, reflecting

the prioritization of essential needs over discretionary products such as vaping devices and e-liquids (Paramashanti et al., 2025).

Nevertheless, this affordability mechanism warrants cautious interpretation given the statistical non-significance of the poverty coefficient. As markets expand, lower-cost devices become available, or informal distribution channels emerge, e-cigarette use may diffuse more broadly across income groups. These dynamics underscore that e-cigarette consumption is closely tied to affordability, positioning vaping alongside other lifestyle products whose use fluctuates with household purchasing power. Supporting this interpretation, evidence from Central Java indicates that higher cigarette consumption is associated with increased poverty, highlighting how tobacco-related expenditures can reinforce household economic vulnerability (Sari, 2016). Taken together, these findings suggest that economic growth alone does not necessarily reduce tobacco use. Instead, targeted public health interventions remain necessary across all income groups, including higher-income populations, to shift social norms surrounding tobacco and nicotine consumption.

These affordability dynamics also help contextualise the role of unemployment, which represents another dimension of economic constraint. The analysis shows that individuals living in provinces with higher unemployment tend to have lower odds of e-cigarette use, although the effect is not statistically significant. The negative direction is consistent with consumer behaviour theory, as unemployment could reduce disposable income and limit the adoption of products that behave as normal goods. The insignificant influence of unemployment may be due to a measurement mismatch. In the Susenas data, e-cigarette consumption is recorded from age five and above, meaning that youths and students who often rely on household financial support are included.

Meanwhile, the open unemployment rate excludes non-labour force youths, despite their potential to consume vaping products through family-provided allowance. Recent evidence also supports that youth vaping is often financed through household allowances or pocket money rather than individual earnings, reflecting a disconnect between labour market indicators and actual spending capacity (Wężyk-Caba et al., 2022). As a result, provincial unemployment statistics fail to reflect purchasing power for vaping adequately. In contrast, broader macroeconomic indicators such as household expenditure and inequality better capture the structural determinants of e-cigarette consumption.

Based on the dual framework of consumer behaviour and innovation diffusion, a comprehensive tobacco control strategy for Indonesia should combine measures that directly address affordability with interventions that disrupt the diffusion of new products. Raising excise taxes and introducing minimum pricing would keep e-cigarettes financially out of reach, even as household purchasing power grows, reinforcing their status as normal goods sensitive to income. At the same time, limiting the diffusion of innovation requires curbing the channels through which vaping spreads. Banning advertising, enforcing plain packaging, and restricting retail outlets can weaken its appeal as a lifestyle trend. A dual-track approach is also essential, recognizing that conventional cigarettes and e-cigarettes follow different adoption patterns and therefore require differentiated strategies. Finally, targeted public education can counter misperceptions of e-cigarettes as "safe" alternatives and prevent further normalization.

While these findings provide meaningful policy guidance, they should be interpreted with several methodological limitations in mind, which also open opportunities for future research. First, the analysis relies on cross-sectional data, which restricts the ability to trace behavioural transitions or identify causal pathways in e-cigarette adoption over time. Second, macro-level variables are aggregated at the provincial level and assigned uniformly to all individuals within a province, reducing the effective sample size to the number of provinces

and potentially introducing bias from unobserved contextual factors or model constraints.

Future research would benefit from the use of richer longitudinal or panel data, the integration of price and market availability indicators, and the incorporation of behavioural variables such as peer influence, risk perception, and exposure to digital marketing. Multilevel designs with a larger number of level-2 units and finer spatial variation would also strengthen inference on macrostructural determinants of e-cigarette adoption in Indonesia.

CONCLUSION

This study demonstrates that e-cigarette adoption in Indonesia is shaped simultaneously by purchasing power and innovation diffusion dynamics. Individuals living in provinces with higher household consumption and greater income inequality are more likely to use e-cigarettes. In contrast, those in provinces with deeper poverty are less likely to do so. At the same time, vaping remains concentrated among men and urban residents, reflecting the role of socially open and affluent groups as early adopters. By contrast, unemployment and poverty show no significant association, suggesting that these economic indicators are weaker determinants of uptake compared to household expenditure and income inequality, which more directly capture purchasing power.

These findings are significant for both theory and policy. The results confirm that e-cigarettes function as normal goods, with adoption influenced by disposable income. The concentration of users among urban residents underscores that new nicotine products spread first within affluent and socially connected groups before diffusing outward. This dual interpretation highlights the risk of growing e-cigarette adoption. Although the poorest provinces are temporarily protected by affordability constraints, without effective regulatory controls, this diffusion is likely to extend to wider population groups and compound the public health burden of tobacco in Indonesia.

Positioning e-cigarette control alongside conventional tobacco regulation is critical to ensure that new products do not compound tobacco-related disease and economic burdens in Indonesia. Raising excise taxes and introducing minimum pricing can limit access even as household purchasing power increases. At the same time, plain packaging, advertising bans, and restrictions on retail outlets, particularly in urban centres, can disrupt the spread of vaping as a lifestyle trend. This dual-track strategy should be implemented alongside continued control of conventional cigarettes, which remain dominant in poorer and rural populations. Education campaigns are essential to address misconceptions regarding safety and to prevent the normalization of e-cigarettes among future generations.

The evidence indicates that e-cigarettes in Indonesia represent both an economic phenomenon associated with purchasing power and a social innovation diffusing among early adopters. It is crucial to consider both dimensions in developing effective and equitable tobacco control policies.

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