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Sociodemographic and Behavioral Determinants of Smoking : A Secondary Analysis in the 2023 Indonesia Health Survei (SKI)

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Abstract

Background: Smoking constitutes a major risk factor for non-communicable diseases and remains a significant public health issue in Indonesia. This study analyzes determinants of smoking status based on sociodemographic and behavioral characteristics from the 2023 Indonesian Health Survey (SKI).

Methods: This study employed a cross-sectional design utilizing secondary data from the 2023 Indonesian Health Survei. A total sampling technique was applied, initially including 877,531 respondents. After excluding individuals with missing data or those who did not respond to the cigarette variable (166,246), the final sample comprised 711,285 participants. Bivariate analyses and multivariate logistic regression identified dominant factors associated with smoking status.

Result: Smoking prevalence was 25.49% (181,278), while non-smoking was 74.51% (530,007). Multivariate analysis showed gender as the strongest predictor, with men having much higher odds of smoking than women (OR = 96.95; $p < 0.001$). Other significant factors were rural residence (OR = 1.133; $p < 0.001$), marital status (OR = 0.676; $p < 0.001$), low education (OR = 0.463; $p < 0.001$), employment status (OR = 1.133; $p < 0.001$), non-BPJS health insurance (OR = 0.884; $p < 0.001$), occasional exposure to other smokers (OR = 4.130; $p < 0.001$), and alcohol use (OR = 3.314; $p < 0.001$). The model showed strong explanatory power (Pseudo $R^2 = 0.485$).

Conclusion: Tobacco control strategies should be integrated with screening and counseling for risky behaviors, including alcohol consumption. Additionally, smoking cessation services should be adapted and expanded to address both rural and urban contexts.

Keywords: Indonesia Health Survei (SKI), Smoking, Sociodemographics

BACKGROUND

Cigarettes pose a significant global public health threat, as World Health Organization (WHO) data indicate that tobacco consumption causes over 8 million deaths annually, including approximately 1.3 million non-smokers who die from exposure to environmental cigarette smoke (1). In the United States, 4,000 teenagers initiate smoking daily, underscoring concerns about adolescent uptake. The impact encompasses biological harm and tobacco-related diseases, resulting in more than 8 million premature deaths worldwide and 480,000 annually in the United States (2). Multiple studies across Asia, the Middle East, Africa, the United States, and Europe demonstrate a clear association between cigarette use and diseases such as cancer, coronary heart disease, respiratory disease, oral cancer, and neck cancer (3). To mitigate these effects, Europe implemented the Tobacco Products Directive (TPD) from 2016 to 2021, regulating cigarettes and other tobacco products, including small cigars, e- cigarettes, and heated tobacco products, aiming to reduce smoking-related morbidity and mortality (4). From a sociodemographic perspective, the 2023 Indonesian Health Survey reports an active smoker prevalence of 70 million individuals, representing 7.4% of the population, including smokers aged 10 to 18 years. The 15-19-year age group exhibits the highest smoking prevalence at 56.5%, consistent with the Global Youth Tobacco Survey (GYTS) findings. The prevalence of school-age smokers aged 13-15 increased from 2016 to 19.2% in 2019 (5). Smoking and alcohol consumption contribute to lung, oral, liver, and esophageal cancers. Additionally, concurrent consumption of energy drinks and smoking is frequently observed, which adversely affects public health and increases healthcare costs (6,7). In Austria, patterns of simultaneous alcohol and tobacco use among women over 18 years old have been documented; among 2,647 female respondents, 60% smoke tobacco daily and potentially consume alcohol concurrently (5). Research from the ITC Four Country Smoking and Vaping Wave (February–June 2020), involving 9,112 active smokers and 1,184 former smokers (quit < 2 years) in Australia, Canada, the United Kingdom, and the United States, indicates that both groups tend to adopt new tobacco and non-smoking nicotine products as part of smoking cessation efforts (6). Neal et al. (2022) report that smoking cessation treatment includes pharmacotherapy, risk reduction counseling post-cessation, and follow-up contact, focusing on the relationship between smoking and cardiovascular disease (7). Chronic obstructive pulmonary disease (COPD) is another smoking-related illness, where cessation interventions effectively reduce the adverse effects of long-term secondhand smoke exposure.

Ongoing smoking behaviors have prompted numerous studies addressing regulations for cigarette consumption control, focusing on health behaviors and gaps in current tobacco control strategies. Higgins (2021) examines behavior change, tobacco control, and regulatory science, highlighting rural-urban disparities, perceptions of tobacco harm, tobacco use patterns, modeling of tobacco-related mortality, and smoking reduction through nicotine-reduction policies and clinical interventions. Tobacco control efforts respond to public health challenges, as smoking causes over 480,000 deaths annually. User perceptions of tobacco-related risks remain low despite evidence of harm. Sociodemographic factors, including residence location, influence tobacco consumption and associated risk factors, particularly among adolescents and males (2).

The latest developments in Indonesia that discuss smoking activities can be illustrated by the age category of the first smoker. This is evident in the 2023 Indonesian Health Survey Report, which found 137,323 people across 38 provinces in Indonesia. Top 5 Provinces with the Proportion of First Age Smoking at Age □ 10 years in the age range of 15-19 years, namely 1. West Java has as many as 32,334 people in the age range, with a proportion of 53.8 people, 2. East Java has 20,464 people, with a proportion of 55.9.3. In Central Java, 20,298 people, representing 54.4%, live there. In Banten, 6,274 people, or 59.5%, are affected. In North Sumatra, as many as 5,996 people have the same thing. 61.7. We can also see that smoking behavior, consumption of alcoholic beverages, and energy drinks are

significant risk factors for public health that can increase susceptibility to infectious and non-communicable diseases in Indonesia. The 2023 SKI report also shows that the prevalence of respiratory tract infections (ARI) based on diagnosis or symptoms in all age groups reaches 36.2%. The same is true for the prevalence of hypertension diagnosed by doctors in the age population ;: 15 years, which reached 19.9%. Then, the prevalence of asthma among people of all ages was recorded at 1.6% nationally, with variations between provinces: West Java at 2.4% and DI Yogyakarta at 3.5%. This figure reflects the burden of respiratory diseases, which is closely related to exposure to cigarette smoke. In addition, respiratory diseases such as pneumonia have a prevalence of diagnosis in Indonesia ranging from 0.55% in Aceh to 0.46% in West Sumatra; in some provinces, it has reached 15%. Other data related to the consumption of alcoholic beverages and energy drinks were also recorded in the report as risky behaviors that affect public health conditions (2).

The evidence indicates that smoking behaviors substantially affect public health in Indonesia. Smoking poses direct risks to active smokers and exacerbates health outcomes for individuals exposed to secondhand smoke. Proximity to smokers, along with alcohol and energy drink consumption, further increases vulnerability to various diseases. Consequently, the study titled "Determination of Sociodemographics, Behaviors, and Diseases Related to Smoking Status in Indonesia: SKI Data Analysis 2023" is pertinent. This research aims to examine the interactions among sociodemographic factors, risk behaviors, related diseases, and smoking status, and to offer recommendations for tobacco and consumption control policies in Indonesia, including excise taxation on cigarettes, sugar, and alcohol.

METHODS

Study Design

This study analyzes factors associated with smoking behavior using a cross-sectional design and secondary data from the 2023 Indonesian Health Survey (SKI), obtained from the Ministry of Health of the Republic of Indonesia's Secondary Data Service.

Population, Concept, and Context (PCC)

The study applied total sampling, resulting in an initial population of 877,531 respondents. After excluding 166,246 individuals with missing or unanswered smoking data, the final sample comprised 711,285 participants. The dependent variable, smoking status, was defined based on the questionnaire item: 'question (NAME) have you ever smoked?' from block G11 and categorized as either 'smoking' or 'not smoking.' Independent variables were extracted from location information and individual interview blocks, including district/city, gender, marital status, age, highest education, employment status, health insurance ownership, and proximity to other smokers, as well as from the consumption block, which includes intake of carbonated drinks, energy drinks, and alcohol. The study was conducted using national survey data from the Indonesian Health Survey 2023, which was obtained through the Secondary Data Service of the Ministry of Health of the Republic of Indonesia.

Eligibility Criteria

Participants with missing or unanswered smoking status data were excluded from the analysis.

Study Selection, Setting, and Data Extraction

Total sampling was applied using the available dataset. After the exclusion process, the final dataset included 711,285 participants who had complete smoking status information. Data were extracted from several questionnaire blocks, including block G11 for smoking status, location

information, individual interview blocks for demographic characteristics, and the consumption block covering intake of carbonated drinks, energy drinks, and alcohol.

RESULT AND DISCUSSION

Univariate Analysis

Table 1. Univariate Analysis of Sociodemographics and Behaviors Related to Smoking Smoking Status In Indonesia

Variable Dependencies	Frequency	Percentage (%)
Smoking Status		
Smoking	181 278	25,49
No Smoking	530 007	74,51
Independent Variables	Frequency	Percentage (%)
Residence Location		
Urban	382 762	53,81
Countryside	328 523	46,19
Gender		
Male	328 869	46,24
Women	382 416	53,76
Marital Status		
Unmarried	184 807	25,98
Ever married	526 478	74,02
Age		
<18 years old	117 982	16,59
19–34 years old	166 722	23,44
35–65 years old	375 388	52,78
>65 years old	51 193	7,20
Education		
Height	72 419	10,18
Low	638 866	89,82
Jobs		
Work	505 344	71,05
Not working	205 941	28,95
Ownership of JAMKES		
BPJS	544 342	76,53
Non-BPJS	166 943	23,47
Proximity to other smokers		
Yes, every day	517 168	72,71
Yes, not every day	194 117	27,29
Energy Drink Consumption		
Every day	14 650	2,06
Weekly	63 467	8,92
Every month	96 950	13,63
Never	536 218	75,39
Consumption of alcoholic beverages		
Yes	18 385	2,58
No	692 900	97,42

Variable Dependencies	Frequency	Percentage (%)
Carbonated Beverage Consumption		
Every day	19 801	2,78
Weekly	91 803	12,91
Every month	150 872	21,21
Never	448 809	63,10

Data Source: Indonesia Health Survey Data, 2023

Table 1 presents the univariate analysis of the sample characteristics. The smoking status variable included 181,278 individuals (25.49%) classified as smokers and 530,007 individuals (74.51%) as non-smokers. Among respondents, 383,762 (53.81%) resided in urban areas, while 328,523 (46.19%) lived in rural areas. Female respondents numbered 383,416 (53.76%), and male respondents numbered 328,869 (46.24%). Married individuals accounted for 526,478 (74.02%), while unmarried respondents accounted for 184,807 (25.98%). Age distribution was as follows: 35-65 years, 52.78%; 19-34 years, 23.44%; under 18 years, 16.59%; and over 65 years, 51,193 individuals (7.20%). Regarding education, 638,866 respondents (89.82%) had low levels of education, and 72,419 (10.18%) had higher levels. Employment status indicated that 505,344 respondents (71.05%) held work-category jobs, while 205,941 (28.95%) were in non-work-category jobs.

This paragraph summarizes respondent characteristics. Most respondents (76.53%) possess BPJS health insurance, whereas 23.47% do not. Daily exposure to other smokers is reported by 72.71%, with 27.29% experiencing less frequent exposure. The majority (75.39%) never consume energy drinks; smaller proportions consume them monthly (13.63%), weekly (8.92%), or daily (2.06%). An overwhelming majority (97.42%) abstain from alcohol consumption. Carbonated beverage consumption varies: 63.10% never consume, 21.21% consume monthly, 12.91% weekly, and 2.78% daily.

Bivariate Analysis

Table 2. Bivariate Analysisof Sociodemographics and Behaviors Associated with Smoking Smoking Status In Indonesia

Variable	Smoking Status				Quantity	OR	(95% CI)	*P value*
	Smoking		No Smoking					
	n	%	n	%				
Residence Location								
Urban	95.593	24,97	287.169	75,03	382.762	1,13	1.115-1,15	0,000
Countryside	85.685	26,08	242.838	73,92	328.523			
Gender								
Male	176.081	53,54	152.788	46,46	328.869	4,57	4,5-4,60	0,000
Women	5.197	1,36	377.219	98,64	382.416			
Marital Status								
Unmarried	29.657	16,05	155.150	83,95	184.807	0,67	0,66-0,70	0,000
Ever Married	151.621	28,80	374.857	71,20	526.478			
Age								
<18 years old	6.706	5,68	111.276	94,32	117.982			
19-34 years old	43.963	26,37	122.759	73,63	166.722	0,98	0,94 – 1,101	0,000
35-65 years old	116.705	31,09	258.683	68,91	375.388	0,91	0,87-0,94	0,000
>65 years old	13.904	27,16	37.289	72,84	51.193	0,12	0,113-0,124	0,000

Education								
Height	14.906	20,58	57.513	79,42	72.419	0,46	0,45-0,47	0,000
Low	166.372	26,04	472.494	73,96	638.866			
Jobs								
Work	167.395	33,12	337.949	66,88	505.344	1,13	1,103-1,163	0,000
Not Working	13.883	6,74	192.058	93,26	205.941			
Health Insurance Ownership								
BPJS	45.343	27,16	121.600	72,84	166.943	0,9	0,86-0,90	0,000
Non-BPJS	135.935	24,97	408.407	75,03	544.342			
Proximity to other smokers								
Yes, Every Day	163.651	31,64	353.517	68,36	163.651	4,1	4,04-4,21	0,000
Yes, not every day	17.627	9,08	176.490	90,92	17.627			
Energy Drink Consumption								
Every day	4.552	31,07	10.098	68,93	14.650	0,99	0,93-1,06	0,925
Every Week	24.109	37,99	39.358	62,01	63.467	1,08	1,01-1,15	0,019
Every Month	35.600	36,72	61.350	63,28	96.950	1,27	1,19-1,34	0,000
Never	117.017	21,82	419.201	78,18	536.218			
Consumption of alcoholic beverages								
Yes	14.589	79,35	3.796	20,65	18.385	3,3	3,17-3,45	0,000
No	166.689	24,06	526.211	75,94	692.900			
Carbonated Beverage Consumption								
Every day	5.375	27,15	14.426	72,85	19.801			
Every Week	28.466	31,01	63.337	68,99	91.803	1,00	0,947-1,063	0,893
Every Month	44.859	29,73	106.013	70,27	150.872	1,03	0,976-1,095	0,244
Never	102.578	22,86	346.231	77,14	448.809	1,04	0,980-1,096	0,207

Data Source: Indonesia Health Survey Data, 2023

Table 2 presents the bivariate analysis results, indicating that 95,593 respondents (24.97%) lived in urban areas, while 85,685 respondents (26.08%) lived in rural areas. The statistical test yielded a p-value of 0.000, demonstrating a significant association between residence location and smoking status. Furthermore, individuals in rural areas had a 1.13 times higher likelihood of smoking compared to those in urban areas. Among respondents, 176,081 males (53.54%) and 5,197 females (1.36%) were classified as smokers. The statistical test also produced a p-value of 0.000, confirming a significant relationship between sex and smoking status. Males had a 4.57 times greater likelihood of smoking than females. Additionally, 151,621 married respondents (28.80%) and 29,657 unmarried respondents (16.05%) were smokers. The statistical test again yielded a p-value of 0.000, indicating a significant association between marital status and smoking status.

The analysis revealed that unmarried respondents had a 0.67 times likelihood of smoking compared to married respondents. The age group 35-64 years exhibited the highest smoking prevalence, with 116,705 individuals (31.09%) identified as smokers. Other age groups included 43,963 respondents aged 19-34 years (26.37%), 13,904 respondents aged 65+ (27.16%), and 6,706 respondents aged under 18 (5.68%). The statistical test produced a p-value of 0.000, confirming a significant association between age and smoking status. Additionally, the 19-34 years age group had a 0.98 times

likelihood of smoking compared to those under 18 years. Regarding education, 166,372 respondents with primary education (26.04%) and 14,906 respondents with higher education (20.58%) were smokers. The statistical test yielded a p-value of 0.000, indicating a significant relationship between education level and smoking status. Respondents with lower education had a 0.46 times likelihood of smoking compared to those with a university education. Furthermore, 167,395 respondents (33.12%) reported smoking status within the employment category.

The statistical test yielded a p-value of 0.000, indicating a significant association between employment status and smoking. Non-workers were 1.13 times more likely to smoke compared to employed individuals. Among respondents, 135,935 (24.97%) without BPJS health insurance and 45,343 (27.16%) with BPJS insurance were smokers. The statistical test also produced a p-value of 0.000, confirming a significant relationship between health insurance ownership and smoking status. Furthermore, respondents reporting occasional proximity to other smokers had a 4.1 times higher likelihood of smoking compared to those without such proximity. Specifically, 163,651 respondents (31.64%) who were exposed to other smokers daily were smokers, whereas 17,627 respondents (9.08%) with no exposure were smokers.

The analysis identified significant associations between proximity to other smokers, energy drink consumption, and smoking status. A p-value of 0.000 indicates a strong relationship between proximity to smokers and smoking likelihood; individuals in the 'yes, not every day' category were 4.1 times more likely to smoke than those in the 'yes, every day' category. Regarding energy drink consumption, respondents who never consumed energy drinks had a 1.27 times higher likelihood of smoking compared to daily consumers, with detailed consumption patterns supporting these results. This association was statistically significant, as indicated by a p-value of 0.019. Furthermore, alcohol consumption correlated with increased smoking rates, with 24.06% of non-drinkers and 79.35% of drinkers classified as smokers.

A p-value of 0.019 further confirms a significant association between alcohol consumption and smoking status. Individuals who never consumed alcohol were 1.27 times more likely to smoke than daily drinkers. Consumption patterns of carbonated drinks reflected similar trends, with smoking prevalence increasing alongside consumption frequency.

Multivariate Analysis

Table 3. Logit Model Multivariate Analysis Results

Variable	Beef	OR	*Let's say.*
Residence Location			
Urban	References		
Countryside	0,016	1.133	0.000
Gender			
Male	0,474		
Women	References	4,57	0.000
Marital Status			
Unmarried	References		
Ever Married	- 0,027	0.676	0.000
Age			
<18 years old			
19-34 years old	- 0, 238	0.098	0.000
25-65 years old	- 0, 253	0.091	0.000
> 65 years old	- 0, 225	0.119	0.000

Variable	Beef	OR	*Let's say.*
Education			
Height	References		
Low	- 0,909	0.463	0.000
Jobs			
Work	References		
Not Working	- 0, 061	1.133	0.000
Health Insurance Ownership			
BPJS	References	References	
Non-BPJS	- 0,012	0.884	0.000
Proximity to other smokers			
Yes, Every Day	References	References	
Yes, Not every day	0,119	4.130	0.000
Energy Drink Consumption			
Every day			
Every Week	- 0,007	0.996	0.925
Every Month	0,002	1.081	0.019
Never		1.275	0.000
Consumption of alcoholic beverages			
Yes	References	References	
No	0,240	3.314	0.000
Carbonated Beverage Consumption			
Every day	Reff	References	
Every Week	- 0,001	1.004	0.893
Every Month	- 0,0005	1.035	0.244
Never	0,0001	1.037	0.207
N	711.285		
Prob> chi2	0,0000		
Pseudo R2	0,4850		

Data Source: Indonesia Health Survey Data, 2023

Table 3 presents multivariate logistic regression results showing that several variables remain significant after simultaneous adjustment. The final model yielded a Pseudo R^2 of 0.485, indicating that approximately 49% of the variation in smoking status is explained by the included variables. Gender was the most influential predictor (Coef = 0.474; OR = 4.57; $p < 0.001$), demonstrating that it remains the primary determinant of smoking behavior after controlling for other sociodemographic factors.

Primary education also had a significant effect (Coef = -0.909; OR = 0.463; $p < 0.001$), indicating that individuals with low education have a greater tendency to smoke. The negative effects of low education on health behaviors have been identified as structural factors that weaken an individual's ability to access preventive information (Maharani et al., 2023). The proximity factor to other smokers showed a strong social effect, with OR = 4.130 ($p < 0.001$). These findings reinforce the hypothesis that the social environment plays an important role in shaping smoking habits, as proposed by Bandura's social learning theory. In addition, alcohol consumption was strongly associated with smoking status (OR = 3.314; $p < 0.001$), supporting the epidemiological finding that addictive behaviors tend to cluster. Factors of residence and marital status also remained significant, with rural and married respondents having higher smoking tendencies. While the consumption variables for carbonated and energy drinks

showed a weaker relationship, they remained positively associated with smoking behavior (p = 0.019 for the monthly consumption category of energy drinks).

DISCUSSION

Residence Location

The analysis revealed a significant association between residence location and smoking status (p < 0.001; OR = 1.13; 95% CI: 1.115–1.15), indicating that individuals living in rural areas are 1.13 times more likely to smoke than those in urban areas. Geographic and social contexts, especially in rural Indonesia, play a critical role in shaping public health behaviors such as smoking. In these communities, cigarettes serve as social tools that reinforce relationships, with practices like sharing cigarettes at gatherings emphasizing their social significance. These findings underscore the need for tobacco control policies that address both smoking prohibition and the broader social meanings attributed to tobacco use in rural settings.

This argument is supported by health behavior theory. The Social Ecology Model illustrates how behavior is strongly influenced by social and cultural environments, explaining the higher smoking rates in rural contexts. Therefore, effective interventions should involve community leaders and religious institutions to modify social norms. According to the Theory of Planned Behavior (TPB), behavior is determined by intention, which is shaped by attitudes, subjective norms, and perceived behavioral control. In rural areas, close social relationships and frequent communal events amplify the influence of subjective norms. The practice of distributing cigarettes at gatherings normalizes smoking, thereby strengthening intentions to smoke. Additionally, easy access to cigarettes and minimal social barriers increase perceived behavioral control, further promoting smoking behavior.

Gender

The analysis indicated that gender strongly predicts smoking status, with an odds ratio of 4.57 (CI 4.5–4.60; p < 0.001). These findings reveal substantial differences in smoking behavior between men and women in Indonesia. The proportion of male smokers (53.54%) is significantly higher than that of female smokers (1.36%). Socio-cultural factors associate smoking in Indonesia with masculinity and maturity, thereby encouraging higher smoking rates among men. Conversely, female smokers encounter a strong social stigma, which discourages smoking among women.

These findings correspond with global studies demonstrating that men predominate in tobacco consumption, particularly in Southeast Asia. National data from the 2023 Indonesian Health Survey confirm that most smokers are men within the productive age group. This evidence suggests that tobacco control programs should incorporate gender-specific strategies. Targeted smoking cessation interventions for men aged 20 to 50 could substantially reduce national smoking prevalence (2,8).

Addressing gender differences in smoking requires recognizing that smoking status is influenced primarily by socio-cultural rather than biological factors. Among men, smoking symbolizes social status and masculinity, whereas women face social sanctions for smoking. The high prevalence of male smoking reflects weak enforcement of social norms in male public spaces and ineffective smoke-free regulations. Although female smoking rates remain low, the increasing trend among adolescents and urban working women is concerning, as some associate smoking with social freedom and emancipation. Eagly's Gender Role Theory explains how social norms shape behavior through gender roles. Society associates smoking with masculinity, independence, and male strength, while women who smoke are often perceived as violating social norms and values. This framework reinforces men's smoking as part of their gender identity, whereas women tend to abstain due to restrictive social norms (9).

Marital Status

Marital status was significantly associated with smoking behavior ($p < 0.001$; OR = 0.676). Married respondents exhibited a higher risk of smoking compared to unmarried individuals. These findings indicate that economic and social pressures within households may contribute to smoking behavior as a stress management strategy (6).

Alternatively, these results may be interpreted differently. Some studies in East Asia report that marital status reduces the risk of smoking due to social support and family regulation of health behaviors (8). In the Indonesian context, this relationship appears to be shaped by familial social and economic norms. Consequently, smoking cessation campaigns should target not only individuals but also couples and families through household-based approaches. Household smoking prevalence is commonly observed in countries with growing populations (10).

Marital status is linked to the effectiveness of family-based interventions aimed at reducing cigarette consumption in Indonesia. Although many educational and socialization efforts regarding smoking dangers primarily target novice smokers, typically young individuals or adolescents, household economic perspectives reveal that cigarette consumption is often regulated to minimize expenditure. Awareness initiatives, including education and child health programs, guide families toward future-oriented understanding (11). Becker, in the book Theory of Household Economics, emphasizes that individual decisions within households, such as smoking behavior, are influenced by negotiations among members. Married couples tend to adjust their consumption patterns for the common good, including limiting unproductive expenses that burden the family economy, such as cigarette purchases (12). Marriage may also promote self-regulation by encouraging individuals to act responsibly toward their spouses and children, thereby fostering the importance of maintaining health.

Age

The age variable demonstrates a significant association with smoking status. Multivariate analysis revealed that the 25-65 age group exhibited the highest likelihood of smoking (OR = 0.091; $p < 0.001$), whereas individuals under 18 showed the lowest likelihood. These findings align with health behavioral theory, which posits that individuals in productive age groups encounter greater stress and social exposure to smoking, thereby increasing smoking rates. The elevated prevalence of smokers within the 19-34 age group exemplifies the phenomenon of "early initiation of smoking," whereby initiation at a young age often leads to persistence into adulthood and heightened risk of chronic diseases such as lung cancer and coronary heart disease. Consequently, effective smoking control in Indonesia necessitates preventive interventions targeting adolescents, particularly within schools and youth communities. The study's results further indicate that smoking habits may be influenced by factors including peer pressure, parental influence, perceptions of masculinity, and curiosity (13,14).

These findings suggest that the relationship between age and smoking reflects a transitional social phenomenon in Indonesia. The younger generation has become a primary target of the cigarette industry, as cigarette advertising and promotion on digital media associate smoking with youth, adventure, and freedom, thereby enhancing its appeal at an early age. Furthermore, the high smoking prevalence among the productive age group indicates shortcomings in education and regulatory systems in protecting youth from nicotine addiction. Adolescence and young adulthood constitute critical periods for modifiable behavioral interventions, since delaying or avoiding smoking until adulthood substantially reduces the likelihood of lifelong smoking. This perspective corresponds with Jessor's Theory of Cumulative Risk, which asserts that early initiation of risky behaviors such as smoking leads to cumulative future health risks. Additionally, risk behaviors during young adulthood often correlate with other unhealthy practices, including alcohol consumption, energy drink use, and physical inactivity (12).

Further considering the Indonesian social context, the researcher observed that the relationship between age and smoking is influenced significantly by social, economic, and cultural factors. For example, a 19-year-old may smoke to express maturity and group solidarity, often imitating peers, artists, or parents. In contrast, for those aged 20-39 years, smoking aligns with a productive work phase characterized by stress, economic pressure, and a permissive social environment. Meanwhile, adults aged 40 and above often experience increased health awareness, particularly after health complaints like chronic cough, hypertension, or diabetes, prompting attempts to reduce or quit smoking due to medical and family pressures. This overall pattern underscores how smoking behaviors shift through the phases of an individual's socioeconomic life, beginning with social impulses in adolescence, intensifying with work stress during the productive age, and diminishing as health awareness rises in later years.

Education

Education was identified as the most influential variable affecting smoking status. Multivariate analysis indicated that respondents with low education levels were 0.463 times more likely to smoke than those with higher education ($p < 0.001$). These results confirm that education protects against smoking behavior.

These findings suggest that individuals with higher education possess greater knowledge of smoking risks, enhanced cognitive abilities, and stronger self-control in health-related decisions. Conversely, low education correlates with limited information and exposure to permissive social environments that encourage smoking. Additional research confirms that educational factors influence health behaviors, including insurance ownership and tobacco use. Consequently, these results underscore the urgency of public health education targeting low-educated populations. Governments should integrate health literacy programs into schools and vocational training to raise awareness of the dangers of smoking from an early age (11,15).In this perspective, researchers find that education acts as a cognitive filter, shaping how people understand health risks. Higher education improves health literacy, critical information analysis, and self-control in decision-making. In contrast, low levels of education are often associated with limited access to scientific information, thereby making individuals more susceptible to environmental hazards. Moreover, an education system that does not emphasize healthy living skills also worsens the situation. Based on these observations, the researchers argue that health literacy should be an integral part of the national curriculum, especially in secondary schools and vocational institutions (16,17).

Jobs

The results demonstrated a significant association between employment status and smoking status ($p < 0.001$; OR = 1.133). Employed individuals were more likely to smoke than unemployed individuals. This association may be attributed to social and psychological factors, including work-related stress, workplace social expectations, or permissive environments that facilitate smoking behavior.

This phenomenon is particularly evident in the informal sector and fieldwork, where smoking remains normalized and often constitutes a form of social interaction among workers. Previous research indicates that workers with low incomes and informal employment tend to exhibit poorer health behaviors, including smoking. Workplace-based smoking cessation programs have demonstrated effectiveness in addressing this issue, especially within manufacturing and informal service sectors (18,19). Additional studies highlight a potential link between employment, smoking status, and sick leave. Working-age individuals may take sick leave related to smoking-related health issues. In Japan, long-term sick leave is prevalent among workers, often due to cardiovascular disease and cancer.

Notably, smoking cessation rates increase following extended leave periods averaging 60 days (20,21). Furthermore, employment provides individuals with purchasing power and income, which may facilitate cigarette consumption. This pattern is particularly common among working-age individuals who have recently begun earning income.

This concept aligns with Keynes's seminal work on consumption, The General Theory of Employment, Interest, and Money, which posits that employment increases an individual's purchasing power, thereby influencing the consumption of goods such as cigarettes. Conversely, unemployment reduces purchasing power, thereby decreasing cigarette consumption (22).

Health Insurance Ownership

Health insurance ownership (BPJS versus Non-BPJS) was significantly associated with smoking behavior (OR = 0.884; $p < 0.001$). Respondents without BPJS coverage exhibited a higher likelihood of smoking compared to BPJS participants. This association indicates that access to health services may enhance awareness of preventive health behaviors, thereby influencing smoking likelihood.

Individuals enrolled in the health insurance system tend to utilize healthcare facilities more frequently, potentially increasing awareness of smoking-related health risks. This observation aligns with evidence that social security systems help reduce risky behaviors by enhancing access to medical consultations and promoting health. Consequently, strengthening health education within BPJS services represents a viable strategy to reduce national smoking prevalence (23,24).

Building on this, the researchers see that the relationship between health insurance ownership and smoking status may reflect differences in levels of health awareness and preventive behavior between social groups. This is not only related to economic problems but also to rational health indicators. Individuals who already have health insurance generally value health as a long-term asset (health capital), have a broader understanding of the risks of smoking, and more often interact with health services that provide health education, especially in complying with health insurance contributions such as BPJS Kesehatan (25). Health insurance ownership, like BPJS, acts as a behavioral filter in the health insurance system that follows, orienting health insurance toward prevention and the willingness to invest in the health sector.

Theories related to Health Insurance Ownership have been advanced by Irwin M. Rosenstock (1974) in his work, Historical Origins of the Health Belief Model. His theory suggests that BPJS participants have felt vulnerable or aware of their susceptibility to disease (26). The socioeconomic characteristics of BPJS health participants generally come from formal groups. These include the State Civil Apparatus (ASN), company workers, or other government subsidies.

Proximity to Other Smokers

The proximity to other smokers demonstrated a highly significant influence (OR = 4.13; $p < 0.001$). Individuals who interact daily with smokers are over four times more likely to be active smokers. This finding supports the theory of social contagion, which posits that individuals tend to imitate dominant behaviors within their social environment (2).

Research in Australia found that women residing in households with smoker family members were more likely to smoke or be exposed to secondhand smoke. Comparable patterns are observed in Indonesia, particularly within large families and densely populated communities. Consequently, tobacco control policies should emphasize community- and household-based interventions over individualized approaches (5). Furthermore, policies must address adolescent exposure to cigarette smoke related to proximity to smokers, as this remains a persistent challenge. For instance, Yuki et al. (2022) report that although adolescent exposure to cigarette smoke in Japan has declined, the national average exposure among other age groups continues to rise. Despite Japan's efforts to establish a

comprehensive tobacco control strategy, enhanced implementation and enforcement are necessary to increase its effectiveness .

Building on these findings, researchers contend that smoking cessation interventions focused solely on individuals are unlikely to succeed without concurrent changes in social norms within their environments. Smoking reflects not only individual behavior but also broader social constructs and interactions. In Indonesia, for example, smoking is embedded in social interactions, symbolizing maturity and familiarity in both workplace and friendship contexts. This perspective aligns with Social Network Theory, as described by Christakis and Fowler, who demonstrated that having a friend or family member who smokes increases the likelihood of smoking initiation through both direct and indirect social network effects. Therefore, close proximity to smokers influences collective behaviors, where norms, habits, and health practices develop through interpersonal relationships (27).

Consumption of alcoholic beverages

Alcohol consumption demonstrated a highly significant association with smoking status (OR = 3.314; CI 3.17–3.45; $p < 0.001$). Individuals who consumed alcohol exhibited a threefold increased risk of smoking compared to non-consumers. This finding is consistent with numerous international studies that identify links between alcohol use, behavioral patterns, and the interaction between nicotine and alcohol (5).

Both alcohol and nicotine exert a synergistic effect on the brain's dopaminergic system, thereby reinforcing addictive behaviors. Moreover, these substances are frequently co-consumed in social and recreational settings. Consequently, cigarette control programs should be integrated with alcohol control policies to maximize effectiveness. Supporting this approach, Shuai (2023) investigated the relationships among alcohol consumption, smoking, and related diseases, identifying a comprehensive link between smoking, alcohol use, and digestive disorders. Shuai's findings suggest that smoking and alcohol consumption may causally contribute to various digestive diseases, with higher intake increasing the risk of indigestion (28). Additional studies have reported associations between coffee, alcohol, and smoking with varying risks of gastrointestinal diseases. Specifically, smoking is genetically correlated with esophageal cancer, peptic ulcers, and irritable bowel syndrome, while alcohol consumption positively correlates with esophageal cancer and chronic gastritis risk (25). Furthermore, another study found that alcohol consumption and smoking increase the risk of Dupuytren's disease; however, it concluded that although the age of smoking onset and weekly alcohol intake are significantly related, the causal relationship between alcohol consumption and Dupuytren's disease is independent of smoking habits (29).

Carbonated Beverage Consumption

Although the association between carbonated beverage consumption and smoking status was not statistically significant ($p > 0.05$), data indicated a tendency for smokers to consume sugary and carbonated beverages more frequently. This pattern exemplifies the clustering of unhealthy behaviors. Behaviors such as smoking, high sugar intake, and physical inactivity commonly co-occur (1).

Building on these findings, global epidemiological studies frequently use carbonated beverage consumption as a marker of unhealthy lifestyle behaviors, particularly among urban and young populations. Consequently, nutritional and behavioral interventions should be incorporated into smoking cessation programs to adopt a more comprehensive approach to health. One study reported that 8% of students consumed energy drinks weekly, while 16% consumed at least one cup per week (30,31), underscoring the association between carbonated drink consumption and adolescents in secondary education. Furthermore, another study found that concurrent consumption of energy drinks with alcohol and tobacco is prevalent among adolescent groups (32,33).

Expanding on the pattern of co-occurring unhealthy behaviors, the researchers propose that these behaviors constitute maladaptive coping strategies, especially among individuals experiencing high work or academic stress. For instance, young workers often perceive energy drinks and cigarettes as productivity enhancers, despite their adverse effects on cardiovascular health and their role in accelerating long-term fatigue. The researchers concluded that cigarette control interventions in Indonesia should address related behaviors, such as energy drink consumption, since both behaviors share similar motivational mechanisms and social contexts. According to Lazarus and Folkman's stress theory, smoking and energy drink consumption may function as coping mechanisms to manage stress, pressure, or fatigue. Both nicotine and sugar stimulate dopamine release, producing a temporary sense of relaxation (34).

Energy Drink Consumption

The analysis revealed a significant association between energy drink consumption and smoking behavior ($p < 0.05$). Respondents consuming energy drinks monthly exhibited an odds ratio (OR) of 1.081, indicating a greater likelihood of smoking compared to non-consumers.

Energy drinks typically contain high levels of caffeine and sugar, which stimulate the nervous system and can induce a euphoric effect similar to that of nicotine. Research indicates that energy drink consumption may serve as a gateway to other addictive substances, including cigarettes and alcohol. Therefore, health education programs should explicitly advise against the concurrent use of energy drinks and cigarettes, as this combination may increase cardiovascular risks and sleep disturbances. Targeted health education is particularly important for university students aged 18 to 25, who, according to Aina's 2022 study, are more likely to consume energy drinks, alcohol, and cigarettes. Health educators should also address academic stressors that may contribute to the use of these substances, emphasizing the heightened correlation between these behaviors during periods of intense academic demand (35).

The researchers further propose that the combination of nicotine from smoking and caffeine from energy drinks produces neurophysiological interactions that reinforce addictive behaviors. Elevated caffeine intake increases dopamine release in the brain, paralleling the effects of nicotine, which induces mild euphoria and enhanced concentration. The simultaneous presence of these effects may increase the likelihood of repeated consumption to sustain the sensation. Socially, smoking while consuming energy drinks can develop into a group ritual, reinforcing social bonds within certain workplaces or communities. According to Becker and Murphy's Theory of Rational Addictive Consumption, individuals seeking stimulant effects from one substance, such as nicotine, may also consume others, like caffeine. Consequently, the combined behavior of smoking and energy drink consumption represents a complementary addiction that is both physiologically and psychologically reinforcing (17).

CONCLUSION

The research findings are intended to inform government efforts to enhance tobacco control policies. The specific recommendations include: (1) increasing health education aimed at populations with lower educational attainment; (2) reinforcing regulations for smoke-free areas; and (3) initiating social campaigns to promote a smoke-free community.

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AUTHOR'S CONTRIBUTION STATEMENT

EJ, RN, HO, MI, YR: conceptualized the study, formulated the research questions, developed the review protocol, conducted literature searches, screened articles according to criteria, extracted data, and drafted the manuscript. EJ, RN, HO developed the methodology, verified the selected articles, analyzed and synthesized data, prepared tables and figures, and reviewed and edited the manuscript. EJ, RN, HO, MI, YR supervised the research, validated the methodology and results, critically reviewed the manuscript, provided guidance, and approved the final version.

CONFLICT OF INTEREST

No conflict of interest to declare in study

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