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RESEARCH

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Perceptions of Tobacco Control Policies and Their Association with Smoking Behavior among the University Community in Tarakan, Indonesia

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Abstract

Smoking and exposure to secondhand smoke remain important public health challenges in Indonesia. Understanding smoking patterns and perceptions among university communities is important for strengthening tobacco control in educational settings. This study aimed to analyze perceptions of smoking, smoking behavior, and the implementation of smoke-free policies among the university community. A cross-sectional survey was conducted from June to November 2022 among 153 university communities selected using simple random sampling, comprising 98 students, 42 lecturers, and 13 educational staff. A validated questionnaire was used to assess perceptions and smoking behavior. Data were analyzed using Chi-square, Mann-Whitney, and Spearman correlation tests, with statistical significance set at $p < 0.05$. Six respondents (3.9%) were active smokers, while 83 (54.3%) were exposed to secondhand smoke. Smoking prevalence was higher among men than women (16.0% vs. 1.6%; $p = 0.001$) and differed significantly by occupation (15.4% among educational staff, 4.1% among students, and 0% among lecturers; $p = 0.044$). Education level showed a weak positive correlation with perception level ($p = 0.218$, $p = 0.007$), and perception levels differed significantly by smoking status ($p = 0.007$). Although 99.3% of respondents supported the implementation of smoke-free policies, 54.3% reported exposure to secondhand smoke, while observational checks found no visible campus signage enforcing the smoking ban. These findings reveal a substantial gap between strong support for smoke-free policies and their implementation on campus. Strengthening institutional enforcement, visible smoke-free signage, and monitoring is therefore essential to translate policy support into effective smoke-free campus practices.

Keywords: Smoking Behavior, Smoke-Free Policy, Campus, Educational Area, Indonesia.

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1. INTRODUCTION

Smoking, with more than 4,000 toxic substances in cigarettes, remains one of the leading preventable causes of disease and death worldwide (World Health Organization, 2021). Despite decades of public health campaigns, tobacco continues to drive the global burden of disease, particularly in low- and middle-income countries (WHO, 2019). Beyond harming smokers, it exposes non-smokers to secondhand smoke, underscoring the urgency of effective tobacco control.

In Indonesia, tobacco use persists as a major public health challenge. Existing policies often fall short due to gaps in communication, acceptance, and enforcement. A formal smoke-free regulation alone does not guarantee protection from secondhand smoke, highlighting the disconnect between policy and practice (Achadi et al., 2005; Sumartono et al., 2011; Ahsan & Wiyono, 2017). Universities are critical settings for tobacco control, as they shape norms and behaviors among students and staff. At the University of Borneo Tarakan (UBT), 99.3% of respondents supported smoke-free policies, yet 54.3% still reported exposure to secondhand smoke, revealing weak compliance and enforcement (Sugiyatmi et al., 2024). The rise of electronic cigarettes and heated tobacco products further complicates the landscape, with younger populations often underestimating their health risks (World Health Organization (WHO), 2019).

University communities represent concentrated social environments where peer influence, institutional practices, and campus policies intersect. Smoking in these settings is not only an individual behavior but also a social and environmental issue that normalizes tobacco use and exposes others to secondhand smoke. Effective smoke-free policies can reduce exposure, discourage smoking in shared spaces, and shift social norms, while universities carry an institutional responsibility to model healthy behaviors (Atiba et al., 2020; Glassman et al., 2011; Sendall et al., 2020).

Perceptions play a central role in shaping compliance with tobacco-control measures. In this study, perception refers to how students, lecturers, and staff interpret information about smoking and Smoke-Free Areas (Kawasan Tanpa Rokok/KTR). Understanding these perceptions is essential for designing interventions that strengthen tobacco control in educational settings (Ickes et al., 2017; Sabrian & Utomo, 2019).

Evidence from universities worldwide shows that comprehensive smoke-free policies reduce smoking rates, protect non-smokers, and support cessation efforts, provided that leadership and enforcement are strong (Bartington et al., 2020; Mohmad et al., 2022; Mohmad & Ismail, 2021). However, research gaps remain, particularly in developing countries. Few studies examine longitudinal changes in perception and behavior, integrate socio-cultural factors such as gender and occupation, or evaluate enforcement mechanisms such as signage, cessation support, and disciplinary measures (Braverman et al., 2018; Karadağ et al., 2021).

Against this backdrop, the present study investigates perceptions of tobacco risks, smoking behavior, and the implementation of smoke-free policies within UBT. By analyzing how perceptions and behaviors interact with institutional measures, the study seeks to explain the gap between policy support and actual protection from secondhand smoke. The findings aim to strengthen tobacco control in Indonesian universities by identifying barriers, subgroup differences, and enforcement challenges.

The novelty of this research lies in its focus on the academic community as a microcosm of public health behavior in Indonesia. By incorporating demographic and socio-cultural factors, it provides context-specific insights into compliance and exposure. Ultimately, the study seeks to bridge the gap between policy and practice, guiding universities toward effective smoke-free environments that reduce smoking prevalence and protect campus residents.

2. RESEARCH METHOD

This study employed a cross sectional survey design with simple random sampling. This design is intended to describe perception variables related to smoking, as well as other variables such as gender, job status, last education, faculty origin, and perception. In this study, the population comprised 7,054 individuals, including lecturers, educational staff, and students, with the largest proportion represented by students. Based on the Lemeshow formula, the minimum required sample size was 80 respondents. However, 153 campus residents (students, lecturers, and staff) were ultimately included to enhance representativeness. The inclusion criteria in this study were as follows: 1) an active student/employee during the study period; 2) being able to complete the questionnaire.

A structured questionnaire was developed and validated. The initial questionnaire contained 32 items; 12 were retained after validity and reliability testing (Cronbach's alpha = 0.926). Items were excluded due to low factor loadings or redundancy. The retained items covered three dimensions: perceptions of smoking, smoking behavior, and implementation of smoke-free areas. Although the number of valid items was reduced, the retained items adequately represented the intended constructs. Perception scores were categorized into five levels (VL, L, M, H, VH) using percentile cut offs. Data analysis employed Chi-square tests for categorical associations, Mann-Whitney tests for group differences, and Spearman's correlation for relationships between education level and perception scores. Statistical significance was set at $p < 0.05$. This research has received approval from the Ethics Commission of the Faculty of Health Sciences, Borneo University of Tarakan. The ethical number for this research is 10/KEPK-FIKES UBT/VI/2022.

3. RESULTS AND DISCUSSION

Table 1 presents the socio demographic characteristics of the 153 respondents. This distribution highlights a predominantly young, female student population, which provides important context for interpreting smoking behavior and perceptions in the study.

Table 1. Socio-Demographics of Research Respondents (n=153)

Attribute	Classification	n	%
Employment status	Student	98	64.1
	Educational staff	13	8.5
	Lecturer	42	27.5
Gender	Woman	128	83.7
	Man	25	16.3
Age group	<17 years	0	0.0
	17-22 years	98	64.1
	23-28 years	9	5.9
	29-34 years	21	13.7
	35-40 years	13	8.5
	41-46 years	5	3.3
	47-52 years	5	3.3
	53-58 years	2	1.3
	>59 years	0	0.0
Faculty affiliation	Non-Health Cluster	52	33.9
	Health	101	66.0
Education Level	Junior High or below	0	0.0
	Senior high school	101	66.0
	Bachelor's degree	10	6.5
	Master's degree	38	24.8

Doctoral degree	4	2.6
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Among the 153 respondents, 6 (3.9%) were active smokers. Among the active smokers, four were men (66.7%), and two were women (33.3%), indicating that smoking was more prevalent among men. When stratified by employment status, students accounted for four active smokers (4.1%), while two were educational staff (15.4%); notably, no lecturers reported smoking. Findings from this study align with prior research indicating that perceptions of smoke-free campus policies vary significantly across stakeholder groups (Sabrian & Utomo, 2019). These findings suggest that smoking was concentrated among men and staff members, while prevalence among students remained relatively low. The persistence of smoking within the university community reflects the challenges of achieving full compliance with smoke free policies, consistent with prior studies in academic institutions (Chido-Amajuoyi et al., 2024). As shown in Table 2, the behavioral patterns of the six active smokers demonstrate various temporal, social, and contextual dimensions.

Table 2. Description of Smoking Behavior among Active Smokers (n = 6)

Question	Answer Category	Percentage (%)
Time of smoking	Midday	16.7
	Evening	16.7
	A combination of 2 times	50.0
	All day long	16.7
Number of cigarettes per day	1-6 sticks	83.3
	7-12 sticks	16.7
Type of cigarette consumed	Kretek	16.7
	White Cigarettes (mild)	55.7
	Electronic cigarettes	16.7
Average daily expenditure (IDR)	< 10.000	16.7
	11,000–20,000	33.3
	21,000-30,000	33.3
	31,000-40,000	16.7
Smoking Context	Free time/work breaks	83.3
	While working	16.7
	While in the toilet	50.0
First cigarette of the day	Smoking alone	66.4
	Smoking with others	83.3
First cigarette of the day	Morning	16.7
	Before going to campus	16.7
	Mid morning (10 am break)	16.7
	Afternoon, during lunch break	33.3
	Evening	16.7
Reasons for smoking	Addiction	33.3
	Work performance	33.3
	Social respect (friends/guests)	33.3
Intention to quit	Yes	100.0
	No	0.0
Reasons to quit	Increased expenditure	83.3
	Health concerns	16.7
Planned time to quit	As soon as possible	83.3
	Gradual reduction (e.g., weekly)	16.7
Smoking is prohibited in the areas	Yes	50.0
	No	50.0

Most respondents reported smoking during two combined times of day (50.0%), with smaller proportions smoking at midday, evening, or throughout the day. The majority (83.3%)

consumed 1–6 cigarettes daily, and white/mild cigarettes (55.7%) were the most common type, followed by kretek and electronic cigarettes. The average daily expenditure ranged from IDR 11,000 to 30,000 (66.6%), indicating moderate spending. Smoking typically occurred during free time or work breaks (83.3%), though half admitted smoking in toilets. Social context was important: while two thirds smoked alone, 83.3% smoked with others for their first cigarette of the day. Timing varied, with most smoking during lunch breaks (33.3%). Reported reasons included addiction, work performance, and social respect (each 33.3%). Encouragingly, all smokers expressed an intention to quit (100%), primarily due to increased expenditure (83.3%), with most planning to stop as soon as possible (83.3%). Awareness of smoking restrictions was mixed: half acknowledged the prohibitions, half did not.

These behavioral insights underscore the complexity of tobacco control within academic institutions. Although active smokers represented a small proportion of respondents, their practices—such as smoking during breaks, in prohibited areas, and in social contexts—contributed to widespread secondhand smoke exposure. This highlights weaknesses in enforcement and the persistence of social norms that tolerate smoking. Importantly, while all active smokers expressed an intention to quit, their motivations were primarily economic rather than health related, with increased expenditure cited as the dominant factor. This pattern reflects findings from prior studies in low and middle income settings, where financial burden often drives cessation attempts more than health concerns.

The findings of this study reveal a striking contrast between the low prevalence of smoking and the high exposure to secondhand smoke. Table 3 summarizes smoking status, secondhand smoke exposure, and support for smoke-free policies among respondents. Only 3.9% were active smokers, while the vast majority (96.1%) reported being non-smokers. The behavioral patterns of active smokers (Table 2)—such as smoking during breaks, in toilets, or with colleagues—led to 54.3% of non-smokers reporting exposure to secondhand smoke. This demonstrates that even a small group of smokers can exert a disproportionate impact on the campus environment through social and contextual practices.

Encouragingly, nearly all respondents (99.3%) expressed strong support for smoke-free policies. However, the persistence of secondhand smoke exposure highlights the disconnect between policy endorsement and actual compliance.

Table 3. Smoking Status, Exposure, and Policy Support (n = 153)

Variable / Question	Answer Category	Percentage (%)
Smoking status	Active smoker	3.9
	Non smoker	96.1
Exposure to secondhand smoke	Yes	54.3
	No	45.7
Support for a smoke-free policy	Yes	99.3
	No	0.7

Taken together, these results reveal a clear policy–practice gap: strong normative support for smoke free policies exists, yet inconsistent enforcement and socially embedded smoking behaviors continue to undermine compliance. This discrepancy underscores the urgent need for stronger institutional leadership, visible signage, targeted cessation support, and consistent monitoring to ensure that policy support translates into effective protection on campus.

Table 4 further contextualizes these results by demonstrating significant associations between demographic variables and smoking status: men and staff were more likely to smoke, while higher levels of education correlated with stronger anti-smoking perceptions and lower prevalence. Together, these findings show that even limited smoking behavior can produce

disproportionate exposure and that demographic and perceptual factors critically shape compliance with smoke-free policies.

Table 4. Cross Tabulation of Perception Level and Smoking Status by Demographic Variables (n = 153)

Variable	Category	Perception Level (%) (VL, L, M, H, VH)	Smoker Status (%) (No / Yes)	p value
Gender	Men (n = 25)	0.0, 0.0, 8.0, 40.0, 52.0	84.0 / 16.0	0.001
	Women (n = 128)	0.6, 0.0, 4.7, 30.5, 64.1	98.4 / 1.6	
Occupation	Students (n = 98)	1.0, 0.0, 7.1, 36.7, 55.1	95.9 / 4.1	0.044
	Staff (n = 13)	0.0, 0.0, 7.7, 30.8, 61.5	84.6 / 15.4	
	Lecturers (n = 42)	0.0, 0.0, 0.0, 21.4, 78.6	100.0 / 0.0	
Education	Senior HS (n = 101)	1.0, 0.0, 7.0, 35.0, 55.0	95.0 / 5.0	0.007 (p = 0.218)
	Bachelor (n = 10)	0.0, 0.0, 0.0, 40.0, 60.0	90.0 / 10.0	
	Master (n = 38)	0.0, 0.0, 0.0, 21.1, 78.9	100.0 / 0.0	
	Doctorate (n = 4)	0.0, 0.0, 0.0, 25.0, 75.0	100.0 / 0.0	
Faculty	Non Health (n = 52)	0.0, 0.0, 3.8, 40.4, 55.8	96.2 / 3.8	0.140 0.439
	Health (n = 101)	0.9, 0.0, 5.9, 27.7, 65.3	96.0 / 4.0	
Perception	Very Low (n = 1)	—	100.0 / 0.0	
	Low (n = 0)	—	—	
	Moderate (n = 12)	—	75.0 / 25.0	
	High (n = 50)	—	93.9 / 6.1	
	Very High (n = 90)	—	98.9 / 1.1	
Total	(n = 153)	0.7, 0.0, 5.2, 32.0, 62.1	96.1 / 3.9	

Generally, statistical analysis revealed significant associations between demographic variables and smoking status. Statistical analysis revealed significant relationships for gender ($p = 0.001$), occupation ($p = 0.044$), and education ($p = 0.218$, $p = 0.007$). Perception itself was significantly associated with smoking status ($p = 0.007$), as individuals with moderate perception reported the highest smoking prevalence (25.0%), whereas those with very high perception had the lowest (1.1%).

Gender was strongly associated with smoking, with men being more likely to be active

smokers (16.0%) compared to women (1.6%), reflecting gendered differences in tobacco use. Research has shown that male students tend to smoke more than female students, which aligns with global trends in tobacco use (Braverman et al., 2018; Karadağ et al., 2021). The strong association between male gender and smoking aligns with regional and global patterns in which men are more likely to use tobacco. In this sample, men accounted for the majority of active smokers despite being a minority of respondents, men accounted for the majority of active smokers, underscoring persistent gendered disparities in tobacco use even within health-oriented academic environments. Statistical analyses used to evaluate these relationships included Chi-square tests for categorical data, with smoking behaviors across gender showing a significant association ($p = 0.001$).

Occupation significantly influenced smoking status and perceptions in academic communities. Moreover, occupation plays a critical role: individuals in health-related fields generally exhibit lower smoking rates and greater willingness to support smoke-free policies than their peers in administrative roles. Occupation was also significantly related to smoking status, with a higher prevalence among administrative staff (15.4%) than among students (4.1%) or lecturers (0%).

This pattern underscores the impact of occupational norms and stress factors on smoking habits, suggesting that workplace environment and job responsibilities play critical roles in shaping health behaviors. Mann-Whitney tests to assess differences in smoking behaviors and occupational groups showed a significant relationship ($p = 0.044$), with smoking more prevalent among educational staff compared to students and lecturers.

The association between occupation and smoking—higher prevalence among students and educational staff and absence of smokers among lecturers—suggests that professional role and social position within the university influence smoking behavior, possibly through differences in health literacy, social norms, or workplace expectations. The occupational pattern—students and educational staff showing higher smoking prevalence—indicates that prevention and cessation programs should be tailored to these groups. Peer-led interventions, integration of tobacco education into curricula (especially for non-health faculties), and visible role modeling by academic staff could reduce initiation and normalize smoke-free behavior. The absence of smoking among lecturers suggests that faculty members may serve as role models and potential champions for smoke-free policy enforcement, reinforcing the importance of professional context in shaping health behaviors.

Prevalence rates of both active and passive smoking among university students and staff vary across studies. For instance, one study reported that 16.3% of medical students were regular smokers, but there was no specific mention of passive smoking rates among medical students (Glassman et al., 2011; Sendall et al., 2020). Another study suggests that among students, particularly in developing regions, the prevalence of passive smoking may be influenced by social norms in public spaces (Chido-Amajuoyi et al., 2024).

Educational attainment is directly correlated with acceptance of and compliance with smoke-free policies. Research indicates that individuals with higher levels of education demonstrate greater support for tobacco control measures and are more compliant with smoke-free regulations (Chido-Amajuoyi et al., 2024). This finding is consistent with the idea that education increases health knowledge and normative support for public health policies. This trend has been observed universally, suggesting that educational campaigns can effectively increase awareness and compliance. The correlation between education and acceptance of smoke-free policies underscores the need for targeted health education programs, which can enhance public understanding of the risks associated with smoking and passive exposure, thereby fostering healthier environments on campuses.

Education level was weakly but significantly correlated with perception ($\rho = 0.218$, $p = 0.007$). Respondents with master's or doctoral degrees consistently reported very high perception levels and no smoking prevalence, whereas senior high school graduates demonstrated lower perception and a higher smoking rate (5.0%). These findings suggest that higher education is linked to stronger anti-smoking attitudes. Moreover, perception levels differed significantly by smoking status ($p = 0.007$), indicating that smokers and non-smokers interpret tobacco risks differently. This finding aligns with previous research indicating that education enhances health literacy and normative support for tobacco control measures (Chido-Amajuoyi et al., 2024). Thus, education appears to be a protective factor against smoking initiation and continuation.

Furthermore, studies have shown that university students, particularly those in health-related disciplines, exhibit greater awareness of the implications of smoking and stronger endorsement of smoke-free initiatives than their peers in other fields. This connection underscores the role of education in fostering supportive environments for public health initiatives aimed at reducing smoking prevalence among youths and adults alike.

Education and professional context greatly influence perceptions and behaviors related to tobacco control in higher education settings. Higher levels of educational attainment typically correlate with increased awareness of the health risks associated with tobacco use, leading to a more favorable attitude towards smoke-free policies. For instance, research has shown that students in health sciences often exhibit stronger support for tobacco control measures compared to those in non-health-related fields, as their training emphasizes the detrimental effects of smoking. Such findings are consistent with the broader understanding of

educational impacts on health behavior. Additionally, professionals within academic institutions, particularly those in leadership and health education roles, play a critical role in shaping a culture that supports compliance with tobacco control initiatives. Faculty background did not show a statistically significant association with smoking status, although students in health sciences reported higher perception levels than those in non-health faculties. This reflects the impact of curriculum content, as health-related training emphasizes the detrimental effects of smoking and fosters stronger support for tobacco control initiatives. Such differences highlight the importance of integrating tobacco education across all faculties to ensure broad awareness and compliance.

Perception itself was significantly associated with smoking status, with individuals reporting moderate perception levels showing the highest prevalence of smoking, while those with very high perception reported the lowest. This suggests that perception mediates smoking behavior, with stronger awareness of tobacco risks translating into healthier choices. These findings are consistent with international studies emphasizing the role of perception and risk interpretation in shaping tobacco use patterns (Lundborg & Andersson, 2008; Murphy-Hoefer et al., 2004). Gaps in awareness and enforcement of smoke-free policies, particularly in Indonesia, highlight the need for institutional leadership to implement robust strategies to enhance compliance. Key actions include establishing clear communication channels about the importance of smoke-free zones, providing smoking-cessation resources, and ensuring consistent enforcement of regulations across campus. Institutions must prioritize educational initiatives that emphasize the adverse health impacts of secondhand smoke and foster an environment that maximizes both awareness and compliance (Etter et al., 2023; OMS, 2017; Suls et al., 2012). The association between occupation and smoking—higher prevalence among students and educational staff and absence of smokers among lecturers—suggests that professional role and social position within the university influence smoking behavior, possibly through differences in health literacy, social norms, or workplace expectations. The occupational pattern—students and educational staff showing higher smoking prevalence—indicates that prevention and cessation programs should be tailored to these groups. Peer-led interventions, integration of tobacco education into curricula (especially for non-health faculties), and visible role modeling by academic staff could reduce initiation and normalize smoke-free behavior. The absence of smoking among lecturers in this sample positions faculty as potential champions for policy enforcement and behavior change.

Several strategies and policy interventions have proven effective in translating positive perceptions into compliance with smoke-free regulations. Educational programs that enhance awareness about the dangers of smoking and the benefits of smoke-free policies are essential.

For example, interactive educational interventions have shown significant improvements in attitudes toward smoking and compliance with tobacco control policies. Additionally, initiatives that engage the entire campus community, including students, faculty, and staff, are important for fostering a collective commitment to smoke-free environments.

Taken together, these results demonstrate that while awareness and support for smoke-free policies are high, compliance remains inconsistent. Institutional leadership must prioritize comprehensive strategies that combine education, enforcement, and community engagement. Clear communication channels, accessible cessation resources, and consistent monitoring are critical to fostering a collective commitment to smoke-free environments. Universities, as centers of knowledge and public health advocacy, have a unique responsibility to model and enforce tobacco control measures (Fallin et al., 2012; Fujita & Marteache, 2020; Seo et al., 2011).

Finally, this study has several limitations that should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships among perceptions, smoking behavior, and policy implementation. Second, the reliance on self-reported questionnaires may introduce recall bias or social desirability bias, particularly regarding sensitive behaviors such

as smoking in prohibited areas. Third, although the instrument demonstrated high reliability, only 12 of the original 32 items were retained, which may limit the breadth of constructs captured. Fourth, the sample was drawn from a single university, which reduces generalizability to other educational institutions in Indonesia. Future research should employ longitudinal designs and broader sampling to strengthen the evidence base for tobacco control in higher education settings

4. CONCLUSION

This study identified significant associations between gender, occupation, education, and smoking status within a university population. Men were substantially more likely to smoke than women, and administrative staff reported a higher prevalence compared to students, while lecturers reported none. These findings highlight the influence of demographic and occupational factors on smoking behavior and suggest that faculty members may serve as role models in promoting smoke free environments. Although education level was weakly but significantly correlated with perception ($\rho = 0.218$, $p = 0.007$), the strength of this relationship was very limited. Higher education may contribute modestly to stronger awareness of tobacco risks, but it should not be interpreted as a major determinant of smoking behavior. Perception itself showed a clearer association with smoking status, with very high perception linked to the lowest prevalence. Overall, the results underscore that while awareness and support for smoke free policies are present, compliance remains inconsistent. Targeted interventions for high risk groups, stronger institutional leadership, and consistent enforcement are essential to reduce smoking prevalence and protect non smokers in academic settings.

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