Changes in smoking behavior among students following the implementation of a campus smoke-free policy: A cross-sectional study

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ABSTRACT

INTRODUCTION Smoking behavior among college students remains a concern. A smoke-free campus policy is a straightforward yet effective approach to protect individuals from exposure to secondhand smoke. Although smoking bans are enforced in government offices, health facilities, and schools, their implementation in universities, particularly on health campus institutions, remains limited. This study aims to examine the impact of a smoke-free campus policy on smoking behavior among public health students in Yogyakarta, Indonesia.

METHODS We conducted a cross-sectional survey using a self-administered questionnaire. This study was conducted at the Health University in Yogyakarta, Indonesia, in August 2017. The study employed a descriptive quantitative method, with variables examined including the implementation of smoke-free areas and smoking patterns among students. A total of 322 public health undergraduate students were recruited in this study through an accidental sampling technique. This study used Fisher's exact test analysis.

RESULTS The smoke-free policy possibly had a positive influence on student smoking behavior, as 6.5% of male and 1.9% of female students quit smoking following its implementation. Additionally, 6.5% of male and 3.7% of female students reduced cigarette use. There are also former smokers, comprising 4.7% of males and 0.3% of females. Finally, 56.8% of female students found the policy effective, compared to 20.8% of male students, indicating greater overall approval among females. The smoking status (crude prevalence ratio, PR=0.92; 95% CI: 0.85–0.98, p<0.05) and smoking behavior (PR=0.85; 95% CI: 0.03–0.26, p<0.05) were significantly associated with gender.

CONCLUSIONS The implementation of a smoke-free campus policy was associated with changes in students' smoking behavior. However, as this study employed a cross-sectional design, it was unable to establish a causal relationship between the policy and behavioral changes. Further longitudinal or experimental studies are required to confirm the effectiveness of smoke-free campus policies in reducing smoking among students.

INTRODUCTION

Smoking behavior among university students is a major concern in health promotion and tobacco-related disease prevention[1]. Moreover, smoking is an important public health problem among university students. Overall, 34% of male university students and 27% of female university students from 23 different countries were current smokers, with large differences between countries and gender[2]. University campuses as educational environments are expected to be smoke-free zones in accordance with health regulations and government policies prohibiting smoking in educational areas[1,3]. The implementation of campus smoke-free policies aims to reduce smoking prevalence among students and lower exposure to secondhand smoke among non-smokers[4].

The World Health Organization (WHO) report on the Global Adult Tobacco Survey (GATS) in Indonesia in 2021 found that 34.5% of adults, or 70.2 million people, use tobacco. The percentage of tobacco use in men is 65.5%, and in women, 3.3%. The use of e-cigarettes has increased 10-fold in 10 years, from 0.3% in 2011, when the previous

GATS was implemented, to 3% in 2021[5]. The implementation of smoke-free policies on campus is a significant public health initiative aimed at reducing the prevalence of smoking among college students and improving the quality of the educational environment. A large body of evidence supports the notion that such policies can lead to significant reductions in smoking behavior among college students, as well as changes in social norms surrounding tobacco use. A meta-analysis found that after the implementation of comprehensive smoke-free policies, college student smoking prevalence decreased from 16.5% to 12.8% after one year and from 9.5% to 7.0% after three years[6]. In addition, a narrative review highlighted that students, faculty, and staff showed increased support for smoke-free initiatives when they experienced lower levels of secondhand smoke exposure on campus[7].

Approaches to enhance the success of smoke-free campus policies include engaging university stakeholders – particularly students – in the policy development process, which can encourage shared positive attitudes toward smoke-free environments[8]. These health initiatives are maximized in their impact by effective strategies. The importance of enforcing smoke-free policies cannot be overstated. Integrated efforts, such as increased policy promotion, stronger enforcement measures, and the availability of smoking cessation counseling services, have been identified as effective tactics for improving compliance and encouraging healthier behaviors among students[8,9]. The previous studies have shown that effective smoke-free policies are associated with decreased smoking rates and increased community support for health promotion efforts on campus[10]. Gaining insight into the factors influencing compliance and support for smoke-free initiatives is essential for shaping and implementing future policies, especially within the diverse student populations of public universitie[10]. This study aimed to assess the impact of a campus smoke-free policy on smoking behavior and smoking status among public health students in Yogyakarta, Indonesia.

METHODS

Study design

In August 2018, a cross-sectional study was conducted at a Health University campus in Yogyakarta, Indonesia, to assess the impact of a smoke-free campus policy on the smoking behavior and status of public health students. The study also sought to describe students' views on implementing the policy and their perceptions of smoking among students, lecturers, and staff.

Data collection

The study population consisted of 504 students enrolled in Public Health programs. A total of 322 public health undergraduate students participated in this study, recruited through a convenience sampling technique. The inclusion criteria include students who are studying in semesters 1, 3, and 5, and have been present during the study. The exclusion criteria included students who were not present during the survey, those participating in off-campus activities such as Field Learning Practices, and those who went to their hometowns. Data were collected by using a self-administered questionnaire. The research was conducted in accordance with applicable procedures and received approval from the Ethics Committee of the Ahmad Dahlan University on 21 June 2017 (Approval number: 614.4/FIKES/PL/VI/2017). Participation in the survey was deemed informed consent.

Instruments and operational definition

A research questionnaire was used in this study and consisted of respondent characteristics, including age, gender, monthly pocket money, and smoking behavior. Age was categorized as 16–19 years (adolescents) or 20–24 years (young adults). Monthly pocket money was classified as ≤IDR1340000 or >IDR1340000, based on the 2017 Yogyakarta Provincial Minimum Wage. Smoking behavior patterns were divided into two categories: positive behavior, a combination of the categories of never smoking, not smoking since being a student, quitting smoking after implementation of the smoke-free area, and reducing the number of cigarettes after the implementation of the smoke-free area; negative behavior, namely continuing to smoke even though there are smoke-free area rules[11,12]. Smoking status was categorized as: non-smoker, i.e. never smoked, former smoker, and experimental smoker; and active smoker, i.e. regular smoker[5,12]. The reduction of smoking behavior was defined as a self-reported decrease in the number of cigarettes consumed following the implementation of the smoke-free campus policy.

Data analysis

Univariate analyses were performed to examine the distribution of main demographic and smoking variables in frequencies and percentages. Univariate analysis was used to describe: 1) information on respondent characteristics (age, gender, and amount of pocket money); 2) students views on smoke-free campuses; 3) students views on students, lecturers, and employees who smoke; and 4) smoking behavior patterns and students smoking status. Bivariate analysis was performed to determine the relationship between characteristics (gender, age, semester, pocket money) and smoking behavior patterns and status, as well as the effectiveness of reducing smoking behavior. Chi-squared tests were used for final analysis, with Fisher's exact test employed to examine the impact of a campus smoke-free policy on smoking behavior and smoking status among students. As the study aimed to describe associations rather than adjust for potential confounding variables, no multivariable or logistic regression models were applied. Crude prevalence ratios (PRs) with corresponding 95% confidence intervals (CIs) were calculated, and statistical significance was defined as a $p<0.05$. The analysis in this

study was conducted using IBM SPSS Statistics version 25.0.

RESULTS

Respondent characteristics

Most respondents were female, comprising 74.2% (n=239), and were in their third semester, accounting for 41.3% (n=133). Furthermore, the majority of respondents were in the adolescents group, namely 59.6% (n=192). Furthermore, most respondents received pocket money in the range of less than or equal to the Provincial Minimum Wage of Yogyakarta, namely 68% (n=219).

Student views on the implementation of smoke-free areas

A total of 56.8% of female students and 20.8% of male students expressed support for implementing a smoke-free campus policy. Overall, 77.6% of respondents agreed that the policy should be implemented, indicating greater support among female students than male students. Meanwhile, students also gave their opinions that the steps taken to create a smoke-free campus were quite adequate, with 15.2% of male students and 47.2% of female students agreeing. However, some still thought it was inadequate and chose not to answer. Most students, around 84.5%, also felt that sanctions or fines were needed if someone smoked on campus, while a small number did not respond, with only 0.6% of female students not participating. The association between gender and level of support for the smoke-free campus policy was statistically significant (PR=0.92; 95% CI: 0.85–0.98, p<0.05), suggesting that female students were more likely to support and perceive the policy as effective compared to male students.

Student views on students, lecturers, and employees who smoke on the campus

The percentage of students who believe that students should not smoke was 48.4% for female students and 12.7% for male students. Meanwhile, students believe that lecturers should smoke outside campus (38.2%) or should not smoke (33.9%). Regarding students' opinions on employees, 42.9% should smoke outside campus or not allowed to smoke (27.0%).

The impact of the implementation of campus smoke-free areas on student smoking patterns

The percentage of students who reported having quit smoking after the implementation of smoke-free areas was 6.5% of male students and 1.9% of female students. Furthermore, some students reduced their cigarette consumption by 6.5% among male students and 3.7% among female students. During the study, 4.7% of male students and 0.3% of female students were identified as former smokers. The prevalence of active smoking remained stable, recorded at 4.3% among males and 1.2% among females. Notably, the proportion of students who had experimented with smoking exceeded that of regular smokers, with 5.3% of male students and 2.2% of female students classified as experimental smokers. Furthermore, the majority of respondents

Table 1. Students' smoking patterns after implementing smoke-free areas at a Health University campus in Yogyakarta, Indonesia, 2017 (N=322)

	Male n (%)	Female n (%)
Smoking patterns		
Never smoked	36 (11.2)	212 (65.8)
Not smoking since becoming a student	5 (1.6)	6 (1.9)
Quit smoking after implementing a smoke-free campus	13 (4.0)	6 (1.9)
Reducing the number of cigarettes after the implementation of a smoke-free campus	21 (6.5)	12 (3.7)
Smoking habits did not change	8 (2.5)	3 (0.9)
Smoking status		
Non-smoker	37 (11.5)	227 (70.5)
Ex-smoker	15 (4.7)	1 (0.3)
Experimental smoker	17 (5.3)	7 (2.2)
Regular smoker	14 (4.3)	4 (1.2)
Reducing smoking behavior (self-reported)		
Effective	67 (20.8)	183 (56.8)
Ineffective	14 (4.3)	46 (14.3)
No answer	2 (0.6)	10 (3.1)

Table 2. Association between student characteristics and smoking behavior patterns and smoking at a Health University campus in Yogyakarta, Indonesia, 2017 (N=322)

Variables	Categories	Smoking behavior patterns				p	PR (95% CI)*	Smoking status				p	PR (95% CI)
		Negative[b]		Positive[a]				Non-smoker		Active smoker			
		n	%	n	%			n	%	n	%		
Gender	Male	75	90.4	8	9.6	0.001*	0.92 (0.85–0.98)	69	83.1	14	16.9	0.001*	0.85 (0.03–0.26)
	Female	236	98.7	3	1.3	®		235	98.3	4	13.4	®	
Age (years)	16–19	184	95.8	8	4.2	®		184	95.8	8	4.2	®	
	20–24	127	97.7	3	2.3	0.54	0.98 (0.94–1.02)	120	92.3	10	7.7	0.27	1.038 (0.98–1.10)
Semester	1	75	94.9	4	5.1	0.55	⁋	74	93.7	5	4.4	0.84	⁋
	3	130	97.7	3	2.3			125	94.0	8	6		
	5	106	96.4	4	3.6			105	95.5	5	4.5		
Monthly pocket money (IDR)	≤1340000	212	96.8	7	3.2	0.86	⁋	208	95.0	11	5	0.58	⁋
	>1340000	64	95.5	3	4.5			62	92.5	5	7.5		
	No answer	35	97.2	1	2.8			34	94.4	2	5.6		

PR: prevalence ratio. a Positive behavior is a combination of the categories of never smoking, not smoking since being a student, quitting smoking after the smoke-free area, and reducing the number of cigarettes after the smoke-free area. b Negative behavior, namely continuing to smoke even though there are smoke-free area rules. ® Baseline category used in the PR calculation. ⁋: PR and 95% CI were not calculated because the relationship was not statistically significant, or because the variable was only analyzed by frequency distribution. IDR: 1000 Indonesian Rupiah about US$0.06. *p<0.05

Table 3. Perceived effectiveness of smoke-free areas based on student characteristics at a Health University campus in Yogyakarta, Indonesia, 2017 (N=322)

Variables	Categories	Perceived impact of smoke-free areas on reducing smoking behavior						p
		Effective		Ineffective		No answer		
		n	%	n	%	n	%	
Gender	Male	67	80.7	14	16.9	2	2.4	0.58
	Female	182	76.2	46	44.5	11	4.6	
Age (years)	16–19	154	80.2	32	16.7	6	3.1	0.29
	20–24	95	73.1	28	21.5	7	5.4	
Semester	1	51	64.6	28	35.4	0	0	0.001*
	3	111	83.5	14	10.5	8	6	
	5	87	79.1	18	16.4	5	4.5	
Monthly pocket money (IDR)	≤1340000	170	77.6	40	18.3	9	4.1	0.97
	>1340000	50	74.5	14	20.9	3	4.5	
	No answer	29	80.6	6	16.7	1	2.8	

IDR: 1000 Indonesian Rupiah about US$0.06. *p<0.05

perceived the implementation of smoke-free zones as effective in curbing smoking behavior. A higher percentage of female students (56.8%) expressed this view compared to male students (20.8%). Nonetheless, a small proportion of students did not express any opinion, comprising 3.1% of females and 0.6% of males (Table 1)

Relationship between characteristics and smoking behavior and smoking status among students

Bivariate analysis revealed a significant association between gender and both smoking behavior patterns (PR=0.92; 95% CI: 0.85–0.98, p<0.05) and student smoking status (PR=0.85; 95% CI: 0.03–0.26, p<0.05). Male students were found to exhibit a higher prevalence of positive smoking behavior (9.6%) and active smoker status (16.9%) compared to their female counterparts.

In contrast, no significant associations were found between smoking behavior or smoking status and other variables such as age, semester, and student allowance. Specifically, age showed no significant relationship with smoking behavior (PR=0.98; 95% CI: 0.94–1.02, p=0.54;) or smoking status (PR=1.038; 95% CI: 0.98–1.10, p=0.27). Similarly, the semester level was not significantly associated with smoking behavior (PR=0.97; 95% CI: 0.93–1.01, p=0.55) or smoking status (PR=1.02; 95% CI: 0.96–1.09, p=0.84). Pocket money also showed no significant association with smoking behavior (PR=0.99; 95% CI: 0.92–1.05, p=0.86) or smoking status (PR=1.01; 95% CI: 0.94–1.08, p=0.58) (Table 2).

Effectiveness of smoke-free areas based on students' characteristics

Among the variables analyzed, the semester in which students were enrolled emerged as the only factor significantly associated with perceived reductions in smoking behavior (p<0.05). Students in the 3rd semester (83.5%) and 5th semester (79.1%) were more likely to perceive the smoke-free area policy as effective in reducing smoking, compared to those in the 1st semester (64.6%). In contrast, no significant associations were observed between the perceived effectiveness of the policy and variables such as gender (p=0.58), age (p=0.29), or amount of pocket money (p=0.97) (Table 3).

DISCUSSION

Students' views on the implementation of smoke-free areas

This study found strong support among public health students for smoke-free campus policies, which aligns with the profession's values of creating a healthy environment and its potential as a role model for health in the future. As reported by Prabandari et al.[12], the agreement to support the smoke-free area is not surprising because the survey was conducted on medical students who, in the future, will become role models in health. The results indicate that most of the respondents are female. This is indicative of the higher rates of female enrollment in health-related fields, a common trend observed across many Indonesian universities[13,14]. Additionally, their average income exceeds the Regional Minimum Wage in the Special Region of Yogyakarta, which may enable them to afford cigarettes.

Respondents held diverse opinions about lecturers and employees, with some believing that smoking outside campus was appropriate. The smoke-free policy was widely regarded as helpful in influencing students' smoking habits;

however, only a small percentage reported stopping or reducing smoking. Female students were more supportive of the policy's success than men, which was reflected in this study, where male students had higher smoking prevalence and nicotine dependence. This presents an ongoing challenge for the effective enforcement of the smoke-free policy, which requires targeted strategies to address.

Relationship between characteristics and smoking behavior patterns and smoking status among students

The results of the study showed that gender had a significant relationship with the characteristics of behavioral patterns and smoking status of students. Age, semester, and amount of pocket money did not have a significant relationship with smoking behavior in students. This study showed that the proportion of male students who had positive smoking behavior patterns and were active smokers was higher than that of female students. This can happen because men's smoking behavior is more intense, almost every day, when compared to women's[15,16]. Therefore, in this study, gender was the only factor significantly associated with smoking behavior and smoking status among students.

Other studies have shown that teenage girls tend to cite health concerns and social stigma as the main reasons for not smoking[17,18]. On the other hand, adolescent boys are more influenced by peer pressure and the desire to fit in with the social environment[19]. Research shows that smoking prevalence is higher among men than women across all regions, with gender norms associating smoking with masculinity. Men tend to be more susceptible to the temptation to smoke and have lower quit attempts, and are also more likely to engage in normalized smoking behaviors within peer groups, which reinforces the cycle of tobacco use[20].

Different from previous studies that stated that age is one of the factors that influence the behavior patterns and smoking status of individuals, the results of this study showed no relationship between age and behavior patterns with students' smoking status. Students who are active smokers are in the age range of 16 to 19 years. This finding is consistent with the results of another study, which was based on a survey conducted in Indonesia. That study found that many individuals began smoking for the first time between the ages of 15 and 19 years[21,22]. As demonstrated in preceding studies, adolescence is a time of increased risk behaviors like smoking, with most smokers starting before the age of 20 years. Students aged 14–17 years often experiment with new activities, including smoking, leading to higher smoking rates in this age of group[23,24]. Previous studies showed that the factors that encourage students to smoke, included feeling stressed, bored, engaged in habits on campus, and following peers who smoke[25,26]. Students argue that the factors they experience need to change, and they choose cigarettes to vent the problems encountered by respondents[25].

This study also found that pocket money was unrelated to students' behavioral patterns or smoking status. However, this is not in line with previous results that pocket money is one of the factors that can cause teenagers to smoke and that the higher pocket money that teenagers have reflects their economic status and purchasing power, making it easier for them to access cigarettes, especially with sales of cigarettes around schools[27].

One of the factors for smoking patterns and smoking status is that adolescents often find it difficult to avoid smoking habits because these habits are influenced by family, peers, and advertising[28,29]. If parents or other family members smoke, teenagers tend to do the same[28]. Peer pressure also plays a vital role in shaping adolescent smoking behavior[28,30].

Effectiveness of smoke-free areas based on students' characteristics

The results of this study indicate that age, gender, amount of pocket money, smoking behavior patterns, and smoking status have no relationship to reducing smoking behavior. However, the semester of the students has a significant relationship to the effectiveness of lowering smoking behavior. The findings of this study indicate that students in higher semesters tend to exhibit greater maturity and awareness of the detrimental impacts of smoking. Consequently, smoking reduction efforts targeting final-year students appear to be more efficacious than those directed at students in earlier semesters. This finding is consistent with prior research indicating that students perceive their academic semesters in relation to both academic and life responsibilities, suggesting that smoking interventions are more effective when linked to these responsibilities[31].

Limitations

This study has several limitations. Firstly, the cross-sectional design limits the ability to establish causal relationships between smoke-free campus policies and changes in smoking behavior or status. Secondly, the utilization of self-reported data may engender information bias, encompassing social desirability bias and the potential misclassification of smoking status. Thirdly, although key demographic and behavioral factors were analyzed, it cannot be ruled out that residual confounding by unmeasured variables exists. Finally, the study was conducted among undergraduate public health students in one university, which may limit the generalizability of the findings to other student populations or settings. Nevertheless, the results provide valuable insights into smoking behavior and perceptions of smoke-free policies in a key group of future health professionals.

CONCLUSIONS

This study found that the implementation of smoke-free policies on campus is associated with differences in student behavior and perceptions. With this policy in place, it was found that female students were more likely to support the implementation of smoke-free areas and considered them

to be more effective than male students in reducing smoking behavior. Given the limitations of the present study, which employed a cross-sectional design, further studies, such as longitudinal studies, are needed to provide stronger and more in-depth evidence regarding the effectiveness of implementing smoke-free areas on campus.

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DATA AVAILABILITY
The data supporting this research can be found in the Supplementary file.

AUTHORS' CONTRIBUTIONS
HT: research concept, methodology, and writing of the manuscript. IWT: contributed to data analysis and writing of the manuscript. FKR: critical revision and writing of the manuscript. All authors read and approved the final version of the manuscript.

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