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Comparison and determination of factors associated with smoking status, smoking knowledge, attitude and practice (S-KAP) between smoke-free and non-smoke-free campuses in public universities in Malaysia: a cross-sectional study

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ABSTRACT

Objectives We compared the smoking prevalence, smoking knowledge, attitudes and practices (S-KAP) between smoke-free campuses (SFCs) and non-SFCs (NSFCs) and determined the associated factors of smoking status and S-KAP.

Design

Cross-sectional study.

Settings The research was conducted in four public universities in Malaysia; two SFCs and two NSFCs.

Participants

Students and staff from SFCs (n=1063) and NSFCs (n=1040).

Main outcome measures Compared the smoking prevalence, S-KAP between SFCs and NSFCs and determined the associated factors.

Results The prevalence of smokers among the SFC and NSFC respondents was 5.2% and 6.7%, respectively. University type and smoking attitude were significantly related (p=0.02). At the SFCs, the factors associated with becoming a smoker were male gender (p<0.001), monthly income ≥RM3000 (p=0.02), positive smoking attitude (p=0.003) and positive smoking practice (p<0.001); at NSFCs, the associated factors were male gender (p<0.001), low smoking knowledge (p=0.004), positive smoking attitude (p=0.001) and practice (p<0.001). The factors associated with good smoking knowledge were female gender (SFCs: p=0.001; NSFCs: p=0.004), and monthly income ≥RM3000 (NSFCs: p=0.02). Male respondents were likely to have positive smoking attitudes (SFCs: p<0.001; NSFCs: p<0.001) and negative smoking practices (SFCs: p<0.001; NSFCs: p<0.001).

Conclusion Overall, smoking prevalence, knowledge and practice were not much different between SFCs and NSFCs. However, there was a significant relationship between university type and smoking attitude due to the existence of the SFC policy likely rendering smoking a less acceptable social norm. Continual education programmes on smoking harms and smoking cessation strategies are

Strengths and limitations of this study

► This study has a high response rate (84.1%), contributing to the quality of the study.
► The use of anonymous self-reported questionnaires may reduce social desirability bias.
► Smoking status was assessed using self-reporting and may have resulted in self-reported bias.
► The respondents were volunteers rather than randomly sampled, which may have introduced selection bias.
► The cross-sectional nature of the data precludes any causal effects.

highly recommended to aid the SFC policy in preventing secondhand smoke in universities.

INTRODUCTION

Globally, over 1.1 billion people, predominantly men, are smokers.[1] Tobacco control is indeed a major challenge to public health, especially for the Southeast Asian region, which is home to 246 million smokers and 290 million passive smokers.[2] Despite declines in overall prevalence in some countries, there are alarming tobacco use trends among young adults.[1] As young adults, university students are a very vulnerable group for risky behaviour initiation, including smoking and drug abuse.[3 4] Smoking prevalence among university students worldwide varies greatly, for example, 15.5% in the UK,[5] 11.1% in New Zealand,[6] 60.2% in Bangladesh,[7] 20.7% in Syria,[8] 3.1% in Hong Kong[9] and 23.4%

in China.[9] In Malaysia, smoking is prevalent among 12%–22.4% of university students.[10–13]

According to the National Health and Morbidity Survey 2019,[14] about 21.3% of the Malaysian population aged ≥15 years were smokers, and most of them were men. An estimated 30.5% of smokers smoked ≥15 cigarettes daily.[14] Although the number of smokers had decreased compared with 23.1% in 2011 and 22.8% in 2015,[15 16] the reduction was insufficiently substantial. Therefore, more awareness and efforts should be made to support smoking cessation. The adverse effects and health consequences of smoking are known and have been discussed for decades.[17–19] Smoking not only affects the smoker but also has many harmful effects on non-smokers through secondhand smoke. Millions of people worldwide are affected by secondhand smoke, which contributes to the increased incidence of chronic conditions such as lung cancer, heart disease and respiratory problems[20] and has resulted in legislative action to reduce tobacco consumption among the public. Article 8 of the WHO Framework Convention on Tobacco Control[21] encourages countries to protect people from tobacco smoke in indoor workplaces, public transport and other public places as appropriate. The main objective of a smoke-free area is to reduce smoking, which primarily benefits non-smokers.

Restricting smoking in universities can curb the number of new smokers and reduce smoking prevalence throughout adulthood. The implementation of the smoke-free campus (SFC) policy in universities has been increasing by the year worldwide. By July 2020, at least 2511 US colleges and universities were 100% SFC.[22] Effective SFC policies may lower the prevalence of tobacco use, increase knowledge on smoking harms, limit the visibility of smoking in universities and reduce smoking initiation and daily use.[23–25] Furthermore, a university campus-based smoke-free policy also can lead to smoke-free norms in the university's communities, thus restricting the occurrence of smoking, discouraging initiation and supporting smoking cessation.[26 27]

Malaysia has been a signatory of the WHO FCTC since 2005[15] and has gazette 23 categories of locations, including universities, where smoking is prohibited under the Control of Tobacco Product Regulations 2004.[28] Although the SFC policy in Western countries, especially in the USA, has been implemented actively, most universities in Malaysia still struggle to implement a 100% SFC policy. The difficulties are due to a lack of standardised policy resources for implementation and a limited workforce for enforcement. Despite these challenges, many university residents support implementing an SFC policy in Malaysia.[29–31] Given the slowly growing number of universities implementing this policy in Malaysia, the impact of the SFC policy has not been evaluated.

Therefore, the purpose of the present study was to compare the smoking prevalence, smoking knowledge, attitudes and practices (S-KAP) between public universities in Malaysia with an SFC policy (SFCs) and those without one (non-SFCs, NSCFs). Second, we wanted to determine the factors associated with smoking status and S-KAP at SFCs and NSFCs.

MATERIALS AND METHODS
Study design and participants
This was a cross-sectional study using baseline data obtained via a self-administered online questionnaire. Invitations to complete the web-based questionnaire were distributed via email and during university events and activities, staff and student electronic newsletters and promotion by representative bodies at the university's main page or social media ads. Data were collected from September 2019 to November 2019. The sample size of 2500 respondents was stratified by the number of students and staff based on the entire population figures from each university.

The inclusion criteria were Malaysian nationality, enrolled student and employed staff at the participating Malaysian public universities and age ≥18 years. The two SFCs (located on the southwestern and northwestern coast of Peninsular Malaysia, respectively) selected are the earliest public universities in Malaysia to have implemented the SFC policy, that is, since 2013, and have been awarded a Blue Ribbon certificate by the Malaysian Health Promotion Board (MySihat).[15 32] The two NSFCs (located on the west and northwestern coast of Peninsular Malaysia, respectively) were selected by convenience sampling, but have yet to enforce the SFC policy and receive a Blue Ribbon certificate.

Questionnaire development
The questionnaire was developed using items adapted from the Global Adult Tobacco Survey[33] and the KAP Towards Smoking Survey questionnaire of International Islamic University Malaysia.[34] Experts validated the questionnaire's content, and a pilot study was conducted for the questionnaire's face validity to assess its acceptability and feasibility, and it was subsequently modified before implementation in the present study.

The developed questionnaire consisted of four parts: sociodemographic characteristics and S-KAP studies were conducted in two universities, one with SFC policy implemented and the other without SFC policy. Both universities are located on the west coast of Peninsular Malaysia. There were 136 respondents involved in the pilot studies. Cronbach's alpha value was 0.823 and the exploratory factor analysis (EFA), that is, Kaiser-Meyer-Olkin (KMO) test, was 0.626, and the Bartlett test was <0.0001. The strength of correlations between questionnaire items was measured with Cronbach's alpha test (>0.7) while internal reliability was measured with EFA (KMO >0.5; Bartlett test <0.05). These results show that the questionnaire has good internal reliability and that there is a significant correlation between the data.

The final four parts of the questionnaire included:
► Sociodemographic characteristics: gender, age, education level, campus role, monthly income and

smoking status. Smoking status was either non-smoker (including ex-smoker) or smoker (current smoker).

► Smoking knowledge: refers to the university community's awareness on general knowledge of smoking and facts on smoking. The items of the knowledge were: (1) a person who does not smoke but inhales the cigarette smoke is called a secondhand smoker, (2) cigarette smoke contains about 7000 toxic chemicals, (3) quitting smoking can improve the smoker's health, (4) smoking is a major contributor to premature death, (5) nicotine is not addictive, (6) smoking is not a major risk factor for sudden infant death syndrome, (7) smoking increases diabetes risk, (8) smoking causes impotence, (9) no safe level of exposure to secondhand smoke, (10) cigarette smoke particles can remain on any surface for 6 months, (11) cigarette smoke does not deplete the ozone layer, (12) the particle size of cigarette smoke is larger than the particle size of haze. The answer to each question was yes/no/do not know. The correct answer was scored 1 point. Smoking knowledge was measured by calculating the score of correctly answered questions per total items and was categorised as good (if respondents scored >median score/50% of the total score) or poor (if respondents scored ≤median score/50% of the total score).[35]

► Smoking attitude: refers to the level of agreement and beliefs regarding smoking norms. The items of smoking attitude were: (1) smoking contributes to many adverse effects on my health, (2) cigarette smoke is a serious threat to my health, (3) quitting smoking can improve smokers' health, (4) I feel better if I so not smoke, (5) I feel uncomfortable when I get close to people who smoke, (6) smoking shows bad behaviour, (7) smoking in universities should be completely banned, (8) I am easily accepted by friends if I smoke, (9) Smoking describes maturity. Smoking was measured using a 5-point Likert scale and with a score of 1 to 5. Smoking attitude was measured by calculating the score of the answered questions and was categorised as negative (if respondents scored >60% of the maximum score) and positive (if respondents scored ≤60% of the maximum score).

► Smoking practice: refers to the consistency of the university's community involvement in controlling smoking habits. The items of the smoking practice were: (1) I reprimand anyone who smokes on university grounds, (2) I have never advised my friends to quit smoking, (3) I cover my nose when someone smokes around me, (4) I avoid spending time with friends who smoke, (5) I avoid going to the smoking area to breathe fresh air, (6) I live a healthy lifestyle instead of smoking. Smoking practice was measured using a 5-point Likert scale and with a score of 1 to 5. Smoking practice was measured by calculating the score of the answered questions and was categorised as negative (if respondents scored >60% of the

maximum score) or positive (if participants respondents ≤60% of the maximum score).

Data analysis
The data were divided into two categories: SFC and NSFC. The descriptive statistics of the sample were computed and showed the percentage distributions for all response categories, among all respondents, and smoking status. The association between university type with smoking status and S-KAP was determined using the χ^2 test for independence. Univariate and multivariate logistic regression was used to measure the relationships between independent variables (gender, age, education level, employment status, monthly income) and the OR of smoking status and S-KAP. The collected data were analysed using IBM SPSS Statistics V.21.

RESULTS
A total of 2103 out of 2500 respondents completed and returned the questionnaire, yielding an overall response rate of 84.1%. For both university types, most respondents were women (SFCs, 64%; NSFCs, 65.9%) and from the 19–40 year age group (SFCs, 95.7%; NSFCs, 95.3%). Up to 29% (SFCs) and 31.6% (NSFCs) of the respondents had secondary education, 65% (SFCs) and 63.1% (NSFCs) had undergraduate education and 6% (SFCs) and 5.3% (NSFCs) had postgraduate education.

The majority of respondents were students (SFCs, 87.9%; NSFCs, 85.5%). Among the students and staff, most of them had a monthly income of <RM3000 (SFCs, 90.4%; NSFCs, 89.8%). The majority of respondents were non-smokers (SFCs, 94.8%; NSFCs, 93.3%). Only 5.2% and 6.7% of the SFC and NSFC respondents, respectively, were smokers. Table 1 shows a detailed summary of the respondents' sociodemographic characteristic.

Association between university type with smoking status and S-KAP
Descriptively, the SFCs had better smoking prevalence and S-KAP than the NSFCs. The χ^2 test for independence showed that the relationship between university type and smoking status (p=0.131), level of smoking knowledge (p=0.17) and smoking practices (p=0.177) was not significant (table 2). However, there was a significant relationship between university type and smoking attitude (p=0.02). Backward likelihood ratio multiple logistic regression was applied (table 3) and the Hosmer-Lemeshow test was >0.05 (p=0.92). There was no significant difference between the observed and expected probability. Thus, the assumption of model fitness was met. Table 4 shows that there was a significant interaction between smoking status×income (p=0.013), smoking status×smoking knowledge (p=0.009), smoking status×smoking attitude (p=0.012) and smoking attitude×gender (p=0.006).

Table 1 Sociodemographic characteristics of respondents at SFC and NSFC

Sociodemographic characteristic		Type of university			
		SFC (n=1063)		NSFC (n=1040)	
		n	Percentage	n	Percentage
Gender	Male	383	36.0	355	34.1
	Female	680	64.0	685	65.9
Age	19–40	1017	95.7	991	95.3
	41 and above	46	4.3	49	4.7
Education level	Secondary education	308	29.0	329	31.6
	Undergraduate	691	65.0	656	63.1
	Postgraduate	64	6.0	55	5.3
Campus role	Student	934	87.9	889	85.5
	Staff	129	12.1	151	14.5
Monthly income	<RM3000	961	90.4	934	89.8
	RM3000 and above	102	9.6	106	10.2
Smoking status	Non-smoker	1008	94.8	970	93.3
	Smoker	55	5.2	70	6.7

NSFC, non-SFC; SFC, smoke-free campus.

Table 2 Association between university type with respondents' characteristics, smoking status and S-KAP

Domain		Type of university		X^2 statistic (df)	P * value
		SFC n (%)	NSFC n (%)		
Gender	Male	383 (36.0)	355 (34.1)	0.829 (1)	0.36
	Female	680 (64.0)	685 (65.9)		
Age	19–40	1017 (95.7)	991 (95.3)	0.18 (1)	0.67
	≥41	46 (4.3)	49 (4.7)		
Education level	Secondary	308 (29.0)	329 (31.6)	2.031 (2)	0.36
	Undergraduate	691 (65.0)	656 (63.1)		
	Postgraduate	64 (6.0)	55 (5.3)		
Campus role	Student	934 (87.9)	889 (85.5)	2.588 (1)	0.11
	Staff	129 (12.1)	151 (14.5)		
Monthly income	<RM3000	961 (90.4)	934 (89.8)	0.210 (1)	0.647
	≥RM3000	102 (9.6)	106 (10.2)		
Smoking status	Non-smoker	1008 (94.8)	970 (93.3)	2.279 (1)	0.131
	Smoker	55 (5.2)	70 (6.7)		
Smoking knowledge	0–8 (≤50%)	334 (31.4)	356 (34.2)	1.883 (1)	0.17
	9–16 (>50%)	729 (68.6)	684 (65.8)		
Smoking attitude	Negative	1018 (95.8)	973 (93.6)	5.088 (1)	0.02
	Positive	45 (4.2)	67 (6.4)		
Smoking practice	Negative	953 (89.7)	913 (87.8)	1.826 (1)	0.177
	Positive	110 (10.3)	127 (12.2)		

*Chi-square test for independence; n=frequency; df=degree of freedom.
NSFC, non-SFC; SFC, smoke-free campus; S-KAP, smoking knowledge, attitudes and practices.

Table 3 Logistic regression model of university type

Variable		Type of university				Adjusted OR (95% CI)	P value
		SFC		**NSFC**			
		Mean (SD)	**n (%)**	**Mean (SD)**	**n (%)**		
Gender	Male		383 (36.0)		355 (34.1)	0.87 (0.72 to 1.04)	0.13
	Female		680 (64.0)		685 (65.9)	1	
Age		23.8 (6.45)		24.0 (6.91)		1.0 (0.98 to 1.03)	0.97
Education level	Secondary school		308 (29.0)		329 (31.6)	1	0.13
	Undergraduate		691 (65.0)		656 (63.1)	0.88 (0.73 to 1.06)	
	Postgraduate		64 (6.0)		55 (5.3)	0.66 (0.43 to 1.02)	
Campus role	Student		934 (87.9)		889 (85.5)	0.81 (0.63 to 1.05)	0.11
	Staff		129 (12.1)		151 (14.5)	1	
Monthly income	<RM3000		961 (90.4)		934 (89.8)	1	0.97
	≥RM3000		102 (9.6)		106 (10.2)	0.99 (0.61 to 1.6)	
Smoking status	Non-smoker		1008 (94.8)		970 (93.3)	1	0.33
	Smoker		55 (5.2)		70 (6.7)	0.91 (0.76 to 1.1)	
Smoking knowledge	0–8 (≤50%)		334 (31.4)		356 (34.2)	1	0.30
	9–16 (>50%)		729 (68.6)		684 (65.8)	0.91 (0.75 to 1.09)	
Smoking attitude	Negative		1018 (95.8)		973 (93.6)	1.56 (1.06 to 2.3)	0.03
	Positive		45 (4.2)		67 (6.4)	1	
Smoking practice	Negative		953 (89.7)		913 (87.8)	1.5 (0.76 to 1.44)	0.78
	Positive		110 (10.3)		127 (12.2)	1	

Backward likelihood ratio multiple logistic regression was applied. Hosmer-Lemeshow test p=0.92 was accepted to check model fitness. NSKC, non-SKC; SKC, smoke-free campus.

Factors associated with smoking status

Multiple logistic regression analyses of the SFCs showed that the determinants for a person to become a smoker were gender, monthly income, smoking attitude and smoking practice (table 5). This analysis was interpreted as: (1) male respondents had seven times higher odds than female respondents of becoming a smoker (95% CI 3.2 to 16.04, p<0.001), (2) respondents with a monthly income ≥RM3000 had two times higher odds than those earning <RM3000 of becoming smokers (95% CI 1.16 to 5.34, p=0.02), (3) negative smoking attitude was less likely to be a smoker's attitude (95% CI 0.12 to 0.66, p=0.003), (4) negative smoking practice was less likely to be a smoker's practice (95% CI 0.09 to 0.33, p<0.001).

Multiple logistic regression analyses of the NSFCs showed that the determinants for a person to become a

Table 4 Significant interaction between variables

Variable	Type of university, adjusted OR (95% CI)	P value
Smoking Status × Income	0.24 (0.08 to 0.74)	0.013
Smoking Status × Smoking Knowledge	0.4 (0.18 to 0.79)	0.009
Smoking Status × Smoking Attitude	2.22 (1.19 to 4.12)	0.012
Smoking Attitude × Gender	1.96 (1.2 to 3.18)	0.006

smoker were gender and S-KAP (table 5). This analysis was interpreted as: (1) male respondents had 10 times higher odds than female respondents of becoming a smoker (95% CI 4.7 to 23.55, p<0.001), (2) >50% correct answers for smoking knowledge was less likely to be a smoker's knowledge score (95% CI 0.21 to 0.74, p=0.004), (3) negative smoking attitude was less likely to be a smoker's attitude (95% CI 0.12 to 0.57, p=0.001), (4) negative smoking practice was less likely to be a smoker's practice (95% CI 0.07 to 0.28, p<0.001).

Factors associated with smoking knowledge

The multiple logistic regression analysis showed that, for SFCs, the determinant of >50% correct answers for smoking knowledge was gender (table 6). This analysis can be interpreted as: (1) male respondents were 29% less likely than female respondents to have >50% correct answers on smoking knowledge (95% CI 0.54 to 0.92, p=0.01).

For the NSFCs, multiple logistic regression analysis showed that the determinants of >50% correct answers for smoking knowledge were gender and monthly income (table 6). This analysis was interpreted as: (1) male respondents were 33% less likely than female respondents to have >50% correct answers on smoking knowledge (95% CI 0.51 to 0.88, p=0.004); (2) respondents earning ≥RM3000 had 1.8 times higher odds than

Table 5 Multiple logistic regression analysis for factors related to smoking status

Variables	SFC (n=1063)				NSFC (n=1040)			
	Smoking status				Smoking status			
	Non-smoker	Smoker			Non-smoker	Smoker		
	Mean (SD) n (%)	Mean (SD) n (%)	Adjusted OR (95% CI)	P value	Mean (SD) n (%)	Mean (SD) n (%)	Adjusted OR (95% CI)	P value
Gender				<0.001				<0.001
Male	336 (87.7)	47 (12.3)	7.24 (3.2 to 16.04)		293 (82.5)	62 (17.5)	10.5 (4.70 to 23.55)	
Female	672 (98.8)	8 (1.2)	1		677 (98.8)	8 (1.2)	1	
Age	23.6 (6.37)	26.0 (7.42)	0.98 (0.92 to 1.05)	0.68	23.9 (6.9)	25.3 (6.99)	1.04 (0.96 to 1.13)	0.30
Campus role				0.87				0.80
Student	893 (95.6)	41 (4.4)	0.86 (0.14 to 5.37)		835 (93.9)	54 (6.1)	0.82 (0.17 to 3.97)	
Staff	115 (89.1)	14 (10.9)	1		135 (89.4)	16 (10.6)	1	
Monthly income				0.02				0.39
<RM3000	918 (95.5)	43 (4.5)	1		869 (93.0)	65 (7.0)	1	
≥RM3000	90 (88.2)	12 (11.8)	2.48 (1.16 to 5.34)		101 (95.3)	5 (4.7)	0.66 (0.26 to 1.68)	
Smoking knowledge				0.64				0.004
0–8 (≤50%)	310 (92.8)	24 (7.2)	1		309 (86.8)	47 (13.2)	1	
9–16 (>50%)	698 (95.7)	31 (4.3)	0.8 (0.45 to 1.62)		661 (96.6)	23 (3.4)	0.4 (0.21,0.74)	
Smoking attitude				0.003				0.001
Negative	978 (96.1)	40 (3.9)	0.28 (0.12 to 0.66)		935 (96.1)	38 (3.9)	0.26 (0.12 to 0.57)	
Positive	30 (66.7)	15 (33.3)	1		35 (52.2)	32 (47.8)	1	
Smoking practice				<0.001				<0.001
Negative	928 (97.4)	25 (2.6)	0.17 (0.09 to 0.33)		889 (97.4)	24 (2.6)	0.14 (0.07 to 0.28)	
Positive	80 (72.7)	30 (27.3)	1		81 (63.8)	46 (36.2)	1	

NSFC, non-SFC; SFC, smoke-free campus.

Table 6 Multiple logistic regression analysis for factors related to smoking knowledge

	Type of university							
	SFC (n=1063)				NSFC (n=1040)			
	Smoking knowledge				Smoking knowledge			
	0–8 (≤50%)	9–16 (>50%)	Adjusted OR (95% CI)		0–8 (≤50%)	9–16 (>50%)	Adjusted OR (95% CI)	
Variables	n (%)	n (%)		P value	n (%)	n (%)		P value
Gender				0.01				0.004
Male	139 (36.3)	244 (63.7)	0.71 (0.54 to 0.92)		142 (40.0)	213 (60.0)	0.67 (0.51 to 0.88)	
Female	195 (28.7)	485 (71.3)	1		214 (31.2)	471 (68.8)	1	
Educational level				0.07				0.40
Secondary Education level	113 (36.7)	195 (63.3)	1		122 (37.1)	207 (62.9)	1	
Undergraduate level	205 (29.7)	486 (70.3)	1.33 (1.0 to 1.77)		223 (34)	433 (66)	1.08 (0.82 to 1.44)	
Postgraduate level	16 (25.0)	48 (75.0)	1.75 (0.94 to 3.2)		11 (20)	44 (80)	1.69 (0.78 to 3.65)	
Monthly income				0.69				0.02
<RM3000	307 (31.9)	654 (68.1)	1		331 (35.4)	603 (64.6)	1	
≥RM3000	27 (26.5)	75 (73.5)	1.12 (0.65 to 1.04)		25 (23.6)	81 (76.4)	1.76 (1.09 to 2.83)	

NSFC, non-SFC; SFC, smoke-free campus.

those earning <RM3000 to have >50% correct answers on smoking knowledge (95% CI 1.09 to 2.83, p=0.02).

Factors associated with smoking attitudes and smoking practices

For both SFCs and NSFCs, multiple logistic regression analyses showed that the determinant of negative smoking attitudes (table 7) and negative smoking practice (table 8) was gender. Male respondents were less likely than female respondents to have negative smoking attitudes (SFCs: 95% CI 0.1 to 0.29, p<0.001; NSFCs: 95% CI 0.16 to 0.55, p<0.001) and negative smoking practices (SFCs: 95% CI 0.14 to 0.33, p<0.001; NSFCs: 95% CI 0.17 to 0.36, p<0.001).

DISCUSSION
Smoking status

We found that the smoking prevalence at SFCs (5.2%) and NSFCs (6.7%) was not much different. Nonetheless, similar to another study in Kazan city that compared SFCs and NSFCs,[36] SFCs had a lower smoking prevalence than NSFCs descriptively. Other studies have also reported low smoking prevalence in universities that implement SFC policies, for example, 9.2% in the USA[37] and 8.4% in Thailand,[24] due to decreases in smoking behaviour. Other studies[38 39] have reported that SFCs are expected to have lower smoking prevalence than NSFCs because students and staff have a greater chance of being exposed to awareness campaigns and knowledge on smoking risk. SFCs also have supportive programmes for smoking cessation and have a policy strictly banning smoking on campus grounds.

However, we found no significant association between university type and smoking status (p=0.131). This is probably because all universities in Malaysia have been gazetted as non-smoking areas under Regulation 11 (1) of the Tobacco Products Control Regulations (Amendment) 2018.[40] Therefore, although there is no specific SFC policy, all universities are expected to advertise smoke-free campaigns and help initiate a smoke-free environment, thus helping smokers stop smoking.

Table 7 Multiple logistic regression analysis for factors related to smoking attitude

	Type of university							
	SFC (n=1063)				NSFC (n=1040)			
	Smoking attitude				Smoking attitude			
	Negative	Positive			Negative	Positive		
Variables	n (%)	n (%)	Adjusted OR (95% CI)	P value	n (%)	n (%)	Adjusted OR (95% CI)	P value
Gender				<0.001				<0.001
Male	354 (92.4)	29 (7.6)	0.17 (0.1 to 0.29)		306 (86.2)	49 (13.8)	0.29 (0.16 to 0.55)	
Female	664 (97.6)	16 (2.4)	1		667 (97.4)	18 (2.6)	1	

NSFC, non-SFC; SFC, smoke-free campus.

Table 8 Multiple logistic regression analysis for factors related to smoking practice

	Type of university							
	SFC (n=1063)				NSFC (n=1040)			
	Smoking practice				Smoking practice			
	Negative	Positive			Negative	Positive		
Variables	n (%)	n (%)	Adjusted OR (95% CI)	P value	n (%)	n (%)	Adjusted OR (95% CI)	P value
Gender				<0.001				<0.001
Male	307 (80.2)	76 (19.8)	0.21 (0.14 to 0.33)		274 (77.2)	81 (22.8)	0.24 (0.17 to 0.36)	
Female	646 (95)	34 (5)	1		639 (93.3)	46 (6.7)	1	

NSFC, non-SFC; SFC, smoke-free campus.

In the present study, we demonstrated, for both university types, males were more likely to be smokers. Others have reported a similar result[41–43] as well as that for smoking prevalence worldwide.[44] In addition, there was a significant interaction between smoking status and gender. The main possible reason is social norms. Some believe that social acceptability of smoking differs between men and women. Women are more likely to believe that society disapproves of smoking, and men tend to believe that smoking will help them appear more mature and more attractive, and that it helps to control body weight.[45]

In the present study, we found that, for SFCs, a monthly income of ≥RM3000 is associated with becoming a smoker. Besides, there was a significant interaction between smoking status and monthly income. Other studies have also reported a strong relationship between personal income and smoking.[46 47] An increase in income may lead to higher cigarette consumption and higher smoking prevalence rates among adolescents with a higher personal income.[47] Income status is a powerful barrier against smoking. Moreover, cigarettes are now becoming more expensive due to high taxes, one of the WHO FCTC initiatives through MPOWER.[21] Increasing the retail price of tobacco products through higher taxes is the single most effective means of decreasing consumption and encouraging smokers to quit.[48] However, monthly income was a predictor of being a smoker for only SFCs and not NSFCs, which requires further exploration.

We also found that, in the NSFCs, the factor associated with becoming a smoker was poor knowledge of the adverse effects of smoking. Surveys from Iraq[49] and India have reported similar results[18]; smokers have only a moderate level of awareness of the health risk effects of smoking, especially on non-smokers, and this might be one reason they became smokers. In contrast, SFCs present the chance to gain awareness of the danger of smoking through their smoke-free policies, and campus campaigns may provide the university community with good knowledge of smoking harms and thus prevent them from taking up smoking.[50]

On the other hand, positive smoking attitude and positive smoking practice were associated with becoming a smoker for both SFCs and NSFCs. The interaction between the variables also indicates that there was an interaction between smoking status and smoking attitude. Smokers tended to agree that smoking norms are acceptable (positive smoking attitudes) and tended to not be involve in the control of smoking activity on campus (positive smoking practices). Such actions mean that there are no smoking-limiting behaviours, thus it is easier for such respondents to become smokers.

Smoking knowledge

In the present study, the descriptive data show that SFC respondents had better smoking knowledge compared with NSFC respondents. Understanding of the harmful effects of smoking increased after the implementation of a smoke-free policy.[51] However, a χ^2 test for independence indicated no significant association between university type and smoking knowledge (p=0.17). This is probably because information on the harm of tobacco is not only obtained from the SFC policy but is mostly at our fingertips, namely, on social media and TV ads. The factors associated with good smoking knowledge among the SFC respondents were gender and for the NSFCs were gender and monthly income. Female respondents were more likely to have adequate smoking knowledge than male respondents because they were more aware of smoking diseases. They were also more attentive and focused on antismoking messages through various channels such as social media ads, TV ads and printed materials.[52 53] Female respondents were less likely to become smokers because of their high awareness of the harm of smoking. Following the results linking monthly income and smoking knowledge, we showed that respondents with an income of >RM3000 have a good understanding of smoking compared with those with an income of <RM3000. This result is similar to that of another study that reported that people with low education, low-level occupations and low income have less access to adequate healthcare information.[54]

Smoking attitude

There was a significant association between smoking attitude and university type (p=0.02). Our findings are consistent with the previous studies reported that the SFC policy directly impacts general attitude towards smoking and that respondents are more likely to see the ban as

having a positive effect on their quality of life.[51 55] At Indiana University, the implementation of the SFC policy significantly reduced the number of people who agreed to allow smoking on campus.[38] The SFC policy might change the perceived tobacco-related norms in a community, making smoking less socially acceptable.[27 38] In the present study, we found that, for both university types, the factor associated with negative smoking attitude was female gender. In addition, there was a significant interaction between smoking attitude and gender. These findings are consistent with other studies examining the role of gender in attitude regarding smoking.[56–58] Women are more likely to have a negative attitude towards smoking. They are more likely to be bothered by tobacco smoke and have a stronger belief in the danger of smoking.

Smoking practice

We found no significant association between smoking practice and university type (p=0.177). However, the SFCs had a higher percentage of negative smoking practice (51.1%) than the NSFCs (48.95%). Consistent with other studies, smoking bans decrease smoking visibility in public areas and are useful for reducing smoking behaviour.[26 27 59] The SFC policy restricts where smoking occurs on campus; later, it may discourage smoking initiation and support tobacco cessation. Consequently, it influences smokers' behaviour, thus they comply with the rules and have negative smoking practice. Here, the multivariate analysis showed that female respondents tended to have negative smoking practices compared with male respondents for both university types. According to Chinwong et al,[43] women are significantly more likely than men to have health concerns and perceive the risk of dying from smoking.

Study limitations and strengths

The limitations of this study are mostly due to the use of the self-administered questionnaire. Smoking status was assessed using self-report and may have resulted in self-reported bias. Furthermore, the low proportion of smokers who participated in our survey may have been due to selective non-reporting or under-reporting and the low response rate. Besides, this study is based on convenience sampling. The respondents were volunteers rather than randomly sampled, which may have introduced selection bias. Finally, the cross-sectional nature of the data precludes any causal effects.

Despite the limitations, this is the first study of public universities in Malaysia that provides valuable novel findings in the comparison of smoking prevalence and S-KAP between SFCs and NSFCs. Although convenience sampling was used in this study, we minimised bias by using it together with probability sampling (stratified sampling). Prior to convenience sampling, the sample size was stratified by the number of students and staff based on the entire population figures from each university. For non-response bias, we minimised the bias by achieving a high response rate (>80%). The use of anonymous self-reported questionnaires may have reduced social desirability bias.

CONCLUSIONS

In general, there is not much difference in the smoking prevalence, knowledge and practice between SFCs and NSFCs in public universities in Malaysia. This is probably because all universities in Malaysia have been gazetted as non-smoking areas under Regulation 11 (1) of the Tobacco Products Control (Amendment) Regulations 2018[40] and are expected to advertise smoke-free campaigns and help initiate a smoke-free environment. However, there was a significant relationship between university type and smoking attitude. The existence of the SFC policy is likely to create new norms related to smoking and render smoking less acceptable as a social norm.[27] Even so, our findings showed that most of the factors associated with smoking status and S-KAP were related to gender. Different approaches between men and women need to be emphasised, so that the impact of the SFC policy is balanced between the genders. We hope that our study can aid policymakers' understanding of the S-KAP among university residents in different environments and enable future evaluation of the policy to improve efforts in effective implementation and make an important contribution to creating non-smoking norms, thus reducing secondhand smoke in universities.

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