ORIGINAL ARTICLE

OUTCOMES OF A TWO-YEAR SMOKE-FREE UNIVERSITY AND ORGANIZATIONAL POLICY MANAGEMENT

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ABSTRACT

This study aimed to evaluate the outcomes of the implementation of a smoke-free university policy after two years and to analyze predictors for organizational policy management and smoke-free university. A cross-sectional survey study was designed and undertaken as a baseline in 2014 and as an evaluation in 2016 in a government university within 2 campuses in the Northeast of Thailand. Students and staff/personnel returned questionnaires at a university. There were 891 and 960 people enrolled in to the study in 2014 and 2016, respectively. Outcomes were smoke-free environment, smoking rate, quit rate and variables affecting a smoke-free university. After two years, the smoke-free environment was improved significantly ($p<0.001$). The smoking rate was not a statistically significant increase, (6.73% in 2014 and 8.42% in 2016, $p>0.05$). Of this increase, the rate for regular smoking was lower than its expected value by 7.6%. The quit rate significantly increased from 8.33% to 33.96% ($p<0.05$). Law and organizational support were significant predictors of organizational policy management (adjusted R2 = 19%, $p<0.001$). Organizational policy management was a significant predictor for being smoke-free university (adjusted R2= 41%, $p<0.001$). Two years' experience of implementing a smoke-free university policy showed significant improvements. The organizational policy management directly strengthened these improvements.

Keywords: *smoke-free university, organizational policy management, smoking rate, quit rate, Thailand*

INTRODUCTION

Smoking is a major component of the ten largest contributors to global disability-adjusted life years (DALYs) and is preventable.[1] Many studies confirmed that quitting smoking attributed to population risk reduction in mortality from coronary heart disease in many countries.[2-3] Taylor Jr. and others[4] showed that the quitting smoking earlier resulted in the longer life in years gained.

A smoke-free policy is mandated and regulated by law to reduce tobacco use which benefits primarily non-smokers such as in Australia,[5] Canada,[6] New Zealand,[7] Chile,[8] Estonia[9] and Costa Rica.[10] The smoke-free policy impacts public and private areas. According to Article 8 of the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC),[11] it encourages countries to 'protect people from tobacco smoke in indoor workplaces, public places, public transport and other public places as appropriate. The main goal of smoke-free policies is to eliminate second-hand smoke exposure and to improve health outcomes.[12] Thailand is one of 31 countries with the most comprehensive smoke-free legislation.[13] The Ministry of Public Health Report No. 19 designates the name or type of public places that are declared as nonsmoking environments pursuant to the Non-Smoker's Health Protection Act of 1992.

Of the 54.9 million citizens of Thailand older than 15 years in 2017, tobacco use was at 19.1 %, which is approximately 10.7 million. The smoking rate for males was 37.7% for a total of 10.2 million male smokers. The smoking rate for females was 1.7% for a total of 483,000 female smokers.[14] Data from the WHO showed that in Thailand, the exposure to second-hand smoke increased among non-smokers at work from 27.2% in 2009 to 30.5% in 2011.[15] Nevertheless, the compliance to the laws measured by the Global Adult Tobacco Survey (GATS) in 2011 showed the five highest rates of smoking among smokers aged 15 years and above over the past 30 days was 68.8% in markets, 68.4% in bars or night clubs, 46.9% in restaurants, 34.9% in universities and 28.8% in secondary schools.[15]

Young adults are at risk of smoking initiation and continuing to be regular smokers. Moreover, young adults ages 18-25 are likely to use multiple forms of tobacco.[16] One strategy of policy implementation of interest to the Thai Health Professional Alliance Against Tobacco, was the smoke-free university. In the beginning, in 2012, five universities agreed to serve in a pilot project to make a smoke-free campus environment. In 2014, this was increased to 32 universities and at the third annual meeting in 2016, 55 universities joined the smoke-free university network.[17] One University publicly announced it would be a smoke-free campus beginning in 2014. The university board appointed a committee composed of deans which was approved to implement the smoke-free policy. The Division of Student Affairs and a smoke-free university committee were in charge of an annual year plan to run activities that supported the smoke-free university policy. Apart from the university support, the Smoke-Free Pharmacy Network under the Thai Health Promotion Foundation supported to establish the policy and strengthen the smoking cessation service together with the Faculty of Pharmacy and Faculty of Medicine on each of two campuses.

A frame work for smoke-free policies has been developed and mentioned by the International Agency for Research and Cancer.[18] Intermediate measures focus on smoke-free policy compliance which affects second-hand smoke exposure and subsequent health outcomes. There are incidental effects of smoke-free regulations such as home smoking, and increased cessation activity among smokers. Moderating variables such as occupation, tobacco control policies, and second-hand smoker awareness/attitude, can be affected by the relationship between a smoke-free policy and compliance with smoke-free policies.[12] One systematic review uses a framework of a smoke-free policy as an intervention to see a reduced smoking rate which showed an effectiveness of smoke-free policies in reducing tobacco use with a median effect of -3.4 % (interquartile interval -6.4 to -1.4%), and an increase in cessation of 6.4% (interquartile interval 1.3-7.9%).[18] Seo and others showed significant results between a smoke-free campus policy and changes in smoking behavior, perceptions of peer tobacco use, and smoking norms.[19]

According to a policy evaluation framework and outcome measures, there still are not many studies reporting effectiveness and policy management. The primary goal of this study was to evaluate the outcomes of the smoke-free university policy after two years' implementation in a smoke-free environment as to the smoking rate and quit rate, and to analyze predictors for organizational policy management and smoke-free universities.

METHODOLOGY

Participants

The ethics committee of Mahasarakham University approved the study. Registered on-campus students in 2014, faculty/staff (from 17 schools/faculties, 2 colleges, 23 departments) and vendors at the university were eligible for the study. In this study, "institution" refers to the different faculties, colleges, and departments in the university. The total number of registered students at the university was 39,171. The Taro Yamane estimation[20] of sample with an error of 0.05 was used. Stratified quota sampling was designed with a subgroup by gender. The formula of $n = N/(1+Ne^2)$ was used where N is the population, n is the sample size, and e is the sampling error. Because the sample was stratified by gender, n was doubled to 800. After factoring in a 30% dropout rate, the final value of n was 920. A quota sample from each school, colleges and department was calculated by multiplying 920 by x/39,171 where x is the number of males or females in a given school, college, or department. The final sample numbers were 845 students and 75 faculty/staff as shown in appendix. In 2014 convenient sampling was used in each school, college, and department. In 2016 convenient sampling was used again to gather data from a new group of people.

Measures

A questionnaire was developed to measure the opinion of members of the University for establishing a smoke-free campus. The questionnaire was constructed and evaluated for content and validity by three experts on tobacco control; one was from the Faculty of Medicine, another from the Faculty of Public Health and the third from the Faculty of Pharmacy. The variables measured in the study include law, information to the public, organizational support and a smoke-free environment. The Cronbach's alpha of variables was 0.887 for the whole questionnaire, 51 items, which met the requirement to be higher than 0.6.[21] The relationship test in regression analysis was performed. The Cronbach's alpha of each variable was 0.673 in information, 0.848 in organizational support/activities, 0.728 in smoke-free environment, 0.835 in organizational management policy and 0.619 in a smoke-free university with the exception of law which was 0.361. The operational definitions of the variables are as follows:

Law. This was measured by three items through a 5-point Likert scale. This covered knowledge, acceptance and compliance with university law and national law.

Information to the public. This was measured by four items through a 5-point Likert scale related to public relations publicly done on the campuses, providing knowledge, desiring to join a smoke-free university campaign, and

studying/learning about tobacco and health in the previous six months.

Organizational support. This was measured by two items through a 5-point Likert scale which covered the support requested by the university by campaigns for tobacco control and the smoking cessation service.

Smoke-free environment. This was measured by five items through a 5-point Likert scale related to smoke-free accommodations, witnesses who see smokers in the university, and opinions as to the harm of being exposed to second-hand smoke.

Organizational policy management. There were measured four main dimensions by 18 items through a 5-point Likert scale related to the general opinion of the smoke-free policy, the agreement to be a smoke-free campus, the procedures and the collaboration to comply with the smoke-free policy.

Smoke-free university. There were measured four main dimensions by 19 items through a 5-point Likert scale related to the impact of smoking on non-smokers, the effect on health, self-image and economics.

Procedures

The cover sheet of the questionnaire presented the Non-Smoker's Health Protection Act of 1992. In the first survey during the period November 2013 through January 2014, three pharmacy students administered the questionnaire to students and staff in individual schools, colleges, units and the vendor group. Data collection was completed in a month. The second survey was performed during April-May, 2016. Thirty students from the Faculty of Accounting and Management administered the questionnaire following the same method. A researcher trained the students to understand the questionnaire before they used it. Neither survey provided incentives for participation.

Statistical Analysis

This research goal was to evaluate the smoke-free environment and smoking rate before and after implementing the smoke-free policy at a university, and to explore relationships between organizational policy management and a smoke-free university by using ordinary least squares (OLS) regression analysis. The proportion of the smoke-free environment and smoking rate/quit rate over two years can be attributed to changes in smoke-free university policy. The decline between two years in a smoke-free environment and the smoking rate and quit rate, was calculated and obtained by calculating the difference between the actual observed proportion in 2016 and the proportion expected in 2016, had the proportion in the 2014 persisted unchanged. For example, from Table 2, the smokers that had been seen within 6 months in the regular subgroup in 2014 were 171 out of 891 people (0.19). The expected number of smokers who were seen for 2016 was calculated by multiplying the factor from 2014 (0.19) by the number of total people in 2016 (738). This shows that the expected number of smokers who were seen should be 141.64 people. The percentage change was calculated by subtracting the observed number from 2016 from the expected number, multiplying by 100 and then dividing by the expected number: (141.64 - 78) x 100/171 = -37.21%. The weight by population was calculated by multiplying the percent change by the observed number from 2016 and then dividing by the total number of people: (37.21x78)/738 = -3.3. Comparison between genders was performed using a Chi-square test for proportion and paired T test for 5-Likert scale variables. Comparison between years was performed using Chi-square and student T test. The research employed OLS regression analysis to test hypotheses. The correlation coefficients between variables and organizational management policy were less than 0.800 and were statistically significant. The variance inflation factors (VIF's) were between 1.000 and 2.048, which were not higher than 10.[22] Both results from correlation coefficients and VIF's showed no multicollinearity problem.

RESULTS

In 2014, there were 891 out of 920 questionnaires returned (96.8% response rate). In 2016, there were 960 out of 1,000 questionnaires returned (96.0% response rate), only 738 were completed for analysis. Most of respondents were students (more than 90%) as shown in Table 1.

Table 1: Demographic characteristic of respondents in year 2014 and 2016

Demographic data	2014 Number (%)				2016 Number (%)				p value**
	Total (n=891)	Male (n=266)	Female (n=625)	p value*	Total (n=738)	Male (n= 233)	Female (n=505)	p value*	
Age (mean±SD)	20.9 ± 4.1	21.3±4.4	20.8±4.0	0.074[1]	21.2±4.8	21.7±5.2	21.0±4.6	0.106	0.171[1]
Career				.067[2]				0.447	0.051[2]
1. Student	811(91.0)	232(87.2)	579(92.6)		692(93.8)	214(91.8)	478(94.7)		
2. Lecturer	15(1.6)	5(1.9)	10(1.6)		4(0.5)	2(0.9)	2(0.4)		
3. Personnel/staff	62(7.0)	28(10.5)	34(5.4)		38(5.1)	16(6.9)	22(4.4)		
4. Vendors	3(0.4)	1(0.1)	2(0.2)		4(0.5)	1(0.4)	3(0.6)		

*Comparisons using *Chi-square test and **student T test*

The smoke-free environment is shown as four items in Table 2A-2B. The percent change of smokers who were seen in the university area declined in the rare, often, and regular subgroups, and increased in the never subgroup, with a statistical significant difference between the years 2014 and 2016, $p<0.05$. The highest percent change following weight by population was in the never subgroup for females and was in the sometimes subgroup for males. The percent changes of exposure to cigarette smoke declined in the sometimes, often, and regular subgroups, and increased in the never and rare subgroups with statistical significant differences between the years 2014 and 2016, $p<0.05$. The highest percent change following weight by population was the never subgroup for males and the rare subgroup for females. The percent change of smokers who were seen in offices declined significantly in the often and regular subgroups, and increased significantly in the never, rare, and sometimes subgroups between the years 2014 and 2016, $p<0.05$.

The highest percent change following weight by population was the rare subgroup for males and the never subgroup for females. The percent change of living with smokers also declined in the never, rare, and regular subgroups, but increased in the sometimes and often subgroups with no statistical significance, $p>0.05$. The smoking rate in 2014 was 6.73% and in 2016 it was 8.42% which was not a statistically significant increase, $p>0.05$. Of this increase, though, the rate for regular smoking was lower than its expected value by 7.6%. This was largely due to the fact that in the 2016 study there were no female regular smokers. Of the above number, the quit attempt increased 271.67% and plans to quit the following month increased by 21.67% as shown in Table 2A-2B. The trends were similar for both males and females.

Organizational policy management was presented in three dimensions, Table 3A-3B, as the agreement dimension showed significant improvement in four items out of six ($p<0.05$). The procedure dimension showed a desire to have an inspector for checking smokers in a smoke-free area and a lesser agreement for punishment of smokers in the smoke-free area ($p<0.05$). The compliance to the policy dimension showed three significant improvements in reminding smokers to leave a smoke-free area ($p<0.05$), no support from a tobacco company ($p<0.05$), and advising smokers to quit smoking ($p<0.05$). The organizational image dimension showed a significant difference in that a smoke-free university is well-accepted internationally ($p<0.05$). Females scored higher than males in most items on the organizational policy management in 2016 and scored significantly higher in all four items in the organizational image dimension ($p<0.05$). Information and organizational support provided through the university improved significantly in all items ($p<0.001$).

Smoke-free university was presented in four dimensions, as impact of smoking on non-smokers, effect on health, effect on self-image, and effect on economics as shown in Table 4A-4B. Impact of smoking on no-smokers, there were 3 items (no 3-6), did not show statistical significant differences between 2014 and 2016. The scores in 2016 decreased significantly when compared with in 2014 in No. 1,2,7, and 8, $p<0.001$, $p<0.001$, $p<0.001$, and $p<0.001$, respectively). The scores in 2016 increased significantly when compared with in 2014 in No. 3, 9, 10, and 11, $p<0.001$, $p<0.001$, $p<0.001$, and $p<0.001$, respectively. The highest score in 2016 was in No. 11. Effect on health showed a significant difference between years in No. 13 and 14, $p< 0.001$ and <0.001, respectively. The highest score in both years was in No. 12. Effect on self-image showed significant difference between 2014 and 2016 in No. 15 and 16. The highest score was in No. 17. The effect on economics showed significant differences in No 18 and 19, $p<0.001$ and <0.05, respectively. The highest score was in No. 18 in 2016. Females showed higher scores than males in most items in 2016.

The ordinary least squares (OLS) regression analysis was used to identify predictors of support for the smoke-free university. In 2016, law and organizational support were significant predictors of organizational management (beta 0.202-0.293, $p<0.001$, adjusted R^2 = 19%, respectively). Organizational policy management is the significant predictor in 2016 of a smoke-free university (beta 0.627, $p<0.001$, adjusted R^2= 41%, respectively). Standardized regression coefficients (beta) for each predictor at each analysis are presented in Table 5.

DISCUSSIONS

Key Findings and Interpretations

More than 90% of respondents were students and approximately 10% were staff. The smoke-free environment showed significant improvement, especially in the following subgroups: often see smokers and regularly see smokers on campus, less exposure to cigarette smoke, fewer smokers seen in offices, and fewer people living with smokers. The smoking rate in 2014 was 6.73% and in 2016 it was 8.42% which was not a statistically significant increase, $p>0.05$. Of this increase, the rate for regular smoking was lower than its expected value by 7.6%. The quit attempt rate increased from 8.33% to 33.96%, which was greater than the expected value by 271.67%.

Table 2A: Percentage changes in smoke-free environment and smoking, and the quit rate in total number among males and females in 2014 and 2016

Group	2014 No(%)			2016 No(%)			Expected Number in 2016			% Change in Total		% Change in Male		% Change in Female	
	Total (n=891)	Male (n=266)	Female (n=625)	Total (n=738)	Male (n=233)	Female (n=505)	Total	Male	Female	Crude	Weight by pop	Crude	Weight by pop	Crude	Weight by pop
[Environment] Have seen smokers within 6 months?*															
Never	124(13.92)	35(13.16)	89(14.24)	144(19.51)	35(15.02)	109(21.58)	102.71	30.66	71.91	33.30	6.50	12.41	1.86	41.67	8.99
Rare	248(27.83)	63(23.68)	185(29.60)	204(27.64)	67(28.76)	137(27.13)	205.41	55.18	149.48	-0.57	-0.16	18.76	5.39	-6.75	-1.83
Sometimes	185(20.76)	43(16.17)	142(22.72)	204(27.64)	62(26.61)	142(28.12)	153.23	37.67	114.74	27.44	7.59	56.59	15.06	19.20	5.40
Often	163(18.29)	60(22.56)	103(16.48)	108(14.63)	31(13.30)	77(15.25)	135.01	52.56	83.22	-16.57	-2.42	-35.93	-4.78	-6.04	-0.92
Regular	171(19.19)	65(24.44)	106(16.96)	78(10.57)	38(16.31)	40(7.92)	141.64	56.94	85.65	-37.21	-3.93	-29.13	-4.75	-43.06	-3.41
[Environment] Have been exposed to cigarette smoke within 6 months?*															
Never	111(12.46)	14(5.26)	97(15.52)	126(17.07)	33(14.16)	93(18.42)	91.94	12.26	78.38	30.69	5.24	148.12	20.98	15.08	2.78
Rare	294(33.00)	80(30.08)	214(34.24)	287(38.89)	81(34.76)	206(40.79)	243.52	70.08	172.91	14.79	5.75	13.66	4.75	15.46	6.31
Sometimes	312(35.02)	102(38.35)	210(33.60)	226(30.62)	82(35.19)	144(28.51)	258.42	89.35	169.68	-10.39	-3.18	-7.20	-2.53	-12.23	-3.49
Often	117(13.13)	45(16.92)	72(11.52)	69(9.35)	26(11.16)	43(8.51)	96.91	39.42	58.18	-23.85	-2.23	-29.82	-3.33	-21.08	-1.79
Regular	57(6.40)	25(9.40)	32(5.12)	30(4.07)	11(4.72)	19(3.76)	47.21	21.90	25.86	-30.20	-1.23	-43.59	-2.06	-21.43	-0.81
[Environment] Have seen smokers in your office?*															
Never	200(22.45)	47(17.67)	153(24.48)	192(26.02)	44(18.88)	148(29.31)	165.66	41.17	123.62	13.17	3.43	6.02	1.14	15.93	4.67
Rare	230(25.81)	58(21.80)	172(27.52)	239(32.38)	78(33.48)	161(31.88)	190.51	50.80	138.98	21.08	6.83	46.89	15.70	12.80	4.08
Sometimes	232(26.04)	78(29.32)	154(24.64)	200(27.10)	57(24.46)	143(28.32)	192.16	68.32	124.43	3.38	0.92	-14.52	-3.55	12.06	3.41
Often	125(14.03)	42(15.79)	83(13.28)	78(10.57)	35(15.02)	43(8.51)	103.54	36.79	67.06	-20.43	-2.16	-4.26	-0.64	-28.99	-2.47
Regular	104(11.67)	41(15.41)	63(10.08)	29(3.93)	19(8.15)	10(1.98)	86.14	35.91	50.90	-54.94	-2.16	-41.25	-3.36	-64.93	-1.29

Table 2B: Percentage changes in smoke-free environment and smoking, and the quit rate in total number among males and females in 2014 and 2016

Group	2014 No(%)			2016 No(%)			Expected Number in 2016			% Change in Total		% Change in Male		% Change in Female	
	Total (n=891)	Male (n=266)	Female (n=625)	Total (n=738)	Male (n=233)	Female (n=505)	Total	Male	Female	Crude	Weight by pop	Crude	Weight by pop	Crude	Weight by pop
[Environment] Have continued to live with smokers at the present?															
Never	621(69.70)	173(65.04)	448(71.68)	512(69.38)	139(59.66)	373(73.86)	514.36	151.54	361.98	-0.38	-0.26	-7.25	-4.32	2.46	1.82
Rare	87(9.76)	32(12.03)	55(8.80)	63(8.54)	23(9.87)	40(7.92)	72.06	28.03	44.44	-10.41	-0.89	-15.72	-1.55	-8.07	-0.64
Sometimes	101(11.34)	29(10.90)	72(11.52)	100(13.55)	44(18.88)	56(11.09)	83.66	25.40	58.18	16.18	2.19	64.13	12.11	-3.02	-0.34
Often	18(2.02)	7(2.63)	11(1.76)	16(2.17)	11(4.72)	5(0.99)	14.91	6.13	8.89	6.06	0.13	69.55	3.28	-35.35	-0.35
Regular	64(7.18)	25(9.40)	39(6.24)	47(6.37)	16(6.87)	31(6.14)	53.01	21.90	31.51	-9.39	-0.60	-23.59	-1.62	-1.31	-0.08
[Clinical outcome] Smoking rate during 6 months															
No	831(93.37)	225(84.58)	606(96.96)	674(91.57)	182(78.45)	492(97.62)	686.44	197.09	489.65	-1.50	-1.37	-6.71	-5.24	0.39	0.38
Yes	60(6.73)	41(15.41)	19(3.04)	62(8.42)	50(21.55)	12(2.38)	49.56	35.76	15.32	20.73	1.74	34.73	7.45	-17.48	-0.42
Seldom	*15(1.68)*	*7(2.63)*	*8(1.28)*	*20(2.72)*	*11(4.74)*	*9(1.79)*	12.39	6.11	6.45	50.73	1.37	69.92	3.30	31.86	0.57
Sometimes	*18(2.02)*	*14(5.26)*	*4(0.64)*	*19(2.58)*	*17(7.33)*	*2(0.40)*	14.87	12.21	3.23	22.95	0.59	34.21	2.50	-30.64	-0.12
Frequent	*7(0.79)*	*5(1.88)*	*2(0.32)*	*8(1.09)*	*7(3.02)*	*1(0.20)*	5.78	4.36	1.61	31.68	0.34	52.78	1.59	-30.64	-0.06
Regular	*20(2.24)*	*15(5.64)*	*5(0.80)*	*15(2.04)*	*15(6.47)*	*0*	16.52	13.08	4.03	-7.60	-0.15	12.78	0.82	-80.64	0.00
[Clinical outcome] Quit rate within 6 months (n=60 in 2014, n=53 (male 43, females 10) in 2016)*															
Quit No.	5(8.33)	1(2.44)	4(21.05)	18(33.96)	12(27.91)	6(60.00)	4.42	1.05	2.11	271.67	92.26	1095.12	305.62	97.37	38.95
A quit plan	42(70.00)	40(96.97)	10(71.43)	25(58.14)	21(63.64)	4(40.00)	30.10	32.00	7.14	-12.14	-7.06	-34.38	-21.88	-31.43	-12.57
Next mo.	*10(16.67)*	*9(21.95)*	*1(5.26)*	*11(20.75)*	*7(16.28)*	*4(40.0)*	8.83	9.44	0.53	21.67	4.50	-27.10	-4.41	347.37	34.74
In 6 mo.	*15(25.00)*	*12(29.27)*	*3(15.79)*	*6(11.32)*	*6(13.95)*	*0*	13.25	12.59	1.58	-48.33	-5.47	-54.88	-7.66	-52.63	0.00
In 6+ mo.	*17(28.33)*	*11(26.83)*	*6(31.58)*	*8(15.09)*	*8(18.60)*	*0*	15.02	11.54	3.16	-41.27	-6.23	-32.15	-5.98	-52.63	0.00
No plan	13(21.67)	8(19.51)	5(26.32)	10(18.86)	10(23.26)	0	11.48	8.39	2.63	-11.41	-2.15	20.12	4.68	-52.63	0.00

** Chi-square test with p<0.05, n/a is not applicable for analysis. An abbreviation of mo. stands for month.*

Table 3: Organizational policy management compared between male and female and between 2014 and 2016

Organizational policy management	2014 (Mean ± SD)				2016 (Mean ± SD)				p value*
	Total (n=891)	Male (n=266)	Female (n=625)	p value*	Total (n=738)	Male (n=233)	Female (n=505)	p value*	
Agreement									
1. Each institution collaborates to establish a smoke-free area.	4.2±0.7	4.2±0.7	4.2±0.7	0.298	4.2±0.7	4.1±0.7	4.2±0.7	0.084	0.301
2. No smoking in public areas such as study buildings, sports field, markets, shops, toilets, doors etc.	4.3±0.8	4.3±0.8	4.3±0.8	0.424	4.3±0.7	4.2±0.7	4.3±0.6	0.131	0.575
3. No smoking in a smoke-free area after arranging a smoking area	4.3±0.7	4.2±0.7	4.3±0.8	0.428	4.4±0.8	4.3±0.8	4.4±0.7	0.124	0.003
4. In a smoke-free area, no-smoking signs were prominently posted.	4.3±0.8	4.2±0.8	4.3±0.8	0.545	4.3±0.8	4.3±0.8	4.4±0.8	0.618	0.038
5. To support the smoke-free policy, the university should include staff/personnel who do not smoke while working in the university.	4.0±1.0	4.0±1.0	3.9±0.9	0.484	4.1±1.0	4.1±1.0	4.1±1.0	0.727	0.027
6. A person who takes a public vehicle at, every vehicle which goes into the university campus area, is not allowed to smoke.	4.2±0.8	4.1±0.9	4.1±0.8	0.813	4.3±0.7	4.3±0.7	4.3±0.7	0.752	<0.001
Procedure									
7. Specify a punishment for students and staff who smoke in the smoke-free area.	4.0±0.9	4.0±0.9	4.0±0.9	0.403	3.9±0.9	3.8+1.0	3.9±0.9	0.374	<0.001
8. Continuously provide teaching about the adverse effects of tobacco/smoking.	4.1±0.8	4.1±0.8	4.1±0.8	0.768	4.2±0.7	4.1+0.7	4.2±0.6	0.076	0.365
9. Continuously provide a campaign for affecting the popularity of reducing, avoiding and quitting smoking.	4.2±0.8	4.2±0.8	4.1±0.8	0.955	4.2±0.6	4.1+0.7	4.2±0.6	0.006	0.448
10. Should have personnel to examine persons who do not follow the smoke-free policy in institutions and public areas in the campus.	4.1±0.8	4.0±0.8	4.1±0.8	0.198	4.2±0.7	4.1±0.7	4.2±0.7	0.386	0.011
Support compliance with a smoke-free policy									
11. If you see a smoker, you are willing to politely remind them and direct them out of the smoke-free area.	3.8±1.0	3.9±1.0	3.8±1.0	0.163	4.0±0.9	3.9±1.0	4.0±0.9	0.823	0.003
12. Institutions in the university should not receive money or other support from any cigarette company.	3.9±0.9	3.9±0.9	3.9±0.9	0.819	4.1±0.9	4.1±1.0	4.1±0.9	0.353	<0.001
13. If there is a person who wants to quit smoking, you should be able to advise to him/her to go to a service organization on campus.	4.1±0.8	4.1±0.8	4.1±0.8	0.448	4.3±0.7	4.3±0.8	4.3±0.7	0.235	<0.001
14. A government employee with authority from the president is able to impose a fine by law for a smoker who smokes in a smoke-free area.	4.0±0.9	4.0±0.9	4.0±0.9	0.733	3.9±0.9	3.9±0.9	3.9±0.9	0.650	0.077
15. A smoke-free university presents a good image for society.	4.3±0.8	4.3±0.8	4.3±0.7	0.431	4.3±0.7	4.2±0.7	4.3±0.7	0.016	0.592
16. The university develops a good reputation from implementing a smoke-free policy.	4.2±0.8	4.1±0.8	4.2±0.8	0.325	4.2±0.7	4.1±0.8	4.2±0.7	0.009	0.883
17. A smoke-free university is well-accepted internationally.	4.2±0.8	4.2±0.8	4.2±0.8	0.572	4.4±0.7	4.3±0.8	4.4±0.7	0.031	<0.001
18. A smoke-free atmosphere at a university promotes safety.	4.3±0.8	4.3±0.8	4.4±0.8	0.059	4.4±0.7	4.3±0.8	4.4±0.7	0.026	0.381
19. A smoke-free university presents a good image for society.	4.3±0.8	4.3±0.8	4.3±0.7	0.431	4.3±0.7	4.2±0.7	4.3±0.7	0.016	0.592

**Comparisons using student T test*

Table 4: Opinion of the smoke-free university in 2014 and 2016

Smoke-free university items	2014 Mean ± SD				2016 Mean ± SD				p value (between 2 years) *
	Total (n=891)	Male (n=266)	Female (n=625)	p value*	Total (n=738)	Male (n=233)	Female (n=505)	p value*	
Impact of smoking on no-smokers									
1. Smokers feel comfortable smoking in a designated smoking area	3.5±1.0	3.7±1.0	3.4±1.0	0.001	3.2±1.0	3.4±0.9	3.2±1.0	0.005	<0.001
2. Smokers not smoking in smoke-free areas makes friends think positively about them.	3.4±1.2	3.5±1.1	3.3±1.2	0.021	3.1±1.2	3.3±1.1	3.0±1.2	0.003	<0.001
3. If a smoker, you will recommend your friends smoke in the provided smoking areas.	4.0±0.8	4.0±0.8	4.0±0.8	0.581	4.1±0.9	4.1±0.9	4.1±0.8	0.612	<0.001
4. I think the no smoking signs have no effect.	3.6±1.0	2.2±1.0	2.5±1.0	<0.05	3.6±1.0	3.8±0.9	3.6±1.0	0.003	0.062
5. I think that the smoke-free campaign has not affected smoking behavior on campus.	3.5±1.0	2.4±1.0	2.6±1.0	0.001	3.4±1.0	3.6±1.0	3.4±1.0	0.016	0.441
6. I think the smoking restrictions on campus will increase the smoking rate off campus	3.5±1.0	3.6±1.0	3.4±1.0	<0.05	3.4±0.9	3.4±0.9	3.4±0.9	0.808	0.436
7. I think designated smoking areas and smoke-free areas violate individual rights	2.9±1.1	2.7±1.1	3.2±1.1	<0.05	2.7±1.1	2.8±1.2	2.6±1.1	0.016	<0.001
8. The image of a smoke-free university is not different from a non-smoke-free university.	3.3±1.1	2.5±1.0	2.7±1.0	<0.05	3.0±1.0	3.1±1.0	3.0±1.0	0.459	<0.001
9. I think that smoke-free university can reduce the smoking rate on campus.	3.8±0.8	3.8±0.8	3.8±0.8	0.786	3.9±0.8	3.9±0.8	3.9±0.7	0.925	0.077
10. Designated smoking and smoke-free areas are generally well-liked to preserve a healthy work/study environment.	4.0±0.9	4.0±0.9	4.0±0.9	0.259	4.0±0.8	4.0±0.9	4.1±0.7	0.058	0.353
Effect on health									
11. Reducing smoking can have a better health on smokers and those close to them	4.3±0.8	4.2±0.8	4.2±0.9	0.974	4.5±0.7	4.4±0.8	4.5±0.7	0.044	<0.001
12. Second hand smoke can be hazardous to your health.	4.2±0.9	4.2±0.9	4.1±0.9	0.732	4.3±0.8	4.2±0.9	4.4±0.8	0.020	<0.001
13. I think that smoking in front of others makes me more self-confident.	3.0±1.3	3.2±1.3	2.8±1.3	<0.05	3.1±1.4	3.2±1.4	3.1±1.4	0.110	0.016
Effect on self-image									
14. I think that those who smoke in public are a good example.	2.7±1.5	2.9±1.5	2.6±1.5	<0.05	2.3±1.3	2.4±1.3	2.2±1.3	0.137	<0.001
15. I think that getting smoking cessation services or encouraging others to do so makes you feel good about doing the right thing.	3.9±0.9	3.9±0.9	3.9±0.9	0.911	3.7±1.8	3.7±2.2	3.7±1.7	0.911	<0.001
16. I think the money saved on cigarettes after quitting can be used for savings or other expenses.	4.2±0.8	4.1±0.8	4.2±0.8	0.105	4.3±0.9	4.2±0.9	4.3±0.8	0.013	0.084
Effect on economics									
17. I think smoking increases health care expenses.	4.1±0.9	4.0±1.0	4.2±0.9	0.017	4.4±0.8	4.3±0.9	4.4±0.8	0.296	<0.001
18. I think that the investment for creating smoking areas and smoke-free areas is worth the cost.	4.0±0.9	4.0±0.8	4.0±0.9	0.316	4.1±0.9	4.1±1.0	4.1±0.9	0.989	0.011
19. I think smoking is a waste of money.	4.2±0.8	4.2±0.8	4.3±0.8	0.034	4.2±0.8	4.2±0.8	4.3±0.8	0.335	0.752

**comparisons using student T test*

Table 5: Predictors for organizational policy management and smoke-free university (n=738 in 2016)

Year	Predictors	Beta (unstandardized Coefficients)	Standard error	95%CI	Beta	Adjusted R^2
2016	**Predictors of Organizational Policy Management**					
	Law	0.202*	0.034	0.135, 0.268	0.201	0.189
	Information to the public	0.093	0.048	-0.002, 0.188	0.091	
	Organizational support	0.293*	0.048	0.199, 0.386	0.289	
	Smoke-free environment	-0.025	0.034	-0.091, 0.041	-0.025	
2016	**Predictor of a smoke-free university**					
	Organizational policy management	0.627*	0.028	0.573, 0.682	0.640	0.408

* analyzed by linear regression with p value <0.001

Organizational policy management showed the three highest scores for smokers not being seen after arranging a smoking area, international acceptance for being a smoke free university, and safety promoted by being a smoke-free atmosphere. Smoke-free university showed the highest score for restricting smoking areas and making work/study areas smoke free. Females showed higher scores when compared with males in most items. Law and organizational support were significant predictors of organizational policy management and that resulted in a smoke-free university policy.

A survey result from Fallin et al.[23] showed that showed that the impacts of high compliance with comprehensive tobacco policy were less second-hand smoke exposure and lower intentions to smoke on campus. This study confirmed that the organizational policy management can predict the improved outcomes of a smoke-free university. This study was designed to measure the relationship weight between the organizational policy management (as a mediator) and a smoke-free university. This is different from a systematic review by Hopkins et al.[18] which used smoke-free policy as a moderator between smokers and a reduction of smoking in the workplace. However, more findings for other variables which influenced a smoke-free university must be explored in further research.

Prior studies stated that written campus policies do not always reflect campus enforcement or actual practice,[24] moreover, to increase compliance to a smoke-free policy additional strategies were needed such as education and environmental strategies[25]. This study showed that the organizational policy management was a significant predictor of a smoke free university. Organizational support in the university for two years was part of the strategic plan by the smoke-free university committee. The university President gave no-smoking signs to every institution on the July 21, 2014 kick-off day in order to post them at the front of buildings. The university assigned 19 smoking areas on the whole campus and supported activities through some modules. There were partial teaching sessions in the Faculty of Public Health (basic public health and advanced public health development), and Faculty of Nursing (psychiatric health). There was also an activity from the Division of Student Affairs which was a competition for short clip videos related to the smoke-free university policy. The winning media were published on YouTube and were presented in many student meetings. For another activity through a module in Pharmacotherapy 1, Faculty of Pharmacy, the smoking cessation services were practiced and provided through 90-100 pharmacy students in the first semester every year to provide an outreach for smoking cessation services. One student was assigned to help one's friend who smokes. One lecture for three hours, and three hours of practice were designed to teach counseling techniques to quit smoking in a real practice with smokers.[26] This teaching method was developed beyond a general practice laboratory for pharmacy students when compared with other studies. [27-28]

The results of this study support the smoke-free policy as is done in many universities in the U.S. and U.K.[29-30] A study showed that faculty/staff (especially females) were very supportive of the smoke-free campus policy[29] which was similar to our findings. A review from 11 studies by Bennett et al.[31] showed 54.5% of universities implemented a 100% smoke-free campus policy. Others were implemented partially using a partial smoking restriction and an integration of preventive education and/or a smoking cessation program into the college-level policy. This partial implementation was similar to this study, more intensive strategic plans should be organized with more partners in the whole university in order to increase more improvement outcomes. A student model of a young generation without smoking was also initiated once a year for inspiring students to keep away from smoking. This activity was aimed to change social norms as another strong predictor from one study for young people's support for a smoke-free public setting.[32]

There was a significant improvement in the university environment, as there were fewer smokers seen in university areas. The smoke-free environment showed a significant improvement in second-hand smoke. Fewer smokers were seen in the university area (58.24% in 2014 and 52.84% in 2016, sum of the sometimes, often, and regular subgroups, $p<0.05$) and in offices (51.74% in 2014 and 41.6% in 2016, sum of the sometimes, often, and regular subgroups, $p<0.05$). There was also less exposure to smoke (54.55% in 2014 and 44.04% in 2016, sum of

the sometimes, often, and regular subgroups, p<0.05). These results seem to be better when compared to other universities. Student exposure to second-hand smoke outdoors ranged between 42.6% and 79.0%, and staff exposure was 73% by which the exposures were difficult to avoid.[29]

The smoking rate increased in males from 15.41% in 2014 to 21.55% in 2016; while in females it decreased from 3.04% to 2.38%.The overall rate for smoking regularly was reduced by 7.60% from the expected value because no female smokers were found in 2016.The results showed a benefit change as in other studies, such as in Helwan University where there was a smoking prevalence of 8.6% in 2014 (28.5% in male and 0.9% in female);[33] and King Saud University where the smoking prevalence was 14.5 % in 2010 (32.7% in male and 5.9% in female).[34] The similar trend of smoking prevalence reduction was evidenced at universities in the USA and UK (16.5% to 12.8% after one year, p<0.001 and 9.5% to 7.0% after 3 years, p=0.046).[29] Nevertheless, Butler et al.[35] showed that the smoke-free policy in the undergraduate college students did not change the quit rate and did not stop smoking in bars. By the quit rate outcome, this study showed a higher quit rate of 33.96%. The quit rate was higher than the national survey of people aged 15 years old or more in 2011 which showed the quit rate at more than six months was 23.9%.[36]

Study Limitations and Strengths

The strength of this study was organizational support used in participation with modules in different faculties and partners in the university, such as three university pharmacies, and the university hospital. However, the teaching/studying seemed to be significantly less in 2016. It might be that the surveys were administered in different times of the semester (October-December of 2014, and April-May of 2016). The modules related to tobacco and health might not cover the entire academic year. There were only two modules in general education in the first semester (developing student and daily consumption). However, a comment from the smoke-free university committee was to have more student models in each institution for more contributions.

The limitations of this study are firstly being unable to run the pilot following the simple random sampling by names registered to the university. Registration in each institution was problematic because some faculties had many groups of students at different times of the day. However, this research has tried to sample from all institutes by quota sampling to represent the entire university. Second, the respondents were mostly students, at 90%, when compared with staff/shop vendors at 10%, according to the research aimed to find predictors of smoke-free university policy. The sample was not designed to be an equal number between students and staff, and between males and females. Third, the questionnaires were administered and filled out as a self-survey. Some information was incomplete. However, the sample was acceptable based on a prior estimation. The administration was informed and trained by one researcher in one meeting to both pharmacy students, and Accounting and Management students. This was to standardize both groups.

Implications for Policy and Practice

The most difficult part of policy implementation is to sustain compliance to the policy. Some strategies are recommended here. The continual teaching of students whether in general or professional education may involve students into smoke-free policy and increase knowledge of tobacco control. Professional education should include tobacco control and smoking cessation. An internship program to provide a counseling service for smoking cessation is encouraged to reduce the death of non-communicable disease in Thailand. Clinical assessment for quit and relapse rates is required for further studies. The monitoring system to measure compliance with the current policy should be more developed and strengthened. The smoking area should be further evaluated with greater support for smokers to use this area. To reduce the smoking rate, organizational policy management through the law and organizational support needs to be highlighted in the university work plan with more involvement and more compliance from every part. Establishing student groups on campus is also possible as a suggestion from one study.[27] The Division of Student Affairs, which runs the student clubs, should build policy support for preventing new smokers, helping smokers to quit, and building up new social norms.

CONCLUSION

After the implementation of the smoke-free university, the smoke-free environment was improved significantly. Of the overall smokers, there was a decrease of 7.60% in the subset group of those who smoked regularly. In 2016, a quit rate was increased to 33.96%. Opinions on the smoke-free university policy have been positive. Organizational policy management has also had positive support especially among females. The organizational policy management showed a significant influence to the smoke-free university, and increase of influence even more after the implementation of the policy within two years, by the increase of the adjusted R^2. The main factors that affected the organizational policy management were law and organizational supports, especially the higher smoking cessation rate.

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CONFLICTS OF INTEREST DISCLOSURE

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APPENDIX

Table: Quota sampling from each faculty/school, divisions, centers in a university

Faculties/College/Departments	Students (No)				Staff (No)				Total quota No
	Male	Quota No	Female	Quota No	Male	Quota No	Female	Quota No	
1. Health Sciences	745	19	3,011	70	159	3	335	9	101
1.1 Faculty of Medicine	192	5	348	8	63	1	150	4	18
1.2 Faculty of Pharmacy	109	3	406	10	26	0	48	1	15
1.3 Faculty of Nursing	38	1	353	8	9	0	65	2	11
1.4 Faculty of Public Health	374	9	1,756	41	21	0	33	1	51
1.5 Faculty of Veterinary Medicine	32	1	147	3	40	1	39	1	6
2. Health and technology	3,001	71	5,726	136	338	7	348	9	223
2.1 Faculty of Technology	490	12	1,401	33	44	1	71	2	48
2.2 Faculty of Science	282	7	972	23	102	2	127	3	35
2.3 Faculty of Engineering	484	11	219	6	63	1	27	1	19
2.4 Faculty of Environment and Resource Studies	210	5	573	13	19	0	25	1	19
2.5 Faculty of Informatics	1,110	26	1,730	41	60	2	55	1	70
2.6 Faculty of Architecture, Urban Design and Creativity	425	10	831	20	50	1	43	1	32
3. Arts and Language	6,316	149	16,815	396	419	12	421	10	567
3.1 Faculty of Humanities and Social Sciences	1,149	27	2,162	51	76	2	91	2	82
3.2 Faculty of Cultural Science	30	1	35	1	21	1	14	0	3
3.3 Faculty of Tourism and Hotel Management	306	7	1,312	31	34	1	38	1	40
3.4 Mahasarakham Business School	1,428	34	8,225	193	92	3	116	3	233
3.5 Faculty of Education	990	23	1,290	31	73	2	77	2	58
3.6 Faculty of Fine and Applied Arts	197	5	498	11	39	1	23	1	18
3.7 College of Music	463	11	44	1	41	1	13	0	13
3.8 College of Politics and Governance	1,753	41	3,249	77	43	1	49	1	120
4. Divisions	0	0	0	0	524	12	539	9	21
4.1 Division of General Affairs	0	0	0	0	31	1	28	0	1
4.2 Division of Human Resources	0	0	0	0	11	0	16	0	0
4.3 Division of Student Affairs	0	0	0	0	29	1	24	0	1
4.4 Division of Finance and Facilities	0	0	0	0	25	1	66	1	2
4.5 Division of the Registrar	0	0	0	0	10	0	22	0	0
4.6 Division of Academic Affair	0	0	0	0	6	0	18	0	0
4.7 Division of Building and Grounds	0	0	0	0	358	8	299	7	15
4.8 Division of Public Relations and International Affairs	0	0	0	0	27	1	26	0	1
4.9 Division of Planning	0	0	0	0	8	0	18	0	0
4.10 Division of Research Facilitation and Dissemination	0	0	0	0	19	0	22	1	1

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5. Others	0	0	0	0	157	4	125	1	5
5.1 Office of the President	0	0	0	0	1	0	1	0	0
5.2 Computer Center	0	0	0	0	30	1	10	0	1
5.3 Internal Audit Office	0	0	0	0	2	0	9	0	0
5.4 Academic Resource Center	0	0	0	0	29	1	42	1	2
5.5 General of Education	0	0	0	0	33	1	28	0	1
5.6 Walairukhavej Botanical Research Institute	0	0	0	0	42	1	24	0	1
5.7 The Research Institute of Northeastern Art and Culture	0	0	0	0	20	0		0	0
6. Centers	0	0	0	0	32	0	29	0	0
6.1 Central Lab	0	0	0	0	0	0	2	0	0
6.2 University Farm	0	0	0	0	14	0	6	0	0
6.3 Center of Excellence for Silk Innovation	0	0	0	0	8	0	4	0	0
6.4 University Business Incubation (UBI)	0	0	0	0	0	0	2	0	0
6.5 Center for Education Quality Assurance and Development	0	0	0	0	5	0	8	0	0
6.6 Palaeontological Research and Education Centre	0	0	0	0	5	0	7	0	0
7. Registered vendors	0	0	0	0	48	1	84	2	3
	10,062	239	25,551	602	1,667	39	1,881	40	920