Smoking Behavior among Adolescents in Rural Schools in Malacca, Malaysia - A Case-Control Study

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ABSTRACT

Smoking among rural adolescents in Malaysia is on the rise with a significant difference seen between urban and rural youths. Therefore, this study was carried out to determine a predictive model of smoking among the rural-school adolescents population in Malacca, Malaysia. An unmatched case-control study was conducted in 2010 involving 484 cases and 444 controls of Form Two students in Malacca, Malaysia, using cluster sampling. Smoking was the dependent factor of this study while the independent factors were individual, family, school and environment. Data were obtained through a self-administered questionnaire. The response rate of the study was 100% whereas the smoking prevalence was 20.9%. Binary logistic regression was used to determine the smoking predictive model. Strong predictors of smoking behavior were: influenced by artistes who smoke (Adjusted OR=8.67, 95% CI 5.53-13.58); the male gender (Adjusted OR=6.7, 95% CI 4.14-10.83); Muslim (Adjusted OR=4.46, 95% CI 2.36-8.44); and the belief that smoking is not dangerous when the teacher is seen smoking as well (Adjusted OR=3.95, 95% CI 2.19-7.10). Other predictors were: being offered cigarettes by friends (Adjusted OR=2.81, 95% CI 1.79-4.42); the belief that smoking will relax the mind (Adjusted OR=2.45, 95% CI 1.33-4.51); having friends who smoke (Adjusted OR=2.32, 95% CI 1.29-4.81); forced by friends to smoke (Adjusted OR=2.17, 95% CI 1.15-4.12); have heard of the national No-Smoking Campaign (Adjusted OR=1.89, 95% CI 1.06-3.37); have problems with the school management (Adjusted OR=1.75, 95% CI 1.07-2.88); parental consent to watch sexual activities, drug use or violence on television or at the cinema (Adjusted OR=1.73, 95% CI 1.06-2.83); and have lunch in school (Adjusted OR=1.58, 95% CI 1.04-2.41). This paper ends with the recognition of the need for intervention in dismantling the predictors that can lead to the development of smoking among Malaysian adolescents in rural schools.

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INTRODUCTION

In Malaysia, smoking is prevalent among the adult as well as the adolescent population; the figures were 27.0% and 14.7% respectively in 2006. The trend recorded a decline in smoking among adolescents from 16.7% in 1996 to 14.7% in 2006 (Ministry of Health Malaysia, 2008). There are more adolescents in rural schools who smoke compared to in urban schools; the figures are 73.0% and 64.4% respectively (Plotnikoff *et al*., 2004). The prevalence of adolescents among urban smokers (12.3%) and rural smokers (18.4%) in Malaysia also showed a significant difference although many anti-smoking campaigns have been conducted (Ministry of Health Malaysia, 2008).

Early adolescents engage in abstract thinking and grow towards reflective thinking by the time they have reached mid adolescence. As they approach adulthood, they mature in their thinking and begin to develop a more distinct identity of their own (World Health Organizations, 2002).

However, in the process of developing their own identity and behavior patterns, as outlined by the Ecological System Theory, adolescents are also affected in their development by the external influences of individuals such as family members, friends, neighbors and people from school as well as extraneous forces such as the law and attitudes of society either directly or indirectly (Bronfenbrenner, 1979). The importance of these factors must be identified to nurture them to grow into good adults in their later life, helping them to manage their dismay and curiosity and eventually prevent them from engaging in negative behaviours.

As outlined by Bronfenbrenner's (1979) Ecological System Theory, smoking can be influenced by individuals, family members, elements connected to the school and environmental factors. Many studies have shown that the following factors can contribute to smoking among adolescents: male gender; being younger siblings; having good communication with parents; awareness of the dangers of smoking; having lunch at school; having a good self-image; and intake of alcohol (Sperber *et al*., 2001; Harakeh *et al*., 2005; Chang *et al*.; 2006, Kalesan *et al*., 2006; Lim *et al*., 2006; Yanez *et al*., 2006).

Although adolescents spend more time with their peers, family members such as the father, mother, siblings and others also influence adolescent behavior in different ways (Larsons & Richards, 1991). Lim *et al*., (2006) found that adolescents in Kota Tinggi, Johore, a southern state in Malaysia, whose fathers were smokers, had a higher significant risk for smoking compared to those who had fathers who were not smokers (OR=3.18, 95% CI 1.54-6.56). The same study also showed a similar higher risk for smoking among adolescents whose brothers were smokers (Lim *et al*., 2006).

Besides family members, school teachers are also role models for school children. Teachers are constantly being observed by their students, and indirectly, teachers gain trust from their students especially in terms of behavior and attitudes. In a cross-sectional study reported by Wen *et al*. (2007), among 3957 school children from Grade Seven to Grade Nine in Guanghzou, China who did not smoke began smoking after they saw their teacher smoking. The school as a microcosm also plays a significant role in adolescents' decision to experiment with or

to take up smoking. If a school has a high prevalence of smoking, it is also likely to have a high number of students who smoke (Alexander *et al.*, 2001). Other influencing factors for adolescents to smoke include: the involvement of students in co-curricular activities; type of school i.e. whether public or private school; having anti-smoking activities in schools; academic performance; and the presence of no-smoking signage around the school compound (Lim *et al.*, 2006; Yanez *et al.*, 2006; Wen *et al.*, 2007; MOH, 2008).

Although environment as a factor does not seem to correlate directly with adolescents who smoke, it does contribute significantly to adolescents' behavioral development. The environment is defined not only as the environment outside the house but all that surrounds the adolescent. Anybody in the adolescent's home who smokes can influence him/her to try smoking (Castrucci & Gerlach, 2006). Peers who smoke and the pressure from peers to smoke are also important factors (Kalesan *et al.*, 2006; Damianaki *et al.*, 2008). A study conducted by Lee *et al.* (2005) on 4500 adolescent students in Negeri Sembilan, a state in central Malaysia, also showed similar findings, with the prevalence of smoking in rural areas at 15.3% while in urban areas it was 12.8% (p<0.05) (Lee *et al.*, 2005).

Numerous studies have been conducted on the risk factors of cigarette smoking among adolescents in general. In Malaysia, however, little is known of the actual predictive factors covering the elements of individual, family, school and environment, which are consistent with the Ecological System Theory. Therefore, this study aimed to determine the predictive factors for smoking among rural school adolescents in Malacca, Malaysia. The results of this contribute to the development of a more effective intervention programme focusing on rural adolescents.

MATERIALS AND METHODS

This study is an unmatched case-control study conducted in the state of Malacca, Malaysia, from May to August 2010. Malaysia has 14 states, one of which is Malacca. The state has an area of 1664 km^2 and a population of 771,500 (Department of Statistics Malaysia, 2007).

The educational system in Malaysia consists of primary, secondary and tertiary levels. The Form-Two students of this study were in the secondary level. Only government secondary schools were chosen for this study. Malacca has 73 secondary schools and they are divided into urban, suburban and rural schools. There are 34 rural schools comprising 13,385 students (Department of Education Malacca, 2008).

The sample population was 14-year-olds who were schooling in 11 different rural secondary schools in Malacca selected through cluster random sampling. The sample size was calculated by a formula from Schlesselman and Stolley (1982) in which the alpha was taken at the level of 0.05 ($Z_{1-\alpha/2}$) with 80% power ($Z_{1-\beta}$). The minimum sample size was 924 after a consideration of design effect of 462 cases and 462 controls.

All students were given a screening questionnaire in order to group them as smoker (case) or non-smoker (control). The inclusion criteria for the case group were: Form-Two (14 years old) students who had taken up smoking; enrolled in regular national, multiracial and non-boarding schools (schools where not all the students stayed in a school hostel). The inclusion criteria for the control group were similar to that of the case group except for smoking status. The exclusion criterion for case and control was students who refused to participate in the study.

Based on the finding of a study investigating 1881 adolescents aged 12-14 years in the southeastern United States, which reported that prevalent estimates of smoking were similar to self-reports and cotinine, a self-administered questionnaire was used for data collection in this study (Dolcini *et al.*, 2003). The questionnaire was divided into smoking profile, socio-demographic factors (8 variables), individual factors (9 variables), family factors (13 variables), schooling factors (6 variables) and environmental factors (9 variables). Smoking is defined as having tried cigarette smoking, even if only one or two puffs (MOH, 2008). Students with school-management problems in this study referred to disciplinary issues leading to behavioral problems such as smoking, truancy, glue sniffing etc. Questions regarding commitment to religion were adapted from Krauss *et al.* (2007). There were 23 questions with a 5-scale answer option. Respondents who scored less than the mean were considered as having high religious commitment. Questions on self-image were adapted from the Rosenberg Self-Esteem Scale. Respondents were classified as suffering from low self-esteem if they scored less than 15 and exhibiting high self-esteem if they scored more than 25 (Rosenberg, 1965).

The questionnaire was newly constructed based on a literature review, observation and expert opinion in the field of smoking. It was sent for content validity to four expert individuals: a clinical psychologist, a medical anthropologist, a public health specialist with experience in the tobacco-control programme of the country and a health promotion specialist. Pre-test and pilot testing was conducted with 35 students. Test-retest using kappa statistics was also conducted since the answer options were categorical data. The duration between test and retest was 14 days (Nunnally, 1994). Kappa agreement of every statement ranged from 0.3 to 0.8.

Anonymity of each respondent was important during data collection, and, therefore, the process of collecting data did not involve any teachers or school representatives. Consent from each respondent was taken and respondents were informed that their answers were confidential. Approval for doing the study was obtained from the Ministry of Education, Malaysia while ethics approval was obtained from the National University of Malaysia, Medical Research Ethical Committee, Cheras, Kuala Lumpur, Malaysia.

Data were analyzed using the Predictive Analysis Software Statistics version 18. A bivariate analysis such as the crude odds ratio was performed. Predictors that were significant from the bivariate analysis were selected in the binary logistic regression analysis using the Enter method in order to develop the final predictive model for smoking. The odds ratio of smoking and the predictors were considered significant if 95% of the confidence interval did not include one ($p<0.05$).

RESULTS

There were 928 respondents who participated in the study, of whom 484 were cases accounted for while 444 were controls. The mean age (year) at which smoking was first tried out was $11.39 + 2.107$.

TABLE 1 Association Between Case and Control by Individual Factors

Individual factors	Category		Crude Odds Ratio	95% CI
	Case N (%)	Control (N %)		
Gender				
Male	427 (88.2)	170 (38.3)	12.074	8.627-
Female	57 (11.8)	274 (61.7)	1	16.899
Ethnicity				
Malay	444 (91.7)	326 (73.4)	4.018	2.731-
Others	40 (8.3)	118 (26.6)	1	5.911
Religion				
Muslim	446 (92.1)	329 (74.1)	4.103	2.768-
Others	38 (7.9)	115 (25.9)	1	6.080
Have consumed alcohol before				
Yes	42 (9.0)..	36 (8.2)	1.109	0.696-
No	425 (91.0)	404 (91.8)	1	1.767
Aware that smoking is harmful to the health				
Yes	442 (94.4)	406 (92.7)	1.430	0.785-
No	26 (5.6)	32 (7.3)	1	2.287
Always skip breakfast				
No	275 (58.3)	25 (56.8)	1.06	0.82-
Yes	197 (41.7)	191 (43.2)	1	1.38
Have lunch in school				
Yes	319 (67.6)	250 (56.7)	1.593	1.217-
No	153 (32.4)	191 (43.3)	1	2.086
Have dinner with family				
No	101 (21.2)	86 (19.5)	1.12	0.81-
Yes	375 (78.8)	356 (80.5)	1	1.54
Belief that smoking will relax the mind				
Yes	134 (28.5)	35 (7.9)	4.649	3.119-
No	336 (71.5)	408 (92.1)	1	6.929
Have sniffed glue and used drugs				
Yes	17 (3.6)	8 (1.8)	2.013	0.860-
No	456 (96.4)	432 (98.2)	1	4.713
I am influenced by artistes who smoke				
Yes	347 (71.7)	63 (14.2)	15.318	10.991-
No	137 (28.3)	381 (85.8)	1	21.347
I have seen a doctor smoking				
I believe that smoking does not cause any harm	198 (40.9)	37 (8.3)	7.62	5.19-
I believe that smoking is dangerous	286 (63.0)	407 (94.0)	1	11.16
I have seen a teacher smoking				
I believe that smoking is dangerous	152 (33.6)	21 (4.8)	9.91	6.13-
I believe that smoking does not cause any harm	301 (66.4)	412 (95.2)	1	16.01
Level of commitment to religion				
Low	146 (30.2)	106 (23.9)	1.38	1.03-
High	338 (69.8)	338 (76.1)	1	1.84
Level of self-esteem				
Low	160 (36.0)	122 (29.4)	1.353	1.016-
Normal	284 (64.0)	293 (70.6)	1	1.802

Individual factors

The majority of smokers were males (88.2%), Malays (91.7%) and Muslims (92.1%). There were significant crude odds ratio for males (OR=12.07; 95% CI 8.63-16.90), Malay ethnicity (OR=4.02; 95% CI 2.73-5.91) and Muslims (OR=4.10; 95% CI 2.77-6.08) (Table 1).

Variables for the individual factors that were significant in this study using a univariate analysis were: having lunch in school (OR=1.59; 95% CI 1.22-2.09); belief that smoking is relaxing (OR=4.65; 95% CI 3.12 to 6.93); influenced by artistes who smoke (OR=15.32; 95% CI 10.99-21.35); and the belief that smoking is not dangerous when a teacher is seen smoking (OR=7.83; 95% CI 5.23-11.72). Other significant factors are given in Table 1.

Family Factors

Table 2 shows that the risks of smoking were higher among respondents whose mothers were smokers (OR=3.56; 95% CI 1.17-10.82); sisters or brothers were smokers (OR=2.19, 95% CI 1.62 to 2.95); and people who stayed with them in their home (except parents, siblings, grandparents) were smokers (OR=1.70, 95% CI 1.24-2.31). These were among the significant risk factors. There were many other risks factors related to the family that contributed to adolescents smoking such as the father was a smoker (OR=1.47; 95% CI 1.13-1.92); grandparents were smokers (OR=1.696; 95% CI 1.2-2.3); and never discussed the danger of smoking with their parents (OR=1.32; 95% CI 1.02-1.71). Other significant family factors are given in Table 2.

TABLE 2: Association Between Case and Control by Family Factors

Family factors	Category		Crude Odds Ratio	95% CI
	Case N (%)	Control N (%)		
Father smokes				
Yes	299 (62.8)	235 (53.4)	1.474	1.132-
No	177 (37.2)	205 (46.6)	1	1.919
Mother smokes				
Yes	15(3.2)	4 (0.9)	3.563	1.173-
No	460 (96.8)	437 (99.1)	1	10.817
Sister/Brother smokes	168 (35.4)	88 (20.0)	2.190	1.622-
Yes No	306 (64.6)	351 (80.0)	1	2.956
Grandparents smoke				
Yes	138 (29.1)	84 (19.4)	1.696	1.244-
No	337 (70.9)	348 (80.6)	1	2.313
Other people (except parents, siblings, grandparents) in the family smoke				
Yes	116 (24.2)	66 (15.2)	1.777	1.271-
No	363 (75.8)	367 (84.8)	1	2.485
Regulations of smoking in the family				
Present	189 (40.0)	84 (19.2)	2.81	2.08-
Absent	283 (60.0)	353 (80.8)	1	3.79
Have you ever discussed the dangers of smoking with your parents?				
No	249(52.1)	200 (45.1)	1.321	1.019-
Yes	229 (47.9)	243 (54.9)	1	1.712

TABLE 2: (continue)

Parents are always available when we need their attention				
No	155 (32.7)	327 (71.1)	1.47	
Yes	319 (67.3)	108 (24.8)	1	1.10-1.97
Parents spent their time				
No	102 (21.4)	54 (12.3)	1.94	
Yes	374 (78.6)	384 (87.7)	1	1.35-2.78
Parents are interested in discussing smoking and related issues				
Yes	102 (21.1)	80 (18.0)	1.215	0.877-
No	382 (78.9)	364 (82.0)	1	1.683
Discuss with parents how to refuse smoking if invited to by friends				
No	322 (66.5)	267 (61.4)	1.22	
Yes	162 (33.5)	168 (38.6)	1	0.93-1.59
Parents are angry if I smoke				
No	78 (16.4)	43 (9.9)	1.79	
Yes	398 (83.6)	392 (99.1)	1	1.20-2.66
Parents advise on the dangers of smoking when they see smoking activity on television or at the cinema when watching TV or movies together				
No	180 (38.0)	133 (30.4)	1.39	
Yes	294 (62.0)	304 (69.6)	1	1.06-1.84
Parental restriction against watching sexual movies, drug use and violence on television or at the cinema when watching TV or movies together				
No	129 (26.9)	83 (18.9)	1.58	
Yes	350 (73.1)	355 (81.1)	1	1.15-2.16

School Factors

As shown in Table 3, seeing a teacher smoking around the school compound (OR=1.82; 95% CI 1.40-2.36); seeing persons other than the teacher smoking around the school compound (OR=1.54; 95% CI 1.17-2.04); being involved in more than one hour per week of co-curricular activities in school (OR=1.41; 95% CI 1.03-1.92) were significant risk factors.

A high prevalence of smoking in the school was among the strongest risk factors (OR=2.11; 95% CI 1.62-2.74) followed by problems with the school management (OR=2.64; 95% CI 1.925-3.638) (Table 3).

Environmental Factors

Most of the environmental variables had a significant relationship with smoking. More than 80% of cases compared to the controlled cases had friends who smoked; had read the health information messages on the cigarette box; were aware that cigarettes cannot be sold to adolescents under 18 years of age; and had heard of the No-Smoking Campaign.

Peers are among the important influences in cases of adolescent smoking. In this study, being offered cigarettes by friends was the most significant risk factor: those in this category were almost 12 times more likely to smoke (OR=11.87; 95% CI 8.68-16.22). Other high

TABLE 3 : Association Between Case and Control by School Factors

School factors	Category		Crude Odds Ratio	95% CI
	Case N (%)	Control N (%)		
Have seen a teacher smoking around the school compound				
Yes	271 (56.7)	185 (41.9)	1.819	1.400-
No	207 (43.3)	257 (58.1)	1	2.363
Being given knowledge about smoking in school				
Yes	438 (92.0)	404 (91.4)	1.084	0.678-
No	38 (8.0)	38 (8.6)	1	1.734
Received advice from teacher not to smoke in school				
Yes	438 (92.0)	404 (91.4)	1.084	0.678-
No	38 (8.0)	38 (8.6)	1	1.734
Have seen signage that smoking is prohibited in the school compound				
Yes	416 (87.6)	374 (85.6)	1.188	0.811-
No	59 (12.4)	63 (14.4)	1	1.739
Have seen people other than the teacher smoking around the school compound				
Yes	348 (72.7)	279 (63.3)	1.542	1.167-
No	131 (27.3)	162 (36.7)	1	2.039
Involved in co-curriculum activities of up to more than one hour per week				
Yes	368 (79.1)	313 (73.0)	1.406	1.032-
No	97 (20.9)	116 (27.0)	1	1.915
Know that termination from school is one of the punishments for students who smoke				
Yes	73 (15.7)	62 (14.9)	1.061	
No	392 (84.3)	353 (85.9)	1	0.73-1.53
Prevalence of smoking in the school				
High	264 (54.5)	161 (36.3)		1.621-
Low	220 (45.5)	283 (63.7)	2.109 1	2.745
Problem with the school management				
Yes	159 (33.1)	70 (15.8)		1.925-
No	321 (66.9)	374 (84.2)	2.64 1	3.638

significant factors were: having friends who smoked (OR=8.55, 95% CI 5.81-12.59); having a best friend who smoked (OR=6.00; 95% CI 4.46- 8.08); having friends who forced the respondent to smoke (OR=5.30; 95% CI 3.28-8.56); and being offered items that carried a particular cigarette brand (OR=5.01; 95% CI 3.06- 8.20). The other significant risk factors are given in Table 4.

TABLE 4 Association Between Case and Control by Environmental Factors

Environmental factors	Category		Crude Odds Ratio	95% CI
	Case N (%)	Control N (%)		
Have friends who smoke				
Yes	442 (92.3)	250 (58.3)	8.553	5.812-
No	37 (7.7)	179 (41.7)	1	12.588
Have friends who offer cigarettes				
Yes	357 (74.7)	87 (19.9)	11.869	8.684-
No	121 (25.3)	350 (80.1)	1	16.223
Have friends who force me to smoke				
Yes	105 (21.9)	22 (5.0)	5.295	3.275-
No	375 (78.1)	416 (95.0)	1	8.559
Have a best friend who smokes				
Yes	284 (59.5)	87 (19.7)	6.004	4.460-
No	193 (40.5)	355 (80.3)	1	8.084
I am influenced by artistes who smoke				
Yes	115 (24.6)	75 (17.1)	1.586	1.146-
No	352 (75.4)	364 (82.9)	1	2.196
Received items with cigarette brand labels				
Yes	96 (20.1)	21 (4.8)	5.014	3.065-
No	382 (79.9)	419 (95.2)	1	8.202
Agreed with new ways to advertise such as through pens, t-shirts, belts				
Yes	139 (29.4)	103 (23.6)	1.345	1.000-
No	334 (70.6)	333 (76.4)	1	1.810
Increased cigarette price can prevent smoking				
Yes	285 (61.0)	210 (48.1)	1.693	1.300-
No	182 (39.0)	227 (51.9)	1	2.205
Aware that adolescent cigarette smoking is an offence that can be punished				
Yes	60 (12.6)	30 (6.8)	1.97	1.25-
No	416 (87.4)	410 (93.2)	1	3.12
Have read the health information messages on cigarette boxes				
Yes	407 (85.0)	312 (72.1)	2.192	1.581-
No	72 (15.0)	121 (27.9)	1	3.040
Aware that cigarettes cannot be sold to adolescents under 18 years of age				
Yes	454 (94.2)	396 (89.6)	1.883	1.155-
No	28 (5.8)	46 (10.4)	1	3.071
Have heard of the No Smoking Campaign				
Yes	419 (87.7)	361 (82.2)	1.534	1.064-
No	59 (12.3)	78 (17.8)	1	2.213

Predictive Model of Smoking

All significant variables in the bivariate analysis were used in the binary logistic regressions to predict the risk factors of smoking. The model was found to be a best-fit model, indicating that the assumed hypotheses were accepted. Forward stepwise logistic regression indicated that 12 variables were significant predictors of smoking with 93.1% correctly assigned by the model.

The predictors of smoking were influenced by: seeing artistes smoke (Adjusted OR=8.67, 95% CI 5.53-13.58); the male gender (Adjusted OR=6.7, 95% CI 4.14-10.83); Muslims (Adjusted OR=4.46, 95% CI 2.36-8.44); belief that smoking is not dangerous after seeing teachers smoking (Adjusted OR=3.95, 95% CI 2.19-7.10); being offered cigarettes by friends (Adjusted OR=2.81, 95% CI 1.79-4.42); belief that smoking will relax the mind (Adjusted OR=2.45, 95% CI 1.33-4.51); having friends who smoke (Adjusted OR=2.32, 95% CI 1.29-4.81); smoking as forced by friends (Adjusted OR=2.17, 95% CI 1.15-4.12); heard about the No-Smoking Campaign (Adjusted OR=1.89, 95% CI 1.06-3.37); problems with the school management (Adjusted OR=1.75, 95% CI 1.07-2.88); parents have never restricted me from watching sexual activities, drug use or violence on television or at the cinema when watching together (Adjusted OR=1.73, 95% CI 1.06-2.83); and having lunch in school (Adjusted OR=1.58, 95% CI 1.04-2.41). The Hosmer-Lemeshow goodness of fit was not significant (p=0.981) and only 68.0% of smoking factors were explained by this smoking model (Table 5).

TABLE 5: Predictors of Smoking

Variables	β	Wald	Adj OR	95% confidence interval	p-value
Gender					
Male	1.90	60.35	6.70		
Female			1	4.14-10.83	<0.001
Religion					
Muslims	1.49	21.09	4.46		
Others			1	2.36-8.44	<0.001
Have friends who smoke					
Yes	0.84	7.92	2.32		
No			1	1.29-4.18	0.004
Have friends who offered cigarettes					
Yes	1.03	20.19	2.81		
No			1	1.79-4.42	<0.001
Have friends who forced me to smoke					
Yes	0.78	5.68	2.17		
No			1	1.15-4.12	0.017
I am influenced by artistes who smoke					
Yes	2.16	88.63	8.67		
No			1	5.53-13.58	<0.001
Have seen a teacher smoking					
I believe smoking does not bring any harm	1.374	21.12	3.95		
I believe smoking is dangerous			1	2.19-7.10	<0.001

TABLE 5: (Continue)

Belief that smoking will relax the mind					
Yes	0.89	8.318	2.45		
No			1	1.33-4.51	0.004
Parents restrict me from watching sexual movies, drug use and violence on television or at the cinema when watching together					
No	0.55	4.76	1.73		
Yes			1	1.06-2.83	0.029
Problems with the school management					
Yes	0.561	4.89	1.75		
No			1	1.07-2.88	0.027
Have lunch in school					
Yes	0.458	4.493	1.58		
No				1.04-2.41	0.034
Have heard about the No- Smoking Campaign					
Yes	0.64	4.621	1.89		
No				1.06-3.37	0.032

The predictor model for smoking among adolescents in this study was: Log (Smoking among rural adolescent) = Log (Male) + Log (Muslims) + Log (Have friends who smoke) + Log (Have friends who offered cigarettes) + Log (Have friend who forced me to smoke) + Log (I was influenced to smoke after I was artistes smoking) + Log (I believe that smoking does not bring any harm after I have seen teachers smoking) + Log (Belief that smoking will relax the mind) + Log (Parents do not restrict me from watching sexual movies, drug used and violence on television or at the cinema when watching together) + Log (Have problems with the school management) + Log (Have lunch in school) + Log (Have heard about the No-Smoking Campaign).

DISCUSSION

The Ecological System Theory by Bronfenbrenner (1979) suggests that human development is influenced by four environmental systems, namely, microsystem, mesosystem, exosystem and macrosystem. However, in this study, only the microsystem and exosystem were finally shown to be significant predictors of smoking. The microsystem components involved were individual, peers, school and family, whereas the exosystem was the mass media.

In this study, the male gender was a significant risk factor for smoking. This is consistent with the previous study which showed that males were more likely to report smoking than females (Jarvelaid, 2004, Rudatsikira *et al*., 2008). Malaysia is a multiracial country with a predominantly Malay population followed by Chinese, Indian and other races. This current study showed that being Malay was one of the significant factors for smoking among rural adolescents in the bivariate analysis (Jarvelaid, 2004). A study conducted in Negeri Sembilan, Malaysia, also found that Malay adolescents compared to non-Malay adolescents had a

significantly higher prevalence of smoking (Lee *et al.*, 2005). However, Malays are not significant in the multivariate analysis.

At adolescence, peers are able to influence behavioral development in terms of engaging in either positive or negative activities. As in the literature, this study found a significant risk of smoking including having friends who smoke; having been offered cigarettes by friends and being forced by friends to smoke, as some of the risk factors. According to Yang *et al.* (2004), the influence of friends and classmates has the strongest effect in contributing to adolescents smoking. The findings of this study are supported by other studies in Malaysia that found that peer group influence to smoke had strong effects (Lim *et al.*, 2006). This may be due to the interaction of adolescents with their friends, particularly their peers, in their daily activities, which may provide easy access to cigarettes. Furthermore, in Malaysia, data have shown that 87% of adolescents smoked with their friends. This may explain why peer smoking and having lunch in school are among the risk factors (Sperber *et al.*, 2001). According to the Contagion Model, the most popular adolescents are the trendsetters in creating the pro-smoking or anti-smoking norm in schools (Alexander *et al.*, 2001). In addition, increased affiliation with peers who smoked mediated as indirect effect of movie-smoking exposure on smoking onset (Wills *et al.*, 2007). This study confirmed the above findings that parents who did not restrict their children from watching movies that displayed sexual content, drug use and violence on television or at the cinema when watching together was one of the predictors of smoking among rural adolescents.

In this study, the risk factor, peers who offered cigarettes was among the significant risk factors for smoking whereby it also had a strong relation to having friends who smoked. This is correlated by the results reported by Chang *et al.*, (2006) where students of the 10th Grade who had been offered cigarettes by their peers showed a significant possibility, by as high as 11 times, of taking up smoking. Another study showed that peer smoking, cigarettes being offered and a pro-smoking attitude are strong predictors of adolescent smoking (Abroms *et al.*, 2005). Whenever people want to be socially accepted in certain groups, indirectly they always tend to follow the group's activities. This social acceptance will submit adolescents to peer pressure. Furthermore, this age group is within the period of exploring and experimenting. Thus, school adolescents who received maximum negative pressure from their peers are nine times more likely to develop the risk to smoke than those who received minimum negative pressure (Kalesan *et al.*, 2006).

This study also found that smoking did not bring any harm when students saw their teachers smoking, which is one of the predictors of adolescent smoking. This is consistent with a cohort study in a southern region of Israel among respondents of the 9th Grade and their association with the smoking status in the 12th Grade, which showed that respondents are influenced to smoke as an effect of emulating their teachers who smoked even if they knew it was negative behavior or a negative influence (Sperber *et al.*, 2001). Wen *et al.*, (2007) also reported similar findings whereby observing teachers who smoked contributed twice to experimental smoking as opposed to those who had not observed teachers smoking (Hanna *et al.*, 2001). Despite the influence of the teachers, when these smoking adolescents witnessed artistes smoking, they tended to be influenced by the latter to smoke. This influence was apparent when they watched movies on television or at the cinema in which the actors smoked (Distefan *et al.*, 1999). The

findings of our study were consistent with this finding, that is, a significantly greater proportion of the respondents have smoked.

The results of this study showed that adolescent smokers feel relaxed when they smoked, and this is consistent with the findings of Distefan *et al*. (1999), Chalela *et al*. (2007) and Lee *et al*. (2005).

This study showed that students who encountered school management problems were more likely to smoke. Lee *et a*l. (2005) found that there were significant associations between playing truant, being absent from school, alcohol drinking and other risk-taking behaviours and smoking. The Third National Health and Nutrition Examination Survey 1988-1994 (NHANES III) also reported that problem students who repeatedly obtained poor grades, were suspended from or who absented themselves from school were five times more likely to be smokers (Hanna *et al*., 2001). Similarly, if a student had tried alcohol or marijuana, which was also a school offence, he/she was more likely to also indulge in smoking (Leatherdale *et al*., 2008)

This study also found that respondents who had heard of a No-Smoking Campaign was a predictor of smoking. A study conducted by Christophi *et al*. (2008) also found that school children who read anti-smoking advertisements in a newspaper and magazine showed a higher risk to smoke. Another study by Siziya *et al*. (2007) supported these findings.

There was a possibility of misclassification of cases as the determination of smoking used screening by questionnaires only, and this could be subjected to measurement bias but the notion of confidentiality had been looked into. Behavioral disorder may involve dropouts; the recruitment of such dropouts in the study may have given better results in understanding the risk factors of adolescent smoking in rural areas. Other limitations such as the exposure factors that were studied, since the respondents were young adolescents in rural areas, showed that recall bias may also have occurred. Therefore, a cohort study is recommended in order to reduce the biases that might have occurred in this study.

CONCLUSION

The development of any behavior is complicated and it needs the multi-system involvement as suggested by the Ecological System Theory of Bronnfennbrener (1979). This also applies in the case of an adolescent becoming a smoker. Hence, this study incorporated many factors on how adolescents developed their behavior towards smoking. Comparison of the groups in cases and controls demonstrated that the predictors of smoking among rural adolescents in this study were mainly: male; Malays; believed that smoking allowed people to relax; were influenced to smoke after seeing artistes smoke; believed that smoking is not dangerous as teachers had been seen smoking; were not prohibited by parents from watching sexual activities, drug user or violence when watching together on television or at the cinema; had problems with the school management; had friends who smoked; had friends who offered cigarettes; and were forced by friends to smoke.

The prevalence of smoking is increasing in trend particularly in rural areas; the findings of this study, therefore, are important in developing intervention that is able to address the predictors of smoking. Parents also play an important role in explaining to adolescent children the negative impacts of smoking.

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