ORIGINAL ARTICLE

Susceptibility to Smoking as a Predictor of Smoking Initiation among Adolescents - A Longitudinal Study in Kota Tinggi District, Malaysia

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ABSTRAK

Kerentanan terhadap merokok yang ditakrifkan sebagai kekurangan komitmen kognitif untuk tidak merokok di masa depan, telah terbukti sebagai pembolehubah peramal bagi permulaan amalan merokok di kalangan remaja di negara-negara maju. Penyelidikan ini bertujuan untuk menilai kegunaan kerentanan terhadap merokok sebagai pembolehubah peramal bagi permulaan amalan merokok di kalangan remaja di daerah Kota Tinggi, Johor Malaysia. Kerentanan terhadap merokok dinilai dengan menggunakan dua item di kalangan 1763 remaja yang tidak merokok pada 2008. Seramai 1288 dari 1763 remaja (73.1%) yang menyertai kajian memberikan maklumbalas dalam kajian susulan dua belas bulan kemudian. Keputusan kajian menunjukkan 14.9% (n=188/1260) responden adalah rentan terhadap merokok, 31.9% daripadanya mula merokok selepas tempoh setahun. Responden yang rentan terhadap merokok adalah 3.7 kali (95%; SK: 2.17-6.30) lebih bermungkinan untuk mula merokok berbanding dengan responden yang tidak rentan terhadap merokok, selepas kesan pemboleh ubah jantina, lokasi sekolah, peratusan rakan-rakan yang merokok, bapa merokok, penerimaan ibubapa terhadap amalan merokok, dan kepercayaan tentang kesan positif dan negatif merokok dikawal. Kajian ini menunjukkan kerentanan terhadap merokok merupakan pembolehubah peramal yang boleh dipercayai dan boleh digunakan sebagai alat saringan untuk mengenalpasti remaja yang berisiko untuk mula merokok.

Kata kunci: kerentanan terhadap merokok, pembolehubah peramal, permulaan amalan merokok, remaja

ABSTRACT

Susceptibility to smoking, which is defined as a lack of cognitive commitment not to smoke in the future, has been shown to be a predictor for adolescent smoking initiation in developed countries. This study aims to evaluate the utility of a susceptibility-to-smoke measure as a predictor of smoking initiation among adolescents in Kota Tinggi

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district, Johor Malaysia. Susceptibility to smoking was evaluated among 1763 adolescents at baseline using a two-item construct. At follow-up 12 months later, 1288 of the 1763 adolescents (73.1%) responded. Results showed 14.9% (n=188/1260) of the respondents were susceptible to smoking at baseline. Among the susceptible adolescents, 31.9% initiated smoking after one year. Respondents who were identified as susceptible to smoking by the measure were 3.7 times (95%; CI: 2.17- 6.30) more likely to initiate smoking compared to non-susceptible respondents after adjusting for gender, school locality, percentage of friends who smoke, father smoking, parental acceptance of smoking, and belief in the positive and negative consequences of smoking. The findings suggest that the susceptibility measure is a reliable predictor and can be used as a screening tool to identify adolescents who are at risk of initiating smoking.

Key words: Susceptible to smoking, predictor, smoking initiation, adolescents

INTRODUCTION

Cigarette smoking is a major contributing factor of lung cancer, cancers of other sites, chronic obstructive pulmonary disease (COPD) and heart diseases (World Health Organization 2005). In spite of this, smoking prevalence among Malaysian adults remains high. In 2006, approximately half of male adults aged 18 years and above were smokers (Institute for Public Health 2008). Ten thousand deaths from diseases related to smoking have been reported annually in Malaysia since 1980 (Chua 2003). It is estimated that the mortality rate may rise to 30 000 annually by 2020 if there is no drastic change in the current trend of smoking among Malaysians (Disease Control Division 2003). The Gateway Drug theory suggests that the use of 'soft' drugs such as cigarettes can lead to the use of other 'harder' drugs (Fleming et al. 1989). Previous studies have also shown that smokers are more likely to risk harming themselves further by resorting to other abusive substances compared to non-smokers (Fleming et al. 1989; Kandel et al. 1992). Therefore, at this critical moment, it comes as no surprise that reducing the prevalence and incidence of

smoking is a priority of the Ministry of Health. Studies have shown that smoking is a learned behavior which generally starts during adolescence. It has been reported that 80-90% of current smokers start smoking as adolescents, and become regular smokers before the age of 18 (USDHHS 1994; Health Canada 2005). Adolescents who smoke are either unwilling to quit smoking, have low motivation to quit or are uninterested to quit because they do not think quitting is important (Balch 1998; Pallonen 1998; Mermelstein 2003). These factors have driven researchers to focus on strategies, at the earliest possible opportunity, at identifying those adolescents who face the greatest risk of becoming habitual smokers in the future. Such a move will certainly help smoking-prevention programmes to be targeted to this group and hopefully, reduce smoking initiation among them.

A 'susceptibility-to-smoking' measure has been developed to identify adolescents who are at risk of initiating smoking (Pierce et al. 1996). It measures the cognitive commitment of adolescents not to smoke and adolescents' capability to resist offers from friends to smoke. Unger et al. (1997) and Difranza et al. (2006)

reported that respondents who were susceptible to smoking were two to three times at higher risk of becoming experimental smokers after a period of two years. Jackson (1998) revealed that cognitive susceptibility was the most significant predictor of smoking initiation among elementary school students after one year. Those who were susceptible to smoking were 80% more likely to initiate smoking compared to non-susceptible respondents. Cognitive susceptibility has been reported to be a more significant independent predictor of experimental smoking compared to parental smoking and peer smoking (Pierce et al. 1996). Huang et al (2005) in their longitudinal study among adolescents aged from 14 to 17 years old found that susceptible adolescents were also two to three times more likely to initiate smoking after two years. The simplicity of the measure lends itself as a useful and efficient predictor of smoking initiation. Although the "susceptibility" measure has been shown to be an effective tool for identifying and predicting adolescent smoking initiation, it has not, hitherto, been applied in Malaysia. The aims of this study were to determine the validity of the measure and to identify the independent factors for smoking initiation among school children in Kota Tinggi district, Johor, Malaysia.

MATERIALS AND METHODS

Study Design

This was a longitudinal study conducted from 2008 to 2009. Baseline data was collected in May 2008 and follow up in June 2009. Respondents were secondary school students in Forms 1, 2 and 4 in the district of Kota Tinggi in Johor. The study was approved by the Ministry of Education Malaysia and the Johor State Education Department while ethics approval was given by the Ethics committee, Ministry of Health, Malaysia. This project was a collaborative effort between the Institute for Medical Research (IMR) and the Kota Tinggi District Health Office.

Study protocol

Passive consent was obtained from students' parents prior to their participation in the study. Respondents were informed that participation was voluntary. Students who agreed to participate were asked to put down their signatures on the questionnaire and were given assurance of anonymity. In addition, teachers were not allowed to observe the students while they were completing the questionnaires. The questionnaires were self-administered by the students. A detailed explanation on the questionnaire was given to the respondents. Further clarification on any of the items was given when needed. At the end of the session, completed questionnaires were packed into envelopes, and the envelopes sealed in the presence of the respondents.

Sampling

Multi-stage sampling was used in this study. Schools were stratified by urban, rural and FELDA settlement areas. Six schools were randomly selected from FELDA settlement areas, three from town areas and one from a rural area. Students in the selected schools were then stratified by Forms: Form 1, Form 2 and Form 4. The sampling frame was then obtained from the schools' administrators, and simple random sampling was used to select respondents using random numbers generated by Epi Info version 6.04d.

A sample size of 2700 was calculated based on smoking incidence of 3.5% for Forms 1 and 2, and 6% for Form 4 students, maximum error of 3%, design effect of 0.67, intra-class correlation coefficient of 0.5, average proportion of students per strata of 0.33 (prevalence of

smoking was assumed to be equal among all three strata), an additional 30% extra to cater for non response and another 30% for exclusion of smokers. (Kalton 1983; Scheaffer et al. 1990; United Nation 2005). The number of students selected from each school was derived as a proportion to the total student population in the respective schools. Students who were non-smokers at baseline were followed up after one year. Each student was given a unique identification (ID) number at the beginning of the study, and the same ID was allocated to the student during the follow-up study.

Study instrument

The same self-administered questionnaire was used at baseline and at follow-up. The instrument used in this study was adapted from previous studies (Hanjeet et al. 2001; Lim et al. 2006) and the questionnaire included demographic and psychosocial factors. These were: percentage of peers who smoke, family members who smoke, percentage of friends who smoke, and perceptions of both parental and social acceptance of smoking. Perceptions of parental and social acceptance of smoking were assessed using a 7-point Likert type scale in which lower scores indicated lower acceptance by parents and society towards smoking behavior among adolescents. Perceived benefits of smoking and perceived negative effects of smoking were assessed using 12 questions comprising six questions for each. Low scores in the "Perceived benefits of smoking" domain indicate positive perception toward smoking, while low scores in the "Perceived negative effects of smoking" domain indicate highly negative perception of respondents towards smoking. The 'Susceptibility-to-Smoking' measure was adapted from Pierce et al. (1996). It consisted of two questions:

a) Do you think you will smoke a cigarette in the next year?
b) If one of your best friends were to offer you a cigarette, would you smoke?

The choice of answers was: (a) Yes, (b) Probably yes, (c) Probably no, and (d) Not at all. If the respondent answered 'Not at all' to both questions, they were categorised as 'Not susceptible to smoking' while those who gave other answers to both questions were categorised as 'Susceptible to smoking'.

The dependent variable in this study was smoking initiation, with 'Yes' or 'No' responses, which was measured at one-year follow-up. Smoking initiation was defined as 'Have smoked at least once in the last 30 days'.

Statistical analysis

Data were entered and analysed using SPSS version 16 (SPSS, 2007). Chi square and independent t test were employed in attrition analysis. The attrition analysis was done to determine the extent to which respondents who dropped out of the study differed from the respondents who continued to participate at follow up. These tests were also used for associations between categorical variables and continuous data with the dependent variable that is initiation of smoking after one year. Independent variables are gender, susceptible to smoking, percentage of friends who smoked, form of study, schooling area, father smoking, parents' reaction toward smoking, perceived benefits of smoking and perceived negative effects of smoking. Variables with p value equal or less than 0.25 from the univariate analysis were included into binary logistic regression to determine the independence of susceptibility-to-smoking variable from other predictor variables. Analysis for two way in-

teractions reveals a non-significant interaction between all the variables in the model. Model fit was checked using Hosmer-Lemeshow goodness of fit test. The p value was not significant indicating the model fitted the data (p = 0.640). The level of significance was set at p-value of less than 0.05 (2-sided).

RESULTS

Table 1 shows that, out of the 1763 non smokers at baseline in 2008, 1288 (73.1%) responded at follow -up in 2009. Attrition analysis revealed that three independent variables, i.e. form, gender and locality, were significantly different between those who responded at follow-up and those who dropped out. Attrition was higher among female (29.1%), Form Four students (30.7%) and FELDA settlement areas (29.5%)

From the univariate analysis, these variables were associated with the initiation of smoking: percentages of friends who smoke, father's smoking status, susceptibility-to smoking, and gender. Gender and susceptibility-to-smoking were the most significant independent variables associated with smoking initiation, that is, at 21.7% for male respondents, compared to females at 2.4%. Respondents who were susceptible were approximately four times more likely to initiate smoking compared to their counterparts who were not susceptible, that is, 31.9% as compared to 8.2 %. It also shows that initiators, firstly, believed more strongly in the perceived positive consequences of smoking, however misguided this may be, secondly, perceived more acceptance of parents towards their smoking behavior, and thirdly, perceived less negative consequences of smoking. The two groups were not significantly different on opinions of (societal) perceptions towards adolescents smoking (Table 2). Table 3 shows the results of multiple logistic regression analysis. Susceptibility

to smoking remained a significant risk factor for smoking initiation after a period of one year, after controlling for the potential confounding effects of gender, school locality, percentage of friends who smoke, father smoking, parental acceptance of smoking, and belief in the positive and negative consequences of smoking. The odds ratio was, however, attenuated by the inclusion of the other independent variables.

DISCUSSION

To our knowledge, this is the first publication towards establishing 'Susceptibility-to-Smoking' as a reliable predictor for identifying adolescents who have the potential to initiate smoking in Malaysia. The response rate was almost similar to previous longitudinal studies (Conrad et al. 1992). The study revealed that this measure is a reliable predictor for identifying adolescents who are at risk of smoking initiation, as well as, for predicting smoking initiation among non-smokers at baseline. It shows a substantial effect size and it predicts smoking initiation independently of other predictors such as, peer smoking, perceived benefits and negative effects of smoking, family members (parents and sibling) smoking, social norms of smoking, gender and age, and factors that have been shown to contribute to smoking in previous studies (Kalton 1983; Kremers et al. 2001; Maxwell 2002; Wen et al. 2005; Wilkinson et al. 2007; Otten et al. 2009) Almost a third of the adolescents who did not smoke but were susceptible to smoking at baseline initiated smoking after a period of one year.

Susceptible adolescents were 3.7 times more likely to be smokers at follow-up. This finding is similar to that reported by Pierce et al. (1996), Unger et al. (1997) and Huang et al. (2005). The effect size of the 'Susceptibility-to-Smoking' measure was attenuated after other in-

Table 1: Attrition analysis for categorical and continuous variables

| | Responded at follow-up | | | | | | |
| | Yes | | No | | χ^{2*} | df | p-value |
	n (%)	Mean (SD)	n (%)	Mean (SD)			
Susceptibility to smoking*							
Yes	1053(74.3)		364(25.7)		0.17	1	0.680
No	179((73.1)		66 (26.9)				
Percentage of friends who smoke*							
0-40%	985(74.3)		341(25.7)		0.18	1	0.894
41-100%	256(74.6)		67(25.4)				
Form*							
Form 1-2	969(75.6)		312(24.2)		6.43	1	0.010
Form 4	280(69.3)		124(30.7)				
Perception of number of friends who smoke*							
None – A few	703(75.5)		228(24.5)		1.97	1	0.160
Many – A lot	532(72.5)		202(27.5)				
Schooling area*							
Urban and Rural	519(79.6)		133(20.4)		16.97	1	<0.001
FELDA	716(70.5)		299(29.5)				
Elder brother smoking *							
Yes	430(70.4)		181(29.6)		2.08	1	0.150
No	304(74.5)		104(25.5)				
Father smoking*							
Yes	551(73.3)		201(26.7)		0.01	1	0.910
No	511(73.5)		184(26.5)				
Gender*							
Male	624(77.5)		181(22.5)		9.50	1	0.002
Female	622(70.9)		255(29.1)				
Parental reaction towards smoking**		2.43(1.99)		2.25(1.83)	1.69		0.090
Society perception towards adolescent smoking**		1.43(1.26)		1.46(1.21)	-0.40		0.690
Pro of smoking**		3.38(0.62)		3.36(0.96)	0.55		0.580
Cons of smoking**		1.59(0.76)		1.59(0.69)	-0.47		0.960

*Chi-square test for independence
**Independent T-Test

Table 2: Univariate analysis for change on smoking status Smoking initiation after one year

| | Smoking initiation after one year | | | | | | |
| | Yes | | No | | | | |
	n(%)	Mean (SD)	n(%)	Mean (SD)	χ^2/t	df	P-value
Susceptibility to smoking*							
Yes	60(31.9)		128(68.1)		94.2	1	<0.001
No	82((7.6)		990 (92.4)				
Percentage of friends who smoke*							
0-40%	91(9.0)		918(91.0)		41.2	1	<0.001
41-100%	63(23.3)		207(76.7)				
Form*							
Form 1-2	139(13.9)		860(83.1)		12.4	1	<0.001
Form 4	18(6.2)		271(93.8)				
Perception of number of friends who smoke*							
None – A few	87(12.1)		631(87.9)		0.03	1	0.874
Many – A lot	69(12.4)		487(87.6)				
Schooling area*							
Urban and Rural	56(10.5)		479(89.5)		1.90	1	0.168
FELDA	96(13.0)		642(87.0)				
Elder brother smoking *							
Yes	58(13.0)		388(87.0)		0.07	1	0.799
No	39(12.4)		276(87.6)				
Father smoking*							
Yes	80(14.1)		488(85.9)		05.2	1	0.023
No	51(9.6)		479(90.4)				
Gender*							
Male	142(21.7)		511(78.3)		112.38	1	<0.001
Female	15(2.4)		617(97.6)				
Parental reaction towards smoking**		1.70(1.53)		1.30(1.21)	-2.35		0.020
Society perception towards adolescent smoking**		2.57(2.01)		2.42(1.97)	0.86		0.391
Pro of smoking**		3.18(0.61)		3.39(0.37)	4.135		<0.001
Cons of smoking**		1.82(0.78)		1.57(0.74)	-3.81		<0.001

*Chi-square test for independence
**Independent T-Test

Table 3: Binary logistic regression analysis of change in smoking status*

	Crude OR	95% CI	Adjusted OR**	Wald	95% CI	P-value
Gender						
Male	11.43	6.63-19.71	6.20	23.71	2.98-12.92	<0.001
Female	1		1			
Susceptible to smoking						
Yes	5.66	3.87-8.28	3.70	23.12	2.17-6.30	<0.001
No	1		1			
Percentage of friends who smoke						
0 - 40%	1		1			
41 - 100%	3.07	2.20-4.33	1.53	2.45	0.90-2.61	0.118
Form						
Forms 1 & 2	2.43	1.96-4.05	1.79	5.7	1.08-2.95	0.017
Form 4	1		1			
Schooling area						
Urban and rural	0.78	0.55-1.11	2.00	5.54	1.12-3.55	0.019
FELDA	1		1			
Father smoking						
Yes	1.54	1.06-2.24	1.79	5.11	1.08-2.95	0.024
No	1		1			
Parents' reaction toward smoking	1.13	1.00-1.27	0.99	0.022	0.88-1.96	0.882
Perceived benefits of smoking	0.92	0.88-9.67	1.31	1.78	0.88-1.96	0.182
Perceived negative effects of smoking	1.06	1.03-1.10	0.77	2.69	0.59-1.05	0.101

Dependent variable- Change in smoking status (Non Smoker to smoker and non smoker to non smoker. The reference group was non smoker to non smoker)

Hosmer-Lemeshow goodness of fit test (p=0.640)

dependent variables were included in the multivariate analysis model. This suggests that a better model may be developed from a combination of this construct with other predictor variables such as gender and smoking status of fathers.

These findings show that the measure can be used in adolescent prevention programmes to reduce smoking initiation among adolescents in the long term. Needless to say, co-operation between school and health authorities is essential, if not vital, to the successful implementation of an effective long term strategy to reduce smoking initiation among our youths. School authorities can carry out surveys using the construct to determine the susceptibility level among those who are not smoking and at the same time, health departments can play a role as training providers. The activities that are to be carried out should be based on the

susceptibility level of the adolescent. Dissemination of information on the health hazards of smoking and training to inculcate the ability to resist smoking offers from peers should be delivered to non-susceptible groups (Johnson 1990). The formation of peer support groups in order to develop the required attitude towards the smoking habit among those who are susceptible is recommended. Care should be taken to prevent stigmatisation of those who have been identified as susceptible to initiate smoking and also to prevent self-fulfilling prophecies that trigger adolescents to initiate smoking (Unger et al. 1997).

The measure can also be used by health workers at adolescent health clinics to identify susceptible adolescents, where appropriate advice and proactive counseling can be given to reduce their risk of initiating smoking in the future. Adolescents who are not susceptible to smoking should be given advice and support against smoking, including tips and methods on how to improve their refusal skills. A study showed that advice given by health professionals regarding a health subject is more acceptable and effective for attitudinal behavioural changes (Morgan et al. 1996).

There was a limitation in this study. The high attrition of respondents after a period of one year may reduce the internal and external consistency of the findings. Differential attrition (more females, Form Four students and FELDA settlement areas dropped out) indicated that the follow-up sample may not represent the population of interest which is all non-current smoking secondary school students in the district.

The study reveals that the susceptibility measure was a significant independent predictor to smoking initiation among adolescents. It may also be used as a screening instrument to identify those adolescents who do not smoke but who are at increased risk to smoking initiation.

School personnel especially those in the secondary sector can use this measure to identify adolescents who are at risk of initiating smoking as the very first preventive step towards battling the smoking scourge. The use of the measure might reduce the incidence of smoking among our adolescents, and ultimately contribute to lowering morbidity and mortality resulting from smoking-related diseases.

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