

Semua laporan kemajuan dan laporan akhir yang dikemukakan kepada Bahagian Penyelidikan dan Pembangunan perlu terlebih dahulu disampaikan untuk penelitian dan perakuan Jawatankuasa Penyelidikan di Pusat Pengajian.

USM R&amp;D/JP-04

## LAPORAN AKHIR PROJEK PENYELIDIKAN R&D JANGKA PENDEK

### A. MAKLUMAT AM

- 1) Tajuk Projek: A study of the determinants of smoking behaviour and the association of smoking with lung function of male secondary school students in Kota Bharu.

Tajuk Program: Smoking behaviour and pulmonary functions

Tarikh Mula: 01 Ogos 2001

Nama Penyelidik Utama: Prof Madya Dr Razlan Musa 630927 03 5177  
(berserta No. K/P)

Nama Penyelidik Lain: Profesor (Dr) Rusli Nordin  
(berserta No. K/P) Dr. Lin Naing @ Mohd Ayub Sadiq  
Dr. Muhamad Fadhli bin Mohd Yusoff

### B. PENCAPAIAN PROJEK:

(Sila tandakan [✓] pada kotak yang bersesuaian dan terangkan secara ringkas di dalam ruang di bawah ini. Sekiranya perlu, sila gunakan kertas yang berasingan)

Penemuan asli/peningkatan pengetahuan

Tabiat merokok dikalangan pelajar sekolah terus menjadi masalah disiplin di sekolah. Seramai 34.6% daripada 541 responden adalah perokok semasa manakala 2.3% adalah bekas perokok.

Hasil kajian juga menunjukkan tabiat merokok mempunyai hubungkait dengan ; mempunyai kawan yang merokok, persepsi tentang bahaya merokok,perhubungan pelajar dengan ibu bapa dan pendapat agama tentang tabiat merokok.

Ujian fungsi paru paru menunjukkan keadaan yang di sebalik jangkaan, iaitu perokok semasa mempunyai keupayaan paru paru yang lebih baik berbanding bukan perokok

BAHAGIAN PENYELIDIKAN PUSAT PENGAJIAN SAINS PERUBATAN	
SALINAN :	
<input type="checkbox"/>	Bhg. Penyelidikan, PPSP
<input type="checkbox"/>	Perpustakaan Perubatan, USMKK
<input checked="" type="checkbox"/>	RCMO
T/Tangan : .....: Tarikh : 17.9.03	

**Rekaan atau perkembangan produk baru,**  
(Sila beri penjelasan/makluman agar mudah dikomputerkan)

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**Mengembangkan proses atau teknik baru,**  
(Sila beri penjelasan/makluman agar mudah dikomputerkan)

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**Memperbaiki/meningkatkan produk/proses/teknik yang sedia ada**  
(Sila beri penjelasan/makluman agar mudah dikomputerkan)

(1) Prosedur pemereksaan ujian fungsi paru adalah prosedur standard  
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### C. PEMINDAHAN TEKNOLOGI

Berjaya memindahkan teknologi.

Nama Klien: (1) Tiada  
(Nyatakan nama penerima pemindahan teknologi ini dan sama ada daripada pihak swasta ataupun sektor awam) (2) \_\_\_\_\_  
(3) \_\_\_\_\_

Berpotensi untuk pemindahan teknologi.  
(Nyatakan jenis klien yang mungkin berminat)

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**D. KOMERSIALISASI**

Berjaya dikomersialkan.

Nama Klien: (1) Tiada  
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Berpotensi untuk dikomersialkan.  
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**E. PERKHIDMATAN PERUNDINGAN BERBANGKIT DARIPADA PROJEK**

(Klien dan jenis perundingan)

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**F. PATEN/SIJIL INOVASI UTILITI**

*(Nyatakan nombor dan tarikh pendaftaran paten. Sekiranya paten/sijil inovasi utiliti telah dipohon tetapi masih belum didaftarkan, sila berikan nombor dan tarikh fail paten).*

(1) Tiada \_\_\_\_\_

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**G. PENERBITAN HASIL DARIPADA PROJEK**

**(i) LAPORAN/KERTAS PERSIDANGAN ATAU SEMINAR**

**(1) Pembentangan kertas**

**1. Di Kolokium Kebangsaan Kesihatan Masyarakat ke IX**

a. Jenis pembentangan: Lisan

b. Tajuk: A Study of the Determinants of Smoking Behaviour  
Among Secondary School Students in Kota Bharu.

c. Tarikh: 24 September 2002, Grand Blue Wave Hotel, Shah  
Alam, Selangor.

**2. Semasa aktiviti 'Journal club' di Jabatan Perubatan  
Masyarakat, PPSP**

a. 18. 10. 2001

i. Jenis pembentangan: Lisan

ii. Tajuk: Comparing SAQ and 'Objective Methods' in  
Assessing Smoking Status

b. 18. 07. 2002

i. Jenis pembentangan: Lisan

ii. Tajuk: The determinants of Smoking Behaviour of  
Secondary School Students in Kota Bharu.

**(ii) PENERBITAN SAINTIFIK**

(1) Penerbitan kertas

1)Dissertasi

Tajuk: A Study of the Associated Factors of Smoking Behaviour and the Association of Smoking With Lung Functions of Secondary School Students in Kota Bharu

(2) Religious and other associated factors of smoking behaviour of male secondary school students in Kota Bharu Kelantan. (completed first draft)

3) Penerbitan lain – dalam perancangan

**H. HUBUNGAN DENGAN PENYELIDIK LAIN**

*(sama ada dengan institusi tempatan ataupun di luar negara)*

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**I. SUMBANGAN KEWANGAN DARI PIHAK LUAR**  
(Nyatakan nama agensi dan nilai atau peralatan yang telah diberi)

- (1) Tiada
- (2) \_\_\_\_\_
- (3) \_\_\_\_\_

**J. PELAJAR IJAZAH LANJUTAN**  
(Nyatakan jumlah yang telah dilatih di dalam bidang berkaitan dan sama ada diperingkat sarjana atau Ph.D).

**Nama Pelajar**

**Sarjana**

**Dr Muhammad Fadli Mohd Yusoff**

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**Ph.D**

**K. MAKLUMAT LAIN YANG BERKAITAN**

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9/3/03

**Tarikh**



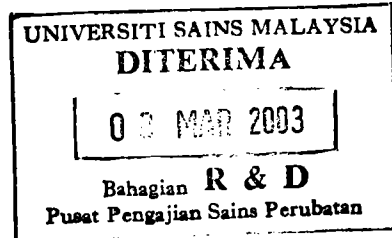
**Tandatangan**

  
**Assoc. Prof. (Dr.) Zabidi Azhar Mohd. Hussin**  
Chairman of Research & Ethics Committee  
**TANDATANGAN Pengerusi**  
**JAWATANKUASA PENYELIDIKAN**  
**PUSAT PENGANTARAN**  
Universiti Sains Malaysia  
16150 Kubang Kerian  
KELANTAN, MALAYSIA.



# Universiti Sains Malaysia

**Pusat Pengajian Sains Perubatan**  
School of Medical Sciences



09 March, 2003

Pengerusi  
Jawatankuasa Penyelidikan dan Pembangunan (R&D)  
Pusat Pengajian Sains Perubatan  
Universiti Sains Malaysia  
Kampus Kesihatan USM

Ruj. Fail: FPP 2001/103

Tuan,

## Laporan Akhir Projek Penyelidikan USM Jangka Pendek

Merujuk kepada perkara di atas bersama sama ini disertakan perkara – perkara berikut untuk tindakan tuan selanjutnya.

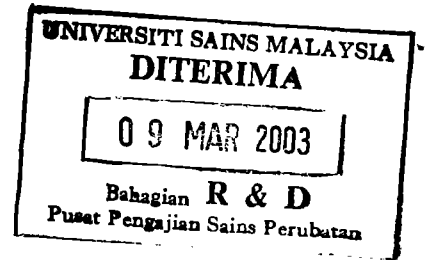
- a) Laporan komprehensif projek – 3 salinan
- b) Laporan Akhir Projek Penyelidikan Jangka Pendek (USM J/P 06) – 3 salinan
- c) Laporan Akhir Projek Penyelidikan R&D Jangka Pendek ( USM R&D/ JP-04) –3 salinan

Sekian terima kaseh.

Yang menjalankan tugas,

Prof. Madya Dr Razlan Musa  
Jabatan Perubatan Masyarakat

**RESEARCH REPORT**



**A study of the determinants of smoking behaviour and the association of smoking with lung function of male secondary school students in Kota Bharu.**

**Grant Account No: 304/PPSP/6131179**

**Grant Holder: Profesor Madya Dr Razlan Musa  
Jabatan Perubatan Masyarakat  
Pusat Pengajian Sains Perubatan  
Kampus Kesihatan  
Universiti Sains Malaysia**



## INTRODUCTION

Smoking in Malaysia has mostly been a male activity and it is among men that there has been a high prevalence of smoking prevalence. This is true for adult as well as for adolescents, based on the National Health and Morbidity Surveys (NHMS) and several studies conducted in Malaysia (Country Report: Malaysia, 2001). The high overall smoking prevalence in Malaysia has been actually contributed by the prevalence among male population. In the National Health and Morbidity Survey 1996, the smoking prevalence of Malaysian population aged 18 years and above was 24.8 percent. The prevalence among men was 49.2 percent compared to 3.5 percent among women. This was higher than the previous National Health and Morbidity survey conducted in 1986 that found a total smoking prevalence of 21.5 percent, with male smoking rates at 41 percent compared to 4 percent among women (Country Report: Malaysia, 2001). The prevalence can be considered high in both surveys even though they are not comparable due to the differences in population characteristics.

Adolescent smoking continues to be a major problem in schools. A number of studies have been done throughout the world concerning smoking problems among this group of population. In Malaysia, based on the second National Health and Morbidity Survey, smoking prevalence among adolescents aged 12 to 18 years was 30.7% for male and 4.8% for the female (Country Report: Malaysia, 2001). In Kelantan, one of the published data stated that of form four male students the smoking prevalence was 44.2%. However, none of the female students smoked (Naing, *et al.*, 1996). Another study by Naing, *et al.* (1996) on form four and five male students also in Kelantan found that prevalence of smokers was 35.9% of the 451 students surveyed.

Regarding smoking behaviour, it has also been shown that most adult smokers begin to smoke regularly during adolescence (Kent, 1998). Furthermore the early onset of smoking increases the number of cigarette smoked per day in adult life (Taioli & Wynder, 1991) and the more likely they become regular smokers as adult (Escobedo, *et al.*, 1993). Generally, once a person becomes a regular smoker it will be very difficult for him to quit. It has been stated that tobacco is one of the most addictive product known and the majority of people who quit smoking relapse within days. One of the reviews has found that only 2 to 3% of regular cigarettes smokers successfully quit smoking each year, and the addition of nicotine replacement can only triple the result (Henningfield, 1995). In a local study on smoking habit among adolescents by Naing, *et al.* (1996b), 72% of the smokers thought of quitting smoking and of these 83% had tried at least once. It would be therefore preferable to concentrate efforts on smoking prevention and these smoking prevention programmes should be started during childhood or early adolescence.

### **Rationale of this study**

Much of our current knowledge on adolescents smoking comes from other countries especially western countries. There are wide ranges of information available starting from smoking prevalence, the risk groups, the associated risk factors and examples of intervention programmes. There are however, very few published data on these aspects with regards to our local population. In order to develop a good anti smoking campaign and promotion that is suitable for the target group, it is very important to have local information on the problem. One of the most important factors that must be considered is the factors associated with smoking. Numerous studies on this aspect have been done overseas (Escobedo, *et al.*, 1993; Greenlund, *et al.*, 1997; Meijer, *et al.*, 1996; Ogawa, *et al.*, 1988; and Reimers, *et al.*, 1990).

Most of smoking prevention programmes in schools emphasize on the awareness of the health hazards of smoking. Some smoking prevention programmes have been found to be effective (Biener, 2000; and Jason, *et al.*, 1991). However, many studies have shown that the efficacy of smoking programmes is very poor despite the increasing student knowledge about the effects of smoking (Murray, *et al.*, 1994; and Nutbeam, *et al.*, 1993). Further research is therefore necessary to develop more effective smoking prevention programmes which is suitable and more targeted to our local population. The purpose of this study is to determine the factors that are associated with smoking behaviour of secondary school students in Kota Bharu district. There is no published data so far on such study in Kelantan. Hopefully, the outcome of this study will be helpful to the development of an effective smoking prevention programme for Malaysia.

### **Factors and development of smoking behaviour**

The development of smoking may be a gradual process. It can take a considerable time for smokers to acknowledge themselves as such. Studies have shown that various factors may be influential at different times (Greenlund, *et al.*, 1997; and Reimers, *et al.*, 1990).

The process of becoming a smoker has been separated into several stages that reflect the transition from non-smoker to experimental smoker and from experimental smoker to regular smoker as illustrated in a model developed by Flay and colleagues (Bellew & Wayne, 1991). In the 'preparatory' stage, attitudes toward early smoking are formed by influences from friends, family and the media. The second stage is the 'initiation of smoking – the trying of the first cigarette. The third stage is that of proper 'experimentation' where young person actually learns how to smoke – any negative (physical) effects tend to recede and the positive (psychological) experiences

are strengthened during this stage (Belew & Wayne, 1991). Regarding the initiation of smoking, the most frequently cited reasons were 'imitate other's behaviour' and 'to see what it was like' (Zhu, *et al.*, 1996). Meijer, *et al.* (1996) in his study on students aged 11 to 17 years also stated that the most common reason (55%) for starting to smoke was "to try something new".

Tobacco products are readily accessible to adolescents. Studies overseas found that a majority of adolescents responding to a survey reported that it would be easy to obtain cigarettes (Forster, *et al.*, 1992; and Smith, 1991). Forster, Hourigan and McGovern (1992) in their study on the availability of cigarettes to underaged youth also found that the successful rate of buying cigarettes by adolescents aged 12 to 15 years was high. A success rate of 53% over the counter and 79% from vending machines was achieved. In Malaysia, the scenario was in fact worse. Zulkifli and Rogayah (1998) found that the successful rate of purchasing cigarettes among minors in Kota Bharu, Kelantan was more than 97%. This shows that minors have easy access to cigarettes in our population. It has also been shown that most of the smokers obtain their first cigarette from a non-retail or social source, usually a friend (Greenlund, *et al.*, 1997). A study by Wolfson, *et al.* (1997) found that more than two third of adolescent smokers had provided tobacco to another adolescent. This again strengthens the fact that tobacco products are easily accessible to adolescents.

#### **Association with friends who smoke**

Many studies have been done on factors that are associated with smoking behaviour among adolescents or school children (Escobedo, *et al.*, 1993; Greenlund, *et al.*, 1997; Meijer, *et al.*, 1996; Morello, *et al.*, 2001; Ogawa, *et al.*, 1988; and Reimers, *et al.*, 1990). Of the factors examined, association with friends who smoke was consistently associated with adolescent smoking status in most of the study

(Greenlund, *et al.*, 1997; Morello, *et al.*, 2001; Ogawa, *et al.*, 1988; Reimers, *et al.*, 1990; Zhu, *et al.*, 1992; and Zhu, *et al.*, 1996).

Morello, *et al.*, (2001) in their study of tobacco use among high school students in Buenos Aires, Argentina stated that current smokers had reported that more than half of their friends of the same gender smoke. Reimers, *et al.* (1990) have examined the longitudinal influences of several behavioral and social factors on the smoking status. They found that eleven graders who smoked not only had the tendency to associate with other smokers more than non-smokers while they were in 11<sup>th</sup> grade but they also already had this tendency in the three years before when most of them were not smoking. A study by Zhu, *et al.*, (1996) stated that of all variables investigated, variables reflecting peer pressure were among the strongest risk factors for cigarettes smoking of elementary school students in Beijing. Meijer, *et al.* (1996) in his study on cigarettes smoking habits among school children also stated that having a friend who smoked substantially increased the likelihood of smoking.

Several other factors were also related including adolescents' relationship with their parents, level of parental supervision, involvement in extracurricular activities, school performance, attitudes regarding positive and negative effects of smoking (Reimers, *et al.*, 1990)

### **Smoking status of the family members**

Smoking among family members was also found to be significantly associated with adolescents smoking status (Anonymous, 2000; Greenlund, *et al.*, 1997; and Ogawa, *et al.*, 1988). Ogawa, *et al.* (1988) in their study to observe the smoking patterns as well as to examine social and psychological aspects of smoking of junior high schools boys and girls in Japan revealed that smoking status was significantly associated with smoking behaviour among people around the students. With

increasing number of smoker among parents, elder siblings and intimate friends, the percentage of current smoker among students increases. The Bogalusa Heart Study group in their study on cigarette smoking attitudes and first use among third through sixth grade students has also stated that the access to cigarette was greater among those from families where either parent smoked compared to those where neither parent smoked (Greenlund, *et al.* 1997). Similarly, Hesketh, *et al.*, (2001) have also reported that maternal and paternal smoking was among the strongest association with adolescents smoking behaviour.

The effects of parental smoking on adolescent smoking was however inconclusive. There has been inconsistency in the findings between studies from different populations and interestingly, some studies did not show any significant relationship between parental smoking and adolescent smoking. West, *et al.*, (1999) in their study on the family and friends' influences on the uptake of regular smoking from mid adolescent to early adulthood stated that, there was no independent effect of parental smoking on the uptake of cigarettes among adolescents at any period of time when other variables are adjusted. A study by Meijer, *et al.*, (1996) has also shown that there was no relationship between the smoking status of the parents and that of the students.

Regarding the effects of sibling smoking on adolescent smoking status, some studies have shown that the effects are more confined at the early adolescent ages compared to the later ages. West, *et al.*, (1999) in a longitudinal survey of adolescents, starting at the age of 15 and followed-up until 23 years of age reported that the effects of sibling smoking being confined to uptake between 15 and 16. In another cohort study, Swan, *et al.*, (1990) reported that the risk of taking up regular

smoking was higher if at the age of 11.7 – 12.7 years, the children had a smoking who smoked.

### **Socioeconomic status and smoking**

Socioeconomic status has an influence on the smoking status. In some countries, a low socioeconomic status increases the chances of a young person smoking. As described in the model by Flay, socioeconomic status is indirectly associated with the stage of smoking behaviour by giving direct effects on family influences and selection of peers (Bellew & Wayne, 1991). Zhu, *et al.* (1996) also reported that smoking was positively associated with having parents of low educational and occupational status. Hesketh, *et al.* (2001) in their study of smoking among youth in China has also reported the same findings. In Malaysia, Habil (1997) has also stated that Malay in lower income groups are those most at risk for smoking. A major reason for their increase is that cigarette smoking has a special cultural connotation, where cigarettes are offered during any feast and celebration (Habil, 1997). Another reason why tobacco has managed to penetrate the Malay culture is that it is considered non-toxic and there is no need to be avoided (Habil, 1997).

Many of researchers did not include financial status of students as one of the possible predictors of adolescents smoking behaviour. It is very hard to find even a single literature locally or internationally on this aspect. Regarding the price of cigarettes, it is quite expensive in Malaysia and one need to have enough money to continue smoking. With regard to this, it is important to investigate whether financial status of the students is an important predictor of their smoking behaviour. Since parents are the most important source of money for most of students in our population, the most possible and practical way of assessing students' financial status is by determining how much pocket money is given to them by their parents to school.

### **Student's perceptions of the effects of smoking**

Students generally agreed that smoking have adverse health, psychological and social consequences (Greenlund *et al.* 1997). Apart from this general attitudes and beliefs, Greenlund *et al.* (1997) have however stated that there were significant differences of these characteristics between those who ever smoked and those who never smoked. A study by Meijer, *et al.* (1996) found that there was a significant difference between views of students with different smoking statuses regarding children who smoke. Non-smoking children associated more negative characteristics to smoking. However, all of the children studied were well aware of the health hazard of smoking. The students who become regular smokers consistently had more positive opinions and less negative opinions about cigarette smoking (Reimers, *et al.* 1990). In their cohort study, they found that the opinion of 11<sup>th</sup> grade regular smokers, especially when they reached 10<sup>th</sup> and 11<sup>th</sup> grades became more positive about cigarette smoking, thus widening the opinion gap between regular smokers and non-smokers. Similar result was also reported by Morello, *et al.* (2001) where they found that attitudes and belief score were higher among smokers indicating more favourable attitudes and beliefs about smoking.

### **Academic and extra-curricular activities**

Students who began smoking regularly tended to be less academically oriented and less involved in extra-curricular activities. Reimers, *et al* (1990) stated that the results for the measures of extra-curricular activities and academic involvement were similar. In their cohort study, they found that the non-smokers were consistently more involved in extra-curricular activities and more academically oriented throughout the 4 years study period. In term of academic performance, Hesketh, *et al.* (2001) have



also found that a poor academic record is associated with students smoking status. Escobedo, *et al.* (1993) in their study on sports participation and the risk of smoking among US high school students reported that the students who participate in sports were less likely to be regular and heavy smokers. It is possible that the lower rate of smoking for students who participate in sports may be the result of greater self confidence derived from such participation, additional counseling from coaching staff about smoking, perceptions about reduce sports performance because of smoking and greater awareness about health consequences of smoking. It has also been mentioned that student's school performance was a key factor in predicting smoking and quitting attempts when other socio-demographic factors were controlled (Hu, *et al.* 1998).

#### **Religious aspect of smoking**

As described in Flay model on influences of smoking behaviour and stages of smoking, preparation and anticipation is one of the main factors that influence the initiation of smoking. Knowledge, values, beliefs, attitudes and intentions are among the important components of this stage. Perceptions on the religious aspect or religious opinion of smoking will come under this part. With regard to this, Habil (1997) has also mentioned that since religious can counteract certain cultural beliefs and even modify cultural behaviours and since virtually all Malays are Muslim, one of the strategy for smoking prevention among Malays is through the religion of Islam. In Malaysia, the National Consensus on the Islamic view of smoking by a group of religious people has agreed that smoking is "haram" or is a prohibited behaviour in Islam (Country report: Malaysia, 2001). Unfortunately, the consensus was not stressed in public and not enacted by many of the states. Regarding scientific data, there is also no published study so far on this aspect in our country. Studies overseas have also not specifically investigated this area. This factor is probably unrelated and

less important in their population. In Malaysia, since the National Religious Consensus on Islamic view of smoking was produced, it is important to include this factor in studying the associated factors of smoking behaviour in this study.

### **Relationship with the parents**

Most of the studies examining the risk factors of adolescents smoking did not assess the relationship with or attachment of students to their parents. Reimers, *et al.* (1990) in their study however have included this factor and reported that regular smokers consistently indicated that they were less attached to and less supervised by their parents. As described in a conceptual framework by Flay *et al.* (Bellew & Wayne, 1991), family influences not only contribute to the development of smoking behaviour but also important in determining self-image and personality of adolescents which also contribute to smoking development. Therefore, in studying factors that are associated with students smoking behaviour it is important to include the relationship or attachment of students to their parents

### **Cigarettes advertisements and smoking**

In Malaysia, cigarettes advertisements are subject to the Control of Tobacco Products Regulations 1993 (Country Report: Malaysia, 2001). Although direct advertising of cigarettes on radio, television, newspapers and magazines was banned, the Government still allow indirect advertisements by tobacco companies. Rogayah *et al.*, (1998) have conducted a study among standard six students in two schools in Kota Bharu on children's perceptions of indirect cigarettes advertisements in Malaysia. They have found that 28.8% of the children identified the advertisements as promoting cigarettes. In relation to that, it was also reported that perceptions of advertising are higher among young smokers compared to adult (Pierce, *et al.* 1991).

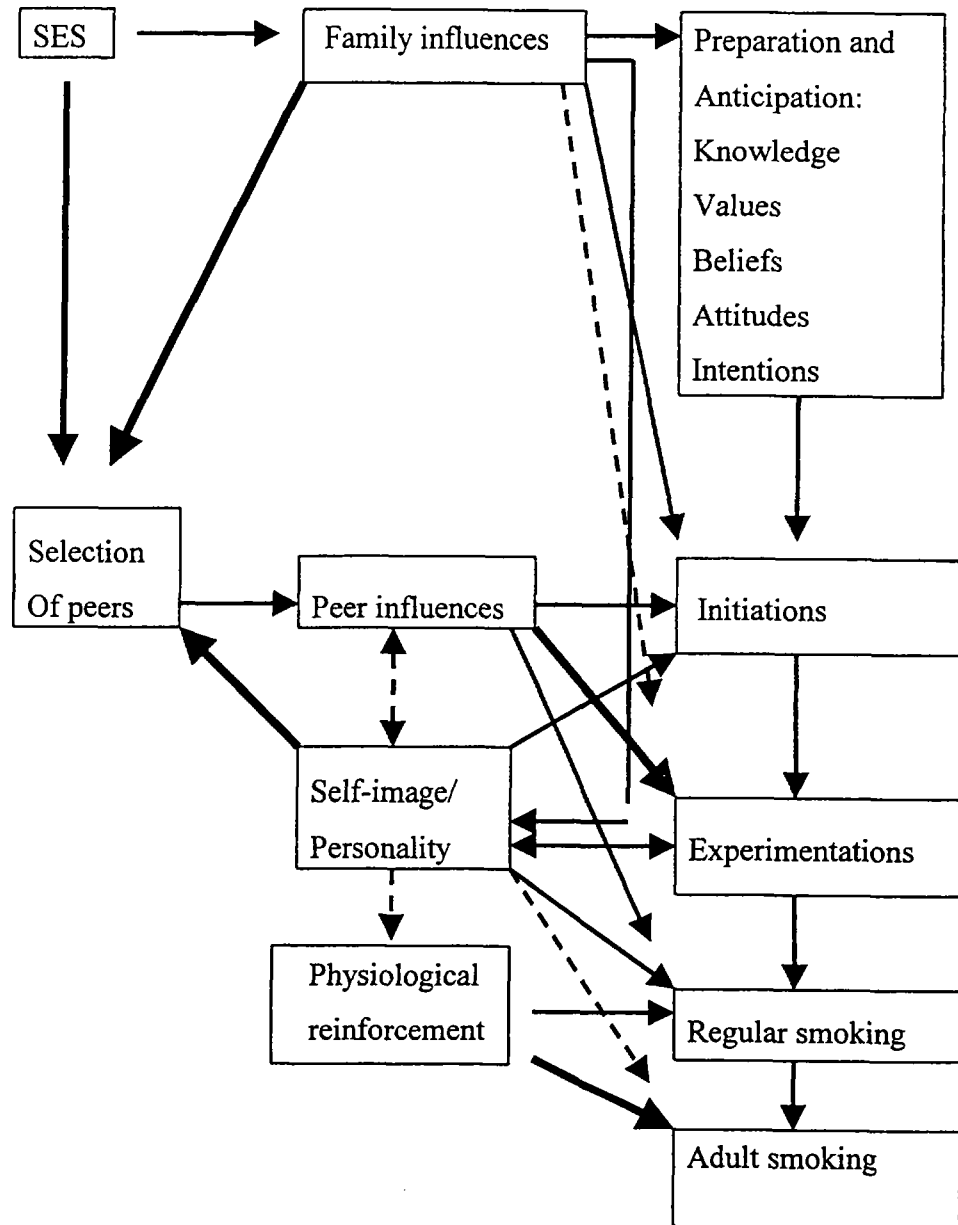
There was not many published data on the effects of advertisement on smoking behaviour in our population. We also do not know whether it has really increased the number of smoker. Therefore, more exploratory studies to investigate the association of cigarettes advertisements on smoking behaviour are required.

## Conceptual framework of smoking development

A model of influences and their relative strengths on stages of smoking behaviour produced by Flay *et al.* (Bellew & Wayne, 1991)

### Influences of Smoking Behaviour

### Stages of Smoking



### **The relationship of lung function and cigarette smoking**

The association between cigarette smoking and diseases of the respiratory system such as chronic bronchitis and lung cancer has been well proven and widely accepted (The World Health Report, 1999). Its association with respiratory illness in those who are exposed to environmental tobacco smoke was also recognized (O'Connor *et al.* 1987; Peter, *et al.* 1996; and Wong, *et al.* 1999). Peters, *et al.* (1996) and Lam, *et al.* (1998) reported that respiratory complaints among children who had been exposed to cigarette smoking were significantly higher than those who had not been exposed. It was also reported that significant trends were noted between the number of smokers living with and respiratory illness of the children (Lam, *et al.* 1998).

The small airways of the lungs have been recognized to be primarily or secondarily affected parts in a variety of clinical conditions (Wright JL. *et al.*, 1992). Regarding their association with cigarette smoking, Wright JL. *et al.* (1992) has also stated that the alteration of the membranous and respiratory bronchioles was one of the temporally early changes in the lung produced by cigarette smoking, and if the distortion of these airways could be detected using sensitive tests, the severity of airflow obstruction could be prevented.

The effects of cigarettes smoking on the lung function test among children or adolescents are however less clear. Lower values for force expiratory volume in one second (FEV1) was reported for children living with parents who smoke (O'Connor *et al.*, 1987; and Kauffmann, F. *et al.*, 1989). Tager *et al.*, (1985) in their study on the effect of cigarette smoking on the pulmonary function of children and adolescents

found that there was a significant decrease in the rate of growth of FEV1 and FEF 25-75% among those who smoked. Gold *et al.*, (1996) however, noted larger values for both FEV1 and forced vital capacity (FVC) in children who smoked than those who did not. In his study, even though FEV1 and FVC were both higher among smoking children, the percentage of FEV1 over FVC and mean force expiratory flow during the middle half of the FVC (FEF 25-75%) were both lower in smoking group. Apart from that, Gold, *et al.*, (1996) also noted a dose response relation between smoking and lower level of FEV1/FVC and FEF 25-75%.

## **Objectives of the Study**

### **General Objective**

The general objective of the study is to identify factors that are associated with smoking behaviour and to see the association of smoking status with the lung functions of secondary school male students in Kota Bharu District, Kelantan.

### **Specific Objectives**

1. To determine the prevalence of smoking among secondary school male students in Kota Bharu.
  
2. To identify the factors that are associated with smoking behaviour of secondary school male students with reference to:
  - 2.1. Financial status of the students
  - 2.2. Extra curricular involvement in school
  - 2.3. Psychosocial influences
  - 2.4. Relationship with the parents
  - 2.5. Level of parental supervision
  - 2.6. Attitudes and perceptions of the students on the effects of smoking
  - 2.7. Student's perceptions on the religious opinion of smoking
  - 2.8. Student's perceptions on the advertisements of cigarettes
  
3. To produce a model to predict smoking status of secondary school male students.
  
4. To compare the pulmonary function of the secondary school male students with regard to their smoking status

## **Materials and methods**

The study was conducted in the District of Kota Bharu, Kelantan. A sample of all students from form four in eight schools randomly chosen from 35 school lists obtained from Kota Bharu department of education.

The students were administered with self administered questionnaire in one room identified by one of the teacher. To encourage reliable response from the students, the teacher was not allowed to be at the room through out the conduct of the survey

Information related to the children's socio economic background, possible exposure variables of smoking behaviour of the students and smoking status of the students were among the questions sought in the questionnaire.

Lung Function was measured with spirometer (Microlab 3300 series). Each subject was asked to inhale deeply in standing position with the nose clamped, blow rapidly and completely as possible. The procedure was explained and demonstrated to each subject. At least three measurements were taken on each subject. Only the best blow was recorded and printed. Result were automatically corrected to body temperature. Height and weight were recorded to nearest 0.5 cm and 0.5 kg respectively.

### **Sample size**

**Objective 1** - To determine the prevalence of smoking among form four male students in Kota Bharu

The sample size was calculated using a single proportion formula to get the prevalence of smoking of secondary school students. Based on previous studies, the prevalence of smoking of secondary school boys was around 35 to 45% (Naing *et al.* 1996a, 1996b). The prevalence of smoking among form four students in the pilot study was 34 %. Based on all the available information, for this study, a prevalence of 40% was used in sample size calculation. Taking the precision of 0.05, the minimum



required sample size to study the prevalence of smoking among secondary school male students was 369. However, the sample size has been 20 percent over estimated to 462 to consider for any missing information.

**Objective 2** – To determine the associated factors of smoking behaviour of secondary school boys

The sample size was calculated using formula to compare two proportions. Since there was limited information on the associated factors of smoking behaviour among secondary school students in our population, data from the pilot study was used to estimate the sample size of this study. There were five categorical and eight numerical independent variables selected in the study. The estimated sample size calculation was done based on the difference in the proportion of characteristics of categorical variables between smokers and non-smokers.

In the pilot study, the proportion of father's smoking among smokers and non-smokers was 0.69 and 0.33 respectively. In calculating the sample size it was however decided to detect a 0.15 difference in the proportion of paternal smoking status between students who smoke and students who do not smoke. The detectable difference of 0.15 was decided after considering the practical aspect of the study. Taking an alpha of 0.05 and power of 0.8, the minimum required sample size based on smoking status of the father was 167 per group.

Regarding smoking status of the siblings, the proportion of siblings smoked among smokers and non-smokers was 0.62 and 0.33 respectively. Considering the practical aspect of the study, it was also decided to detect 0.15 differences in this proportion between the smoking status groups. By using the same precision and power of the study, the minimum required sample size was also 167 for each group.

Regarding the perception of religious opinion on smoking, 16.7% of the non-smokers believed that smoking is prohibited by their religion whereas none of the smokers did. Even though in the pilot study, none of the smokers believed that smoking is prohibited by their religious, the proportion of 0.1 was taken as the detectable difference of this variable in the population. Similarly with previous variables, the sample size was calculated using an alpha of 0.05 and power of the study of 0.8 and the minimum required sample size was 165 for each group.

In the pilot study, 69.2% of the smokers and 73.9% of the non-smokers believed that advertisements on television using cigarette brands were also promoting cigarettes. Even though the difference was very small, considering the practical aspect of the study it was decided to detect the proportion of 0.15 as the detectable difference in the actual study. Using the same precision and power of the study, the minimum required sample size was 104 for each group.

It was decided that the minimum sample size of 167 for each group must be obtained to study the associated factors of smoking behaviour among secondary boys. Based on the prevalence of smoking of about 35 to 45 percent among secondary school male students, it was likely to get 184 smokers if 462 students were included in the study. This will satisfy the minimum sample size requirement of 167 for each group.

**Objective 3 – To compare the pulmonary functions of the male secondary school students between smokers and non-smokers**

Since the dependent variables in the analysis for this objective were all a continuous variable, the sample size in objective 2, which was calculated, based on the comparison of two proportion would be enough to study the difference of lung

function test between smokers and non smokers. Therefore, it was decided to use the sample size in objective 2 for this objective.

Data analysis was done by SPSS software at the Unit of Biostatistics, School of Medical Sciences, Universiti Sains Malaysia.

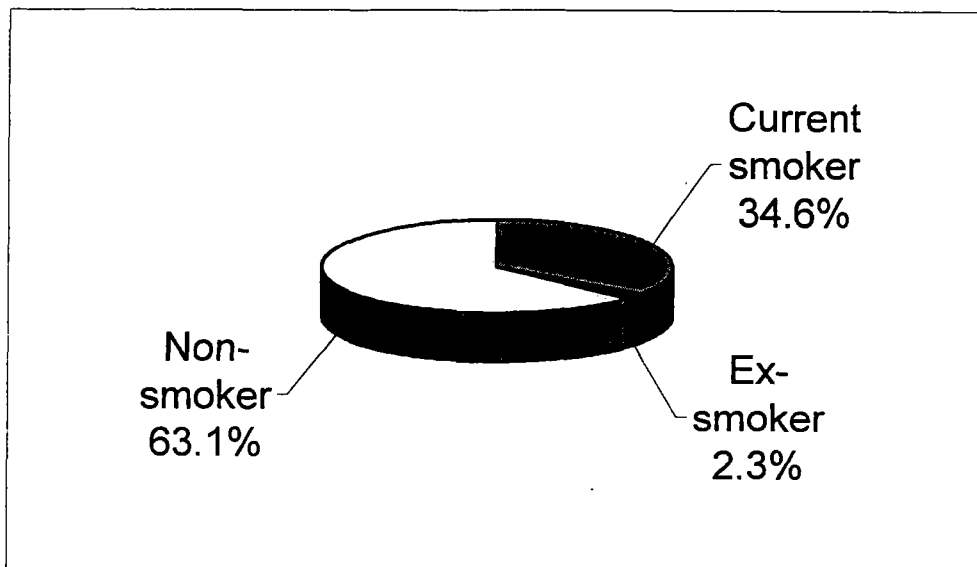
## RESULTS

A total of 541 Form Four students from eight selected schools in Kota Bharu participated in the study. They were 15 to 17 years old at the time of the survey. Most of them were Malay and Muslim (75.4%), 125 were Chinese (23.1%), 5 were Indian (0.9%) and 3 were from other races (0.6%).

### a) Prevalence of smoking

Out of 541 subjects, 526 (97.2%) were classifiable according to smoking classification and fifteen subjects (2.8%) were unclassified due to missing data. One hundred and eighty two students (34.6%) were current smoker, twelve students (2.3%) were ex-smoker and 332 (63.1%) were non-smoker. Figure 5.1.1 shows the percentage of subjects based on their smoking status.

Figure 1 – Percentage of current smoker, ex-smoker and non-smoker

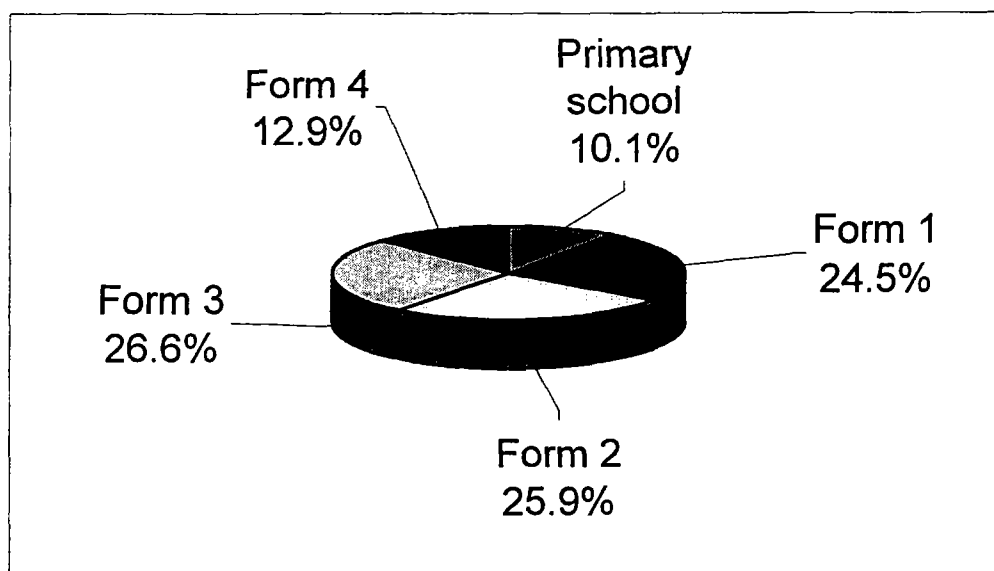


More than half (53.4%) of the students who were labeled as current smoker smoke regularly that is at least one cigarette daily. About half of the current smokers (48.9%) smoke one or two cigarettes per day and 1.4% were heavy smokers.

The most common reason for starting to smoke was 'just to try' (48.0%) and the most common reason for continuing smoking was 'addiction' (66.0%). The majority of the smokers (54.5%) got their first cigarette from a friend and most of them (83.5%) continued to buy cigarettes from shops.

Regarding the duration of smoking, 14 (10.1%) of the smokers started to smoke while in primary school, 34 students (24.5%) in Form 1, 36 students (25.9%) when they were in Form 2, 37 students (26.6%) in Form 3 and 18 students (12.9%) in Form 4. Figure 2 shows the percentages of the smokers based on their level when they started to smoke.

Figure.2 – Percentage of the smokers according to level when they started to smoke.



#### b) The associated factors of smoking behaviour

Based on the smoking classification, only 12 students (2.3 %) were classified as the ex-smoker. Since the number was small, they were then excluded from the

analysis to determine the factors that have been associated with smoking behaviour of the secondary school students.

Exploration of individual variable based on current smoker and non-smoker found that the mean score for the association with friends who smoke and perceptions on the benefit of smoking were significantly higher in smoking group compared to the non-smoking group whereas the mean score for the supervision by the father, supervision by the mother and students' perceptions on the negative effects of smoking were significantly higher in non-smoking group. Table 1 shows the mean score and standard deviation of continuous independent variables of current smokers as well as non-smokers and their p-value.

Table 1 – The mean score and standard deviation of continuous independent variables of current smokers and non-smokers and p-value.

Variables	Current smoker		Non-smoker		# p value
	Mean	(SD)	Mean	(SD)	
1. Amount of pocket money per day	2.06	(1.08)	2.00	(1.05)	0.534
2. Association with friends who smoked	5.23	(2.82)	1.84	(2.30)	<0.001**
3. Relationship with father	10.76	(2.38)	11.03	(2.41)	0.223
4. Relationship with mother	12.24	(2.32)	12.63	(2.21)	0.064
5. Supervision by father	3.48	(1.14)	3.68	(1.02)	0.047*
6. Supervision by mother	3.57	(1.10)	4.01	(0.90)	<0.001**
7. Perception on negative effects of smoking	31.43	(5.07)	35.02	(3.73)	<0.001**
8. Perception on the benefits of smoking	23.56	(6.14)	16.15	(6.20)	<0.001**

# p value of the independent t test

\* p < 0.05

\*\* p < 0.001

As for the categorical variables, the proportions of students who have participated in school uniformed society and who said that smoking is prohibited by their religion were significantly higher in the non-smoking group whereas the proportion of students whose siblings smoked and who responded that advertisements on television using cigarette brands were also advertising cigarettes were significantly higher in smoking group. Table 2 shows the difference in percentages of the categorical variables between current smokers and non-smokers and their p-value.

Table .2 – Number and percentages of responses for categorical variables among current smokers and non-smokers and their significant value.

Variables		Current smoker		Non-smoker		p value#
		No.	(%)	No.	(%)	
1. Joining School	Yes	92	(50.8)	242	(73.3)	<0.001**
Uniformed society	No	89	(49.2)	88	(26.7)	
2. Smoking status	Yes	102	(57.6)	158	(48.8)	0.058
of father	No	75	(42.4)	166	(51.2)	
3. Smoking status	Yes	77	(43.5)	100	(30.6)	0.004*
of siblings	No	100	(56.5)	227	(69.4)	
4. Smoking is prohibited	Yes	25	(14.0)	115	(34.8)	<0.001**
by religion	No	154	(86.0)	215	(65.2)	
4.1 Smoking is prohibited	Yes	19	(11.9)	69	(30.9)	<0.001**
by religion (Muslim)	No	140	(88.1)	154	(69.1)	

4.2. Smoking is prohibited	Yes	6	(30.0)	46	(43.0)	0.278
by religion (Non-muslim)	No	14	(70.0)	61	(57.0)	
5. Indirect advertisements	Yes	157	(87.4)	245	(76.6)	0.004*
are promoting cigarettes	No	22	(12.6)	75	(23.4)	

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# p value of chi-square test

\*  $p < 0.05$

\*\*  $p < 0.001$

Simple logistic regression was done for each of the variable to determine the association with smoking when other variables were not included. Based on LR statistic, at alpha 0.05, out of thirteen variables tested, nine variables were significantly associated with smoking. The significant variables were; joining school uniformed society ( $p < 0.001$ ), smoking status of the siblings ( $p = 0.004$ ), relationship with friends who smoke ( $p < 0.001$ ), level of supervision from the father ( $p = 0.047$ ), level of supervision from the mother ( $p < 0.001$ ), students' attitudes and perceptions on the negative effects of smoking ( $p < 0.001$ ), students' attitudes and perceptions on the benefits of smoking ( $p < 0.001$ ), perceptions of the students on the religious opinion on smoking ( $p < 0.001$ ) and perceptions of the students on the cigarette advertisements on television ( $p = 0.003$ ).

It was found that of the significant variables in univariate analysis; smoking status of the siblings, relationship with friends who smoked, students' attitudes and perceptions on the benefits of smoking and students' perception that advertisements on television using cigarette brands were also promoting cigarettes were positively associated with current smoking status. On the other hand, joining school uniformed



society, level of supervision by the father, level of supervision by the mother, students' attitudes and perceptions on the negative effects of smoking and perception that smoking is prohibited by religious were negatively associated with current smoking status. Table 3 shows the summary of univariate analysis of the individual independent variables in the study.

Table 3 – The summary of univariate analysis - crude odd ratio with it's 95% CI of the independent variables in predicting current smoking status.

Variables	<u>p value*</u>	<u>B</u>	<u>Crude OR (95% CI)</u>
1. Amount of pocket money per day	0.535	0.053	1.06 (0.89 – 1.25)
2. Joining school uniformed society	<0.001	-0.978	0.38 (0.26 – 0.55)
3. Smoking status of father	0.057	0.357	1.43 (0.99 – 2.07)
4. Smoking status of siblings	0.004	0.558	1.75 (1.20 – 2.55)
5. Association with friends who smoked	<0.001	0.449	1.57 (1.44 – 1.70)
6. Relationship with father	0.223	-0.048	0.95 (0.88 – 1.03)
7. Relationship with mother	0.064	-0.076	0.93 (0.86 – 1.01)
8. Supervision by father	0.047	-0.174	0.84 (0.71 – 0.99)
9. Supervision by mother	<0.001	-0.442	0.64 (0.53 – 0.78)
10. Perceptions on negative effects of smoking	<0.001	-0.198	0.82 (0.78 – 0.86)
11. Perceptions on the benefits of smoking	<0.001	0.185	1.20 (1.16 – 1.25)
12. Smoking is prohibited by religion	<0.001	-1.192	0.30 (0.19 – 0.49)
13. Indirect advertisements are promoting cigarettes	0.003	0.756	2.13 (1.27 – 3.57)

\* p value of LR statistic

### **Multivariate analysis**

Multiple logistic regression analysis was used in multivariate analysis to select the significant variables explaining the outcome after controlling the effects of possible confounders in the study. Backward stepwise logistic regression was done to screen for the significant variables and all independent variables in the study were included in the screening. Selection of the variables was based on the significant change of  $-2 \log$  likelihood. Setting alpha at 0.05 as the removal level from the model, out of thirteen independent variables tested, five of them were significantly associated with smoking status and could not be removed from the model. The significant variables were association with friends who smoke, relationship with the father, perceptions on the negative effects of smoking, perceptions on the benefits of smoking and perception that smoking is prohibited by the religious.

The rejected variables in screening procedure were again tested one by one together with the significant variables to make sure that no important variables are excluded from the model and it was found that none them was significant. The rejected variables were also tested one by one for multicollinearity together with the significant variables. This is to make sure that they were not rejected because of multicollinearity. It was found that the variance inflation factors for all the rejected variables were very small. Therefore, the non-significant variables that had been excluded from the model were really not significant with this data set. Variables that had been selected in the model also had very small variance inflation factors and do not have multicollinearity.

The variables that have been selected in the model were then tested for any interaction between them in predicting the outcome. All possible two factors interaction terms were tested one by one together with the main effects and it was found that there was no significant interaction of the independent variables in predicting smoking status. Therefore, each of the variables can explain the outcome independently in the model. Table 4 shows the adjusted odd ratio with 95% CI of all the independent variables in the model

Table 4 – Adjusted odd ratio with its 95% CI of the independent variables in predicting current smoking status

Variables	P value*	B	Adjusted OR	95% CI of OR
1. Association with friends who smoked	<0.001	0.396	1.49	1.35 – 1.64
2. Relationship with father	0.010	0.156	1.17	1.04 – 1.32
3. Perceptions on the negative effects of smoking	<0.001	-0.133	0.88	0.82 – 0.93
4. Perceptions on the benefit of smoking	<0.001	0.157	1.17	1.12 – 1.22
5. Smoking is prohibited by religion	0.035	-0.663	0.52	0.28 – 0.97

\* p value of LR statistic

Table 5 – Adjusted odd ratio with 95% CI of all the independent variables in predicting current smoking status in the second model

Variables	<u>p value*</u>	<u>B</u>	<u>Adjusted OR</u>	<u>95% CI of OR</u>
1. Association with friends who smoked	<0.001	0.427	1.53	1.38 – 1.70
2. Relationship with father	0.001	0.222	1.25	1.10 – 1.42
3. Perceptions on the negative effects of smoking	<0.001	-0.118	0.89	0.83 – 0.95
4. Perceptions on the benefit of smoking	<0.001	0.198	1.22	1.16 – 1.28
5. Smoking is prohibited by religion	0.010	-0.859	0.42	0.22 – 0.83

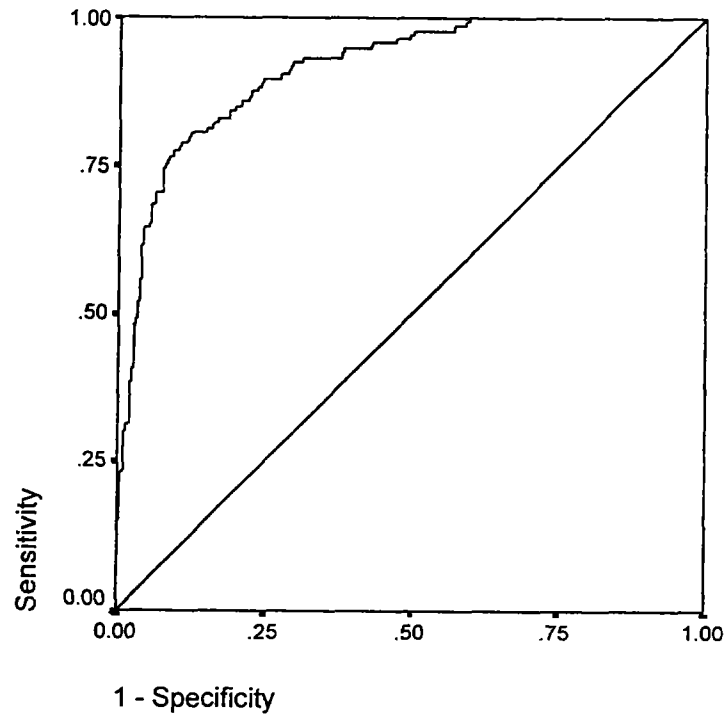
\* p value of LR statistic

#### **Model diagnosis- Testing the fitness of the second model**

Fitness of the model was again tested using Hosmer and Lemeshow goodness of fit method. The Chi-square test was 6.268 with 8 degree of freedom ( $p = 0.617$ ). Therefore, the model was fit for the present data set and valid for interpretations. Taking 0.5 as the cut off value of predicted probability for current smoker, based on the classification table, the sensitivity of the model in identifying current smoker in the study was 75.7% and the specificity was 91.6%. The overall percentage of correct outcomes was 86.1%. Based on the relationship of the predicted probability and

observed outcome ROC curve was also plotted for this second model. The proportion of area under the curve was 0.914. Figure 3 shows ROC curve of the second model.

Figure 3 – ROC curve of the second model



### Comparing the first and second model

Two models have been developed in the study in predicting current smoking status. Comparing between them, the second one gave more fit and better prediction of the outcome. Therefore, the second model was taken as the final model in predicting and explaining the outcome. Table 6 shows the comparison between the first and second model.

Table 6 – Comparison between the first and second model

	Model 1	Model 2
1. Model fitness	p = 0.330	p =0.617
2. Area under ROC curve	0.899	0.914
3. Sensitivity	73.3	75.7
4. Specificity	90.7	91.6
5. OR of the association with friends who smoked	1.49	1.53
6. OR of the relationship father	1.17	1.25
7. OR of perceptions on the negative effects of smoking	0.88	0.89
8. OR of perceptions on the benefits of smoking	1.17	1.22
9. Smoking is prohibited by religion	0.52	0.42

### **The final model**

Since the second model gave more fit and a better prediction of the outcome, it was taken as the final model in the study. Most of the variables selected in the model are continuous variables. A perception on religious opinion on smoking is the only categorical variable included in the final model. Retrospectively, with the available sample, same precision and power of the study, the proportions of detectable difference were 0.124 for joining school organization, 0.132 for smoking status of the father, 0.128 for smoking status of the siblings, 0.121 for students' perceptions of religious opinion on smoking and 0.104 for cigarettes advertisements.

The final multiple logistic regressions model

$$\beta'X = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5$$

$$\beta'X = -4.387 + 0.427 (\text{friends}) + 0.222 (\text{relationship (F)}) - 0.118 (\text{negative effects}) + 0.198 (\text{positive effects}) - 0.859 (\text{religious})$$

$\beta'X$  can be put in the multiple logistic response function to get the probability of smoking status of individual subjects.

### **The association of smoking with the lung function**

Based on smoking classification, lung function test was done to both groups of the students to detect the relationship of smoking with the lung functions among secondary school students. 100 subjects were traced from current smokers and 128 students were traced from non-smoking group. Since lung function tests were done on the subsequent visits, selection of the subjects was depend on the ability of the students to identify their identification number which was given during the questionnaire survey.

### **Univariate analysis**

#### **Univariate analysis of the independent variables**

In studying the difference of lung functions between smokers and non-smokers, height and weight of the student were considered to be potential confounders (American Thoracic Society, 1991) and were included as covariates in the analysis. Independent t-test was done to each of covariates to identify whether they were significantly differed between the two groups. At alpha 0.05, there was no significant difference of height and weight of the students noted between the two groups. Table 7 shows the description and summary of independent t-test of the covariates.



Table 7 – Descriptions and summary of the univariate analysis of the covariates between the current smokers and non-smokers

Variables	<u>Smoking status</u>	<u>mean (S.D)</u>	<u>p value*</u>
Height	Yes	166.1 (5.82)	0.392 (NS)
	No	165.5 (5.58)	
Weight	Yes	58.3 (13.44)	0.385 (NS)
	No	56.7 (13.03)	

\* p value of the independent t-test

NS – Not significant

#### Univariate analysis of the dependent variables

Force vital capacity (FVC), force expiratory volume in one second (FEV1) and mean forced expiratory flow during the middle half of the FVC (FEF 25-72%) as part of the measurements of lung function test were taken as dependent variables in the analysis. Independent t-test was also done to each of them to test the difference of the FVC, FEV1 and FEF 25-72% between the smoking status groups when other possible confounders were not considered. At alpha 0.05, it was found that both FVC and FEV1 were significantly differed between those who smoke and those who do not smoke and the mean of the measurements were both higher among current smokers. There was however, no significant difference of FEF 25-75% noted between the groups. Table 5.3.2 shows the descriptions and summary of independent t-test of the dependent variables

Table 8 – Descriptions and summary of independent t-test of lung function between the current smokers and non-smokers

Variables	<u>Smoking status</u>	<u>mean</u> (sd)	<u>p value</u> *
FVC	Yes	3.92 (0.57)	0.005 (S)
	No	3.71 (0.52)	
FEV1	Yes	3.45 (0.46)	0.008 (S)
	No	3.28 (0.50)	
FEF 25-75%	Yes	4.76 (1.00)	0.831 (NS)
	No	4.73 (1.08)	

\* p value of the independent t-test

S – Significant

NS – Not significant

### **Multivariate analysis**

As this is a confirmatory analysis, no variable selection was done. A multivariate analysis of covariance (MANCOVA) was used to examine the difference of lung function test between current smokers and non-smokers and at the same time to control the effects of possible confounders. The fixed factor was smoking groups; height and weight of the students were the covariates whereas FVC, FEV1 and FEF 25-75% were the dependent variables in the analysis. At alpha 0.05, the overall multivariate analysis shows significant different of the lung function test between current smokers and non-smokers ( $p = 0.028$ ) when height and weight were included in the model. Table 5.3.3 shows summary of the overall multivariate test.

Table 8 – Summary of the overall multivariate test in explaining the lung function test

Variables	<u>F statistic</u>	<u>p value</u>
Smoking status	3.10	0.028
Height	15.47	<0.001
Weight	14.19	<0.001

There was no possible multicollinearity between factor and covariates as well as among the covariates in explaining the outcomes as shown by small standard error of parameter estimates. Therefore the fixed factor and covariates could be maintained in the model. Two-way interaction terms were checked one by one between factor and covariates and none of them was significant.

#### **Stratification analysis of the outcomes**

The interpretation of the result in multivariate analysis of covariance was then continued with stratification analysis of covariance for each outcome. By putting a fixed factor of smoking status, and height and weight as covariates, the corrected model explaining the changes in FVC, FEV1 as well as FEF 25-75% were all statistically significant with p value of less than 0.001 for FVC as well as FEV1 and 0.002 for FEF 25-75%. In the stratification analysis, it was found that smoking status has significantly contributed to the mean difference of FVC and FEV1 but not to the mean difference of FEF 25-75%. The mean FVC and FEV1 evaluated when covariates appeared in the model were also higher among current smokers. Table 9

shows the summary of stratification analysis for each outcome in the study between current smokers and non-smokers.

Table 9 – Summary of the stratification analysis of dependent variables between current smokers and non-smokers.

Variables	p value*	Mean difference	95% CI
FVC	0.005 (S)	0.163	0.049 – 0.278
FEV1	0.011 (S)	0.137	0.032 – 0.242
FEF 25-75%	0.962 (NS)		

\* p value of the F and t statistic

with the father, student's perceptions on the negative effects as well as on the benefits of smoking and student's perceptions on the religious opinion on smoking.

### **Students association with friends who smoked**

The relationship of adolescent smokers with friends who smoked is a common risk factor found in many studies. Ogawa, *et al.*, (1988) reported that adolescents smoking behaviour is significantly associated with smoking behaviour among people around them. With increasing number of smoker among parents, elder siblings and intimate friends, the percentage of current smoker among students increases. Most of the studies also reported that peer influence is among the most consistent association with adolescents smoking status (Greenlund, *et al.*, 1997; Morello, *et al.*, 2001; Ogawa, *et al.*, 1988; Reimers, *et al.*, 1990; Zhu, *et al.*, 1992; and Zhu, *et al.*, 1996).

Peer pressure, as emphasized in other studies, seemed to be among the most important factors associated with cigarette smoking. This study revealed that the mean score for the students association with friends who smoked was obviously higher in the smoking group. Out of the maximum score of nine, current smokers have got a score of 5.23 compared to non-smokers who have got a score only 1.84. A higher score indicates a stronger relationship with friends who smoked.

This variable measure how many of the subject's friends smoked based on the composite score of three items. The items were best friends, friends with whom they associated most often and friends' known longest to them. Information on the number of friends who smoked that the students associated most is very important as it is indirectly reflects peers influence on smoking. Reimers *et al.* (1990) in their study on

the risk factors of adolescent smoking behaviour have also used the same method of assessment.

In the multivariate analysis, it was found that the mean score of this variable significantly differ between smokers and non-smokers. The difference was very strong as shown by the p value of less than 0.001. The odd ratio was 1.53 indicating the positive effects of peers influence on smoking behaviour. This finding is consistent with most of the reported studies in other populations (Greenlund, *et al.*, 1997; Morello, *et al.*, 2001; Ogawa, *et al.*, 1988; Reimers, *et al.*, 1990; Zhu, *et al.*, 1992; and Zhu, *et al.*, 1996).

#### **Student's perceptions on the effects of smoking**

There were two variables concerning attitudes and perceptions of students on smoking included in the study. The first one was on the negative effects and the second one on the benefits of smoking. In this study, we have separated the two sub-domains in the analysis. As mentioned in the research methodology, two sets of statements have been made concerning the negative effects and benefits of smoking. The score for each variable was based on the total score of the items. The views of the students with different smoking statuses regarding smoking behaviour was measured and compared.

Students in both groups generally agreed with the statements on negative effects of smoking. Most of them were well aware of the bad consequences of smoking especially on their health. Both groups have scored more than 30 of the maximum score 40. A higher score indicates a stronger agreement with the

statements. The mean score was however higher among the non-smokers as compared to smokers. This finding was similar with what has been reported by Greenlund, *et al.* (1997).

In contrast with the negative effects of smoking, the mean score for the benefits of smoking was higher among current smokers indicating more favourable attitudes and perceptions about smoking. A similar result was also noted by Morello, *et al.* (2001) in his study on tobacco use among high school students in Argentina. In summary, this study has shown that having more positive opinions and less negative opinions about cigarette smoking contribute to smoking behaviour. The differences in these opinions and perceptions were very strong as proven by p value of less than 0.001 in both univariate as well as multivariate analysis. These results are also consistent with studies by Reimers, *et al.*, (1990) and Meijer, *et al.*, (1996).

Regarding the strength of association, it was found that the adjusted odds ratio of these two variables were not very much different from one and if we consider the 95 percent confidence interval, they were actually very close to one. This information is very important especially in designing and conducting any smoking prevention programmes.

#### **Student's relationship with their parents**

Regarding the student's relationship with their parents, many studies did not include this as one of the risk factor. As for our population, this factor could be important and was included in the study. In the Flay model, family members might give some influences on the development of beliefs and attitudes of adolescents on

smoking, which then may contribute to the initiation of cigarette smoking. In this study, the student's relationship with their parents was measured by giving a score to the variable. The score was based on the total score of three items that measure the degree to which a student's parents seemed to understand him, made him feel close to them and talk over problems with him. A higher score indicate a better relationship of the students with their parents.

The mean score of the student's relationship with their mother were higher than with their father. Out of the maximum score of fifteen, both groups have got around eleven for the mean score of relationship with the father and approximately twelfth for the mean score of relationship with the mother. This shows that male students in our population are generally having better relationship with their mother compared with their father. In this study, the main interest was actually on the comparison between smokers and non-smokers and it was noted that both scores were higher among non-smokers.

The group difference in the student's relationship with their father was strongly significant with p value of 0.001 in the multivariate analysis. There was however, no significant difference in the student's relationship with their mother between the groups. Surprisingly, even though the mean score of the student's relationship with their father was higher among the non-smokers, it's relationship with smoking behaviour after controlling the effects of other confounding factors was reversed. Statistically, based on the adjusted odds ratio of 1.25 (95% CI: 1.10 – 1.42), students who are having better relationship with their father are noted to have a higher risk of cigarette smoking.



This finding must be interpreted carefully to make sure that correct message can be given to the people. Looking at this finding differently, we may say that students who are having a better relationship with their father might take advantage on that relationship. This message is very important especially to the parents and specifically to the fathers. Those who feel that their children are very close to them must also be strict in certain aspects especially on their disciplines.

Regarding fathers who smoked, by having a better relationship with their children might also influence them to emulate his behaviour. In contrast with this finding, Reimers, *et al.*, (1990) in their study on the risk factors for adolescent cigarette smoking in Iowa reported that regular smokers consistently indicated that they were less attached to their parents. Differences in population characteristics, knowledge, values and attitudes may explain the contradictory results.

### **Student's perceptions on the religious opinion of smoking**

In Malaysia, the National Consensus on the Islamic view of smoking or "fatwa" has been produced by a group of religious leaders of Islam in this country. The committee has agreed that smoking is "haram" or prohibited in Islam (Country Report: Malaysia, 2001). Unfortunately, the consensus has not been enacted in many states and most of the Muslim in this country may not be aware of this "fatwa".

Since the majority of the Kelantan population are muslims, a variable has been included to represent the student's perceptions on their religious opinion of smoking.

Generally, the majority of the students feel that their religion does not prohibit smoking. Surprisingly, to Muslim students, only 23% of them felt that their religion prohibit smoking. This shows that on this aspect, Malays who are also Muslim are having higher risk of cigarette smoking compared to non-muslims. The result also shows that the "fatwa" about smoking prohibition in Islam has not reached the population yet.

Comparing smokers and non-smokers, it was found that only 14.0% of smokers compared to 34.8% of non-smokers who thought that their religion prohibits smoking. Among the Muslim, only 11.9% of smokers and 30.9% of non-smokers gave the similar response. The difference in this perception was statistically significant with p value of 0.012.

Regarding the strength of association, after considering confounding factors the risk of smoking among those who thought that their religion prohibits smoking was more than two times lower than those who did not think so. Comparing with other significant variables in the multivariate analysis, the religious aspect has shown the highest strength of association in this study based on their adjusted odds ratio and 95 percent confidence interval.

Therefore, it is important to consider this aspect in designing and implementing any smoking prevention programmes especially for Malays and muslims. Habil (1998) has also mentioned that the right approach for smoking prevention among Malays is through a religious approach. The right religious beliefs and attitudes about cigarette smoking must be made known to adolescents so that it

may reduce the risk of initiating cigarette smoking. With regard to beliefs, perceptions and attitudes, cigarette smoking especially among Malay adults is considered culturally acceptable. This is another reason of why cigarette smoking is wide spread in the population. Regarding other scientific data, Zulkifli, et al. (2001) found that the current health-warning message on cigarette packs was not effective in preventing students from smoking.

There were not many published study on the relationship of the religious aspect and smoking behaviour in our country. Review of studies done overseas have not found religious to be included, as it might not perceived to be important in their populations. Further exploratory studies on the relationship of the religious aspect to smoking behaviour are therefore recommended.

#### **Smoking status of the father**

Previous studies overseas have shown that the effect of parental smoking on adolescent smoking was inconclusive. There has been inconsistency in the findings between studies from different populations. Many studies have shown a significant association between smoking status of the students and smoking behaviour among the family members (Anonymous, 2000; Greenlund *et al.*, 1997; and Ogawa, *et al.*, 1988) whereas some other studies did not show any significant relationship (Meijer, *et al.* 1996; and West, *et al.*, 1999). It is therefore important to include this variable as one of the independent variables in this study. Since the prevalence of smoking among women in our population is low (NHMS 2) it was decided to exclude smoking status of the mother in the study and to focus on the smoking status of the father as one of the potential risk factor.

It was noted that higher percentage of the father from smoking group smoked (57.6%) compared to 48.8% in the non-smoking group. The prevalence specify was also higher than the national figure of the prevalence of adult male smoker (49.2%) based on the Second National Health and Morbidity Survey. The difference was however not significant in the univariate as well as multivariate analysis. Descriptively, the difference in smoking prevalence of the fathers between the two groups was almost 10% and this is quite big that require further attention. The marginally insignificant difference as shown by a p value of 0.057 in the univariate analysis is also an indicator of the importance of this factor in smoking status of the students.

Other predictors of smoking behaviour have also been included in the study and this was result in making the smoking status of the father marginally insignificant in the multivariate analysis. There is also a possibility of an inadequate sample size to significantly differentiate the two groups. As smoking status of the father is a categorical variable, the effect of sample size is very important and generally larger sample size is required to achieve statistically significant result as compared to a continuous variable. In this study, taking alpha of 0.05 and power of 0.8, the detectable difference of smoking status of the father was 0.132 or 13.2% with the present sample size. This show that larger sample size is required to test the significance of smoking status of the father.

Several studies have also supported the importance of parental smoking status in determining students smoking behaviour. A greater access to cigarettes among the students whose father smoked was reported by Greenlund, *et al.* (1997) and it was

also stated to be among the strongest association of adolescents smoking behaviour (Hesketh, *et al.*, 2001).

### **Smoking behaviour of the siblings**

A number of studies have shown that the influence of siblings who smoked on adolescent smoking behaviour is more confined to the early adolescent ages (Swan, *et al.*, 1990; and West, *et al.*, 1999). It is therefore important to include this variable in determining the risk factors of adolescents smoking behaviour. A dichotomous variable was included to assess the presence of any smoking siblings in their family. This information may indirectly measure the effect of siblings smoking on student's smoking status. Most of the previous studies have used this method in assessing the influence of siblings smoking status on adolescents smoking behaviour.

In this study, it was found that smokers were having higher percentage of smoking siblings. It was noted that 43.5% of current smokers reported to have smoking siblings compared to 30.6% of the non-smokers. The difference of nearly 13% can be considered high and warrant more attention in our next prevention programmes. Statistically, the variable was significant in the univariate analysis but with the presence of other important variables it has been excluded from the model to predict smoking status in the multivariate analysis.

Looking at the difference in the percentage, it was quite large, yet the variable was still not included in the final model. As smoking status of the siblings is a categorical variable, the effect of sample size is very important and larger sample size is probably needed to detect the significant difference of this variable.

Retrospectively, with the same alpha of 0.05 and power of 80 percent, the detectable difference for this variable was 12.8%.

In summary, the effect of smoking siblings on adolescents smoking status must not be ignored even though it was not included in the final model. Based on the descriptive statistic and univariate analysis, the importance of this factor could be seen. Studies overseas have also noted the significant contribution of siblings smoking status on adolescents smoking behaviour (Zhu, *et al.*, 1996; West, *et al.*, 1999)

### **Parental supervision**

Maternal and paternal supervision was separated in the assessment of parental supervision. The reason was that they were not actually the same. Those who are having good maternal supervision does not necessarily have a similar type of supervision by their father. There was only two questions, one on paternal supervision and the other one on maternal supervision. The score measures the degree to which the father and the mother knew where the subject was when he was away from home. This information alone is considered enough to indicate the degree of parental supervision for adolescents.

In this study it was found that the scores were both higher for paternal as well as maternal supervision in the non-smoking group indicating better supervision by their parents. Without considering the effects of other variables, it was noted that parental supervision was associated with smoking behaviour. The odds ratios of less

than one in the univariate analysis indicate the protective effects of parental supervision.

In multivariate analysis, comparing with other variables that have given a strong influence on smoking status (associations with friends who smoke, student's perceptions on the negative effects of smoking, student's perceptions on the benefits of smoking, relationship with the father and student's perceptions on the religious opinion of smoking), the effect of parental supervision became negligible. A possible reason for the insignificant contribution of this variable to smoking status in the multivariate analysis was the inclusion of the student's relationship with the father in the final model. The significant contribution of the relationship with the father may have reduced the apparent influence of parental supervision. It has been stated that parental supervision and attachment to parents are likely interrelated (Reimers, *et al.*, 1990).

### **Extra-curricular activities**

A number of studies have examined extra curriculum activities and academic involvement in the association with smoking status (Reimers, *et al.*, 1990; Escobedo, *et al.*, 1993). Generally, it was reported that students who smoke regularly tended to be less academically oriented and less involved in extra curricular activities. Reimers, *et al.*, (1990) noted that the non-smokers were consistently more involved in extracurricular activities and more academically oriented. Escobedo, *et al.*, (1993) reported that students who participate in sports were less likely to be a regular and heavy smoker. In relation to previous findings in other populations, the relationship

between participation in school-uniformed activities with smoking behaviour was included in this study.

Most of the non-smokers were involved in school-uniformed societies, 73.3% of them responded to joining the societies as compared to 50.8% of the smokers. The difference in the proportion between the two groups was quite large and need some explanation. Ignoring the contribution of other factors, the relationship between this variable and student's smoking status is very strong as shown by p value of less than 0.001 in the univariate analysis. It is possible that the lower rate of smoking for students who have participated in school uniformed activities may be the result of greater discipline derived from such participation, additional counseling by teachers about smoking and greater awareness about health consequences of smoking.

In the multivariate analysis, the presence of other important variables in predicting smoking status made students involvement in school-uniformed societies less significant and was excluded in the final model. However, the fact that significant difference of this variable has been noted between the two groups in the descriptive as well as univariate analysis, indications of the importance of this factor in our population can still be seen.

#### **Student's perceptions on cigarettes advertisements**

Although direct cigarette advertisement on radio, television and newspapers or magazines was banned, indirect advertisement is still allowed in Malaysia. The news about banning of indirect cigarettes advertisement has just been announced recently. There was not many published study found on the effects of advertisement on smoking behaviour in our population. Evidence on whether it has really increased the



risk of taking up cigarettes among our adolescents was also not available. It was therefore decided to include a variable to assess student's perception on cigarette advertisements and to compare it between smokers and non-smokers.

The majority of students in both groups could identify indirect cigarette advertisements on television. About 87% of the current smokers and 76.6% of the non-smokers believed that any advertisements on television using cigarette brands were also promoting cigarettes. These percentages are higher than what has been noted by Rogayah *et al.* (1998) in their study on standard six students in Kota Bharu. They have reported that 28.8% of the children identified the advertisements as promoting cigarettes. The difference in age groups could probably explain the difference of the results. This finding shows that perception on indirect cigarette advertisements is higher during adolescence.

In the univariate analysis, the perception on indirect cigarette advertisement was significant in predicting smoking behaviour and p value of 0.003 indicates the importance of this variable. The effects of this variable has however been reduced by some other more important predictors of smoking behaviour in the multivariate analysis. Since this is a categorical variable, a larger sample size was probably needed to detect a significant difference and maintain it in the final model. Therefore, although it was not in the final model, we should not ignore it's role in smoking behaviour. The banning of indirect cigarette advertisements in the future will hopefully give greater impact on smoking prevention programmes in Malaysia.

### **Financial status of the students**

The amount of money brought by students to school daily was used to assess the financial status of the students. There could be many other ways of assessing it but with regards to potential risk of smoking behaviour, the amount of pocket money was taken as the indication of the financial status of the students. However, this information alone would not adequately reflect the socioeconomic status of the family. The reason for not including socioeconomic status of the family in this study was that the possibility of misclassification will be high. The validity and reliability of information obtained from students especially on the total family income were expected to be poor.

Unlike socioeconomic status of the family, most studies did not include financial status of students as one of the possible predictor of adolescents smoking behaviour. Cigarettes are quite expensive in Malaysia and one need to have enough money to continue smoking. It is important to investigate whether the financial status of the students is an important predictor of their smoking behaviour. Since parents generally are the most important source of money for most students in our population, the most possible and practical way of assessing student's financial status is by determining the amount of pocket money given to them by their parents.

In this study, it was found that the mean amount of money was higher among smokers but the difference was not significant. The mean amount of money brought by current smokers and non-smokers was RM 2.06 and 2.00 respectively. Statistical analysis also did not show any significant difference of this variable between the

groups even on the individual basis. This finding shows that the amount of money brought by student to school is not important in determining smoking behaviour.

### **Association of lung function with smoking status**

Spirometric examination was used in this study to assess the lung function of the students. Although it is an effort dependent test, the results were generally accepted based on the good cooperation from the subjects and the quality control check on the performance of the subjects by the spirometer. In this study, it was decided to include the forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and mean forced expiratory flow in the middle half of the FVC (FEF 25-75%) as part of the measurements of the lung function test as the dependent variables in the study.

It was found that there was no significant difference of the mean forced expiratory flow in the middle half of FVC (FEF 25-75%) between smokers and non-smokers. As stated earlier, FEF 25-75% is the most sensitive indicator of small airway resistance in the lung function test. It can be the only abnormality detected in early obstructive airway disease where FEV1/FVC is still normal (Weinberger, SE. & Drazen, JM., 1991; and Wright, JL. 1992). Therefore, it can be concluded that there was no significant difference of airway resistance between students who smoke and students who do not smoke in our population.

It was found that majority of the students started to smoke in Form 2 and Form 3 with the mean duration of about two years. Almost all of the current smokers were a light smoker and about half them only smoke about one or two cigarettes per day. It

was also found that about half of the current smokers in our sample did not smoke regularly. These could be the explanation for the insignificant difference of FEF 25-75% among smokers as what has been obtained among non-smokers. The characteristic of smoking behaviour among secondary school boys in our population was still inadequate to cause significant changes of the lung function.

In a related study in the United States by Gold, *et al.* (1996), it was noted that the FEF 25-75% were significantly lower among smokers compared to the non-smokers. In their study, they have also found that the overall mean number of cigarettes smoked by adolescence boys aged 15 to 18 years was 8.9 cigarettes per day and this was much higher than what has been observed in our population. Tager, *et al.* (1985) has also reported the FEF 25-75% was significantly lower among adolescents who smoked.

It was found that both FVC and FEV1 were significantly higher in smokers group compared to the non-smokers group. The significant difference of both measures was maintained after controlling the effects of height and weight in the multivariate analysis. This must be interpreted carefully to make sure the right explanation can be given and also the right conclusion can be made from the findings. The similar result was also observed by Gold *et al.*, (1996) in their study among adolescence in the United States. However, they have also reported that the percentage of FEV1 over FVC, which reflex the airway resistance, was lower among the smokers.

As stated earlier, apart from giving information on the lung function, the forced vital capacity (FVC) as an index of pulmonary function is also a good indicator of the strength of respiratory muscles (Ganong, WF., 1991). Similarly, the FEV1 as part of the FVC can also reflex the strength of respiratory muscles apart from measuring airway resistance in the form of percentage from the FVC. Since FEF 25-75% which is the most sensitive indicator of early small airway resistance was not significantly differed between smoking status group, the most likely explanation for the significant difference of the FVC and FEV1 was due to the difference in the strength of respiratory muscles. Current smokers in our sample have got higher strength of respiratory muscles compared to the non-smokers. The reason for having higher strength of respiratory muscles among smokers could not be obtained from the study as no assessment was made on that aspect.

It was also noted that even though FVC and FEV1 were significantly higher among current smokers, the measurement were actually within normal range in both groups of current smokers and non-smokers. The mean percentage of FVC from the predicted value of Asian population (CHEST M.I. INC) was 89.8 and 94.5 among non-smokers and smokers respectively. Both groups obtained the mean FVC of more than 80 percent of the predicted value, which was normal (American Thoracic Society, 1991). As for FEV1, both groups have obtained the mean percentage of FEV1 from their FVC of about 88% and were within the normal limit (American Thoracic Society, 1991). Therefore, the statistical significant of the difference of FVC and FEV1 between current smokers and non-smoker were actually of no clinical importance.

In monitoring a lung function, apart from the serial measurements, it is useful when adequate baseline studies are available for comparison. A change from patient's baseline values is more likely to indicate pulmonary impairment than the comparison of values measured in patients with reference values obtained from population studies. Small changes from the baseline could be missed if only reference values are used in the comparison. Smokers from one normal spirometric test may still have and accelerated loss of lung function that is detectable only by serial measurements. Smokers may be more likely to stop smoking if they are informed of such functional abnormalities

## CONCLUSIONS AND RECOMMENDATIONS

Smoking among secondary school students is increasingly prevalent in Malaysia, specifically in Kelantan. There was no reduction in the prevalence of smoking among secondary school boys since 1996. In this study, it was found that 34.6% of the male students smoked. This indicates that the present programmes implemented to prevent adolescents from smoking have not been very successful. Renewed efforts to reduce smoking initiation and promote smoking cessation are needed to provide an effective public health approach to this problem.

This study found that association with friends who smoked, student's perception on the benefits of smoking and students relationship with the father were positively contributed to smoking behaviour, while student's perceptions on the negative effects of smoking and perceptions that smoking is prohibited by the religion were negatively associated with smoking behaviour. These findings suggested that modifying the smoking prevention programmes to include the religious aspect are required. This can be done through all possible ways available. The "fatwa" on smoking prohibition in Islam should frequently be addressed in forum and mass media to educate people on the Islamic perspective of cigarette smoking. This can be followed by making the "fatwa" being enacted in all states in Malaysia. Further exploratory studies on the relationship of the religious aspect to smoking behaviour are recommended.

Regarding the association of the lung function with student's smoking status, there was no significant difference of airway resistance between smokers and non-smokers as shown by insignificant difference of FEF 25-75% between them. The FEF

25-75% is the most sensitive indicator of the small airway resistance (Weinberger, SE. and Drazen, JM., 1991; and Wright, JL. 1992). This indicates that the characteristics of smoking behaviour of our secondary school male students have not affect the lung function yet.

Surprisingly, this study found that the FVC and FEV1 were significantly higher among smokers compared to the non-smokers. The fact that FEF 25-75% were similar between smoking status groups, the higher level of FVC and FEV1 was most likely due to higher strength of respiratory muscle among smokers. However, there was no other information to indicate the strength of respiratory muscle in this study.



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