WORKPLACE SMOKING CESSATION: SMOKING RELAPSE, SUSTAINED CESSATION AND BEHAVIOURAL ATTRIBUTES FOLLOWING A QUIT ATTEMPT

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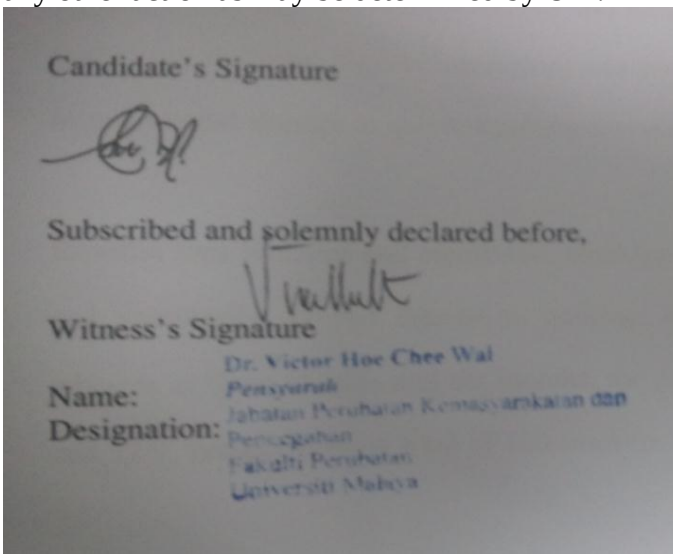

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Abstract

Introduction: Smoking cessation studies are often conducted in clinical settings. This study first aims to identify predictive factors involved in smoking relapse and sustained cessation. Secondly, the author examined the psychological components involved in the quitting process that can lead to sustained cessation, which include motivation, perception and changes in behaviour. Lastly, taking the Transtheoretical model (TTM) as the behavioural model under study, the investigator also tested whether this model is applicable in assessing and predicting smoking relapse.

Methods: This was a prospective cohort study involving employees from two major public universities in Malaysia. Smoking employees from these workplaces received an invitation to participate in this study. At the start of the treatment, participants completed a questionnaire on their sociodemographic variables and smoking habits as well as the Job Content Questionnaire (JCQ) and the Transtheoretical Model (TTM) Questionnaire. Participants were given behavioural therapy with free nicotine replacement therapy (NRT) as treatment for two months. Subsequently, they were followed up at one week, three months and six months. They were all asked to complete similar sets of questionnaires, and their smoking status was determined. This study used recurrent logistic regressions and survival analysis to study the progression from an initial attempt to quit to smoking cessation or eventual relapse.

Results: One hundred and eighty five smoking staff from both universities responded and voluntarily showed interest in quitting. At one week, 55.7% of smokers quit, whereas at three months and six months, the percentage of quitters declined to 14.6% and 13%, respectively. A total of 120 smokers achieved at least 24 hours of abstinence

at the end of six months; of these, 80% relapsed. Smoking relapse was shown to decline with time. The majority of relapses occurred within the first two weeks, and most relapses occurred within two months.

This study has produced six main findings: 1) most relapses occurred within the first two months of quitting; 2) reduced exposure to other smokers in the workplace can potentially prevent smoking relapse; 3) a good relationship between co-workers and their resultant support are important factors in smoking cessation in the workplace; 4) healthcare professionals can help smokers with low motivation to quit; 5) positive changes in perception following counselling sessions are associated with quitting, and finally; 6) the results of the TTM suggest that this model can be used to predict smoking relapse. This is the only work thus far that extends the applicability of the TTM as a model for smoking relapse among smokers attending face-to-face counselling sessions.

Conclusions: Workplace social support, workplace environmental tobacco exposure, motivation change and perception change are important contributing factors in achieving and maintaining six-month abstinence. Furthermore, conducting a small-scale intensive workplace programme for smokers may return a potentially good outcome on cessation rates, but it may lead to poor long-term success rate due to smoking relapse. Hence, a strict workplace smoking ban is recommended to ensure greater and longer quit maintenance among former smokers.

Abstrak

Pendahuluan: Kajian berhenti merokok sering dilakukan dalam persekitaran berasaskan klinik dan jarang dilakukan di tempat kerja. Kajian ini bertujuan untuk mencari faktor-faktor yang menyebabkan seseorang individu kembali kepada merokok setelah berhenti dan faktor-faktor yang menyebabkannya berhenti terus. Kedua, penyelidik ingin menyiasat komponen psikologi yang terlibat dalam cubaan berhenti merokok yang melibatkan motivasi, persepsi dan perubahan pada tingkah laku yang membawa kepada percubaan berhenti merokok yang berjaya. Akhir sekali, mengambil model Transtheoretical (TTM) sebagai model tingkah laku, penyelidik juga ingin mengkaji sama ada model ini boleh digunapakai dalam menilai dan meramalkan seseorang bekas perokok yang kembali merokok.

Metodologi: Ini adalah kajian kohort yang melibatkan pekerja dari dua buah universiti awam yang utama di Malaysia. Kakitangan-kakitangan di kedua-dua universiti tersebut telah dijemput untuk mengambil bahagian dalam kajian ini. Pada awal kajian, para peserta telah diminta untuk mengisi soalan kajiselidik sociodemografi, tabiat merokok, "Job Content Questionnaire" (JCQ) dan Soal Selidik Model Transtheoretical (TTM). Peserta diberikan Terapi tingkah laku dan Terapi Penggantian Nikotin (NRT) secara percuma sebagai rawatan selama dua bulan. Perkembangan para peserta telah diikuti pada minggu pertama, bulan ketiga dan bulan keenam. Borang soal selidik yang serupa telah dilengkapkan pada setiap masa tersebut, dan status merokok dan kembali kepada merokok mereka diselidiki. Kajian ini menggunakan "multiple logistic regression" dan " survival analysis" sebagai analisis utama.

Keputusan: Seratus lapan puluh lima kakitangan dari kedua-dua universiti secara sukarela menunjukkan minat untuk berhenti. Pada minggu pertama, 55.7% perokok berhenti merokok, dan pada bulan ketiga dan keenam, peratusan perokok yang berhenti menurun kepada 14.6% dan 13% masing-masing. Seramai 120 perokok berhenti merokok sekurang-kurangnya 24 jam pada akhir enam bulan, yang mana 80% telah kembali semula merokok. Jumlah bekas perokok yang kembali semula merokok setelah berhenti berkurangan dengan masa. Majoriti kes-kes tersebut berlaku dalam tempoh dua minggu pertama sehingga kira-kira dua bulan.

Kajian ini telah menghasilkan enam penemuan utama 1) kebanyakan kes kembali merokok berlaku dalam tempoh dua bulan pertama berhenti; 2) kurang pendedahan kepada perokok lain di tempat kerja boleh mencegah seseorang bekas perokok untuk kembali merokok; 3) hubungan yang baik antara rakan-sekerja dan sokongan yang baik daripada mereka adalah faktor penting dalam pemberhentian merokok di tempat kerja; 4) profesional kesihatan dapat membantu perokok yang memiliki motivasi yang rendah untuk berhenti merokok; 5) perubahan persepsi yang positif terhadap merokok setelah mengikuti sesi kaunseling dapat dikaitkan dengan status berhenti merokok, dan akhirnya; 6) model TTM boleh digunakan untuk meramal kembalinya bekas perokok kepada merokok. Setakat ini, ia adalah penemuan pertama yang memanjangkan model TTM ini kepada bekas perokok yang kembali merokok setelah mengikuti sesi kaunseling.

Kesimpulan: Sokongan sosial di tempat kerja, pendedahan tembakau dan asap rokok di tempat kerja, perubahan motivasi dan perubahan persepsi adalah faktor-faktor penting yang menyumbang dalam pencapaian dan pengekalan status pemberhentian merokok. Tambahan pula, mengendalikan program kecil-kecilan yang intensif di tempat

kerja untuk perokok boleh meningkatkan kadar pemberhentian, tetapi ia mungkin membawa kepada kes kembali merokok di kalangan bekas perokok. Oleh itu, penguatkuasaan pengharaman merokok di tempat kerja yang ketat amat disarankan untuk memastikan status bebas merokok yang lebih tinggi dan lebih lama di kalangan bekas perokok.

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List of Abbreviations

1. NHMS: National Health Morbidity Survey
2. FCTC: Framework Convention on Tobacco Control
3. WHO: World Health Organisation
4. NRT: Nicotine replacement therapy
5. QALYs: Quality adjusted life years
6. MOH: Ministry of Health
7. CO ppm: Exhaled carbon monoxide parts per millison as measured by carbon monoxide analyser
8. BMI: Body mass index
9. BP: Blood pressure
10. CFTR: Control of Tobacco Products Regulations
11. FDA: Food and Drug Administration
12. ETS: Environmental tobacco smoke
13. GDP: Gross domestic product
14. FTND: Fagerstrom test of nicotine dependence
15. TTM: Transtheoretical model
16. DBQ: Decisional Balance Questionnaire
17. DB: Decisional Balance
18. WHO: World Health Organization
19. HBM: Health Belief Model
20. NGOs: Non-governmental organisations
21. SHS: Second-hand smoke
22. US: United States
23. vs.: Versus

24. SS: Sidestream smoking
25. MS: Mainstream smoking
26. M: Mean
27. OR: Odds ratio
28. SD: Standard deviation
29. ANOVAs: Analyses of variances
30. ROC: Receiver operating characteristic curve
31. NICE: National Institute for Clinical Excellence
32. nAChRs: Nicotinic acetylcholine receptors

List of Publications

Journal articles (published and submitted) and conferences arose from this thesis:

Journal articles – full paper: *(publications and submissions)*

1. **Yasin SM**, Retneswari M, Moy FM, Koh D (2011). Predictors of Smoking Cessation Among Staff in Public Universities in Klang Valley, Malaysia. *Asian Pacific J Cancer Prev, 12 (3), 811-816 (ISI-cited)*

2. **Yasin SM**, Khairul Mizan T, Rafdzah Ahmad Z (2011). Reliability and Construct Validity of the Bahasa Malaysia Version of Transtheoretical Model (TTM) Questionnaire for Smoking Cessation and Relapse among Malaysian Adult Smokers. *Asian Pacific J Cancer Prev, 12 (6), 1439-1443 (ISI-cited)*

3. **Yasin SM**, Retneswari M, Moy FM, Koh D (2011). Does change in perception following counseling result in improved quitting outcome among Malaysian smokers? *Asia-Pacific Journal of Public Health.* doi: 10.1177/1010539511426472 *(ISI-cited)*

4. **Yasin SM**, Retneswari M, Moy FM, Koh D, Marzuki I (2011). Smokers can quit regardless of motivation in a worksite smoking cessation programme. *Asian Pacific J Cancer Prev, 12 (9), 2193-2198 (ISI-cited)*

5. **Yasin SM**, Retneswari, M., Moy, F. M., Darus, A., & Koh, D. (2012). Job stressors and smoking cessation among Malaysian male employees. *Occupational medicine (Oxford, England), 62* (3), 174-181 *(ISI-cited)*

6. **Yasin SM,** Moy, F. M., Retneswari, M., Isahak, M., & Koh, D. (2012). Timing and risk factors associated with relapse among smokers attempting to quit in Malaysia. *Int J Tuberc Lung Dis*. doi: 10.5588/ijtld.11.0748 *(ISI-cited)*

7. **Yasin SM**, Retneswari M, Moy FM, Taib KM. (2013) Results of a low-intensity intra-workplace smkoing cessation and predictors of sustained six months quitting success. (In press- *Accepted in Annals, Academy of Medicine Singapore*) *(ISI-cited)*

8. Yasin SM, Retneswari M, Moy FM, Koh D. Testing the Transtheoretical Model in Predicting Smoking Relapse among Malaysian adult Smokers in a Worksite Smoking Cessation Programme. (*Submitted* to Journal of Health Psychology)

Journal Abstract Proceedings

1. **Yasin SM**, Retneswari M, Moy FM, Azlan D, Koh D (2011). Job Stressors in Relation to Smoking Cessation among Malaysian Male Employees in Worksite Smoking Cessation Programme (abstract only). *Malaysian Journal of Public Health Medicine*, 11 (Suppl 2), 34-35. ISSN: 1675-0306 (Non ISI/ Non Scopus cited)

2. **Yasin SM**, Retneswari M, Moy FM, Koh D (2011). Risk factors for smoking relapse among Malaysian smokers attending worksite smoking cessation programme (abstract only). *Malaysian Journal of Public Health Medicine*, 11 (Suppl 4), 22-23. ISSN: 1675-0306 (Non ISI/ Non Scopus cited)

3. **Yasin SM** (2011). Smokers can quit regardless of motivation in a worksite smoking cessation programme in Malaysia. (abstract only). *Malaysian Journal of Community Health (Jurnal Kesihatan Kemasyarakatan)*, 17 (Suppl 1), ISSN: 1675-1663 (Non ISI/ Non Scopus cited)

Conference(s):

Oral Presentations:

1. **Yasin SM**, Masilamani R, Moy FM, Koh D. Changes in Decisional Balance After Counseling is Associated with Improved Quit Rates Among Malaysian Smokers. Asia Pacific Academic Consortium of Public Health. Nusa Dua, Bali, Indonesia. 24- 27th November 2010

2. **Yasin SM,** Masilamani R, Moy FM, Koh D. Predictors of Smoking Cessation Among Staff in Public Universities in Klang Valley, Malaysia. AsiaLink International Conference, Kuta, Bali. Indonesia. 27-28th November 2010.
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3. **Yasin SM,** Masilamani R, Moy FM, Koh D. Can Perceived Risk and Benefit of Quitting Predict Smoking Cessation Outcome? ; Malaysian Experience. First Regional Health Science and Nursing Conference, SACC, Shah Alam, Malaysia. 22-24th February 2011. Pg. 16

4. **Yasin SM**, Retneswari M, Moy FM, Azlan D, David K. Job Stressors in Relation to Smoking Cessation among Malaysian Male Employees in Worksite Smoking Cessation Programme. 4th Regional Conference of Occupational Medicine, Kuala Lumpur, Malaysia. 23-25th June 2011

5. **Yasin SM,** Retneswari M, Moy FM, Koh D. Risk factors for smoking relapse among Malaysian smokers attending worksite smoking cessation programme. 6th National Public Health Conference, Klana Resort, Seremban, Malaysia, Malaysia 11-13th July 2011

6. **Yasin SM.** Smokers can quit regardless of motivation stage in a worksite smoking cessation programme in Malaysia. First International Public Health Conference & 18th National Public Health Clloquium, Kuala Lumpur 27th-28th September 2011

Poster Presentations and Research awards:

1. **Yasin SM**, Retneswari M, Moy FM, Koh D. Factors contributing to quitting success, early lapses and 50% cigarette reduction in a worksite smoking cessation programme in Malaysia. Asia Pacific Conference on Tobacco or Health, Sydney, Australia. 6-9th October 2010. Pg. 187-188

- ***Awarded Scholarship Travel Award from Global Dialogue for Effective Stop-Smoking Campaigns, U.S.***

2. **Yasin SM,** Retneswari M, Moy FM, Koh D. Can Perception About Qutting Predict Smoking Cessation Outcome?; Malaysian Experience. Cancer Research Exhibition, University Putra Malaysia, Malaysia 23-24th February 2011.
Pg. 243-244

- ***Awarded 2nd Prize for Best Poster Presentation (Category: Epidemiology and Environmental research)***

3. **Yasin SM**, Retneswari M, Moy FM, Koh D. Timing to smoking relapse and risk factors associated with relapse among Malaysian smokers. The 4th International Cancer Control Congress, National Cancer Center, Korea. 3-5th November 2011

- ***Awarded Scholarship Travel Award from the 4th International Cancer Control Congress, Korea.***

4. **Yasin SM**, Retneswari M, Moy FM, Koh D. Risk factors for smoking relapse among Malaysian smokers attending worksite smoking cessation programme. 15th World Conference on Tobacco or Health, Singapore 20-24th March 2012

- ***Awarded Scholarship Travel Award from the 15th World Conference on Tobacco or Health, Singapore.***

1.0 Introduction

1.1 Background

The problem of tobacco smoking is not new in this country; in 1963, cigarettes became commercialised in Malaysia, and the government began efforts to control the problem in the 1970s.

Tobacco plantations first arose in Malaysia in 1883 in Sabah, but the industry itself did not form until 1931; by 1963, it was commercialised in Peninsular Malaysia (Joseph, 2008). Currently, the tobacco industry is dominated by 3 major companies: British American Tobacco (BAT), Japan Tobacco Inc. and Philip Morris Int. Advocacy for control of tobacco regulation first emerged in Malaysia in the early 1970s but failed to translate into meaningful tobacco control regulations in the three decades that followed.

The progress of tobacco control has been very slow in Malaysia due to various disputes in and among government and non-government agencies. The reason for the slow progress of tobacco control was the challenge posed by working within larger government agendas as well as a myriad of policies such as poverty alleviation (job availability), the promotion of bumiputera business (small and medium-sized local tobacco companies) and the encouragement of foreign investors and direct financial interest through ownership of shares in the tobacco industry; these governmental policies protected the local tobacco market through high import tariffs. Another reason for the slow implementation of regulation was the success of strategies used by the major tobacco companies to lobby for fewer restrictions and regulations (Assunta & Chapman, 2004).

The truth about the health and economic burdens of tobacco was only realised by the Malaysian government after the enactment of the Control of Tobacco Products Regulations (CFTR) in 1993. Since then, various forms of control have been

implemented, including legislative control, tobacco control programmes and anti-tobacco campaigns. Furthermore, in light of the global effort for tobacco control, a window of opportunity has arisen for the Ministry of Health to sign and ratify the WHO Framework Convention on Tobacco Control (FCTC) beginning in the year 2003. According to the FCTC, all signatories must follow stated guidelines regarding tobacco control within a 5-year time span (Bialous, Kaufman, & Sarna, 2003). Since the ratification, Malaysia has increased the tax rate to 45% of retail price in 2011 (SEATCA, 2011), banned all indirect tobacco advertisements in 2003, increased anti-tobacco campaigns and set up smoking cessation services (Assunta & Chapman, 2004).

The smoking cessation services offered in Malaysia have been provided by the Ministry of Health. As of November 2007, there were a total of 194 quit smoking clinics that provide smoking cessation services. This service is heavily subsidised by the government and offers a combination of both counselling and pharmacotherapy, using algorithms set in the relevant Clinical Practice Guidelines (2003). With regards to the attendance and cessation rates of clients, each clinic has a variable level of performance that is determined by numerous factors including drug availability (i.e., nicotine replacement therapy) and the motivation of the staff running the clinic (Aziz, 2005).

To date, according to the NHMS 3 (2006), the prevalence of smoking among adults over the age of 18 years is still high, totalling up to 21.5% and including 46.4% of the overall male general population. Despite various efforts implemented to reduce the number of smokers in the country, including smoking cessation services/clinics, there was only a reduction of 2% (from a previous prevalence of 23.5%) from what was reported in a similar survey 10 years previously (NHMS 2-1996). Such data indicate that all the efforts of the government to combat tobacco have not been very successful (Zarihah, Foong, Salehuddin, & Kalthom, 2007).

The financial burden of smoking is far too great for the government to bear. A recent study in Malaysia showed that the estimated annual health care cost of smoking is equivalent to 0.1 to 1.1% of the GDP and constitutes 16.5% of healthcare expenditures and 26.1% of the MOH (Ministry of Health) budget (Aljunid, 2006). A study in the UK in 1997 showed that health care costs for smokers at a given age are 40% higher than those of non-smokers (Barendregt, Bonneux, & van der Maas, 1997). The smoking cessation clinics that exist in this country have been using pharmacological therapy with recommended counselling sessions as the mainstay of treatment, and this regimen consumes a considerable amount of the government's budget. According to Aljunid (2006), approximately MYR 4200.53/ EURO 1053.00 must be spent per person for a successful smoking cessation programme, which includes relapse cases. In the United Kingdom, the nicotine replacement therapy and counselling per successful cessation costs approximately EURO 1600 of quality adjusted life years (QALY) (Vemer & Rutten-van Mölken, 2010).

In the workplace, smoking leads to increased absenteeism, reduced productivity and increased occupational injuries (Halpern, Shikiar, Rentz, & Khan, 2001; Lana, de León, García, & Jaime, 2005). The workplace may also be considered a significant source of ETS (environmental tobacco smoke), which puts innocent people at risk. Economic costs associated with exposure to ETS in the workplace can also be very high (Parrott, Godfrey, & Raw, 2000). Hence, over recent years, concern has grown over the need to protect employees at the workplace. The responsibility for this, as with other types of health and safety at work, lies not only with the employers but also with the employees.

1.2 Statement of problem and research gaps

An important reason for the failure of smokers to achieve long-term abstinence is smoking relapse. In a study involving adolescents who undertook a serious attempt to

quit, it was noted that for a total follow-up of 3 weeks, 70.4% of participants had at least one lapse episode and 59.3% went into full-blown relapse (Van Zundert, Nijhof, & Engels, 2009). Thus, to reduce the relapse rate, healthcare providers must have a deeper understanding of relapse episodes and how they change over time.

Another reason that some smokers are incapable of maintaining abstinence is a lack of knowledge among health professionals regarding the follow-up of these patients. It is important in any quit attempt involving behavioural counselling to capture the critical relapse period. Few studies have been performed on this aspect of relapse, either in Western countries or countries in the FarEast. In the present study, the author explored the time frame from the date of smoking cessation until the development of relapse. Furthermore, predictors of smoking relapse remain unknown in our population because no such study has yet been published in Malaysia or any other Asian country. This information is essential for health professionals as they plan appropriate interventions that take into account the factors related to relapse as well as those that lead to successful cessation.

Although individual and clinical predictors of success have been examined in the current literature from Western populations (Breslau & Peterson, 1996), predictors of success have been largely based on the clients of cessation clinics. These were mainly self-supported efforts, with very few concentrating on programmes conducted in the workplace, especially in university settings. The results for such populations may be skewed, as smokers attending such programmes tend to be less motivated smokers (Tanaka et al., 2006). Hence, the identification of client characteristics that predict success and prevent relapse in a workplace smoking cessation effort in this region is important, as this information could match smokers with a workplace strategy that is most effective in helping them quit. It may also be useful to recognise smokers who

might require more intensive therapy or referral to specialist centres to make the most of health care resources.

When examining the behavioural component of smoking cessation and relapse, many studies have underlined the importance of both perception and motivation in achieving cessation. Although some studies have explored the role of the perceived risks and benefits of quitting on smoking initiation and intensity (Lyna, McBride, Samsa, & Pollak, 2002), few studies have examined how the perception of continuing smoking or quitting may affect abstinence. With regard to motivation, both public preconceptions and psychological theories hold that the initial motivation to quit is a crucial factor in successful cessation (Rosenstock, Strecher, & Becker, 1988; Segan, Borland, & Greenwood, 2002). However, the evidence supporting this theory is mixed. Although the initial motivation may be predictive of whether an individual attempts to quit, it does not predict maintenance or relapse (Borland et al., 2010). Other studies have found a negative association between initial motivation level and the outcome of the cessation attempt (Hyland et al., 2006; R. West, McEwen, Bolling, & Owen, 2001). Thus, another aspect of this study is to examine both perception and motivation during the progression from smoking cessation to smoking relapse and to determine how they influence the outcome.

Moreover, the Transtheoretical Model (TTM) by Prochaska and DiClemente (1983) has played a crucial role in the development of behavioural interventions and understanding the behavioural process involved in smoking cessation. Nevertheless, the role of the TTM in smoking relapse remains unclear. According to Etter and Sutton (2002), the distinction between the action and maintenance stages is poorly understood. The action stage (the first 6 months after quitting) leads to the maintenance stage (6 months after quitting) and is the crucial time period in which smokers either progress to sustained cessation or relapse. In this research, the boundaries that define the action

stage were explored among Malaysian smokers engaged in a workplace smoking cessation programme.

1.3 Study objectives

The general objective of this research is to understand the factors associated with smoking relapse and sustained quitting and the associated behavioural attributes among a group of working employees in Malaysia who attempted to quit smoking. This study was designed to achieve the following specific objectives:

1. To identify the time frame from initial cessation to relapse after the administration of nicotine replacement therapy (NRT) and counselling;
2. To identify risk factors for smoking relapse and sustained abstinence after the administration of NRT and counselling with respect to sociodemographic characteristics, smoking history, family support, coping, general stress, work strain variables and environmental influences.
3. To investigate the influence of change in perception on smoking cessation and change in motivation on smoking relapse and cessation following treatment;
4. To predict smoking relapse within the action stage of the TTM.

1.4 Research questions and hypotheses

The main hypothesis of this study was divided into four parts. Each part was designed to test smaller hypotheses and to thus increase the understanding of smoking relapse and sustained cessation.

1.4.1 Time-frame and risk factors of relapse

Smoking cessation is a dynamic process, in which each long-term successful cessation period often involves a sequence of unsuccessful attempts. Almost 75% of smokers who attempted to quit relapsed during the first 6 months of abstinence (Health & Services, 1990). Therefore, the problem of relapse has recently been studied in developed nations

and remains to be established in the next few decades (Hughes, Shiffman, Callas, & Zhang, 2003; Piasecki, 2006; Piasecki, Fiore, McCarthy, & Baker, 2002). These studies have provided valuable information on risk factors for relapse and their effect on the relapse process. However, smoking relapse is a complex process that may not be similar in different populations. To date, no single metric can accurately summarise the process of relapse (Piasecki et al., 2002).

In the present study, the investigator examined various risk factors and their effects on smoking relapse in a workplace smoking cessation programme in Malaysia.

The study also aimed to investigate the following research questions and hypotheses:

1) What is the time frame from initial quitting to relapsing among former smokers who relapsed?

2) What are the risk factors of relapse within 6 months after quitting with respect to all independent variables in the study (as below)?

a) sociodemographic characteristics; b) smoking history; c) family support;

d) coping; e) general stress; f) job stressors and g) environmental influences

3) What is the influence of the positive relapse-related factors on survival curve?

Null Hypothesis 1: No differences exist between previous studies and the current study in terms of the risk factors of smoking relapse.

1.4.2 Predictors of smoking cessation

A number of studies have identified predictors of smoking cessation. These include factors such as age of smoking initiation, previous quit attempts, depression, nicotine dependence, alcohol use, motivation and marital status (Caponnetto & Polosa, 2008). However, these predictors were identified in clinical populations; predictors in

workplace cessation programmes may differ, especially in a developing country like Malaysia.

Therefore, the investigator hypothesised that predictors of success in workplace cessation programmes differ from previous studies conducted in other countries. In addition, it was also hypothesised that differences may exist between clinical and workplace programmes. On the basis of findings in the literature, the investigator studied many variables that may influence smoking cessation.

The research questions included:

1) What are the univariate predictors of sustained abstinence at 1 week, 3 months and 6 months months with regard to:

a) sociodemographic characteristics; b) smoking history; c) family support;

d) coping; e) general stress; f) job stressors and g) environmental influences

2) What are the multivariate predictors of sustained abstinence at 1 week, 3 months and 6 months with regard to the above mentioned variables?

Null Hypothesis 2: No differences exist between previous studies and the current study in terms of the predictors of smoking cessation after NRT and counselling.

1.4.3 Role of perception and motivation

Several conceptual models have suggested that many factors influence smoking cessation (Strecher & Rosenstock, 1997). These models postulate that in order for smoking cessation to occur, an individual must first perceive personal vulnerability to the negative outcomes of smoking (Rosenstock, 1974). The patient must understand that the outcome is severe and that quitting will reduce the likelihood of their personal susceptibility (Weinstein, 1988). Previous studies have shown that a smoker's

perception on the advantages and disadvantages of smoking are associated with motivation (Dijkstra, De Vries, & Bakker, 1996) and can be used to predict future outcomes (Velicer, DiClemente, Prochaska, & Brandenburg, 1985). These findings are important for smoking prevention.

The TTM constructed by Prochaska and Declemente (1983) consists of 3 core constructs: the stages of change, the processes of change and decisional balance. The stage of change (DiClemente et al., 1991) views smoking cessation as a continuous process that involves several phases and includes a range of individuals, from those without awareness to those who are seriously planning to quit. The second part of this section proposes that the initial stages of change, i.e., the smoker's initial motivation, are able to predict cessation. The model also predicts that changes may occur in the motivation of smokers after counselling.

To date, little attention has been given to the changes in both perception and motivation of smokers after they receive appropriate counselling. In addition, we do not know whether these changes actually improve cessation outcomes, especially among Southeast Asian smokers. Therefore, the author examined the following research questions and hypotheses.

Perception

1) Is there any difference in the perception of smoking at baseline between smokers who quit and did not quit at 2 months?

2) Is there any change in the perception of smoking between smokers who quit and did not quit at 2 months and is it related to the success of the cessation attempt?

Null Hypothesis 3a: There is no difference in the perception of smoking at baseline between smokers who quit and did not quit at 2 months.

Null Hypothesis 3b: There is no change in the perception of smoking between smokers who quit and did not quit at 2 months and it is not related to the success of the cessation attempt.

Motivation

1) Is there a change in motivation (stage of change) among relapsers and the never quit group from 0 month (presession) to 6 months (postsession)?

2) Can the initial motivation (stage of change) predict sustained cessation and relapse at 6 months?

Null Hypothesis 3c: There is no change in motivation (stage of change) among relapsers and the never quit group from 0 month to 6 months.

Null Hypothesis 3d: Initial motivation (stage of change) does not predict sustained cessation and relapse at 6 months.

1.4.4 Action stage of the Transtheoretical model

The TTM was mostly applied in the precessation process, where it was used to assist healthcare professionals in recognising the motivational stages that smokers move through and to encourage smokers to quit. Because relapse is the most likely outcome in a cessation attempt (Piasecki et al., 2002), little attention has been focused on the postcessation phase between quitting for at least 24 hours and quitting for a total of 6 months. It is also known that relapse occurs rapidly and that the risk of relapse decreases the longer a person remains abstinent (Hughes et al., 2003).

The TTM had previously assumed homogeneity in smokers within the action stage, i.e., the first 6 months of cessation. Progression from one stage of change to another was assumed to be homogenous, and this progression was utilised in the

development of stage-based intervention (Prochaska & Velicer, 1997). To date, this has not been proven to be the case in relapse cases. Segan et al. (2006) proved that there was an unclear stage boundary within the TTM's action stage. This uncertainty must be elucidated by future studies. A better understanding of the factors that contribute to relapse is thus crucial to achieving higher quitting rates.

The hypothesis of this section attempts to identify factors involved in relapse as they relate to the TTM. It also explores whether there is a stage boundary that exists within the action stage of TTM.

1) Can TTM be used to predict relapse among smokers engaging in assisted quitting during the first 6 months of quitting?

Time 0=0 month; Time 1=3 months; Time 2=6 months

a) TTM predictors during time 0 to time 1

b) TTM predictors during time 0 to time 2

c) TTM predictors during time 1 to time 2

Null Hypothesis 4a: TTM measures in the action stage cannot predict relapse from time 0 to time 1.
Null Hypothesis 4b: TTM measures in the action stage cannot predict relapse from time 0 to time 2.
Null Hypothesis 4c: TTM measures in the action stage cannot predict relapse from time 1 to time 2.

1.5 Theoretical framework

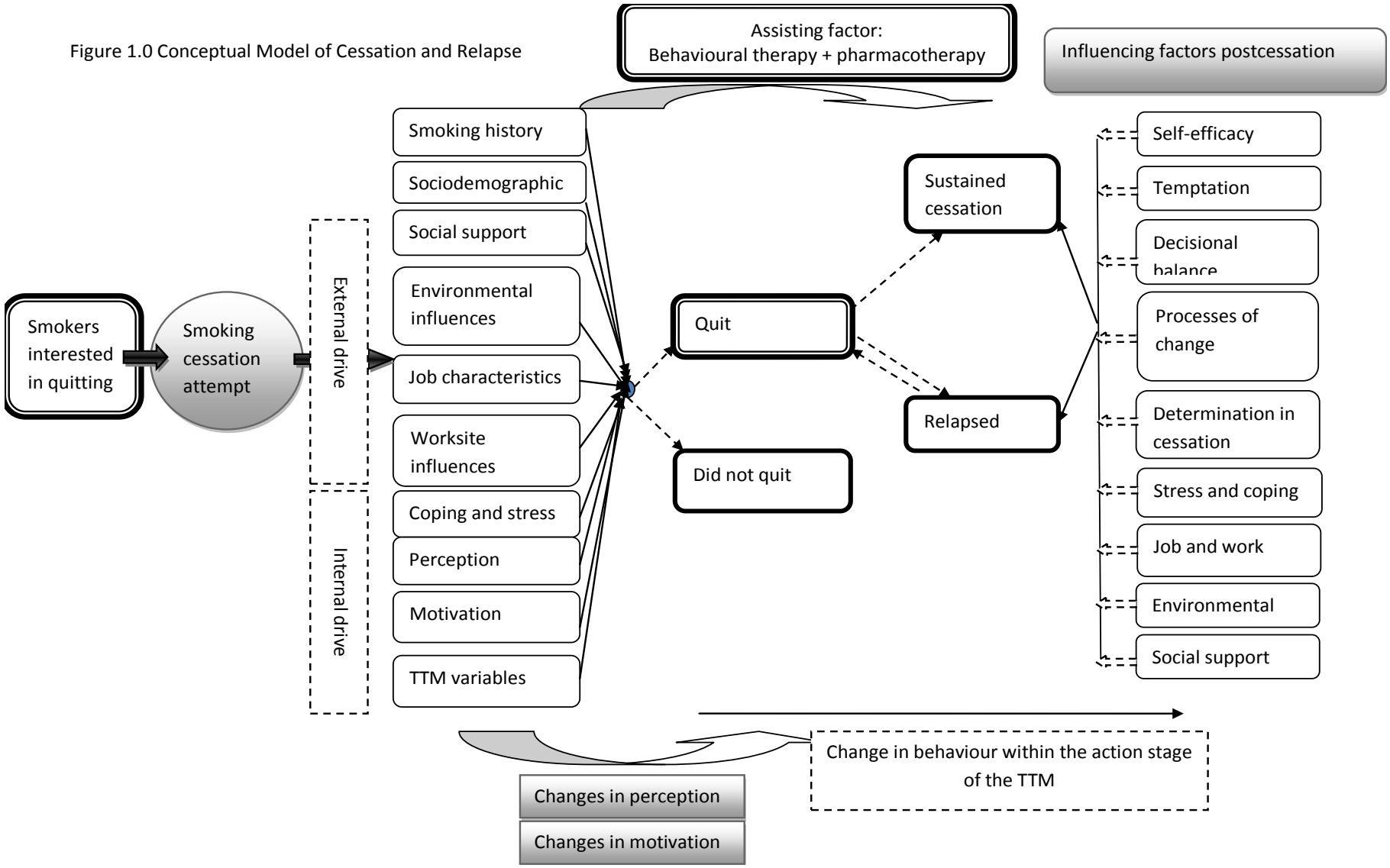
Many studies have identified factors that correlate with successful smoking cessation. However, few studies have looked specifically at relapse. The current study proposes that factors contributing to smoking cessation differ from those that influence relapse. Smokers must undergo the process of cessation, which may be influenced by both

internal and external factors. External factors could include social support, environmental influences, workplace support and job characteristics. Internal factors include coping and stress, perception, motivation and TTM variables.

In the present study, changes in perception and motivation are theorised to be a strong factor in predicting smoking cessation. Assisting factors, which are derived from the smoking cessation programme, are used as a baseline for every smoker in the current study. Intervening variables include the administration of nicotine replacement therapy and counselling sessions.

Smokers who successfully achieve a 24 h period of abstinence then progress to either maintaining cessation or relapsing within the next 6-month period (Fig. 1.0). Factors contributing toward either of these outcomes will be explored in this study.

Figure 1.0 Conceptual Model of Cessation and Relapse



1.6 Operational definitions

Table 1.1 Terms and definitions

Terms	*Definitions*
Smokers/ current smokers	Adults who smoked 100 cigarettes per day in their lifetime and currently smokes cigarette everyday (daily) (Schoenborn & Adams, 2010).
Quitters	Subjects were considered quitters/abstainers if at the time of the visit they reported not having smoked for at least 24 hours. This is based on self-reported status and diary confirmation (Van Zundert et al., 2009) and may or may not be confirmed by CO ppm measurement of < 6.
Never quit	A subject who never achieved abstinence for at least 24 hours from the quit date to the time of assessment.
Point prevalence smoking abstinence	Not smoking for the past seven days as reported by the ex-smoker and confirmed by a CO ppm measurement of < 6.
Sustained quitters/cessation	Subjects who stopped smoking since they first quit and never relapsed from the quit date to the time of assessment.
Non-sustained quitters	Subjects who stopped smoking for at least 24 hours but later relapsed.
Relapser/relapse	Subjects who reported resuming smoking (even a puff) after obtaining 24 hours of abstinence (Segan et al., 2006).
Stage of change	a) Precontemplation: has no intention to take action within the next 6 months b) Contemplation: intends to take action within the next 6 months c) Preparation: intends to take action within the next 30 days and has taken some behavioural steps in this direction.
Action stage of the Transtheoretical Model	The stage in which participants made adjustments to their lifestyle for a specific behavioural problem (in this case, smoking) within the past six months (Prochaska & Velicer, 1997). In identifying TTM factors related to relapse, this stage was defined from the point at which subjects achieved 24 hours of abstinence (Segan et al., 2006).
Compliance/ adherence to NRT	Consumed NRT for a minimum duration of 2 weeks.

1.7 Contributions of this thesis

The rationale behind conducting this study was to 1) understand the factors that are involved in smoking cessation and smoking relapse; 2) understand the psychological components of motivation and perception, and 3) examine the behavioural components that lead to smoking relapse. This research will assist in increasing cessation rates and prevent relapse among smokers, thus reducing the burden associated with diseases related to smoking.

This study has contributed in four main areas. The first part of this study examines the factors that are associated with smokers who relapsed. This population was analysed according to their length of time to relapse. These factors that are associated with relapse have important implications in clinical practice. The second major finding involves general, psychological and work-specific predictors of smoking cessation. In the next two sections, the psychological components leading to both quitting and relapse are discussed in greater detail. The third contribution was in researching the importance of the changes in both perception and motivation that may have occurred during a cessation attempt. The final contribution was in the use of the TTM in analysing the behavioural changes that lead to relapse at 0 months, 3 months and 6 months. Both of these two final sections contribute to a greater understanding of factors that may help health counsellors in motivating smokers to quit.

1.7.1 Time frame of smoking relapse and its associated factors

The data from this study were obtained from quit smoking clinic sessions after a standardised process of participant recruitment, administration of medication, counselling sessions and clinical follow up. The data used to determine relapse were collected from individual participants based on self-recorded diary entries and face-to face counselling sessions conducted by the investigator. This study is one of the first performed in a developing country or Southeast Asia that pinpoints the time periods that

are critical for follow-up. This study also advances our understanding of the factors that contribute to smoking relapse and how they change over time. Identifying the time to relapse and the factors correlated with relapse is vital for healthcare providers and public health physicians/health promoters in the development of an effective/optimal follow-up plan for any smoking cessation programme in the country. As for the relapse section, this investigation has resulted in a publication (Yasin, Moy, Retneswari, Isahak, & Koh, 2012) and was presented at international conferences (Yasin, Retneswari, Moy, & Koh, 2012a, 2012b).

1.7.2 Factors leading to a successful quit attempt

The second aspect of the current study focused on identifying factors related to a successful quit attempt. Although current literature has discussed a number of factors related to smoking cessation, many of these studies focused on Western societies and cessation programmes conducted in clinical settings. These studies rarely focused on workplace smoking cessation; in fact, studies on workplace smoking cessation programmes are rarely conducted, especially in developing countries.

The inclusion of moderating variables (e.g., coping and stress, environmental influence, social support and worksite environment) further enhanced the understanding of the effects of these factors on the outcomes of cessation. Job stressors were specifically included in the analysis because the relationship between job stress and smoking cessation remains inconclusive and is rarely studied.

This section on the relationship between moderating variables and smoking cessation resulted in two peer-reviewed indexed journal publication (Yasin, Retneswari, Moy, Darus, & Koh, 2012; Yasin, Retneswari, Moy, & Koh, 2011e), and conference proceedings (Yasin, Retneswari, Moy, Darus, & Koh, 2011; Yasin, Retneswari, Moy, & Koh, 2011d).

1.7.3 Perception and motivation and their relation to quitting and relapse

The next stage of the project involved analysing the behavioural components that lead to successful cessation or to relapse. The perception of smokers and their motivations were analysed separately. The changes in both perception and motivation were analysed against the participant's success in quitting. Thus far, only one recent publication has suggested that initial motivation is not vital for a successful quit attempt. However, that study was conducted in Western societies, and the results have not been replicated in other regions. In terms of perception, few previous studies have shown that perception is important in behavioural change, but unlike the current study, those studies were not conducted prospectively. This section, which has contributed to a better understanding and greater emphasis on the idea that perception in smokers is important in a cessation attempt, resulted in an indexed journal publication (Yasin, Retneswari, Moy, & Koh, 2011c) and conference proceedings (Yasin, Retneswari, Moy, & Koh, 2011a, 2011b). The section on motivation resulted in another indexed journal publication (Yasin, Retneswari, Moy, Koh, & Isahak, 2011b) and a conference proceeding (Yasin, Retneswari, Moy, Koh, & Isahak, 2011a).

1.7.4 The action stage of the Transtheoretical model and smoking relapse

The last section of this thesis explores the behavioural components of smoking relapse by applying the action stage of the TTM. There are two studies to date that have explored this relationship (Borland & Balmford, 2005; Segan et al., 2006). However, both studied callers to quitlines who were not on any medication, and there was no direct contact with participants. This study has shown that the TTM is universal in its use in smoking cessation and extends to smoking relapse in understanding the complexity of smoking behaviours. Therefore, it can be adapted for use in different populations and among smokers receiving pharmacotherapy and direct counselling. This

section resulted in a validation study, an indexed journal publication (Yasin, Taib, & Zaki, 2011) and a full paper journal submission.

Overall, the investigator hopes that this research will lead Malaysian policy makers to prioritise smoking as an important agenda in the same way that developed nations have. A larger budget should be dedicated to smoking cessation programmes, and greater incentive for further research on ways to implement more effective smoking cessation programmes and to prevent relapse must be considered. The current Quit Smoking Clinics available from the Ministry of Health are set up in primary care settings and receive referrals mainly from hospitals and outpatient clinics. Workplace programmes may also encourage other NGOs and workplaces to contribute to this tobacco control effort. Hopefully, the findings of this research will lead to a guideline for cessation attempts spanning from cessation to relapse that can be utilised by all healthcare providers.

1.8 Structure of thesis and conclusion

This dissertation is divided into five chapters. The present chapter has discussed the background, objectives, significance and the theoretical framework of the study and the hypotheses to be proved. Chapter two elaborates on the theoretical context of the research and includes an in-depth review of the literature, including the four main aspects of the thesis: smoking cessation, smoking relapse, motivation and perception and the Transtheoretical Model of smoking relapse. Chapter three describes the methodology employed, the analysis conducted and the evaluation of the process. Chapter four reports on the findings in detail. The fifth chapter critically analyses the findings and interpretations in relation to what is already known in the literature and new knowledge that has been generated from this research; this chapter also discusses the limitations and strength of this study. The final chapter draws conclusions and summarises the implications and recommendations of these results on current practice.

This conclusion chapter also highlights the areas that need to be expanded upon in future research.

In summary, the primary focus of this study was to identify factors correlated with smoking relapse and smoking cessation and to obtain a deeper understanding on the behavioural aspects involved in a cessation attempt. The behavioural aspects studied include perception, motivation and other components involved in relapse. The final focus of this study was to gain a greater understanding of the progression from the initial quit attempt to smoking cessation or eventual relapse with regard to Transtheoretical model.

2.0 Literature Review

2.1 Nicotine addiction and smoking cessation

2.1.1 Nicotine addiction

There are over 4000 chemicals in cigarette smoke, many of which may contribute to the reinforcing properties of tobacco. However, the most significant component that affects the physiology of the body is nicotine. It is this component that produces addiction to tobacco. Gaining a good understanding of the ways in which tobacco is associated with addiction and how it influences smoking behaviour is essential for smoking cessation programmes and intervention (Benowitz, 2008).

The terms drug "addiction" or "dependence" have been used interchangeably in the literature and in this thesis. These two terms are similar, as they have similar psychological and neurobiological processes. They indicate a loss of power over drug-taking characteristics/ behaviour, which is a principal factor of drug addiction. Drug addiction/ dependence has also been was also defined by the World Health Organisation (WHO) as "a behaviour pattern in which the use of a psychoactive drug is given a sharply higher priority over other behaviours that once had a significantly higher value." Put another way, the drug controls the behaviour that is considered damaging to the individual and to society (WORK, 1981).

Nicotine is a fast-acting substance that can arrive in the brain within seven seconds of inhalation. It stimulates the adrenal glands via its binding to the nicotinic acetylcholine receptors (nAChRs) (Dajas-Bailador & Wonnacott, 2004), resulting in the discharge of epinephrine, resulting in the "kick" felt by smokers. The interaction is proposed to cause the activation of the reward centers in the central nervous system (Yildiz, 2004). In the brain, nicotine causes dopamine release and decreases inhibitory (gamma amino butyric acid).

After repeated exposure to nicotine, neuro-adaptation to some of the effects of nicotine exists (Wang & Sun, 2005). Concurrent to this neuro-adaptation is the increase in the expression of nicotinic acetylcholine receptors (nAChRs). This desensitisation has a role in nicotine dependence and tolerance. As with other drugs of abuse, the subjective effects of nicotine may be critical to its reinforcement efficacy. The onset of regular smoking suggests that continuous or repeated exposure to nicotine gradually reduces its magnitude of effects. This reduced drug effects with increased drug exposure is called chronic tolerance. The onset of tolerance may lead to enhanced smoking intensity and greater amount by the smoker to continue to maintain similar magnitude of reinforcing effects of nicotine (Kenneth A Perkins et al., 1993).

Craving and withdrawal symptoms have been suggested to begin in chronic smokers when the previously desensitised α4 β2 nAChRs become unoccupied and then become responsive again after a short period of abstinence (e.g., during sleep) (Dani & Heinemann, 1996). Therefore, the nicotine binding and desensitisation of the receptors may increase cravings and withdrawals in these individuals. Studies have shown that the amount of cigarette smoking in daily smokers reached near-full saturation, and therefore, desensitisation of the nAChRs in the brain (Brody et al., 2006).

As such, to avoid withdrawal, smokers should maintain the α4 β2 nAChRs in the desensitised condition. In addition, another theory claimed that conditioned smoking cues (e.g., learned behaviours, such as pleasure from the taste and feel of smoke), a component of nicotine addiction behaviour, preserve smoking behaviour during the saturation and desensitisation of the nAChRs (Balfour, 2004). In actual situations, these two theories were intercorrelated: smokers may smoke to maintain their plasma nicotine levels to avoid withdrawal symptoms and also to obtain some psychologically advantageous effects as a result of conditioning (Balfour, 2004; Donny et al., 2003).

Nicotine withdrawal syndrome in humans may manifest between 1-10 weeks after smoking cessation. This syndrome arises as a result of the reduction of nicotine intake in nicotine-dependent individuals. The nicotine withdrawal symptoms consist of “physical” (or somatic) and affective components. The most common somatic symptoms include bradycardia, gastrointestinal discomfort, and increased appetite. Affective symptoms primarily include craving, depressed mood, dysphoria, anxiety, irritability and difficulty concentrating (Kenny & Markou, 2001). Thus, these factors explain the reasons why individuals have difficulty quitting smoking.

2.1.2 History of smoking cessation

Edward Lichtenstein (2002), a pioneer in smoking cessation efforts, suggested that his efforts started from a report from the Surgeon General in 1964 on smoking and health. This inspired him to conduct intervention and behaviour research and to review the available literature. He divided the era of smoking cessation into three eras/seasons: Season 1: Rapid smoking (1967-77); Season 2: Cognitive behavioural and social support (1978-85); and Season 3: Population-based interventions (Lichtenstein, 2002).

He and his fellow researchers initially focused on self-control intervention strategies in smoking cessation; however, these were found to be ineffective (Lichtenstein & Keutzer, 1969). Later, he studied psychological techniques (e.g., in rapid smoking, smokers are required to take a puff every few seconds as a way to make smoking unpleasant), which were more efficacious (Lichtenstein, Harris, Birchler, Wahl, & Schmahl, 1973). Nevertheless, research in the area was later found to have some limitations, which included inadequate sample size and limited outcomes (e.g., smoking reduction alone), and the interventions themselves were rather stressful and risky (Hajek & Stead, 2004).

Season 2, which focused on small-group interventions, self-efficacy and social support, took place from 1978-1986. It was initiated by Rick Brown from Oregon in the United States, who introduced a nicotine-fading procedure in small-group interventions that replaced rapid smoking (Foxx & Brown, 1979). Later, Mark Condiette applied the self-efficacy concept to smoking cessation (Condiotte & Lichtenstein, 1981), which was followed by other studies that evaluated the role of self-efficacy in smoking cessation (Baer, Holt, & Lichtenstein, 1986). Subsequently, the concept of social support came into popularity, in which spouses and partners were trained to become more facilitative in assisting smokers in quitting. Studies found that the ratios of positive and negative support roles were associated with higher quitting rates (Coppotelli & Orleans, 1985),

but intervention results were disappointing (Lichtenstein, Glasgow, & Abrams, 1986). Adding the component of partner support to the cessation package resulted in non-significant improvements in success rates. Nevertheless, recent evidence has shown that using social or partner support to facilitate quitting produces positive outcomes (Fiore, 2000; Johnson et al., 2008). To enhance such social support for quitting rates, it is essential to identify potential mediators, as the relationship between social support and quitting is influenced by other factors, such as culture, smoking restrictions and advertising. Social support, however, may also be in the forms of a quit line (phone call quit assistance), individual behavioural counselling and group therapy. These types of treatments provide sources of high levels of emotional, educational and instrumental support, although they are not explicitly called social support interventions (Westmaas, Bontemps-Jones, & Bauer, 2010).

In the Season 3, (from 1986 onwards), studies started to focus on population-based interventions (Lichtenstein, 2002), in which researchers started to develop and implement smoking prevention programmes (Biglan et al., 1987) and workplace cessation programmes (Glasgow, Klesges, Godding, Vasey, & O'Neill, 1984). Rather than being confined to clinical/hospital-based interventions, these efforts have shifted their focus to reaching smokers in real-world settings by attempting to deliver interventions to the most smokers in a chosen population. Many studies subsequently demonstrated significant quitting rates via brief interventions in healthcare and non-healthcare settings. The Clinical Practice Guidelines summarised this research as meta-analyses and derived various recommendations for future smoking cessation (Fiore, 2000, 2008b).

2.1.3 Recommended smoking cessation treatment

Many meta-analyses have been conducted to identify the most effective treatments for smoking cessation. These include the Fiore US Agency for Healthcare Policy and

Research, the Cochrane databases, the National Institute for Clinical Excellence (NICE) and several others (Anderson, Jorenby, Scott, & Fiore, 2002; Fiore, 2008a; NICE, 2002; Stead, Perera, Bullen, Mant, & Lancaster, 2008; R. West, McNeill, & Raw, 2000). In this subsection, the investigator discussed recommended support modes and pharmacological therapies that are currently available based on these meta-analyses and other individual studies.

2.1.3.1 Different support modes for smoking cessation

Support modes for smoking cessation begin with the smallest impact intervention: i.e., self-help materials. Self-help materials, which consist of pamphlets and booklets delivered to patients to assist them in quitting, resulted in a minimal impact on the cessation rate. A meta-analysis of 11 trials showed that there was a pooled effect [OR: 1.24; 95% CI: 1.07-1.45] (Lancaster & Stead, 2005b). The effect only achieved a small statistically significant difference when compared to no intervention. However, when self-help materials was tailored to the individual smoker and was made easily accessible (i.e., computer-generated), the results were significantly higher compared to non-tailored self-help materials sent by mail (12.2% vs. 9.0%, respectively) (Sutton & Gilbert, 2007). This may suggest that self-help materials may be much more helpful if they are tailored to individual needs. This is because tailored materials are designed to cover specific sources/ information for individual smokers based on their smoking history and quitting concerns.

Telephone counselling can be utilised as an adjunct to face-to face counselling or can serve as its substitute; it is useful in self-help intervention. Quitline, a national toll-free line adapted by many countries to provide telephone counselling for smokers, produced a promising outcome compared to minimal or no counselling [OR: 1.6; 95%CI: 1.4-1.8] (Fiore, 2008a). In reactive counselling, the helpline takes calls from smokers who are willing to quit. Meta-analysis reveals a small effect for this

intervention (Stead, Perera, & Lancaster, 2006). Nevertheless, later researchers suggested that reactive telephone counselling may be inadequate, as it relies on the motivation of the smoker to initiate the calls, and it is used infrequently (Sood et al., 2009). The researchers recommended introducing call-back or proactive counselling, which requires the counsellors/ health professionals to call the smokers back after their initial contact according to a schedule properly tailored to the individual needs of the smoker. These include paying particular attention during the initial quitting process and taking into account the peak periods for smoking relapse (Sood et al., 2009). A review revealed that proactive counselling was the most cost-effective intervention for smoking cessation and that it was found to increase the effectiveness of pharmacotherapy use with a low additional cost (Shearer & Shanahan, 2006). Despite its effectiveness, the utilisation rate of quit lines remains low (e.g., 1% in the US) (Cummins, Bailey, Campbell, Koon-Kirby, & Zhu, 2007).

Simple advice on smoking cessation given by either general practitioners or nurses has led to significant but small improvements in the odds of quitting (Chan et al., 2005; Lancaster & Stead, 2005a; Rice & Stead, 2008). This corresponds to 2.5% of the absolute difference in the cessation rate among smokers who received medical advice compared to those who did not (Table 2.1).

Table 2.1 Absolute difference in smoking cessation rate compared to no interventions

Type of interventions	*Absolute difference in quit rate*
Self- help materials	1%
GPs short advice	2%
Proactive telephone counselling	2%
Intensive Behaviour therapy	7%
Bupropion SR	9%
Nicotine products	5-15%
Behaviour therapy & NRT/bupropion	13-19%
Behavior therapy & varenicline	22-23%

(Jorenby et al., 2006; Tonstad et al., 2006)

With regards to the intensity of the counselling and support, studies have shown that even a short duration of less than 3 minutes of counselling is effective (Fiore, 2008a). Nevertheless, there is a dose-response relationship between the time utilised in each session and the number of sessions attended. That is, the more sessions there are, the more the effective they are (Fiore, 2008a). Additionally, the counselling session is most effective when tailored according to individual needs and when combined with encouragement and support (Fiore, 2008a).

Group therapy, however, has shown superiority over no intervention (OR: 2.17; 95%CI: 1.37-3.45) and over self-help materials alone (OR: 2.04; 95% CI: 1.60-2.60) but has not been shown to be more effective than individual counselling (Lancaster & Stead, 2005a, 2005b). Furthermore, there is still a lack of evidence regarding whether group counselling is more cost-effective than intensive individual counselling (Stead & Lancaster, 2005).

From the meta-analyses and studies, it is important to note that smoking cessation counselling can be delivered by single or multiple clinicians or other

healthcare professionals (i.e., nurses, pharmacists, dentists and physicians) as long as there is prerequisite training in smoking cessation counselling. Thus, it is not necessary for counsellors or psychologists to deliver the behaviour counselling therapy. These meta-analyses and studies also conclude that combining both pharmacotherapy and counselling is more effective than employing either one alone (Fiore, 2008a). Nevertheless, additional variations in the modes of treatment exist. This fact may assist health professionals in deciding the most effective evidence-based methods that may suit their target group, according to their adequacy of manpower and financial capacity.

2.1.3.2 Nicotine replacement therapy and other pharmacological treatments

The rationale behind the use of pharmacological therapies is that, once a person quits smoking, the drug reduces the withdrawal symptoms in the early months, thus allowing the ex-smoker to cope with the psychological and behavioural aspects of addiction and smoking. Nicotine replacement therapy (NRT), bupropion SR and varenicline are the first-line recommended drug therapies for smoking cessation, while older agents, such as nortriptyline and clonidine, though effective, are second-line therapies. This is due to their unwanted side effects (Fiore, 2008a; NICE, 2002).

Nicotine replacement therapy (NRT)

The oldest and most highly documented are the NRT products. The nicotine of these products replaces, to some degree, the nicotine from cigarettes in a safe form to help smokers quit smoking. The NRT products are available as sublingual tablets, nasal spray, gum, inhalator, mouthspray and skin patches. They are safe and are ideally used for 6-12 weeks, as smokers often gradually reduce them with the advice of a physician when there is a decrease in withdrawal symptoms (Tønnesen, 2009).

A large study found that there is no difference in cessation rate when NRT is used for 3 months or 6 months (Tonnesen et al., 1999). Furthermore, using NRT for one day was predicted to be 16.8 times more effective in producing one full day of

abstinence than not using NRT (Amodei & Lamb, 2010). Results from a Cochrane analysis reported that 39,503 smokers from 103 trials found that the use of NRT nearly doubled the long-period abstinence from 6 to 12 months (Stead et al., 2008) (Table 2.2). Even without support, over-the-counter NRT has been shown to yield modestly significant cessation rates (Hughes et al., 2003).

Table 2.2 Cochrane meta-analyses of smoking cessation after 6 months to 1 year with Nicotine Replacement Therapy (NRT), veranicline and bupropion SR vs placebo

Types of treatment	*No. of studies*	*OR (95% CI)*
NRT[a] vs. placebo	108	1.73 (1.62; 1.85)
Varenicline vs placebo	5	3.22 (2.43; 4.27)
Bupropion SR vs placebo	16	1.97 (1.67; 2.34)

[a] Nicotine patch, gums, inhaler, nasal spray, sublingual tablet
(K. Cahill, Stead, & Lancaster, 2008; Hughes, Stead, & Lancaster, 2007; Stead et al., 2008)

In Malaysia, nicotine patches and chewing gum are available on the market. In the US, other NRT products, such as nasal spray and mouth wash, are also available (Grable & Ternullo, 2003). Patches may be found in the Malaysian market in three different dosages of 7, 14 and 21 mg/ unit; each individual pack contains seven units. These patches will maintain nicotine levels in the blood for 16 to 24 hours; thus, they should be replaced daily (DeGraff Jr, 2002).

Chewing gum comes in two dosages: 2 mg and 4 mg. Gums should be slowly chewed until mouth numbness occurs or a tobacco taste is perceived. Then, the patient should stop chewing and should hold the gum between the cheek and the teeth until the numbness subsides and then resume chewing for the next 30 minutes (Balbani & Montovani, 2005). Although nicotine patch has been shown by the Cochrane systematic review to be more effective than nicotine gums, with pooled relative risk for each type

were 1.43 (95% CI: 1.33 to 1.53) for nicotine gum; 1.66 (95% CI: 1.53 to 1.81) for nicotine patch (Stead et al., 2008); the gums are much cheaper in the market. In addition, the review concluded that the effects were largely independent of the duration of therapy, the intensity of additional support provided or the setting in which the NRT was offered (Stead et al., 2008).

The recommended treatment period by drug manufacturers for NRT is three months. The normal mean for NRT use in practice is approximately eight weeks (DeGraff Jr, 2002). Furthermore, some smokers used it for an even shorter duration. In Switzerland for instance, after a month, only 74% of 848 smokers were still using NRT gums, 9% were using it ocassionally and 17% had stopped using it completely (Etter, 2009). In contrast, in US national samples, 5 to 6% of gum users, used it for more than recommended duration of three months (Shiffman, Hughes, Di Marino, & Sweeney, 2003), and in the United Kingdom, 9% smokers in smoking cessation clinics used it for over a year (Hajek, McRobbie, & Gillison, 2007). Nonetheless, NRT is generally safe, as long-term use is not associated with harmful effects (Fiore, 2008a), and may be beneficial to prevent late relapse (Etter, 2009). It is however, not recommended in individuals less than 18 years of age and those with severe cardiovascular diseases (i.e., an acute myocardial infarction that occurred within the previous two weeks and unstable angina). NRT use in nicotine- dependent pregnancy and breastfeeding is possible; treatment risks and benefits should be assessed (Molyneux, 2004).

It is advised that patients should stop smoking once NRT commences. The most common side effects of NRT include: hiccups, nausea and headache (Molyneux, 2004). The main adverse effect related particularly to the gums is a rash on the oral mucosa and skin irritation for the patch (Molyneux, 2004). In a sample of 1,219 adult (+18 years) from four different countries; Canada, United Kingdom, US and Australia, 69% of the smokers discontinued NRT prematurely. Development of side effects (18%),

believing that the medication was no longer necessary (17%) and relapse back to smoking (42%) were the most common reasons reported (Balmford, Borland, Hammond, & Cummings, 2011). In addition, those who completed NRT treatment had higher percentages of 6-month quitting success compared to those who discontinued prematurely (38% vs. 16%). Nonetheless, 65% of smokers who discontinued NRT because believing that the medication had worked, were reported abstinent (Balmford et al., 2011).

Varenicline

Varenicline acts by binding to the α4β2 nicotine receptors in the brain as an agonist with some antagonist functions. Thus, varenicline mimics the effect of nicotine but prevents the pleasure that comes from smoking by preventing the binding of nicotine to the receptor. When comparing varenicline 1 mg twice daily with bupropion SR 150 mg versus placebo for 3 months in 2 studies (n = 1025, n = 1027), the quit rates after 1 year were: 22% and 23% for varenicline; 16.1% and 15% for bupropion SR; and 8.4% and 10.3% for placebo (Tønnesen, 2009). In the latest Cochrane Systematic Review, the pooled RR for veranicline versus bupropion at 1 year was 1.52 (95% CI: 1.22 to 1.88). The RR for veranicline versus NRT for point abstinence at 24 weeks was 1.13 (95% CI: 0.94 to 1.35) (Kate Cahill, Stead, & Lancaster, 2012). The major side effects of the drug are nausea (28% of subjects) and vivid dreams (10% of subjects) (Tønnesen, 2009).

Furthermore, there were reports of depression and suicidal ideation post-marketing with the use of varenicline. The Food and Drug Administration (FDA) has published warnings of the effects of this product to consumers and doctors. This has become part of the product information, as a causal relationship between varenicline and depression cannot be ruled out (Tønnesen, 2009).

Bupropion SR (Zyban)

Bupropion is an antidepressant drug that has an inhibitory effect on dopamine and noradrenaline uptake and possibly has a direct effect on nicotine receptors. Nevertheless, the exact mechanism behind this has yet to be determined (Tønnesen, 2009). Bupropion, when combined with behaviour therapy for 7-12 weeks, produced a 1-year quit rate of 18-25% for bupropion vs. 10% for placebo (Hurt et al., 1997; Tønnesen et al., 2003).

A meta-analysis involving 16 studies reported a 1.97 odds ratio (95% CI: 1.7-2.3) for a 1-year success rate compared to placebo (Hughes et al., 2007). Thus, NRT and bupropion seem to have almost similar effectiveness in facilitating smoking cessation (Table 2.2). However, the use of bupropion produces severe adverse effects, including insomnia (42%) and dry mouth (11%). This led to the discontinuation of treatment in 10-12% of individuals (Tønnesen et al., 2003). In summary, bupropion is as effective as NRT in the treatment of smoking cessation, but it produces severe adverse effects, which limits its use among the general population.

Other therapies

Other therapies that are frequently used include acupuncture and hypnosis, cue exposures and negative effects (i.e., trying to expose smokers to smoking cues, but not allowing the smoker to smoke). Nevertheless, evidence found no such effectiveness for these therapies compared to placebo (Barnes et al., 2010; White, Rampes, Liu, Stead, & Campbell, 2011). Another therapy, aversion therapy (i.e., replacing the pleasure effect of smoking with an unpleasant stimulus), such as rapid smoking, may have been recently shown to be effective, but the unpleasant nature of this treatment makes it less preferable (Hajek & Stead, 2004).

Lastly, the use of exercise as a moderating effect for smoking cessation has been used as an intervention to protect from smoking relapse. However, recent findings

suggest the evidence is insufficient to support its effectiveness (Ussher, West, Taylor, & McEwen, 2008). Therefore, to ascertain the effectiveness of these additional therapies for smoking cessation, more research with larger sample sizes, adequately intense interventions and equally controlled conditions are required.

2.1.3.3 Confirmation of quit status by exhaled CO ppm

Self-reporting provides an accurate measure of whether someone smokes or not, although 20% of cases tend to underreport as social acceptibility reduces (Martínez, Reid, Jiang, Einspahr, & Alberts, 2004). Hence, many objective methods are being used to distinguish smokers from non-smokers, such as measuring nicotine, cotinine, or thiocyanate levels in the blood, saliva, or urine. These methods are invasive and time-consuming (Javors, Hatch, & Lamb, 2011). Breath carbon monoxide (CO) is non-invasive, inexpensive, and the most widely utilised measurement tool of smoking status in research and clinical settings (Javors et al., 2011).

Breath CO accumulates during inhalation of carbon monoxide due to incomplete burning of tobacco while smoking. The main advantages of using breath CO to indicate recent smoking are that it can be quickly measured with immediate results and the results are not influenced by the use of NRT or its smokeless preparation. The disadvantages of breath CO are its interference with CO environmental exposure (Benowitz et al., 2002), and its short half-life (2-6 hours), which only allows for smoking detection within the past 8-24 hours (Jatlow, Toll, Leary, Krishnan-Sarin, & O'Malley, 2008). Nonetheless, a recent study proved that the use of breath CO in combination with plasma or saliva cotinine can extend the detection period of smoking to the previous few days (Javors et al., 2011).

The exhaled CO level has been shown to be well correlated with blood carboxyhaemoglobin (Wald, Idle, Boreham, & Bailey, 1981) and has been reported to be highly correlated with smoking status. Measuring exhaled CO using a portable CO

analyser is a non-invasive method that has been well adapted to assess individual smoking status (Javors et al., 2011).

Various definitions have been used to define smoking status based on the CO ppm reading. One study found that a definite indication of smoking is a CO ppm level of 11 and more. The study also defined a definite non-smoker as a person with a CO ppm level between 0 and 5, whereas levels of 6-10 may indicate a light smoker (Groman, Bernhard, Blauensteiner, & Kunze, 1999). In another study, a CO level < 8 is confirmed as smoking cessation (Oncken, Cooney, Feinn, Lando, & Kranzler, 2007).

In Taiwan, when mean exhaled CO ppm was measured against the number of cigarettes smoked per day in a workplace smoking cessation programme, a CO reading > 6 ppm suggested that the individual is a smoker with a specificity and sensitivity of 85% and 84%, respectively; there was a good correlation between CO level and self-reported daily smoking (Hung, Lin, Wang, & Chan, 2006). These findings are supported by the work of Middleton and Morice, who also showed that CO ppm measurement detected 94% of smokers and 96% of non-smokers in an outpatient respiratory clinic , when the cut-off point was set at 6 ppm (Middleton & Morice, 2000).

These studies demonstrated that there is actually no standard level of confirmation for a non-smoker. Studies interpret the confirmation of smoking status differently depending on operational definitions. However, a high cut-off point may reduce the sensitivity of CO monitoring (Hung et al., 2006) and may misclassify smokers and non-smokers.

2.2 Smoking relapse

2.2.1 Smoking relapse and interventions to reduce relapse

Relapse is the most challenging problem encountered by clinicians and researchers in the topic of addiction (Piasecki, 2006). It has been reported by repeated studies in the United States (US) that the rate of relapse within one year after a quit attempt ranged

from 70 to 90% (Hughes, Goldstein, Hurt, & Shiffman, 1999; Osler, Prescott, Godtfredsen, Hein, & Schnohr, 1999). Smokers who continuously failed to maintain longer than a two-week abstinence after a designated quit date (Swan, Ward, Carm Elli, & Jack, 1993) and the majority of smokers that experienced early initial lapse eventually progressed to full-blown relapse (Shiffman, Paty, Gnys, Kassel, & Hickcox, 1996).

A recent systematic review found that smoking cessation treatments may be effective at preventing smoking relapse when used by abstinent smokers who have recently quit. Self help materials appeared to be effective in preventing relapse at long term follow-up in initially unaided quitters (pooled OR 1.52; 95% CI: 1.15 to 2.01). Other behavioural interventions e.g. telephone counselling, individual and group counselling, appeared effective in preventing relapse in the short tem only. Results for pharmacotherapies showed that bupropion was effective for long term follow-up, while, nicotine replacement therapy was effective for both medium term and long term follow-ups (Agboola, McNeill, Coleman, & Leonardi Bee, 2010). Single trial of extended treatment for varenicline also revealed the effectiveness of its use in short term and medium term follow-ups (Tonstad et al., 2006). Later research in relapse prevention in the UK revealed that Bupropoin resulted in an incremental of 0.07 Quality Adjusted Life Years (QALYs) with a cost saving of EURO 68. Likewise, NRT and veranicline both caused incremental QALYs of 0.04 at a cost of EURO 12 and EURO 90 respectively (Taylor, Leonardi-Bee, Agboola, McNeill, & Coleman, 2011).

Although there is no previous data available on relapse in Malaysia, the rate of relapse identified in Western studies may explain the reason behind the high percentage of Malaysian males (49%) who are still current smokers in 2006 (Zarihah et al., 2007). This is in spite of various efforts put forth by the Malaysian government to set up smoking cessation services, provide free pharmacological treatment and conduct health

promotion activities. Malaysia may also conduct further research in testing the effectiveness of various behanvioural and pharmacological treatment in preventing relapse.

2.2.2 Relapse timing

Survival curves from smoking cessation trials have shown that the majority of relapse cases occur during the first five to ten days after an attempt. It was thus concluded that the initial 5-10 days act as a window period prior to achieving long-term abstinence. After this critical period, relapse curves of the control and treatment groups became parallel in intervention studies (Hays et al., 2001; Shiffman, Ferguson, & Gwaltney, 2006). However, other evidence may contradict these findings. A study by Yong Cui and associates (Cui, Wen, Moriarty, & Levine, 2006) in the US claimed that the grace period was within the first 30 days of cessation. A recent review paper reported that the maximum number of people who relapsed occurred within 70 days and reached nearly zero incidences after 100 days (Kirshenbaum, Olsen, & Bickel, 2009).

Treatment for nicotine addiction has previously yielded low success rates. The importance in predicting individual characteristics that lead to relapse will enable health practitioners to match individuals that are suitable for a more intensive intervention, thus making the most of our scarce healthcare resources. As yet, there are no published studies in Malaysia that identify factors that lead to relapse. However, studies from overseas may give clues of factors that might affect this study population.

2.2.3 Risk factors for smoking relapse

A group therapy session consisting of cognitive and pharmacological treatment among US veterans identified 6 risk factors related to smoking relapse at 6 months. Individuals who had a household income higher than $30,000 per year, were 18 years old or older at the time of smoking initiation, or attended the programme 3 or more times had a lower risk of relapse. In contrast, those with many smoking co-workers (HR= 2.74, 95% CI

1.42-5.28), who were younger (< 55 years old) (HR= 1.65, 95% CI= 0.99-2.77) and who had a history of schizophrenia (HR= 2.13, 95% CI= 0.97-3.80) were more likely to relapse. Upon examining the process of relapse, the relapse rate at the end of 6 months was 68.2%. Fifty per cent of relapse occurred within the 1st 4 weeks, and the vast majority of relapse (91.2%) occurred during the 1st 3-4 months (Cui et al., 2006).

Another large community-based longitudinal cohort study in the US involving 1143 former smokers surveyed at both the baseline and again 4 years later revealed a host of variables that may predict relapse 4 years after quitting. These variables included age, smokeless tobacco use, being bothered by smoke at work, having the confidence to be a non-smoker and self-related health. However, after adjusting for the baseline duration of abstinence, workplace, treatment and the interaction of predictor variables with the baseline duration of abstinence, there were no significant main effects for any of the predictor variables except for marital status. Being married was significantly associated with less relapse or sustained abstinence (Wetter et al., 2004). The process of relapse is determined by multiple factors. In turn, these factors interacted in a non-linear manner to reach to a relapse event (Hufford, Witkiewitz, Shields, Kodya, & Caruso, 2003; Marlatt & Witkiewitz, 2005). The understanding of relapse requires an understanding of not only the aetiology of relapse but also the influence of the episodes on various proximal and distal cues to smoking.

Proximal cues include lighting a cigarette and seeing others smoke, whereas distal cues could include the working environment where people are exposed to smokers (Conklin, Robin, Perkins, Salkeld, & McClernon, 2008; McKay, Franklin, Patapis, & Lynch, 2006). A study by Piper and associates, which used decision tree analysis, suggested that the risk of relapse is affected by interactions of various risk factors (Piper, Loh, Smith, Japuntich, & Baker, 2011). Cui and associates (2006) found that

relapse was higher among those who attended fewer smoking cessation sessions and in those with many smoking colleagues or a history of schizophrenia.

With regards to workplace environment, to date, very few studies examined this issue. The latest systematic reviews (Albertsen, Borg, & Oldenburg, 2006; Mermelstein, Cohen, Lichtenstein, Baer, & Kamarck, 1986; Wewers & Ahijevych, 1991) have categorised the workplace environment into three components. First, smoking relapse is associated with work demand, such as an increase in workload, high responsibility for the work of others, working long hours, role ambiguity and conflicts in roles played (Wewers & Ahijevych, 1991). Second, it was related to low participation in decision-making but sufficient skill utilisation (Wewers & Ahijevych, 1991). Third, relapse was related to social support. After 12-month cessation, smoking relapse was predicted by the presence of smoking co-workers (Wewers & Ahijevych, 1991). However, relapse in less than six months was predicted by low general social support at work but not by the presence of other smoking co-workers (Mermelstein et al., 1986). Although the studies involved in this systematic review were of high quality and also of good methodological quality, there is still a necessity for intervention studies in which changes in the work environment can be easily observed alone or in combination with health promotion efforts.

A later study among nurses reported that another important determinant of smoking relapse was a poor social climate with frequent exposure to violence and threats at the workplace (Eriksen, 2006). This may emphasise the importance of the psychosocial workplace environment in influencing smoking relapse. Furthermore, it may point to the notion that different work environments may give rise to different risk factors for smoking relapse and should not be generalised. Therefore, health services in workplaces should put extra effort into creating a relaxed, balanced, trustful and

supportive social climate in the work unit to ensure ex-smokers can maintain their quit status.

Various other psychological and treatment factors influence progression from the initial lapse episode (a short quit episode) to full-blown relapse. For instance, withdrawal syndrome (which predominantly consists of negative affects; namely, sadness, anxiety, irritability and frustration) has been viewed as an important factor for relapse (Hughes et al., 1984). However, clinical studies have reported little evidence that development of withdrawal symptom is a good predictor of relapse. This is because relapse may be masked by various other factors, such as pharmacological treatment, behaviour treatment and environmental factors (Piasecki, 2006).

Another important psychological factor of smoking relapse is cravings (Piasecki, 2006). Historically, urges or cravings have been considered part of the smoking withdrawal syndrome. However, theorists sometimes consider these factors separately. These studies tend to categorise urges as more directly tied to the motivational system than are the other withdrawal effects (Baker, Brandon, & Chassin, 2004; Shiffman, 2000). In addition, cravings can also be described as episodic but responsive to environmental stimuli and pharmacological treatment (Piasecki, 2006). Despite the reduction in the frequency of cravings after a period of abstinence, they can be permanent for some smokers. In one study, 52% of smokers still reported occasional craving episodes even after 4-5 years of abstinence (D. M. Daughton et al., 1999).

These studies have contributed to the increasing new perspectives on the risk factors that are involved in the process of relapse. However, the complexity of the relapse process may differ across populations and subpopulations, and no isolated metric can ideally explain the entire process (Piasecki et al., 2002). A better understanding of the factors that influence the rate of relapse and the dynamics of

relapse among Asian populations and in the region could invite opportunities for future interventions and improved cessation services.

2.3 Factors that contribute to smoking cessation

Individual and clinic-based predictors of success have been examined in the West. Success in quitting is associated with a younger age of smoking initiation (Breslau & Peterson, 1996) and a history of previous quit attempts (Etter, 2004; Murray et al., 2000; Zhu, Sun, Billings, Choi, & Malarcher, 1999). However, predictors of success have been mainly focused on attendees to cessation clinics and self-supported efforts, with very few concentrating on programmes conducted in workplaces, especially in university settings. Results may differ, as smokers attending such programmes tend to be less-motivated smokers (Tanaka et al., 2006). Hence, identification of individual characteristics that predict success in a workplace smoking cessation effort in this region is important, as this could help match smokers with a workplace strategy that is more likely to help them quit. It may also be useful to identify smokers who might need more intensive treatment (who would then require referral to specialist centres) to make the most of the healthcare resources.

There are several predictors that were identified from previous literature in the area of smoking cessation. These predictors can be grouped into the following sections: nicotine dependence, demographic and smoking history (e.g., gender, age, past quit attempts), psychological and physiopathological factors (e.g., stress, depression, anxiety), social and environmental influences (e.g., environmental tobacco smoke, family support, motivation) and work environment (e.g., job stress).

2.3.1 Nicotine dependence and tobacco consumption

The severity of nicotine addiction has been an important determinant of successful cessation in trials with bupropion, in nicotine replacement therapy (NRT)-related

studies and in studies without pharmacotherapy (Boutou et al., 2008; Caponnetto & Polosa, 2008).

The Fagerstrom Test of Nicotine Dependence (FTND) (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) has been widely used in assessing the severity of nicotine dependence. This is a 6-item straightforward questionnaire that can be easily administered within a few minutes. Results are expressed as scores that range from 0-10, with the highest score being the highest level of nicotine addiction. Normally, FTND scores of ≥ 7 indicate severe nicotine dependence (Heatherton et al., 1991). A high FTND score is typically used as a guide to categorise smokers who require higher doses of pharmacotherapy (Gwaltney, Shiffman, & Sayette, 2005). However, evidence linking FTND and smoking cessation produced mixed results. While some studies strongly linked low FTND scores with cessation (Boutou et al., 2008; Myung et al., 2008), regional studies among Chinese smokers (Abdullah, Lam, Chan, & Hedley, 2006) and Malaysian smokers found no such associations (Wee, West, Bulgiba, & Shahab, 2011).

In addition to the FTND scores, another way of measuring the degree of addiction would be the number of cigarettes smoked. In a Korean study involving participants calling the quitline over seven sessions conducted in one month, smokers who previously smoked $\leq$20 cigarettes per day had a higher likelihood of quitting compared to those who smoked 21 or more cigarettes a day (Myung et al., 2008). A local study in smoking cessation clinics found that smoking < 15 cigarettes per day is a predictor of success (Ezat, Selahuddeen, Aljunid, & Zarihah, 2008). Nevertheless, although many such studies agreed that a lower cigarette consumption number is associated with higher quitting success, the predictive value of cigarette consumption has been considered a weak marker of dependence (Sun HQ et al., 2009; Yang,

Abdullah, Mustafa, Chen, & Feng, 2009) or was not at all correlated (Sperber, Goren-Lerer, Peleg, & Friger, 2000) in these other studies.

With all of the above evidence, nicotine dependence as an addictive component in cigarettes does not necessarily determine success in smoking cessation, as quitting involves many other factors under consideration. This issue shall be discussed in subsequent sections.

2.3.2 Treatment adherence and counselling sessions

Adherence to treatment and number of counselling sessions

Another factor that is related to success in quitting is adherence to treatment. To date, few studies have examined this factor. A study in Hong Kong revealed that smokers who were adherent to NRT while attending a smoking cessation clinic showed greater quit outcomes (40%) compared to those who were non-adherent (20%) over a 12-month follow-up ($p < 0.001$). However, significant predictors of adherence include older age, being male and educated, and having previous experience with NRT. In addition, the adherent smokers also tend to perceive quitting as a more difficult task and also have greater willingness to pay for the cessation services (Lam, Abdullah, Chan, & Hedley, 2005). The study suggests that smokers who are less likely to pay for cessation services may require intensive intervention that will benefit the greatest number of people for the smallest price. Similar findings were previously reported regarding the relationship between adherence to treatment and smoking reduction or cessation (Alterman, Gariti, Cook, & Cnaan, 1999; Fornai et al., 2001).

A later study among a smaller group of the Chinese population concluded that adherence to NRT for at least four weeks is a significant predictor of success. However, the study also found that not reporting any withdrawal symptoms is highly correlated with both success and adherence (Abdullah et al., 2006). It can be presumed that smokers who are non-adherent to pharmacotherapy may experience greater withdrawal

symptoms, which lead them to continue smoking or to relapse. Moreover, abrupt cessation was suggested to be highly correlated with the development of withdrawal symptoms, such as negative affect (i.e., irritability, sadness, anxiety, and changes in appetite, heart rate and sleep quality) (Piasecki, 2006), which further enhance the difficulty in maintaining smoking abstinence without medication.

Besides pharmacotherapy, behaviour therapy is an important adjunct to a successful quit attempt (Fiore, 2008a), as it helps to guide and boost the motivation to initiate and maintain cessation. Studies have shown that smokers who attended more smoking cessation sessions have a greater likelihood of quitting. For example, from the results of their study, Nollen et al. proposed that advice-oriented and regularly conducted directive counselling (i.e., approximately six times within six months) may facilitate success (Nollen et al., 2006). In addition, a local study performed in a smoking cessation clinic concluded that attending at least four sessions and allowing each counselling session to last at least 30 minutes will boost the effectiveness of the session (Ezat et al., 2008). However, some patients express their inability to spend time off work to commit to such smoking cessation sessions (Blumenthal, 2007) and thus failed to commit subsequent sessions. Other reasons for dropout include lack of interest in continuing the programme after failing to quit smoking (Blumenthal, 2007).

Studies among 6322 smokers calling the quit line suggested that decreasing the contact time and frequency of counselling yielded similar effectiveness compared to multiple sessions with boosters. The short sessions were between 15 to 25 minutes, and the standard protocol, which lasted 50-70 minutes for each session, yielded non-significant quit rates (Rabius, Pike, Hunter, Wiatrek, & McAlister, 2007). The result that a different protocol yielded a similar outcome might be because the counselling sessions contained similar essential elements required to motivate and educate patients

to quit. In this regard, it might be useful to schedule fewer appointments but that concentrate on effective sessions.

2.3.3 Sociodemography and smoking history

Age

Smokers who started smoking early were associated with greater cigarette consumption, longer smoking duration and increased nicotine dependence (Breslau, Fenn, & Peterson, 1993; Caponnetto & Polosa, 2008). In the 1994/1995 National Population Health Survey in Canada, which involved 3,499 respondents aged 21 to 39, Chen and colleagues observed that a smoker who smoked in early adolescence was associated with a lower probability of quitting in the future. It was reported that 18% of smokers who initiated smoking as early as 13 years old quit smoking within ten years. However, 42% of smokers who started smoking at the age of 20 or older stopped smoking within a ten-year period (Chen & Millar, 1998).

A prospective cohort study in a larger sample among 13,415 respondents, demonstrated that the age at which a person started smoking significantly predicted whether a smoker would continue to smoke in later life. The study also showed that starting smoking after 20 years of age was a significant predictor of smoking cessation (Hymowitz et al., 1997). Findings by Khunder and associates (1999) were similar. Among male smokers above age 35, 66% of the 1,700 smokers interviewed started smoking before the age of 18. This age of initiation significantly predicted continuous smoking. Furthermore, starting smoking before 16 years of age was found to have an odds ratio of 2.1 (95% CI: 1.4- 3.0) of not quitting compared to smokers who started smoking at a later age (Khuder et al., 1999).

While the age of initiation was related to cessation, there are also studies that have identified positive associations between age and the year of cessation. In 2000, in a sample of 3990 smokers and ex-smokers, the National Health Survey in the United

States found that smokers who were above 35 years old were more likely to quit compared to the younger age group. Although the younger age group had a fairly high quit success rate (21.7%), it was comparable to the percentage of failed attempts (22.5%) (Lee & Kahende, 2007). Similarly, when cessation predictor surveys were conducted in two Southeast Asian countries (Malaysia and Thailand), a significantly higher quitting maintenance was identified among smokers aged 55 years and above (Li L et al., 2010). In smoking cessation clinics in Peninsular Malaysia, older smokers were also associated with a greater probability of quitting (Ezat et al., 2008; Wee, West, et al., 2011).

Other studies have found no such associations. Such studies include a large population cohort of 11,101 smokers (6161 female and 4849 male). There were no differences in either smoking cessation or smoking reduction between smokers aged 60 years and above and those between 19 and 59 years of age (Godtfredsen, Prescott, Osler, & Vestbo, 2001). Another study was a cross-sectional survey conducted in a cessation clinic among the Chinese population that involved 129 smokers. One week of free NRT was supplied as a treatment in addition to the cessation counselling. Although no associations with age were evidenced, older age was associated with greater withdrawal symptoms (Abdullah et al., 2006).

The above studies showed that smoking cessation is associated with the age of initiation and the age of quitting, although some reported negative findings. Suspected reasons for the difference in results compared to the larger cohort might be related to sample sizes, the existence of on-site cessation programmes (which mainly recruited participants motivated to quit), the differences in accessibility to free treatment and those related to types of medication and durations of treatment given.

Gender and marital status

Previous studies have suggested that male smokers have a better quit outcome compared to female smokers (Caponnetto & Polosa, 2008; Myung et al., 2008). Several factors may contribute to this finding. Perkins showed that there is evidence of a lack of effectiveness of NRT for women (K.A. Perkins, 2001), as it was suggested by a later meta-analysis that in an unaided quit attempt, women are less likely to be associated with nicotine dependence compared to men (Cepeda-Benito, Reynoso, & Erath, 2004). In addition, this lower success in quitting among females could possibly be related to the psychological aspect of a lower self-efficacy (Etter, Prokhorov, & Perneger, 2002), poor motivation (Ward, Klesges, Zbikowski, Bliss, & Garvey, 1997) and low intentions to quit (Etter et al., 2002). Moreover, women tend to be more worried about weight gain, which prevented them from quitting (Westmaas & Langsam, 2005).

Contrary to the belief that females are less likely to quit smoking, some meta-analyses also found relatively little difference in effectiveness of NRT or bupropion in both sexes (Killen, Fortmann, Varady, & Kraemer, 2002; Munafo, Bradburn, Bowes, & David, 2004). In UK, USA and Canada, women aged below 50, were more likely to give up smoking completely than man. However, among older age groups, men were more likely to have quit than women (Jarvis, Cohen, Delnevo, & Giovino, 2012). Furthermore, some studies found no significant difference in abstinence in either group, but the predictors of success differ. Females were predicted to continue smoking with increasing age, having extra concern over weight control and developing more withdrawal symptoms. Among males, failure was predicted by high social support-seeking behaviour (Abdullah et al., 2006; Westmaas & Langsam, 2005). Therefore, it is essential that special consideration should be given when providing cessation services for women compared to men. This includes issues of body weight gain, pregnancy,

motivation, medication consideration and other external considerations, all of which require further exploration.

In addition to sex differences, marital status was shown to have some influence on smoking cessation. Lee and associates found that smokers who were married or living with a partner tend to quit smoking more easily compared to those who have never married or are divorced, separated or widowed, although no relationship with gender was identified (Lee & Kahende, 2007). Being married was shown to have twice the odds of contributing to success in a quit attempt at 3 months after initiating sublingual nicotine replacement therapy by another study (Sun HQ et al., 2009); a greater success rate was also identified among married Malaysian smokers (Wee, West, et al., 2011). As evidenced, a meta-analysis showed that interventions targeted toward enhancing partner support resulted in an improvement in smoking cessation (Park, Tudiver, Schultz, & Campbell, 2004). In conclusion, attempts at quitting, maintenance and cessation were influenced by support from family members or spouses.

Education and economic status

Previous research has shown that heavy smoking is associated with low education attainment (Osler et al., 1998) and poor knowledge of smoking-related consequences (Nourjah, Wagener, Eberhardt, & Horowitz, 1994).

In turn, education and economic status was discovered to be a potent predictor of smoking cessation. As evidenced, a prospective cohort study among staff at 114 workplaces in the United States found that only 6% of smokers with less than a high school education quit in the four years of the study period. In contrast, 28% of smokers with at least a college degree quit ($p = 0.02$) (Wetter et al., 2005). Similarly, a National Health Survey in 2000 found that smokers who quit tend to have at least some college or an associate's degree (Lee & Kahende, 2007).

Nevertheless, there are many mediating factors that influence the pathways of socioeconomic status and smoking cessation. These include intrapersonal and individual factors, the societal community and any interventions involved to modify and influence these factors. For example, lesser-educated smokers tend to be less likely to quit smoking than highly educated smokers because they are likely to be more nicotine-dependent, living/ employed in a society that may be less supportive of quitting and subject to few or no smoking policies, which may reduce their chance and ability to quit. In this regard, a workplace health promotion intervention managed to reduce the occupational differences in smoking cessation by targeting the occupational risks of blue-collar workers (Sorensen et al., 2002).

Smoking history

Previous quit attempts

Previous quit attempts and duration of quitting have been shown to be important indicators of successful future quitting (Etter, 2004; Murray et al., 2000). For example, smokers with more than two previous quit attempts were shown to have higher success rates compared to those without any previous attempts. This was described for a 5-year cohort from a telephone tracking survey involving 13,415 smokers in the United States and Canada (Hymowitz et al., 1997). However, these findings were not supported by a later study that suggested that a single quit attempt was a risk factor for continuing abstinence compared to three or more previous quit attempts (Macy, Seo, Chassin, Presson, & Sherman, 2007). This is due to the fact that these smokers have a higher risk of relapse; this will be discussed in the relapse section.

Furthermore, a four-country survey of the US, Canada, Australia and the UK reported that shorter previous quit attempts (less than a week) were related to a lower probability of success (Hyland et al., 2006). It was also shown that smokers that reported shorter durations of abstinence in previous quit attempts were markedly

associated with subsequent relapse (Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992). Conversely, longer attempts (more than six months) doubled the odds of success compared to no attempts (Hyland et al., 2006), and a previous abstinence of 6 months or more was associated with the maintenance of abstinence (Li L et al., 2010). Moreover, another study among a group of female smokers showed that quit attempts lasting more than five days had a greater chance of sustaining abstinence compared to quit attempts of shorter duration (Borrelli et al., 2002).

Factors that influence a smoker to make a quit attempt may also play a role in the success of the attempt. A multivariate analysis from a recent large population-based survey in Malaysia and Thailand revealed that smoking fewer cigarettes per day, quick quitting intentions and greater self-efficacy predicted greater success for quit attempts and greater abstinence in both countries (Li L et al., 2010).

From the literature, it can be concluded that previous quit attempts should be able to boost motivation because a smoker who has attempted quitting in the past is more likely to quit in the future. It could also suggest that a fast-failure quit attempt may affect subsequent attempts, while a longer quit maintenance is advantageous. Moreover, other factors and reasons for making a quit attempt may contribute to a successful attempt and should be further studied in the future.

2.3.4 Psychological, social and environmental factors

Depression

Studies have also shown that there is an association between nicotine dependence and manic depressive disorder (MDD); a high prevalence rate of smokers was identified for this group (Breslau, Kilbey, & Andreski, 1993; Rodríguez-Esquivel, Cooper, Blow, & Resor, 2009). Likewise, it was recently noted among ethnic Turkish and Moroccan minority groups residing in the Netherlands that there was a significantly higher

percentage of depressive symptoms among smokers (42.9%) compared to non-smokers (29.5%) (Acartürk, Nierkens, Agyemang, & Stronks, 2011).

Different causal pathways have been suggested to unwind this relationship. It was found that nicotine may reduce negative affect (i.e., anxiety, sadness, anger and depression) and/or increase positive affect (i.e., being excited, alert and determined) (Lasser et al., 2000). Nicotine dependence was also shown to produce initial signs of depression (Klungsøyr, Nygård, Sørensen, & Sandanger, 2006). Recently, it was postulated that there may be two causal pathways between smoking and depression: 1) they have common risk factors or 2) there is a direct pathway in which smoking increases the possibility of depression (Boden, Fergusson, & Horwood, 2010). Nevertheless, the association remains unclear (Caponnetto & Polosa, 2008), as it was previously argued that smoking may help smokers alleviate stress (Revell, Warburton, & Wesnes, 1985), and it may even help sufferers to cope with a depressed mood (Glassman, 1993).

With regards to smoking cessation, it has long been widely believed that smokers with a history of depression have a reduced probability of quitting smoking (Glassman, 1993). This may be related to the development of withdrawal symptoms, which are part of the cessation process. These include symptoms such as affective symptoms and mood disturbances, which are more prominent in the earlier days of cessation. Thus, it was presumed that smokers with more depressive symptoms and negative moods were less likely to quit smoking (Anda et al., 1990). Additionally, it was observed that a higher nicotine dependence was found in depressed smokers compared to normal smokers (Dierker & Donny, 2008), which may further explain why depressed smokers have greater difficulty quitting.

Nevertheless, contradictory findings exist. A meta-analysis has observed that there was no significant difference in cessation rate (both in short-term abstinence ≤3

months and long-term abstinence ≥ 6 months) among smokers with or without a history of depression (Hitsman, Borrelli, McChargue, Spring, & Niaura, 2003). This might suggest that a history of major depression is not an independent risk factor for the success or failure of smoking cessation. Moreover, a recent follow-up study among nearly 2000 recent quitters over a nine-month period discovered that quitting smoking did not seem to increase the risk of depression and anxiety among quitters free from symptoms of depression (Bolam, West, & Gunnell, 2011). From the above literature, we can conclude that the relationship between depression and smoking or cessation remains unclear and debatable.

Anxiety

Studies have shown that smoking has a significant association with anxiety. Previous research reveals that smokers reported higher incidences of general anxiety disorders and social anxiety disorder compared to non-smokers (McCabe et al., 2004). Smoking is also highly prevalent among smokers with agoraphobia and post-traumatic stress disorders (Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007; Op den Velde et al., 2002). Furthermore, upon quitting, smokers reduced their anxiety levels gradually within a period of four weeks. This may relate to the notion that smoking is chronically anxiogenic rather than anxiolytic. That is, smoking leads to higher anxiety levels (Robert West & Hajek, 1997). In addition, it was also shown that unsuccessful quitters were noted to experience more depression and anxiety compared to non-quitters (McClave et al., 2009). A possible explanation for this could be that smokers with anxiety disorders tend to experience more withdrawal symptoms than those without anxiety disorders (Breslau, Kilbey, & Andreski, 1992). In turn, anxiety has been suggested to be one of the risk factors for smoking relapse (Morissette et al., 2007).

Social and environmental influences

Social support

Beginning to quit smoking, maintenance and complete cessation seem to be influenced by the social environment. Smokers are normally more inclined to attempt to quit if people who were important to them advised them to quit smoking and when they apprehend that the smoking habit is unacceptable in many social circumstances. For instance, a large British population study (Chandola, Head, & Bartley, 2004) showed that the strongest sociodemographic predictors of quitting were social support (i.e., marital support and supportive family members), occupational social class and the number of smokers in the household. This has been supported by other studies in the area of close family support (Caponnetto & Polosa, 2008; R. West et al., 2001). With respect to peer support, smokers with a higher number of individuals who were able to provide support in quitting were shown to have a greater likelihood of quitting for at least six months (Johnson et al., 2008). Similarly, Cobb and associates (2005) reported that the use of other means of peer social support, such as emails, forums and/ or chat rooms, yielded approximately three times better odds of quitting at three months after controlling for the intensity of website usage.

Although it has been shown that social and family support may provide emotional and motivational assistance to smokers, the use of social support to facilitate quitting has been questioned by many previous studies (May & West, 2000; Park et al., 2004). These studies claimed that smoking cessation programs only added peer support as supplements or adjuncts to other interventions, such as telephone counselling or group-based interventions and are therefore not true tests for measuring social support's effectiveness. For example, a review by May and West (2000) identified only one study among many studies that added a buddy component to a self-help programme, and the result was insignificant. A subsequent review by Park and Tudor (2004) listed five of

nine studies that met their inclusion criteria and were in favour of the benefit of social support. These findings led the latest updated version of the Tobacco and Dependence Guideline (2008) to exclude the recommendation of social support from the previous guidelines (Fiore, 2000, 2008a). Nevertheless, in their latest review, Westmaas and colleagues suggested a better differentiation of the concept of social support and its mediators. This should be further studied in the future, as it may improve in cessation services (Westmaas et al., 2010).

Environmental tobacco smoke (ETS) exposure and home environmental exposure

ETS is essentially exposure to smoke from other people, which is a combination of "sidestream smoking (SS)"– smoke that is being produced from the puffs of a pipe, cigar or burning cigarette – and "mainstream smoking (MS)"– smoke being exhaled by a smoker (Dresbach & Senderow, 2008), which may lead to adverse health consequences almost similar to those of a smoker, such as cardiovascular diseases, pulmonary diseases and cancers (Barnoya & Glantz, 2005; Brownson, Eriksen, Davis, & Warner, 1997; Lam et al., 2000; Zhong, Goldberg, Parent, & Hanley, 2000). In addition, exposure to cigarettes from others may influence the intention to quit smoking and may hinder a successful quit attempt.

Indirectly, in a study in Poland conducted among smokers and non-smokers, it was reported that smokers suffered from symptoms such as cough (31%), sputum production (42%), lachrymation (25%) and wheezing (21%) when exposed to ETS, which did not differ greatly from the symptoms reported by the non-smokers. It was also found that 70% of subjects previously exposed to ETS during childhood started smoking earlier than those with no exposure. Furthermore, related to this, 66% expressed their wish to quit smoking (Chadzyński, Woźniak, Nowogórska, & Domagała-Kulawik, 2009). Although this study did not follow up with these participants, the study might provide a clue regarding the effects of ETS on the

difficulty smokers who are attempting to quit encounter if they have many friends who smoke.

In another recent study among current smokers in low-income urban communities in the US, results reported a clear association between SHS (second-hand smoke exposure, or smoking by others) in the home and the outside environment with nicotine dependence. After adjustments for sociodemographic characteristics, smokers exposed to SHS at home and both at home and in other settings exhibited twice the odds of having nicotine dependence compared to those with no exposure to SHS (Wilson-Frederick et al., 2011). Due to the high nicotine dependency among the SHS-exposed group, they may suffer from difficulty in quitting.

As evidence for this, the introduction of smoke-free homes has been shown to be effective in smoking cessation. In 2000, a US population survey revealed that successful quitters were more likely to quit if they have rules against smoking in their homes (Lee & Kahende, 2007). In addition, when adopting a complete home smoking ban and comparing it to no bans or partial bans, results demonstrated a three times greater likelihood of achieving smoking abstinence (Fu et al., 2010).

Although many studies are still warranted in the area of smoking cessation and ETS/ SHS, these previous studies may suggest that the expansion of clean-air policies at home and in the surrounding environment should be emphasised as a psychosocial assistance to any attempt to quit smoking. Furthermore, adopting a smoke-free home policy and smoke-free public places policy has potential benefits that extend beyond the smokers and encompasses their households and communities.

2.3.5 Workplace environment and job stress

2.3.5.1 Workplace environment

Work has been shown to be related to smoking in various ways. Smoking produces adverse outcomes, such as occupational disabilities (Claessen, Arndt, Drath, & Brenner,

2010), sickness absence (Laaksonen, Piha, Martikainen, Rahkonen, & Lahelma, 2009) and early retirement (Husemoen, Osler, Godtfredsen, & Prescott, 2004). In addition, mong healthy adults exposed to passive smoking at the workplace, there is also an association of cigarette exposure to extra time off work and increase in health service utilisation (McGhee et al., 2000). In all, these cost financial impact to employers.

Pursuant to these problems, many developed nations have taken measures to prohibit smoking and to enforce new smoking policies, often in addition to introducing workplace smoking cessation programmes. These measures were expected to reduce the smoking prevalence and smoking consumption and to increase smoking cessation.

For example, in Western countries, the introduction of smoke-free policies at the workplace has produced a substantial impact on smoking cessation. Smoke-free workplaces have contributed to a 3.8% reduction in smoking prevalence and 3.1 fewer cigarettes smoked per day. It was also estimated that if all workplaces were to become smoke-free, consumption of tobacco per capita would drop by 7.6% in the United Kingdom and 4.5% in the United States (Fichtenberg & Glantz, 2002).

From their reviewed studies, the *Community Guide's* rules of evidence in the US showed that these smoke-free policies are effective in reducing tobacco use when implemented in both workplaces and communities. The evidence includes both studies implemented by individual workplaces and studies involving community standards that require workplaces to be smoke-free (Hopkins et al., 2010). Furthermore, in England, the responsibility of enforcing smoke-free policy lies with local authorities. They have powers to impose penalties or substantial fines on any organisation that allows smoking within its premises (Cormac & McNally, 2008). To date, however, no study discusses the amounts of penalties that are considered sufficient.

In another study in Japan, a multicomponent workplace programme was introduced. This included: 1) a media component (e.g., books, pamphlets, websites, and

newsletters); 2) a smoking-cessation campaign; 3) the designation of smoking areas; and 4) the prevention of second-hand smoke. In all, it contributed to a significantly higher cessation rate in the intervention group compared to the control group (12.1% vs. 9.4%; p = 0.02) (Tanaka et al., 2006).

Workplace wellness programmes have similar potential for inculcating positive health behaviours. This includes assisting smokers in quitting by providing counselling sessions and free medications. For instance, The Syngenta Group, consisting of workers in crop production companies, offered a wellness programme called Reaping Rewards (Merrill, Aldana, Garrett, & Ross, 2011). Workers were given incentives in the form of exchanged cash up to an annual maximum of USD 150.00 based on accumulated points earned for attending a health screening, a smoking cessation programme, aerobic classes, etc. Although this incentive programme improved other health parameters (i.e., reductions in BMI and cholesterol, the capability to cope with stress, and dietary improvement), no significant improvements were noted for quitting smoking.

Similarly, in a workplace financial incentive trial among 878 smokers at a US-based company, results showed that cessation programme attendance was greater in the incentive group than when no incentives were received (20.2% vs. 7.1%, $p < 0.01$) (Kim, Kamyab, Zhu, & Volpp, 2011). Nonetheless, the majority (69.8%) of quitters who were in the incentive group claimed that the incentives were "not at all" or only "somewhat" significant to them. The non-quitters in the incentive group reported that even an amount of USD 1500.00 would not be able to motivate them to quit smoking. The result of this study suggests that incentives are best targeted to smokers who are likely already partly inclined to participate in a quit-smoking programme. Therefore, health professionals should consider how incentives could be best optimised for the right target population.

Although these measures taken have contributed to the decline in smoking prevalence in developed countries (Hahn, 2010), this remains an important issue, especially in developing countries. Above all, studies that involve workplace smoking cessation would require support from the top management of these workplaces. Support is required in both financial and managerial aspects for the development of a comprehensive workplace smoking cessation programme coupled with a strict smoke-free workplace policy.

2.3.5.2 Job Stress and workplace social support

It was hypothesised by occupational health researchers that not only unfavourable work environments but also adverse psychosocial work conditions may play important roles in increasing smoking behaviour and in reducing the cessation rate (Albertsen et al., 2006). The Job Demand Control Model (or Job Strain Model) is often used to understand this relationship. This model postulated that high job demand and low control (a combination referred to as high job strain) may give rise to adverse health effects (Hurrell Jr, Nelson, & Simmons, 1998; Karasek et al., 1998).

Based on the model by Karasek et al. (1981) , a job strain indicator was created from the job demands and decisional latitude parameters and was dichotomised by the median value and classified into four domains (Figure 2.1): i) high-strain jobs (low decisional latitude and high demand); ii) low-strain jobs (high decision latitude and low demand); iii) passive jobs (low decision latitude and low demand) and iv) active jobs (high decision latitude and high demand).

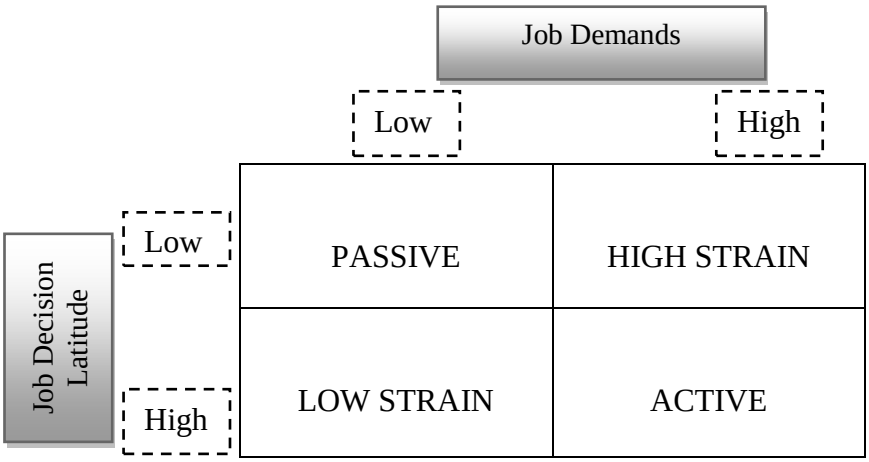


Figure 2.1 Job Strain Indicator based on Karasek's Demand-Control Model
(Karasek et al., 1981)

Studies on this issue of smoking and job strain produced mixed outcomes. Some studies showed that high smoking intensity/prevalence was associated with high job demands (Li X, Liang, Guan, Yin, & Zhou, 2010) or low job control (Kouvonen et al., 2007). Other studies identified none of these associations (Brisson, Larocque, Moisan, Vézina, & Dagenais, 2000; Otten, Bosma, & Swinkels, 1999), and another study has shown that low job control was related to fewer cigarettes smoked (Tsutsumi et al., 2003), and high job strain reduced smoking prevalence (Niedhammer et al., 1998).

In relation to smoking cessation, results were also inconclusive. A Finnish study reported that smoking cessation was predicted by low job strain (Kouvonen et al., 2009). In contrast, another cohort study in Denmark found that smokers with high psychological job demands had higher odds of quitting compared to workers with low job demands (Albertsen, Hannerz, Borg, & Burr, 2004). Others, however, found no associations (Fukuoka et al., 2008; Ota et al., 2010).

Social support could be an important influence on quitting smoking. Social support at the workplace can vary from simple advice, such as "telling your friends to quit", to social support interventions. There are three aspects of social support (Sutherland, 1997). First, structural support involves the existence of friends (or work

colleagues)/ family within an individual environment. Second, functional support deals with the quality of the support and covers issues such as empathic understanding, providing information and practical assistance (i.e. emotional and instrumental support). This functional support is specifically related to smoking cessation. The third support is the smoking behaviour of other people within the environment, which includes friends, partners and colleagues who are smokers (Sutherland, 1997). However, these three aspects of support may intertwine and cannot always be clearly differentiated.

In assessing functional support, it has been shown that the existence of supportive friends (Mcmahon & Jason, 2000) and a supportive partner (Park et al., 2004) predicts success in quitting smoking. With this, many community-based interventions have included the support of a buddy to assist in quitting. The participants selected were those within the social culture, such as family, friends and partners. These studies have generally found that having such a buddy is correlated as much as a three times higher chance of success in quitting (Murray, Johnston, Dolce, Lee, & O'Hara, 1995; Pirie, Rooney, Pechacek, Lando, & Schmid, 1997). However, May and colleagues (2000) later conducted a systematic review in which they reported that out of ten studies on buddy systems, only two studies supported the advantage of a buddy system, and only in the short-term. Similarly, a subsequent large intervention study among 563 participants also proved that a buddy system is ineffective for quitting at 1, 4 and 26 weeks compared to the control group (May, West, Hajek, McEwen, & McRobbie, 2006). From this, it can be assumed that it is not clear whether social support interventions that involve an attempt to change an established relationship have any effect on quitting or if it was the previous existing relationship that counts. It is also not clear what sorts of behaviours or relationships may lead to successful quit attempts.

Due to the contradictory findings and the limited evidence in this area (Ota et al., 2010), and with no previous reports of this association in Southeast Asian countries, the

investigator attempted to explore the association between job stressors and smoking cessation.

2.4 Behavioural changes in smoking cessation and smoking relapse

2.4.1 Models of smoking cessation and smoking relapse

A theory is a systematic way of understanding situations or events. It consists of a set of definitions, concepts and propositions that predicts or explains these situations by demonstrating the relationships between the variables. The theories of health behaviour and health promotions consist of various disciplines, which include psychology, anthropology, sociology, marketing and consumer behaviour. However, many of these are not highly developed or rigorously tested (Rimer, Glanz, & Institute, 2005).

The theories give health planners tools for how to design and evaluate health promotion intervention and health behaviour based on their understanding of human behaviour. The researchers and health practitioners use these theories to answer questions concerning “what”, “why” and “how” these problems should be addressed and help give clarification to the nature of the targeted health behaviours (Rimer et al., 2005). Using the theories as a foundation for programme planning, development and implementation is consistent with the current emphasis of applying the best evidence-based practices in public health, behavioural medicine and clinical medicine.

While the TTM is the model utilised in this research, there are other models that have gained popularity in smoking cessation and smoking relapse. In smoking behaviour, the Health Belief Model (Becker, 1974) is an example that has gained considerable empirical support. The model posits that readiness to engage in health behaviour arises from a perceived threat of disease, which has originated from the perception of an individual regarding his or her disease susceptibility and its potential severity, after taking into account their belief in health care and medicine. When initiating a change in behaviour in an individual, the benefits of health-seeking actions

are taken into account and are weighted against their perception of the barriers to the health behaviour change (e.g., psychological, physical, financial and other costs). There are many review papers that have focused on the value of the model in predicting various health-related behaviours (Janz & Becker, 1984; Mikhail, 1981). However, when considering smoking cessation as a health behaviour, other variables pertinent to smoking are not readily predicted by the health belief model (Galvin, 1992). For example, people often quit smoking for financial reasons, to gain social approval or for weight loss reasons. Expanding research has also explained that important variables, such as nicotine dependence/ addiction, habit, self-motivation and relapse, cannot be explained by the Health Belief Model (HBM).

A more recent theory that has received considerable important views in smoking-cessation behaviour is The Theory of Reasoned Action (Ajzen & Fishbein, 1980). This model is based on the assumption that individuals usually make systematic use of the information they possess. Thus, they are thought to consider the implications of their actions prior to engaging in a specific behaviour. Consistent with this, the theory views the intention to perform as an immediate antecedent of future action. This is influenced by two main factors: personal and social influences. In contrast to the HBM, this model considers external variables, which may interact with the two factors (Galvin, 1992). While the HBM cannot conceptualise diverse factors in smoking, such as dependence, nicotine addiction, habit or cognition, the theory of reasoned action gives room for investigation of such factors, although it is not well developed.

While the two models being discussed have focused on smoking cessation, there are also models that are specifically attributed to smoking relapse: Relapse Prevention Theory (Marlatt, 1985) and the Self-Control Strength Model (R. Baumeister, Heatherton, & Tice, 1994). The Relapse Prevention Theory is the prime model to date that explains why an individual progresses from a lapse (an initial episode of drug use

after quitting) to relapse. According to this model, the main determinant that a person will successfully quit or relapse is the cognitive and emotional response of that person to lapsing. Relapse was predicted to be more likely when lapses produce an abstinence violation effect (AVE), which consists of reduced self-efficacy, self-blame and negative affect. Alternatively, when a person manages to quit successfully and resists temptations to smoke, the self-efficacy to maintain abstinence is expected to increase (Marlatt, 1985, 2005).

However, an alternative model, the Self-Control Strength Model, postulates that self-control appears to be a central function of oneself and a key successor in life (Baumeister, Vohs, & Tice, 2007). Self-control is a capacity to alter one's own response, especially to achieve their own standards of ideals, values and morals and to achieve long-term goals. Based on the model, repeated and continuous self-regulation of emotion gradually declines the limited self-control resources. Like a muscle that gets tired from exertion, acts of self-control lead to short-term impairments in subsequent self-control. In the case of multiple lapses, although relief from later lapses may allow the recovery of self-control, the model predicts that the self-control resource will progressively reduce with continued application, despite intermittent periods of rest and recovery. This is in line with negative reinforcement (Baker et al., 2004), in which relief from a lapse may increase the chance of subsequent short-term lapse/ relapse when the control resources deplete. Nevertheless, for quitters, the model also assumes that, like working out to build muscles, repeated cycles of self-control and depletion-recovery will build up the strength of self-control over time.

Although the last two models (Relapse Prevention Theory and the Self-Control Strength Model) were more specific in analysing smoking relapse compared to the TTM, the two models require successive examination of behaviour during each lapse episode, specifically using electronic diaries. In addition, the TTM model, which will be

explained in the next section, has wider coverage in that it covers many aspects of behaviour and addiction components of smoking. Nonetheless, evidence of its applicability in smoking relapse is not well established and shall be discussed in this research.

2.4.2 The Transtheoretical model (TTM)

The TTM is a famous model of behavioural change by Prochaska et al., (1988), which provides a theoretical basis for the complexities of smoking behaviour. Why do health professionals need to understand this change process? It allows practitioners/counsellors to view clients where they are, to understand and predict the changes that might happen to them and thus to find motivational ways to change the behavioural patterns. In addition, the model recognises that a person involved in the process of behaviour change should be given intervention appropriate to the start of their individual change process. For example, in the case of a smoker who has never thought of the effect of smoking to herself/ himself, there is no benefit of giving them information about the behavioural coping process of quitting. Rather, it will be more useful to communicate to them the harms related to smoking and the positive effects of quitting. After the stage of change process has been assessed, an appropriate programme can be initiated that meets the desire of each individual to promote behavioural change.

Over many years, numerous studies have revised, supported and modified the questions used in the model. However, some criticised the model and its applicability in health behaviour interventions. To date, the majority of the studies postulate that the TTM represents a view of behaviour change. It brings together a set of constructs based on when and how they function and occur throughout the process of the behavioural change involved in smoking cessation.

2.4.2.1 Constructs of the TTM

TTM is a behavioural change process that has been validated and popularised by Prochaska and colleagues for over 20 years (Fava, Velicer, & Prochaska, 1995; Norman, Velicer, Fava, & Prochaska, 1998; Prochaska & DiClemente, 1983; Velicer, Norman, Fava, & Prochaska, 1999) Although the construct of the TTM is often referred to as the "stage of change" model, it includes 15 theoretical constructs that have been drawn from various theories of behavioural change. This includes "stage of change – the basic principles", 10 processes of change, self-efficacy, temptation and the perceived pros and cons of making the behaviour change. The TTM thus integrated the different constructs into a single framework–the "transtheoretical model". In the "stage of change", independent variables are the transitions between the stages, and the other theoretical constructs are the dependent variables that influence the transition of the construct in the "stage of change".

2.4.2.1.1 Stages of change

Prochaska and DiClemente (1982) originally described five stages of change: precontemplation, contemplation, preparation, action and maintenance. The stages represent a dynamic aspect of motivation of the change process over time, thus dividing the process into specific required tasks to achieve a sustained behavioural change. The five stages characterise the readiness of a person to participate in an intervention programme of behavioural change (Table 2.3). According to Prochaska (1983), in smoking cessation, every patient undergoes a series of processes before quitting that need to be understood by health personnel. Within the "staging algorithm", participants are classified into these stages based on their responses to a small number of questionnaire items. The first three stages are for current smokers, while the remaining two stages are for ex-smokers. Those who have never tried smoking are not included in this model.

Progression from one stage to another occurs sequentially. Normally, people start at the bottom of the precontemplation stage and progresses from contemplation to preparation, action and eventually maintenance. However, most individuals relapse back to their previous stage. They may cycle through the stages multiple times before eventually achieving long-term behavioural change (Prochaska, DiClemente, & Norcross, 1992).

Precontemplation is a period where the person is not considering behavioural change (for reasons, see table 2.3). The precontemplators who seek therapy are normally pressured by employees, spouses, parents or schools. However, they are highly likely to drop out and are the least responsive to interventions due to their poor motivation (Brogan, Prochaska, & Prochaska, 1999).

In contemplation, the person is seriously considering changing his/her behaviour in the next six months. Compared to the precontemplators, a person in the contemplation stage has greater confidence that they can change. Despite this fact, many do not change. For example, in a sample of 800 smokers who were seriously planning to quit smoking, the majority were not even trying to quit in a self-help program (Prochaska, DiClemente, Velicer, & Rossi, 1993).

Preparation is a stage in which the person is planning to change their behaviour in the next 30 days. They normally have attempted to quit at least once in the previous years. Smokers in this stage are more prepared and confident to make a change, as they have more control over their problem behaviour.

The fourth stage, the action stage, may be defined as the stage where the person has already taken actions to change their behaviour. Here, an individual makes specific modifications in their lifestyles. This stage is where most of the change processes occur. A person usually stays in this stage for six months, during which the risk of relapse significantly reduces.

Subsequently, maintenance is defined as a period after 6 months of stable action. People in this stage tried to consolidate the gain they obtained during the action stage to prevent relapse. However, they do not apply as many of the change processes as frequently as those in the action stage. Furthermore, they have lower temptations towards relapse, as they develop more confidence for maintaining the behavioural change.

Table 2.3 Stage of change constructs

Stage of Change	*Attitude to change*	*Behavioural*	*Interventions*
Precontemplation	Not thinking of quitting within 6 months	- Not intended to change and deny its need - Being defensive of the unhealthy behaviour	- Enhance awareness - Increase understanding of the problem - Emphasise the benefit of changing
Contemplation	Have thought about quitting within 6 months	- Have awareness of the problem - Collects information about the problem but has no specific plans on quitting	- Enhance confidence in the ability to change - Aware of difficulties in changing, and enhance benefits of quitting
Preparation	Planning on quitting in the next 30 days	- Normally has taken some action in the past years - Started to visualise life in a different way - Have schedule on the date of quitting - Started telling others on their plan to quit	- Negotiate plans on quitting - Enhance the importance of preparation to quit before embarking on it.
Action	Starting to quit within first 6 months	- Actively trying to quit - Achieve abstinence and preventing from relapse	- Engaging and encouraging active problem solving - Plan on how to prevent relapse
Maintenance	Staying quit after 6 months	- Free from the problem for 6 months onwards	- Emphasise the positive feedback

(Prochaska, DiClemente, & Norcross, 1992; Prochaska & Velicer, 1997)

Other TTM constructs

There are 14 other TTM constructs.

2.4.1.1.2 Processes of change

The first set of constructs is the processes of change, which consist of 10 items (Prochaska et al., 1988). The ten processes facilitate movement through the five stages of change. These ten processes include consciousness raising, environmental re-evaluation, self re-evaluation, social liberation, dramatic relief, self-liberation, stimulus control, counter-conditioning, contingency management and helping relationships. The first five processes are called Experiential Processes; these are used primarily in the early stage transitions. The last five processes are classified as Behavioural Processes; these are used in the later stage transitions. The ten processes are explained below, and examples related to smoking are displayed in Table 2.4 (Prochaska et al., 1988).

1. Conciousness raising

This process involves an increase in awareness regarding the consequences, causes and cures of a problem behaviour. Interventions to increase awareness include feedback, confrontation, education and media campaigns.

2. Dramatic relief

Dramatic relief involves an increase in emotional experiences followed by reduced effect if certain and appropriate actions are taken.

3. Environmental re-evaluation

This process involves the combination of both the affective and cognitive assessments on how the presence or absence of a personal habit affects the social environment of the individual, such as the effects of smoking on others. This process may also consist of the awareness that a person can serve as either a positive or a negative role model for others.

4. Social liberation (environmental opportunities)

This process requires an increase in social opportunities or alternatives, especially for a person who is depressed or deprived. Empowerment, advocacy and appropriate policies can lead to increased opportunities for health promotion in minority groups (e.g., impoverished people, gay populations, etc.). These same procedures can also promote changes in people, such as introducing smoke-free zones, providing easy access to condoms/ other contraceptives and making salad bars available for school lunches.

5. Self re-evaluation

Self re-evaluation is a combination of both the affective and cognitive assessments of the self-image of a person, with or without a particular unhealthy habit. An example is one's image as a couch potato or as an active individual. Healthy role models and imagery are techniques that can change people.

6. Stimulus control

Stimulus control involves removing cues for unhealthy habits and replacing them with healthier alternatives. Avoidance, environmental re-engineering and self-help groups may provide stimuli that can support change and reduce relapse risks. Examples of environmental re-engineering include encouraging more exercise by planning parking lots so that it takes a few minutes to walk to the office and displaying art in stairwells.

7. Helping relationships

Helping relationships consist of trust, caring, openness, acceptance and support for a healthy behavioural change. Such sources of social support may include counsellor calls and buddy systems.

8. Counter-conditioning

This requires learning healthier behaviour that substitutes for problem behaviour. Assertion can counter peer pressure, relaxation can counter stress and nicotine replacement therapy can be a substitute for cigarettes.

9. Reinforcement management

Reinforcement management provides consequences that occur for taking steps in a certain direction. Open or hidden reinforcements, positive self-statements or group recognitions are required to increase reinforcement; therefore, there is a higher probability for healthier repeated responses.

10. Self-liberation

Self-liberation is the belief that a person can change and a belief in their commitment to make that change. This may include New Year's resolutions, public testimonies and willpower. This may involve multiple choices; the higher the number of choices, the greater the commitment towards change. For example, among smokers, three action choices that can be given to smokers for quitting are cold turkey, nicotine fading and nicotine replacement.

Research has discovered that there is a relationship between the stage that a person is in and the processes associated with that stage (Prochaska, DiClemente, & Norcross, 1992). The researchers suggested that in the initial stages, people utilise cognitive and affective evaluation processes to progress across the stages. However, in later stages, people depended more on commitments, contingencies, conditioning, environmental control and support to progress towards termination (Prochaska, Redding, & Evers, 2008).

Table 2.4 The 10 Processes of Change in Transtheoretical Model

TTM Processes	*Explanation*
Experiential	
Dramatic relief	Experiencing the negative thoughts (fear, worry, anxiety) that comes with the unhealthy behaviour "e.g. When I see warnings of health hazards, it touched me emotionally"
Consciousness raising	Learning and finding new facts, tips and ideas that support the change to healthy behaviour "e.g. I seek for information on smoking"
Environmental re-evaluation	Realising the positive impact of healthy behaviour or the negative impact of the unhealthy behaviour to the physical and social environment. "e.g. I stop to think that smoking cause pollution to the environment"
Self re-evaluation	Realizing the importance of behaviour change towards one's identity "e.g. I felt disappointed in myself for depending on cigarettes"
Social liberation	Realising that the change in social norms is directed towards healthy behaviour "e.g. I realized that there are sections for non-smokers in public places"
Behavioural	
Stimulus control	Removing bad reminders/cues of unhealthy behaviour and adding reminders/cues of the healthy behaviour "e.g. I tend to remove things at my workplace that reminds me of smoking"
Counter conditioning	Substituting the unhealthy alternative behaviours with a healthy cognitive behaviour "e.g. Instead of smoking I shift to do something else to relax"
Helping relationships	Seeking and utilising social support for a healthy behavioural change "e.g There is someone who listens when I have something to talk about my smoking problem"
Reinforcement management	Decreasing rewards for unhealthy behaviour and increasing it for the healthy behaviour "e.g Others reward me if I don't smoke

Table 2.4, continued

TTM Processes	*Explanation*
Self-liberation	Giving a strong commitment to change "e.g. I realised that there are sections for non-smokers in public places"

2.4.2.1.3 Decisional balance

Decisional balance consists of two terms that represent a second set of constructs that examines an individual weighing the pros and cons of making a change. This concept originally came from the Janis and Mann model (Janis & Mann, 1977), which included four categories each of pros and cons. Here, in the TTM, the eight categories have been simplified into two: the pros and cons of making a change (Velicer et al., 1985). Prochaska and colleagues (1994) proposed that when a person progresses from precontemplation to contemplation, the pros must increase; to progress from contemplation to action, the cons must decrease.

2.4.2.1.4 Self-efficacy

The next construct in TTM is self-efficacy (Velicer, DiClemente, Rossi, & Prochaska, 1990). Self-efficacy conceptualises the perceived capability of an individual to perform a certain task as a mediator of their performance on future tasks. Any change in the level of self-efficacy can lead to a lasting change in behaviour if appropriate incentives and skills are provided. This includes two components: confidence and temptation. Confidence is what an individual needs to survive high-risk situations and to keep from relapsing into their old behaviour. Temptation is explained below.

2.4.2.1.5 Temptation

The second component, temptation, covers the intensity of the urges towards a specific behaviour in the middle of a difficult situation (Velicer et al., 1990). It assesses how tempered a person is to engaging in problem behaviour in a specific situation. The three temptation situations include: emotional distress or negative affect, positive social

temptations and addictive temptations/ cravings. Temptations can be regarded as the opposite of self-efficacy; in fact, the same items can be used to measure both by using a different response format, as they have the same structure (Velicer et al., 1990).

2.4.2.2 Movement from one stage of change to another

In general, for a person to move from one stage to another (e.g., from precontemplation to contemplation or from action to the maintenance stage), they need to have (Prochaska & DiClemente, 1992; Prochaska et al., 2008):

1. Increased awareness that the advantages of changing (the "pros") will outweigh the disadvantages (the "cons"). The TTM calls this decisional balance.
2. Confidence that they can make and maintain the changes in tempting situations so that they do not return to old unhealthy behaviour. The TTM calls this self-efficacy.
3. Strategies that can help them make and maintain the required change. This is called "the processes of change".

In smoking cessation, each of the processes and constructs is related to the stage of change by a curvilinear function (Velicer, Prochaska, Fava, Norman, & Redding, 1998). For example, processes use is at a minimum in precontemplation; it increases over the middle stages and later declines at the lower stages. Normally, the experiential processes reach their peak early, and the behavioural processes reach their peak late. Figure 2.2 demonstrates the relationship of the two processes (Velicer et al., 1998).

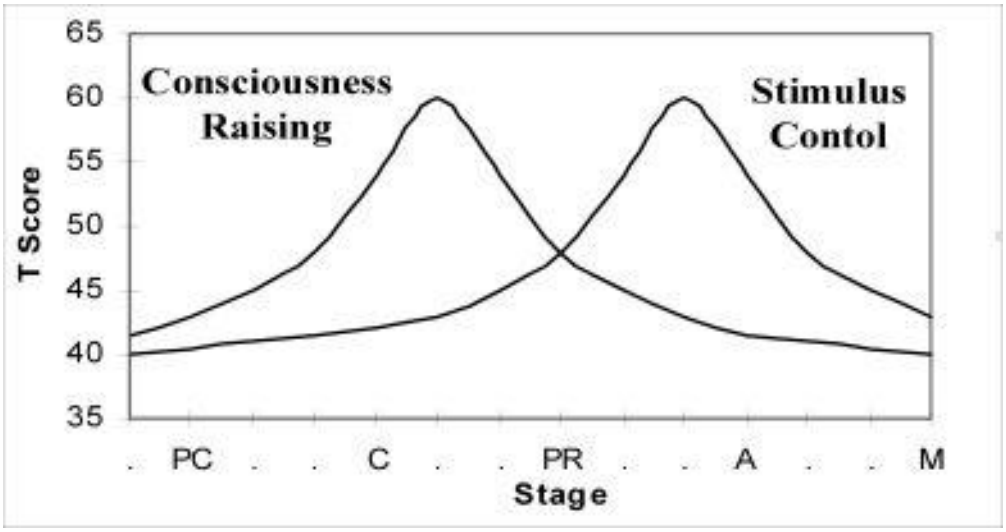


Figure 2.2 The relationship between stage and two sample processes:, consciousness raising and stimulus control

PC: precontemplation; C: contemplation; PR: preparation; A: action; M: maintenance

2.4.2.3 The role of perception in the TTM

For effective smoking cessation outcomes, healthcare professionals should have structured counselling sessions. Besides using the well-known 5 A*s* method (Balbani & Montovani, 2005; Quinn et al., 2009), the healthcare professionals need to equip patients with adequate knowledge and awareness before they begin their quit attempt. The Agency of Healthcare Policy and Research suggested that healthcare professionals should advise patients on the negative consequences of continuing smoking (e.g., heart disease, stroke, and lung disorders) and should highlight the benefits of smoking cessation (e.g., improved health and feeling better about oneself) to help motivate smokers (Fiore, 2008a).

Various conceptual models suggest that many factors influence smoking cessation (Strecher & Rosenstock, 1997). For smoking cessation to occur, an individual must first perceive their personal vulnerability to the negative outcomes of smoking (Rosenstock, 1974). They must understand that the outcome would be severe, and quitting would reduce the likelihood of their personal susceptibility. Further, it has been

argued that smokers tend to acknowledge the risks of smoking generalised to other smokers but fail to fully link those risks to their own vulnerability (Weinstein, 1988).

Previous studies have shown that the perception of a smoker regarding the advantages and disadvantages (pros and cons) of smoking is associated with motivation (Dijkstra et al., 1996) and can be used to predict future outcome (Velicer et al., 1985). These findings are important for smoking prevention. The authors suggested that targeting the perceptions of the smokers toward pros and cons of smoking might increase smoking cessation rates in any cessation programmes. However, these were mainly cross-sectional studies that were not verified longitudinally.

To date, little attention has been given towards assessing changes in perception that may occur after receiving appropriate counselling. In addition, we do not know whether the changes actually improve cessation outcome, especially among Southeast Asian smokers.

2.4.2.4 The role of motivation and stage of change in the TTM

The challenge faced by many smoking cessation experts and researchers is to produce a smoking cessation programme or intervention with a high success rate (Hjalmarson & Boėthius, 2007; Moshammer & Neuberger, 2007). In most circumstances, smokers must actively search for such programmes to receive assistance in quitting. However, this strategy only manages to appeal to well-educated groups and highly motivated smokers (Velicer et al., 1995). Consequently, it has resulted in low participation rates but has achieved a considerably good abstinence rate (Moshammer & Neuberger, 2007). In proactive recruitment, smokers are actively recruited and offered cessation assistance, such as counselling sessions, free pharmacotherapy and self-help materials. Although this can reach a greater segment of the population with various backgrounds and motivation stages, the abstinence rates at six-month or one-year follow-up interviews

seem low in some studies (< 10%) (Ashenden, Silagy, & Weller, 1997) but reasonable in others (> 16%) (Pisinger, Vestbo, Borch-Johnsen, & Jørgensen, 2005).

The TTM popularised by Prochaska and DiClemente (1983) consists of three major constructs that have been utilised in smoking cessation: stages of change, decisional balance and processes of change. The "stages of change" describes smoking cessation as a process involving several phases (DiClemente et al., 1991). These phases can categorise smokers based on their awareness of the need to quit and their immediate and future quit plans. Nevertheless, the majority of smoking cessation campaigns and programmes are aimed at smokers who are planning to quit soon and focus less on the smokers who are reluctant to quit in the near future. As such, these smokers may only be reached by an active recruitment strategy (Pisinger et al., 2005).

Many efforts have concentrated on providing adequate behavioural therapy as a means of increasing motivation for smokers and enhancing quitting success (Lai, Cahill, Qin, & Tang, 2010). However, the empirical evidence supporting the relationship between motivation, success rate and relapse remains inconclusive. While previous results have shown that smokers in the highly motivated group have an increased likelihood of quitting (Marlatt, Curry, & Gordon, 1988; R. West, 2004; Young, Hopkins, Smith, & Hogarth, 2010), more recent evidence from large population-based trials show that smokers may quit regardless of their initial motivation stage (Pisinger et al., 2005) and their unaided smoking cessations (Borland et al., 2010). In addition, motivation stage may not be able to predict relapse (Segan et al., 2002).

To our knowledge, this association has not been examined in proactive workplace cessation programmes, which, given the support of the employer, might be able to capture a significant number of lower-motivated smokers. In this study, the author aims to explore the predictive value of the initial motivation stage on quitting and

relapse and to investigate whether changes in motivation stage among smokers involved in a workplace smoking cessation programme are related to success in quitting.

2.4.2.5 Conceptual issues of the TTM

Weinstein and colleagues, in a critical review of the TTM (Weinstein, Rothman, & Sutton, 1998), argued that the TTM should have four properties:

1) *Classification of the stages.* According to the TTM, each individual is assigned to a stage in which they share all attributes of that stage. However, the stage is only a theoretical construct, and each stage is different. As a result, few people match the stage perfectly.

2) *The order of the stages.* It is the sequential nature of the stages that differentiate this theory from other theories. By specifying the sequence, health professionals can identify the intervention needed to assist people in their change. Nevertheless, due to the fact that human nature is flexible, this does not imply that the stages are irreversible or fixed. People do not require certain amounts of time to be in certain stages. If the person has fulfilled all of the factors needed and is willing to perform all the actions, the person may progress through all of the stages in a short amount of time.

3) *The common barriers of change for a person in the same stage.* A stage change is helpful in changing behaviours, as the people in a given stage may face similar barriers; thus, they can be enrolled in similar intervention.

4) *Different barriers are faced by people in different stages.* Certain health behaviours are important in certain stages, while others are not. Therefore, the TTM includes many factors that may be able to facilitate movement from one stage to another (Prochaska, DiClemente, & Norcross, 1992).

2.4.2.6 Conceptual issues of the action stage of the TTM: Relapse

The stage that has not been well studied within the TTM is the action stage on relapse. The TTM is not clear on how people who are intending to change sustain that behaviour

in the short term. Moreover, although relapse is the most likely event in a quit attempt and is very much associated with behaviour change, limited attention has been paid to the action stage of TTM (e.g., quitting for a minimum of 24 hours) leading to the maintenance stage (e.g., quitting for at least six months). Previous work focused on the pre-cessation rather than the post-cessation stage. Relapse occurs very rapidly during the early days of quitting, and the risk of relapse decreases with the increasing duration of abstinence (Piasecki, 2006).

Many studies have been performed in the area of relapse, including measurements of the progression from lapse to full-blown relapse. These were measured in relation to self-efficacy (Gwaltney et al., 2005), distress tolerance (Brown et al., 2009), and hedonic response (Shiffman et al., 2006), but very few tested the prediction of the TTM in that action stage (Segan et al., 2006; Van Zundert et al., 2009). Results were inconclusive and require further support.

In a study examining the transition from contemplation to action, a suggestion was made that some changes within the processes may inhibit making quit attempts (DiClemente, Prochaska, & Gibertini, 1985). Thus, exploration of the role of change processes is important.

Freeman and Dolan (2001) have made a revision to the Prochaska action stage by adding 3 new stages within it. The first of these stages is prelapse, in which the client evaluates whether the change made in the action stage is beneficial or even needed. The concept of prelapse is needed to explain that initially, clients will go through a rejection phase. The second stage, the lapse stage, is derived from an unsuccessful prelapse stage. This is characterised by a single behavioural event, and if there is successful therapeutic redirection, the client will return to the change state. However, if prelapse does not succeed or redirection from lapse to prelapse is unsuccessful, the person will move to relapse. Relapse is simply the return to old behaviours.

Segan et al. (2006) conducted a study among 204 people calling the quitline in a prospective cohort study and assessed predictors of the TTM model, during the first 6 months. Predictors of relapse were examined at time 1 (< 1 month), time 2 (3 months), and time 3 (6 months). Segan found that consistent predictors of relapse include low self-efficacy, determination to quit and higher temptations to smoke. They also showed that there was a stabilisation of some of the change processes at approximately 1 month post-cessation, concluding that there may be a stage boundary within the action stage. Thus, the results call to question the Prochaska TTM action stage, which was meant to be homogeneous.

Shiffman et al. (1986) and Borland et al. (2005) suggested that the challenges of maintenance differ in the first few months post-cessation compared to 3-6 months afterwards. Thus, there might be three distinct post-cessation periods. The first period, implementation, is the initial days of abstinence in which a person suffers frequent withdrawal symptoms and cravings to smoke. The second period, consolidation, is a period after acute withdrawal when cravings or urges to smoke are still frequent. The third period, synthesis, is a period in which strong cravings have dropped, similar to the maintenance stage in TTM.

The transition points in the three areas have not been thoroughly investigated. Further, the boundaries of the three periods named above are still unclear. The work performed by Borland (2005) has actually characterised the stages as follows:

1) *Implementation:* The first few days of cessation. Cotinine, the main metabolite of nicotine, would normally disappear from the body within 1 week of quitting, and withdrawal experiences begin to decline (Piasecki, 2006).
2) *Consolidation:* The period in which acute withdrawal symptoms have usually subsided, but temptations to smoke continue to be experienced frequently. Based on

the experience by Borland among quitters calling the quit line, this phase occurs when strong urges to smoke drop to at least daily.

3) *Synthesis:* Urges become less common, which is defined here as less than daily.

The results of the Borland study, based on a correlation between the length of abstinence and the urges to smoke, concluded that there were several TTM variables that were predictive earlier on in a quit attempt that lost their predictive value over time. Variables such as self-efficacy and scales of positive social and negative affect temptations reversed the predictive value. Thus, the study provides evidence that there seem to be stages within the Action Stage of the TTM. However, weaknesses in this study include: 1) the lack of patient-doctor/health personnel contact (the study involved only calls to the quitline), and the results cannot be generalised to any other population; 2) the short follow-up time; 3) the results were self-reported and were not validated by any biochemical measurements; 4) withdrawal symptoms were not taken into account; 5) the analysis was performed at only one point in time.

The transition from the action stage to the maintenance stage of TTM remains controversial. It has been cited that the passage from action (the first 6 months of cessation) to the start of the maintenance stage (6 months post-cessation) does not result in significant behavioural and cognitive change (Etter & Sutton, 2002). However, the first relapse, normally occurring during an early quit attempt, is related to behavioural aspects, including withdrawal symptoms (Piasecki et al., 2002), negative affect, presence of other smokers, urges and cravings (Piasecki, 2006; Shiffman et al., 1996). Later studies suggest that there is a boundary within the action stage of TTM and question the validity and homogeneity of the TTM-described action stage. A suggested boundary is either the one month (Segan et al., 2006) or the one week mark (Borland & Balmford, 2005). Weistein and associates (1998) postulated that what defines a stage

boundary is the discontinuation of prediction or a change in the capacity of a stage's variables to predict an outcome as the stage progresses.

Discontinuity patterns within the stages of TTM have been shown to vary based on time in cessation and relapse. Self efficacy, for instance, was proven to be an important predictor of the success of an early quit attempt, but gradually lost its predictive power over time (Stuart, Borland, & McMurray, 1994). Similarly, self liberation was reported to prevent early relapse but not later relapse (Segan et al., 2002), perhaps because such thoughts may be difficult for former smokers as their cravings weaken. Furthermore, negative and positive affect (and their effects on temptation) may predict initial relapse (Kassel, Stroud, & Paronis, 2003) but not later relapse, as the urge to smoke is reduced (Borland & Balmford, 2005).

Similarly, TTM does not clearly show which factors are pertinent in preventing or predicting relapse once the action stage has been reached. Prochaska and associates (1992) predicted that the use of four out of five behavioural change processes (counter-conditioning, helping relationships, reinforcement management and stimulus control) acts as a mediator during the progression from action to maintenance. Furthermore, a higher level of self-efficacy has effectively been shown to predict continued abstinence (Ockene et al., 2000). In assessing its importance among smokers for both behavioural and pharmacotherapy, we assessed self-efficacy based on individualised items; these items included confidence in the ability to quit, temptation to smoke and doubt in the ability to quit (Segan et al., 2006).

With regards to the experiential change process and the decisional balance (the pros and cons of smoking), TTM does not play a clear role in preventing relapse. Nevertheless, it has been shown that self re-evaluation, an experiential change process (feeling upset and disappointed when thinking of the smoking habit), has predicted relapse (Prochaska, DiClemente, Velicer, Ginpil, & Norcross, 1985). Furthermore,

consistent with the finding that stronger beliefs about the benefits of quitting smoking can predict relapse, it is possible that relapse could also be predicted if the pros of smoking outweigh the cons in the decisional balance. To measure this association, this study included an additional item pertaining to worries about the problems caused by quitting ("worrying about quitting problems") such as weight gain (Segan et al., 2006).

Thus, this study shall focus on movement within the action stage (early quitting) to maintaining longer quits, which is important for achieving the maintenance stage. Other reasons to focus on this action stage include: 1) a key test for any theory is the extent to which it can actually predict behavioural change; 2) if the model does not actually predict this transition, it will cast doubt on the utility and importance of a stage-based approach (as was used for other behavioural changes), especially during the action phase; and 3) the latest study by Segan and colleagues cannot be generalised to other smokers who are not calling the quitline. Hence, this study is unique in examining the effects of TTM on smoking relapse among former smokers receiving assistance in quitting, as previous studies were either among "quitline" callers or those not receiving assistance in quitting. The results in this study may differ to the other studies, as these smokers received external support that may have enhanced their motivation throughout the behavioural and cognitive change processes.

2.4.2.7 Some criticms of the TTM

Although the TTM has been widely used for many health-related behaviours, there are many critics of the TTM. This includes the earlier argument regarding a lack of a solid theoretical basis (Davidson, 1992), which was countered by Prochaska and colleagues (Prochaska, DiClemente, Velicer, & Rossi, 1992). West (2005) summarized that, the TTM theory has flaws in:

1) The concept of "stage:" the boundary between the motivation stages is arbitrary (e.g., from precontemplation to contemplation). For example, a person who is

planning on making a quit attempt must be within 30 days in order to be in preparation stage. If a person is within 31 days' time of a quit attempt, he/she is considered to be at the contemplation stage. These line boundaries are thus simply arbitrary lines and not definite, as length of stages varies between individuals.

2) The approaches of TTM assume that individuals make stable and coherent planning in quitting. West (2005) suggested, however, that most individuals did not make earlier quit plans and do not set a specific occasion on quitting (e.g. Anniversary or New Year's resolutions). As evidenced, Labarie (2005) reported that the majority of smokers attempted quitting does not make any early quit plans.
3) The stage definitions represent a mixture of different constructs that fail to fit in coherently (e.g., time since quitting, past quit attempts, and quit intentions) (Etter & Sutton, 2002). West (2005) argued that the real readiness and preparedness is not really assessed in the model.
4) The model is more focused on conscious decision-making and the planning process of quitting, while it fails to take into account the concept of reward and punishment (or cost and benefit) which are important factors in making a behavioral change.

The above criticisms described by West (2005) led him to propose a new theory of motivation, called the PRIME Theory. This theory consists of five structures of motivation (plans, responses, impulses and inhibitions, motives and evaluations). PRIME theory proposed that an intention to quit would influence quitting only when it was accompanied by a need or a desire to quit. Furthermore, an attempt in quitting would occur when the desire to quit exceeded the desire to smoke, and the beliefs on the duty to quit do not play a role in quitting, unless the attempt is desired by the smoker himself. Recently this theory was tested in the UK population, and certain parts of the PRIME theory were not being supported. As for example, it was shown that intention appeared to predict quit attempts independently from desire, and duty does not mitigate

the effect of desire and intention (Smit, Fidler, & West, 2011). This calls for further research with regard to the refinement of the theory before it is applied worldwide to replace the current TTM model.

Thus, to date, the TTM model still remains the prime model in smoking related behaviour. This overall critism of TTM shall not be further discussed here, as it is not the main focus of this research.

3.0 Methodology

This study examined variables influencing smoking cessation vs. relapse in a sample of the working population. This chapter is divided into four major sections: 1) the first section describes the research design; 2) the second section discusses the background of the participating workplaces, the recruitment of the participants and the cessation programs being employed; 3) the third section explains the study instrument and the validation of the questionnaires, and 4) the last section describes the data collection and analysis techniques that were used.

3.1 Study design and research design

The focus of this study was to assess the factors contributing to relapse and sustained cessation that occurs in each individual. Since cessation and relapse are a continuous process, and individuals were followed-up for six months, a prospective cohort design was determined to be the best study design for this research. The research design contained two arms: an etiological arm, intended to identify the predictors of smoking cessation and smoking relapse, and a prognostic arm, intended to find time-dependent predictors of relapse.

This study was divided into non-behavioural and behavioural components. The non-behavioural components included socio-demographic characteristics, family support, smoking history and work-related variables. The TTM was used as the behavioural component in the selection of variables. An examination of interrelationships within variables was conducted to identify the predictors of relapse and cessation. This approach facilitated a better understanding of the passage from smoking initiation to relapse and sustained cessation, between the action and maintenance stages.

3.2 Sampling methods and sample size estimation

As previously noted, the main goal of this study was to identify predictors of cessation and relapse. The study was exploratory in that the researcher was attempting to explain the factors that influence a quit attempt, including the progression towards relapse. As such, the population of this study was smokers who were interested in quitting.

3.2.1 Sampling method

Due to the nature of this study and the difficulty of recruiting participants, a non-probabilistic sampling method was deemed most appropriate. Moreover, this study used a non-random sampling method because of the absence of any workplace with a smoking cessation programme in the Klang Valley. Random sampling would have required a larger population of smokers who planned to quit. Thus, convenience sampling and snowball sampling methods were used in this study. Both types of non-purposeful sampling have been used extensively in other smoking cessation studies (D. Daughton et al., 1998; Glavaš, Rumboldt, & Rumboldt, 2003; Molyneux et al., 2003). To ensure higher external validity, the investigator put forth a deliberate effort to obtain representative samples by inviting staff from all departments into the study, regardless of their educational background, work position or age. In addition, smokers themselves encouraged their smoking colleagues to participate.

3.2.2 Sample size estimation

The sample size was calculated using Power and Sample Size Calculations (Version 2.1.31 (Dupont, 1988; Dupont & Plummer Jr, 1990). The sample size used was based on the optimum sample size given in Table 3.1. After accounting for a 20% attrition rate, the sample size required was 153. For the relapse cases, based on the study by Van Zundert et al. (2009), obtaining 67 relapse cases would be adequate for the analysis.

The sample size needed for logistic regressions was also examined to determine the validity of the model being studied. On the basis of other studies, this study

postulated that an average of 20% of smokers would quit after a cessation programme (Smedslund, Fisher, Boles, & Lichtenstein, 2004). On the basis of a table of logistic regression sample size calculations by Vergouwe et al. (2005), the required sample size to achieve 80% power when the event is 35 subjects would be 104 subjects. An event of 56 would require a higher sample size of a minimum of 125 (Vergouwe et al., 2005). Another table used to determine the sample size for the logistic regression concluded that a balanced design with both high and low odds ratios required between 119-166 subjects for a power of 95-99% (Hsieh, Bloch, & Larsen, 1998).

In the present study, the investigator tried to target at least 150 participants after accounting for a 20% attrition rate and a 60% risk of relapse with a 20% success rate.

Table 3.1 Studies for sample size estimation

Study Description	*Methodology*	*Sample size calculated*
1. Title: Risk factors and their effects on the dynamic process of smoking relapse among veteran smokers. (Cui et al., 2006) Aim of study: To investigate risk factors for relapse.	Study Design: Prospective cohort Study Population: Veteran smokers who quit - Follow-up call after 6 months to determine cessation status - 189 veteran smokers; 68% relapsed after 1 month	Using survival analysis in PS software: α: 0.05; Power: 0.8; *R*: 0.7; m_1: 0.22; A: 0.5; F: 0.7; *m*: 1 Sample size needed: **128** Sample size accounted for 20% attrition: 153
2. Title: Testing Social Cognitive Theory (SCT) as a theoretical framework to predict smoking relapse among daily smoking adolescents. (Van Zundert et al., 2009) Aim of study: To provide prospective information on the effects of SCT-derived smoking-specific cognitions and the intensity of smoking on relapse.	Study Design: Prospective cohort Study Population: Adolescents intending to quit - Follow-up of 2 months, using an ecological momentary assessment (EMA) - 135 daily adolescent smokers - Looking into decisional balance, self-efficacy and the intensity of smoking, - Predictors of relapse by survival analysis	Using survival analysis in PS software: α: 0.05; Power: 0.8; R: 1.84; m_1: 0.1; *A*: 0.2; F: 0.2; *m*: 1 Sample size needed: 56 Sample size accounted for 20% attrition: 67

Table 3.1, continued

Study Description	*Methodology*	*Sample size calculated*
3. The role of negative affect in risk for early lapse among low distress tolerance smokers (Abrantes et al., 2008). Aim of study: To examine affective mechanisms of low distress smokers as a predictor of early smoking relapse.	Study design: Prospective cohort study Study population: 81 adult smokers planning to quit smoking without assistance. Follow-up was for one month. Results: Relapsers: 25; abstainers: 52 Analysis: Chi-squared test, logistic regression	Sample size calculation for proportion: using dichotomous proportions, α: 0.05 power: 0.8; P_0: 0.3; P_1: 0.64 *m*: 0.5 Sample size needed: 57 Sample size accounted for 20% attrition: 58

Using proportion:

In prospective studies, α is the Type I error probability for a two sided test; *Po* is the event rate among controls; P_1 is the event rate among cases; *m* is the number of matched controls per case participant or the ratio of control to case participants.

Survival analysis:

A is the type I error probability for a two sided test. This is the probability that we will falsely reject the null hypothesis; *A* is the accrual time during which participants are recruited; *F* is the additional follow-up time after end of recruitment; *R* is the hazard ratio (relative risk) of the control treatment relative to the experimental treatment; *m* is the ratio of control to experimental participants; m_1 is the median survival time on control treatment

3.3 Study population

This study was conducted among the staff of two public universities in the Klang Valley. Smokers who wanted to quit were invited to join the study. The sampling frame consisted of staff from both universities aged 20 years and older who were smokers interested in quitting their smoking habits. The details of the participating universities are described in the following sections.

3.3.1 Background of participating study sites

There are a total of three public universities in the Klang Valley. Two of these were chosen as the site of this research. Data collection started in University A and was expanded to University B due to an inadequate sample size. Universitiesy A and B were chosen because of their accessibility and support in conducting smoking cessation programmes. Accessibility was a major issue because conducting a smoking cessation programme requires approval from the top management of each university. Universities need to support such programmes by allocating a suitable location and environment as well as allowing time off for their staff to attend the sessions.

One of the universities is the school where the investigator is currently studying, whereas the investigator is a member of the permanent staff (on study leave) of the other university. Having this relationship with both study sites facilitated the process of obtaining space and approval for the programme. Moreover, this relationship hastened the recruitment of staff members via staff emails and university web portals.

Due to the time constraints of this research and the reasons stated above, the programme was not extended to the third public university in the Klang Valley.

3.3.1.1 University A

University A is a research university that has more than 27,000 students and 1,700 academic staff with 17 faculties and research centres. At this university, there was a

total of over 2500 academic staff and 3500 non-academic staff in 2009. The non-academic staff ranged from technicians, security guards and office workers to canteen staff and drivers.

University A has a strict non-smoking regulation banning smoking at the workplace for over a year. According to this ban, smokers caught smoking on the campus are fined up to RM 200.00. The security department of University A has been given authority to penalise smokers who smoke on the campus by giving them a warning card that may lead to a punishable offence.

Smokers were recruited to join this study through; 1) the yearly Wellness Health Screening (110 participants); 3) the Wellness Day Exhibition (25 participants), and 3) individual e-mails (30 participants) sent to all staff (20 participants). Out of those participants who showed interest in joining, 138 attended the clinic for treatment and counselling (see chapter 4 for further details on participant recruitment under "Process Evaluation").

3.3.1.2 University B

University B is Malaysia's largest institution of higher learning in terms of size and population. The university has 12 branch campuses, three satellite campuses, nine city campuses and 21 affiliated colleges. With this vast network and a workforce of 17,000, the university offers more than 300 academic programmes. It is also home to some 172,000 students.

Presently, the Shah Alam Campus host to 45.5% of the total number of students attending University B, and the rest are distributed over the other district campuses, with the Arau campus handling the greatest number (6.3%). The site used for this study was located at the main branch of Shah Alam University B. This facility has a total of 8000 academic and non-academic staff.

Unlike University A, University B has very loose smoking regulations and policies. University B follows the country's regulations regarding the prohibition of smoking in the campus area, but there is no enforcement of this rule. There are also very few no-smoking signs, and smokers smoke freely on the campus.

There are also very few health promotion activities available on the campus of University B. The health promotion activities available, which included health screening, blood donation and health campaigns, were isolated activities conducted at faculty levels or units.

Prior to this programme, there was a smoking cessation clinic conducted for staff and students at the university's health centre in 2005. This clinic was established as part of the health services provided to students and staff. A total of 26 smokers participated. This programme involved partially subsidised pharmacotherapy (participants were required to pay half of the price of the medication) and clinic sessions. At the end of six months, no smokers had actually quit. Thus, due to the low response rate and poor cessation outcomes, the clinic was closed a year later.

3.3.2 Recruitment and participation

After approval was granted from the University of Malaya Ethical Committee, the programme was started in University A and subsequently in University B. Data were collected between November 2009 and August 2010 at University A and between March 2010 and January 2011 at University B. Informed consent was obtained from each participant (See the section entitled "Medical Ethics" for ethical approval).

Smoking cessation programmes were conducted at both universities. Participants were recruited from the working staff of the two universities. Various methods of recruitment were conducted, including sending individual emails and letters to all staff and to the heads of the departments/centres, advertising through Wellness Workplace

Programmes and conducting a road show. The details of the recruitment process are discussed in Chapter 4 (“Process Evaluation”).

The basic message was: “Quit Smoking Now! Participate in a quit smoking programme. Please contact Dr. Siti Munira Yasin at 019-2515325”. Each participant who called or agreed to quit was given a brief outline of the programme. If the individual was able to meet the basic time restraints (meeting weekly or twice weekly for the first two months) and agreed to be followed up for six months, an individual interview and group session were scheduled.

3.3.3 Screening interview

Prior to attending the clinic sessions, each participant went for a screening interview, which was conducted either at the recruitment site or via telephone. The interview, which lasted five minutes, had three major purposes: (1) to provide interested participants with information about the project, requirements of the project, and information about the dates and times of anticipated sessions, if known at the time of the interview (2) to include and exclude eligible participants based on the set of inclusion and exclusion criteria set forth below, and (3) to ensure that participants were given an appointment based on their individually preferred time and date.

3.3.4 Subject enrolment: Inclusion and exclusion criteria

The eligibility criteria were designed to select subjects who fulfilled the treatment protocol. All relevant medical and non-medical considerations were taken into account when producing these criteria. Subjects that met the following criteria were considered for enrolment into this study: (1) staff of the university; (2) individuals who had been smoking at least five cigarettes per day for a minimum of one year; 3) individuals who were interested in quitting, and (4) individuals who were willing to adhere to a protocol that included follow-up visits.

The exclusion criteria were individuals with the following cardiovascular diseases: (1) myocardial infarction in the preceding two weeks; (2) serious arrhythmias, and (3) unstable angina.

The above criteria were based on the safe use of nicotine replacement therapy (NRT) (Molyneux, 2004). The long-term use of NRT is not associated with serious side effects; however, concerns over the safety of NRT in some circumstances, e.g., in acute cardiovascular conditions, have led to recommendations that they be avoided in these patients.

3.4 Smoking cessation sessions

The study treatment consisted of combined medical and cognitive behavioural therapy. The smoking history, sociodemographic variables, stress and coping questionnaire and family support were determined prior to treatment. The medical treatment consisted of NRT gum/patches; the method of NRT depended on each participant's medical history, degree of nicotine dependence and preferences. Cognitive behavioural therapy involved a minimum of 3 sessions covering coping strategies, the risks and benefits of quitting, relapse prevention, stress reduction and weight control. Figure 3.1 illustrates the sessions that participants were required to attend.

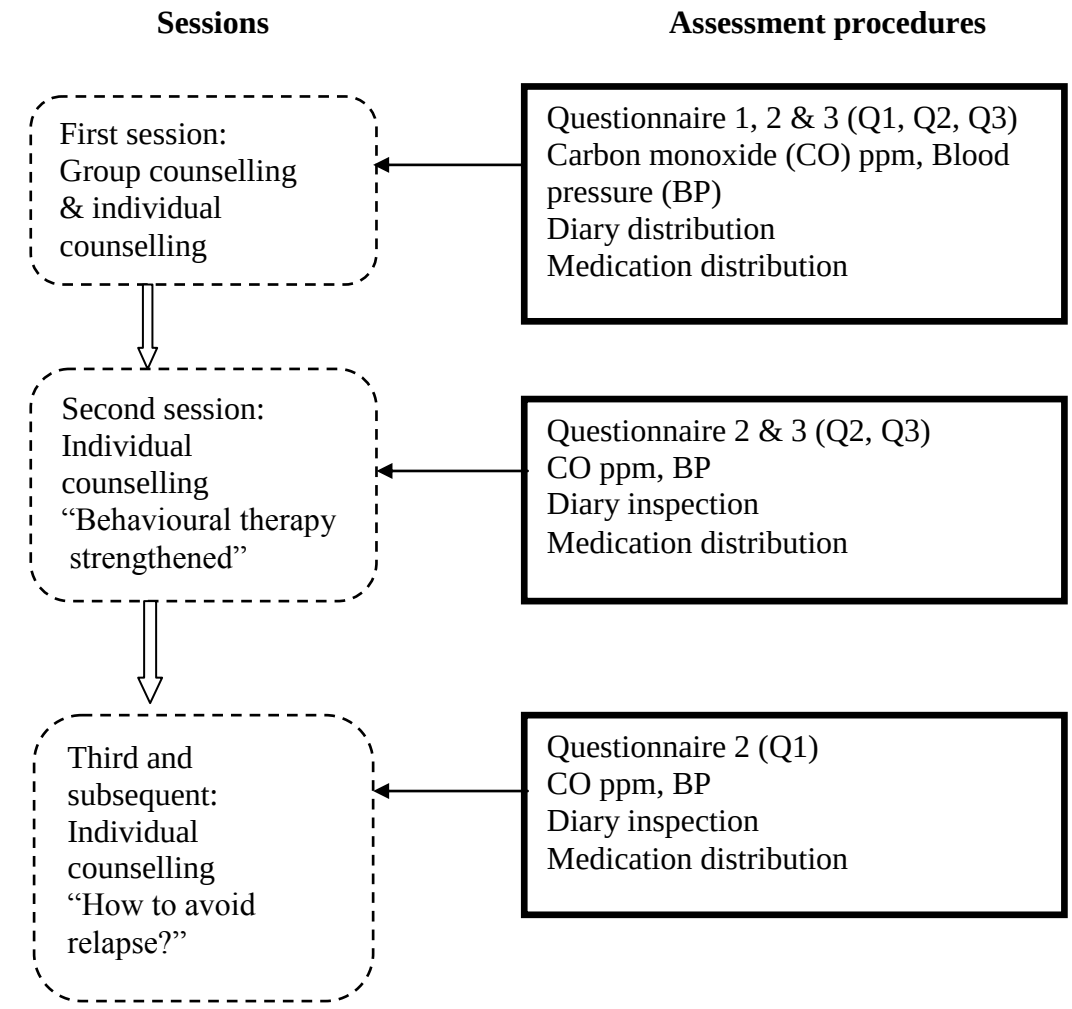


Figure 3.1 Flowchart of smoking cessation sessions and assessment procedures

3.4.1 First clinic session

After recruitment, participants were required to attend an initial session. The first session consisted of five major parts: (1) a briefing; (2) measurements of CO ppm; (3) administration of the questionnaire; (4) a group session, and (5) an individual session

3.4.1.1 Briefing

During this session, 3-5 participants were briefed on the study in detail. The following procedures were performed for each participant:

1) The participant, after agreeing to the terms and condition of the study and reading the participant information sheet, signed the informed consent form. In the case of participants who did not understand the participant information sheet, the investigator explained each session and its parts in detail.
2) The investigator ensured that the participants once again meet the inclusion and exclusion criteria.

3.4.1.2 Measurements and administration of questionnaire: (see the "Assessments" section)

3.4.1.3 Group Session

All participants were required to attend the first group session. This session consisted of an introduction, a PowerPoint presentation that lasted approximately one hour and the distribution of medications and a diary. The session was conducted in a small group of 3-5 participants. The contents of this group session were:

1) Introduction of investigator and clients

The purpose of this portion of the session was to let the participants know that the investigator was glad they came and that it was important to take the first step, which they did by coming to the session.

2) *PowerPoint Presentation*

This consisted of a general talk on smoking cessation techniques. In this session, participants were also required to make a pledge to quit smoking and to set a quit date.

The sessions were taught in accord with national and international guidelines on smoking cessation (Anczak & Nogler II, 2003; Fiore, 2008a; Robson et al., 2003). The contents of the teaching and counselling sessions are described in appendix C.

3) *Distribution of Medication*

Each participant was given a one week supply of NRT gum after receiving a detailed explanation on the administration and side effects of the medication. NRT was distributed based on the number of cigarettes each participant smoked per day. Smokers who smoked < 20 cigarettes per day were given a 2 mg NRT gum, and those who smoked ≥ 20 per day were given a 4 mg gum. Participants were taught how to properly chew and use the NRT gum. Subsequent doses of gum were given during follow-up sessions.

The subjects who were absent on their appointed counselling/follow-up dates received telephone calls from the investigator to set a new appointment date. Appointments were made for participants to return for their 2nd visit within two weeks of the initial visit.

3.4.2 Second clinic session

In the weeks following the initial meeting, participants were required to attend individual sessions. The first individual session was set two weeks after the group session. The first individual session consisted of three components: examination, questionnaire completion and individual behaviour therapy.

Behavioural therapy involved a 40 minute individual PowerPoint presentation on “How to Maintain Cessation”. Participants were also individually counselled on any problems that developed during their cessation attempt, including problems with the

medication, personal problems and social problems. Each problem was discussed with the investigator and possible solutions were given. (See appendix C for the contents of the 2nd and 3rd sessions)

During this session, participants were given more NRT gum. Participants were required to bring along any unused gum. Participants who were unable to tolerate the NRT gum due to its side effects were given a supply of NRT patches. The correct use of NRT patches was explained. Appointments were made for subjects to return for the 3rd visit within two weeks of the second visit.

3.4.3 Third and subsequent clinic sessions

The subsequent sessions were short individual sessions lasting less than 20 minutes each. The third session taught participants on how to maintain cessation. During this session, subjects were also advised on the possible side effects or tendencies that may occur during the first six months of quitting, including weight gain and the return of past behavioural habits. Any queries or problems related to this information were discussed and possible advice and solutions were sought.

3.4.4 Telephone follow-up

At three months and six months after the initial cessation attempt, each participant was contacted by the investigator via telephone. This telephone session was meant to assess the smokers' smoking status and to document relapse episodes.

3.5 Data collection

Data were collected by self-conducted questionnaires (completed during clinic sessions and via mail for follow-ups) and clinical assessments. The investigator had direct access to all the respondents from recruitment, treatment modalities and follow-up assessments.

A clinical assistant was hired on a contract basis for a period of nine months. The clinical assistant had basic high school qualifications (equivalent to O level) and was given a monthly salary of RM 800.00 from the investigator's research grant. Prior to the start of the cessation programme, she was trained by the investigator in distributing questionnaires and conducting basic clinical measurements, including body mass index (BMI) assessment and CO ppm measurement. She also ensured that the respondents' files were neatly kept and that the waiting room for the smokers prior to counselling was being kept clean and well-organised.

3.5.1 Study assessments during each session

3.5.1.1 Administration of questionnaires during clinic sessions

Questionnaires were administered during clinic sessions. Participants who did not understand any section of the questionnaire were asked to seek guidance from the investigator. The questionnaires were administered as in Table 3.2.

Table 3.2 Summary of assessment procedures

Time of assessment	*Types of questionnaire administered*
Initial clinic session	• Questionnaire 1 (Q1) • Questionnaire 2 (Q2) • Questionnaire 3 (Q3)
Individual clinic sessions at weeks one, two and four Three months and six months follow-up	• Questionnaire 2 (Q2) • Questionnaire 3 (Q3)
Via e-mail/ mail	• Questionnaire 2 (Q2) • Smoking Status Questionnaire (SSQ)

3.5.1.2 Administration of questionnaire via mail

At three months and six months after the initial cessation attempt, each participant was contacted by telephone. The telephone sessions were conducted by the investigator alone. Data obtained regarding smoking status, date of relapse and the numbers of relapse episodes were gathered during this session.

Each participant was then mailed a set of Q2 and SSQ (Table 3.2). An envelope addressed to the investigator was attached. Smoking status was meant to identify the number of cigarettes smoked, relapse episodes, if any and changes in behaviour. Participants were required to mail back the Q2 and SSQ within two weeks. Participants who failed to do so were reminded via telephone by the investigator. Any additional queries by the participants were answered during that telephone call. Participants who preferred email instead of internal mail were sent a Microsoft Word version of the questionnaire via email attachment and they were required to complete and email their response within two weeks.

Participants who quit were visited by the investigator at their workplace to confirm their cessation status by CO ppm. Smokers who were unable to be contacted either by mail, email or telephone were considered to be smokers without any successful cessation attempts. The questionnaire administered at three months and six months and the telephone script used at those time points are as shown in appendix A and B**.**

3.5.1.3 Quit smoking diary

A diary (as per appendix D) was given to participants at the initial session. This diary was made specifically for this study. The aim of this pocket-sized diary was to assess the amount of medication taken, the number of urges that smokers felt daily and the number of cigarettes they smoked during a particular day. The dairy also contained an oath that the participants were required to take to ensure that that they would try to quit

smoking once they had joined this programme. A general guide and tips on how to quit and maintain abstinence from cigarettes were also included.

Participants were required to write the number of cigarettes smoked and the number of NRT gums taken daily in the dairy. Participants were asked to carry the diary wherever they went, if possible. The smoking cessation diaries were assessed by the investigator or the assistant during each follow-up, photocopied and kept in the participant's personal file for reference.

3.5.1.3 Clinical assessments

Clinical assessments consisted of carbon monoxide (CO), BP and weight measurements. These were taken during each visit prior to the counselling sessions. In addition, former smokers who had quit after the clinic sessions ended were visited at their workplace for CO ppm measurement. These visits were performed at three months and six months to confirm their quit status. Each participant's weight and BP measurements were complimentarily assessed and discussed during each visit. These measurements were not reported on in this dissertation.

3.5.2 Study instruments

Various study instruments were utilised to answer the objectives of this research. Below are the instruments used and adapted in this study.

3.5.2.1 Measurements of carbon monoxide parts per million (CO ppm)

In this study, measurements of CO ppm were taken at every follow-up session. CO ppm measurements were obtained using a standard handheld CO analyser (piCO Smokerlyzer, Bedfont Scientific Ltd, England). The CO level was obtained from the participants via expired air. Three readings of the CO ppm level were taken and an average was taken as the result.

The categorisation of subjects according to their CO ppm measurements was defined as follows; individuals with CO values of < 6 were non-smokers, 6-10 were

occasional smokers, 11-21 ppm were termed mild daily smokers, and those with CO values > 21 ppm were defined as heavy smokers. Abstinence was determined during follow-up sessions, with self-reported abstinence confirmed by CO < 6 ppm.

3.5.2.2 Self-administered questionnaire

There were three sets of self-administered questionnaires that participants were required to complete. The 1st set contained sociodemographic, smoking history, family support, environmental influence, stress, coping and job content questionnaires. Participants were only required to complete it once, during the first session.

The second set of questionnaires contained questions addressing smoking history and behavioural questions related to smoking. Participants were required to complete this set of questionnaires 3 times during the entire follow-up period (baseline, 3 months and 6 months). The 3rd questionnaire is the questionnaire used to determine the level of nicotine dependence and was given before administering the medication. The self-administered questionnaires and their origins are explained below.

Questionnaire 1: Sociodemographic, smoking history, family support, environmental influences, perceived risk and benefit

Q1 consisted of:

1) ***Sociodemographic and smoking history***

Sociodemographic information was gathered via questionnaire administration. Data gathered included age group (18-30; 31-40; 41-50; 51 and above), education level (primary school; secondary school; diploma and above), occupational status (support staff; professionals) and marital status (single; married; divorced). Information on smoking history gathered included number of cigarettes/day (< 10; ≥ 10), age at which the participant began smoking (8-12; 13-18; 19 and above) and previous quitting attempts within the past year (0; ≥ 1). Data on the subject's awareness of university rules regarding smoking and whether he/she smoked on campus were also collected.

2) Stage of change profile

The stage of change of each participant in the sample was measured using the Stage of Change Questionnaire Short Form (DiClemente et al., 1991). This questionnaire was initially developed in 1982 (Prochaska & DiClemente, 1982) and is a survey asking subjects about their previous cessation attempts and current plan for smoking cessation. Stage membership is determined by the subject's level of readiness to make a behavioural change. This is a three item measure of a participant's motivation designed to categorise participants into 3 stages: precontemplation, contemplation and preparation. Morera and associates (1998) tested the reliability of the stage of change construct in a longitudinal study involving 261 women over a period of 24 months. Values of 0.88-0.98 and 0.69-0.76 were obtained for measurements of stability and reliability, respectively. These values indicated a good fit for the stage of change model (Morera et al., 1998).

3) Family support

Partner smoking and support may influence the smoking behaviour of the spouse (Gulliver, Hughes, Solomon, & Dey, 1995). A brief questionnaire was administered to examine these variables and their impact on cessation and relapse. This questionnaire uses a four item, five point Likert scale adapted from an adolescent smoking study (C. Redding et al., 1998; C. A. Redding et al., 1999) ranging from 5-20. The five-point Likert scale was defined as 1 (never) to 5 (very often).

In a recent study among adolescent smokers in a school-based prevention programme, the scale used demonstrated good internal consistency ($\alpha = 0.9$). A comparative fit index of the items gave a value of at least 0.78 (Velicer, Redding, Anatchkova, Fava, & Prochaska, 2007).

4) ***Environmental influences***

Environmental influences may also affect smoking cessation when smokers are exposed to Environmental Tobacco Smoke (ETS) (Honjo, Tsutsumi, Kawachi, & Kawakami, 2006). The questionnaire used here was adapted from a path analysis study that involved 481 respondents who were followed by telephone survey for a total of up to 3 years in a cohort of US adults. In this study, it was found that workplace environment, home environment and peer factors play an important role as mediating factors between social class and smoking cessation (Honjo et al., 2006). The questionnaire consisted of three simple questions and was meant to examine the influence of workplace environment, home environment and peer smoking on smoking cessation. Notably, in the study from which this questionnaire was adapted, a Likert scale was used. The present study, in contrast, has categoried each item into four response categories. The effects of these influences on both smoking cessation and relapse were examined.

5) Rhode Island stress and coping inventory

Stress and coping skills were associated with smoking relapse and cessation, as studied by Fava et al. (1998). This was a general perceived stress and coping inventory developed in a random sample of 466 adult smokers. Coefficient alphas on the subscales of both stress and coping were 0.86 and 0.87, respectively. Several confirmatory factor analysis (CFA) fits indicated an excellent fit for the items, demonstrating that the items were moderately correlated with each other. This questionnaire was given at baseline only. This 12 item survey asked participants to rate how often they experienced stress, in a 5 point Likert scale of 1 (never) to 5 (always).

6) Job content questionnaire (JCQ)

The psychological aspect of job stress was evaluated using the Job Content Questionnaire (JCQ). This tool is based on Karasek's demand-control model and is

frequently used in the assessment of the psychosocial work environment (Hurrell Jr et al., 1998; Karasek Jr, 1979).

Responses were recorded using a Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The questionnaire had the following JCQ scales − job skill discretion (six items), job decision-making authority (three items), psychological job demand (five items), supervisor and co-worker support (eight items) and job insecurity (four items). Decision latitude was a combination of job skill discretion and job decision-making authority. Scores for decision latitude, psychological job demand and social support were calculated based on Karasek's recommended format.

Cronbach's alpha values for a previously conducted local study by Maizura et al. (2009) using the questionnaire for all of the items were within internationally acceptable standards (Keegel, Ostry, & LaMontagne, 2009), i.e., between 0.64-0.79, with correlations of > 0.3 (Maizura et al., 2009). Subjects were classified based on separate tertiles for all seven items (low, medium and high) (Fukuoka et al., 2008; Kouvonen, Kivimäki, Virtanen, Pentti, & Vahtera, 2005).

Questionnaire 2 (Q2): Transtheoretical model questionnaire

The TTM consisted of four parts: a) smoking decisional balance; b) temptations to smoke; c) impacts of smoking, and d) individual beliefs regarding self-efficacy. The questionnaires for this section are specifically related to the TTM and are frequently used in smoking cessation studies. They were popularised by Velicer et al. (1990) and may be used to study relapse situations. Subjects were taken from a pool of 960 adult smokers. From this pool, 255 subjects had relapsed. An analysis was conducted to find the most appropriate model for self-efficacy and temptations. The Complex Hierarchical Model (GFI) of the data presented was 0.906 (Velicer et al., 1990).

The decisional balance scale had three-item subscales. Participants were asked their opinions regarding quitting, and their responses were recorded from *1 (not*

important) to 5 (extremely important). Measurements of situational temptations were based on a three-item subscale indicating temptations to smoke, ranging from *1 (not tempted at all) to 5 (extremely tempted).* All items were measured in three separate high-risk circumstances: positive/social, habit/addictive, and negative/affective. Aggregate measures of decisional balance and temptation were the averages of all the subscales within the items.

Impacts of smoking, which affected the change process, consisted of behavioural change processes (counter conditioning, reinforcement management, self-liberation, helping relationships and stimulus control) and experiential change processes (consciousness raising, environmental re-evaluation and self re-evaluation). Two other experiential change processes, social liberation and dramatic relief, were excluded from our analysis, as these processes were not previously found to predict relapse (Prochaska et al., 1985). Each item was rated on a 5-point Likert scale (1 = never to 5 = repeatedly). The original questionnaire, assessing the change process "during the past month", was modified to reflect the "current" change process, as administered in previous studies (Borland, Segan, & Velicer, 2000; Segan et al., 2006).

Additional items measured on a similar scale (1 = never to 5 = repeatedly or 1 = not at all to 5 = extremely) included two negative thoughts associated with self-efficacy (resisting urges to smoke and doubting the ability to quit), three measures of motivation to quit ("doubting worth of quitting", "worry about problems associated with quitting" and "determination to remain abstinent") (Segan et al., 2006) and two self-efficacy related beliefs pertaining exclusively to quitters ("self-efficacy to resist temptations" and "self-efficacy to remain a non-smoker") (Borland & Balmford, 2005).

In a study involving a large sample (n = 2080) of smoking adolescents, a decisional balance inventory for both smokers and non-smokers showed an excellent fit of the three-factor model (social pros, coping pros and cons) with the decisional balance

inventory (CFI = 0.963) (Plummer et al., 2001). A more recent study among Bulgarian smokers also showed a good fit for both the 3-factor model for temptations (CFI = 0.95) (Anatchkova, Redding, & Rossi, 2006). The additional self-efficacy related belief was modified from the version developed by Borland & Balmford (2005) that pertains specifically to quitters. The entire set of questionnaires was based on the specified five-point Likert-scale. Results were averaged for each variable.

Questionnaire 3 (Q3): Fagerstrom test of nicotine dependence (FTND)

The FTND score is a set of questionnaires that are used to determine the level of nicotine dependence among smokers. This score is a self-reported measure for smoking that has received considerable acceptance among researchers. It was developed by Fagerstrom (1978) and has since been validated and revised (Heatherton et al., 1991). This questionnaire consists of eight items that were designed to assess smoking behaviours, including estimates of the quantity and type of intake of nicotine, the difficulty of maintaining abstinence and other aspects of smoking.

Smoking status questionnaire (SSQ):

SSQ is a simple set of questionnaire developed by the investigator consisting of items related to quit status, length of quit and relapse episodes.

3.5.2.3 Investigator's standard sheet

Several sheets were used by the investigator during both the individual sessions and the phone sessions. The sheets were in the possession of the investigator throughout the sessions and were placed inside each participant's individual file together with the completed questionnaires. This sheet was used in the 1^{st}-4^{th} individual sessions. It contains measurements of abstinence, withdrawal symptoms if any and CO ppm readings. I was also utilised at two months, three months and six months to assess smoking status and relapse.

3.5.3 Study variables

Instruments used for this study consisted of independent and dependent variables obtained from the questionnaires and assessments. The independent variables included socio-demographic history, smoking history, work-related history and FTND score. Other specific behavioural-related independent variables were: TTM variables, individual beliefs regarding self-efficacy, work-related variables, environmental influences, family support, stress and coping variables. Furthermore, independent variables that were obtained during the follow-up session were length of abstinence, adherence to NRT and number of clinic sessions.

The primary dependent variable in this study was smoking cessation vs. relapse at follow–up. Smoking cessation was measured as a dichotomous variable. The dependent variables were then categorised into point abstinence, sustained abstinence and relapse (please refer operational definitions in Table 1.1).

Table 3.3 Study variables

Variable name	*Characteristics*	*Source*
Independent Variables		
1. Participant sociodemographics and smoking history (in Q1)		
Age group	Categorical; coded as 1 = 18-30; 2 = 31-40; 3 = 41-50; 4 = 51 and above	Baseline Survey
Educational level	Categorical; coded as 1 = primary school; 2 = secondary school; 3 = diploma and above	
Occupational status	Categorical; coded as 1 = support group; 2 = professionals	
Marital status	Categorical; coded as 1 = single; 2 = married; 3 = divorced	
Number of cigarettes/day	Categorical; coded as 1 = < 10; 2 = ≥ 10	
Age of smoking initiation	Categorical; coded as 1 = 8-12 years; 2 = 13-18 years; 3 = 19 and older	
Previous quit attempt within one year	Categorical; coded as 1 = 0; 2 = ≥ 1	
NRT used	Categorical; coded as 1= Non adherent; 2 = Adherent	
Counselling sessions attended	Categorical; coded as 1 = 1 session; 2 = 2 sessions; 3 = 3 sessions; 4 = 4 sessions or more	
Aware of university rules	Categorical; coded as 1 = Yes; 2 = No	
Smoking on the university campus	Categorical; coded as 1 = Yes; 2 = No	
2. Stage of change variable (in Q1)		
Stage of change	Categorical; coded as 1 = preparation; 2 = contemplation; 3 = precontemplation	Baseline survey and at 6 months

Table 3.3, continued

Variable name	*Characteristics*	*Source*
Independent Variables		
3. Family support variables (in Q1)		
Family support	Five-point Likert scale rated from 1 (never) to 5 (very often); categorical coded as: 1 = Good family support; 2 = Poor family support In the analysis: Values for each individual score were summed to obtain an overall score. The mean scores were treated as a cut-off point to categorise them into good support and poor support.	Baseline survey
4. Environmental influences variables (in Q1)		
Worksite environment (exposure to cigarette smoking)	Categorical; coded as: 1 = 0 hour; 2 = 1-2 hours; 3 = 3-8 hours; 4 = 9 hours or more	Baseline survey
Home environment (exposure to cigarette smoking)	Categorical; coded as: 1 = 0 hour; 2 = 1-4 hours; 3 = 5-14 hours; 4 = 15 hours or more	
Peer influence (number of smoking friends)	Categorical; coded as: 1 = None; 2 = Very few; 3 = Less than half; 4 = Most are smokers	
5. Stress and coping inventory variables (in Q1)		
Stress	Categorical; coded as: 1 = ≤ 3 (low stress); 2 = > 3 (high stress)	Baseline survey
Coping	Categorical; coded as: 1 = ≤ 3 (low coping ability); 2 = > 3 (high coping ability) In the analysis: The scoring for both stress and coping skills was performed by summing the points assigned for the coping questions and stress questions for an overall stress score of 7-35 and a coping score of 5-25. The mean scores were treated as cut-off points to divide them into two categories.	

Table 3.3, continued

Variable name	*Characteristics*	*Source*
Independent Variables		
6. Job stress questionnaire (JCQ) variables (in Q1)		
Job decision-making authority	Ordinal initially in all variables of JCQ via a 4-point Likert scale, 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree; then coded into categorical variables based on calculated tertiles; coded as: 1= 12-27 (low); 2= 28-39 (medium); 3= 40-48 (high)	Baseline survey
Job demands	Categorical; coded in tertiles as: 1 = 18-29 (low); 2 = 30-33 (medium); 3 = 34-48 (high)	
Co-worker support	Categorical; coded in tertiles as: 1 = 5-11 (low); 2 = 12 (medium); 3 = 13-16 (high)	
Supervisor support	Categorical; coded in tertiles as: 1 = 4-9 (low); 2 = 10 (medium); 3 = 11-15 (high)	
Job insecurity	Categorical; coded in tertiles as: 1 = 4-5 (low); 2 = 6 (medium); 3 = 7-9 (high)	Baseline survey
Job decision latitude	Categorical; coded in tertiles as: 1 = 30-61 (low); 2 = 62-73 (medium); 3 = 74-126 (high)	
Job skill discretion	Categorical; coded in tertiles as: 1 = 18-31 (low); 2 = 32-35 (medium); 3 = 36-46 (high) In the analysis: For each of the scales, the scores were calculated based on Karasek's recommended format (see appendix).	
Job strain	1 = low strain; 2 = passive; 3 = active; 4 = high strain A job strain indicator was created from the job demands and decision latitude parameters. This indicator was dichotomised by the medians of the two parameters and classified into four domains: i) high-strain jobs (low decision latitude and high demand); ii) low-strain, relaxed jobs (high decision latitude and low demand); iii) passive jobs (low decision latitude and low demand) and iv) active jobs (high decision latitude and high demand) (Robert Karasek et al., 1981; H. Maizura et al., 2010; Xun et al., 2010)	

Table 3.3, continued

Variable name	*Characteristics*	*Source*
Independent Variables		
7. Transtheoretical Model (TTM) variables (in Q2)		
7a. Decisional balance		
Pros of smoking	Ordinal initially for all variables via a 5-point Likert scale, 1 = not important; 2 = slightly important; 3 = moderately important; 4 = very important; 5 = extremely important This was treated as a continuous variable (scores) in the analysis.	
Cons of smoking	as above	
7b. Temptations in quitting smoking		
Positive social temptations	Ordinal initially for all variables via a 5-point Likert scale, 1 = not at all tempted; 2 = not very tempted; 3 = moderately tempted; 4 = very tempted; 5 = extremely tempted This was treated as a continuous variable (scores) in the analysis.	Baseline survey, with follow-up, at 3 months and 6 months
Habit/ addictive temptations	as above	
Negative/ affective temptations	as above	
7c. Impacts of smoking		
Counter conditioning	Ordinal initially for all variables via a 5-point Likert scale, 1 = never; 2 = seldom; 3 = occasionally; 4 = often; 5 = repeatedly This was treated as a continuous variable (scores) in the analysis.	
Self-liberation	as above	
Reinforcement management	as above	
Stimulus control	as above	
Helping relationship	as above	
Consciousness raising	as above	
Self re-evaluation	as above	

Table 3.3, continued

Variable name	*Characteristics*	*Source*
Independent Variables. (Continued 7c)		
Environmental re-evaluation	as above in 7c	
Worry about problems associated with quitting	as above	
Resisting urges to smoke	as above	
Doubting ability to quit	as above	
Doubting worth of quitting	as above	
Determination to maintain cessation	as above	
7d. Beliefs related to self-efficacy		
Self-efficacy in resisting temptations	Ordinal initially for all variables via a 5-point Likert scale, 1 = not at all; 2 = slightly; 3 = moderately; 4 = very; 5 = extremely This was treated as a continuous variable (scores) in the analysis.	
Self-efficacy to stay a non-smoker	as above	
8. Fagerstrom Questionnaire (FTND) (in Q3)		
FTND	Categorical; coded as: 1 = low nicotine dependence: < 5 2 = moderate nicotine dependence: 5 3 = high nicotine dependence: 6-10 In the analysis: The level of nicotine dependence was derived from the total score of the FTND. In the original score the following classifications were used: 0-2: very low dependence; 3-4 low dependence; 5: medium dependence; 6-7: high dependence; 8-10: very high dependence. However, in this study, the category will only be divided into 3: < 5: low, 5: medium and 6-10: high nicotine dependence.	Baseline survey and during follow-up

Table 3.3, continued

Dependent variables		
1. Smoking cessation		
1a. Predictors of Smoking cessation	Obtained during clinic sessions follow-up and SSQ at 3 months and 6 months, confirmed by CO ppm. Categorical; coded as 0 = did not quit 1 = quitters	1 week, 2 months, 3 months and 6 months
1b. Changes in pros and cons at two months	Categorical; coded as 0 = quitters 1 = non-quitters	2 months
1c. Changes in motivation	Categorical; coded as 0 = relapsers 1 = never quit	6 months
1d. Predictors of Motivation	Divided into 3 different predictors; 0 = sustained quitter 1 = quitter 2 = relapser Outcome of quitting, categorical; coded as: 0 = did not quit 1 = quitters	6 months
2. Smoking relapse (in SSQ and during follow-up)		
2a. Risk factors for relapse	Categorical; coded as 0 = quit/censored cases 1 = relapse/event cases	6 months
2b. Time to relapse	Continuous variable: time to relapse was censored at 180 days and analysed every five days.	Based on smoking cessation diary; recorded daily by participants for up to 6 months
2c. Relapse in TTM	Categorical; coded as 0 = maintain quit 1 = relapse	During follow-up at 3 months and 6 months

3.6 Validation of study instruments

A measured instrument in any study must first be subjected to tests of both validity and reliability. Although most of the items utilised in this study were adapted from the literature and had been previously validated, re-validation seemed appropriate because this study was undertaken in the Malaysian population, which may be different from other countries in terms of individual behaviour, environment, social norms and culture.

The validation study undertaken in this research involved a validity and reliability test of the questionnaires that were not previously validated in their Bahasa Malaysia versions. Among the questionnaires used in this study, only the Job Content Questionnaire was available in Bahasa Malaysia and was locally validated (Edimansyah, Rusli, Naing, & Mazalisah, 2006).

3.6.1 Materials and methods for validation

1) Study design and sample size

A one-month cross-sectional validation study was performed in four different workplaces and was conducted in the months of September and October of 2009. The reason for such diversity was to capture the various occupational groups and education levels that exist in the university setting.

The participants were from:

1) University Technology Mara, Puncak Alam Campus, Selangor – lecturers and technicians;
2) University Malaya, Kuala Lumpur – Staff and postgraduate students of the Social Preventive Medicine Department, Faculty of Medicine;
3) University of Malaya Medical Centre- security guards;
4) Bukit Aman Police Station- administrative workers.

Smokers from each workplace were individually invited and approached to participate in this validation study. Each participant was informed that the validation had to be performed twice within a week's duration.

Inclusion criteria were smokers who smoked at least five cigarettes per day, were not currently involved in any quit attempt, were not planning on quitting in the next one month and were fluent and able to read and write in Bahasa Malaysia. Smokers who were interested in quitting/planning to quit in the near future and who were not willing to complete two sets of questionnaire in two consecutive weeks were excluded.

Self-administered Malay versions of the Questionnaires were distributed to 48 smokers at their respective workplaces over a period of two weeks. An average of 30 minutes was utilised to complete the questionnaires. The response rate for the first set of questionnaires was 100%. However, after one week, two of the smokers did not return their questionnaires, and six failed to fill out the second set due to shift hours, or they kept their questionnaires longer than eight days. Smokers who returned the second set of questionnaires after seven days were excluded from the analysis. In total, 83% of participants (n = 40) returned the second set of questionnaires and were included in the analysis. Smokers who answered both questionnaires in the time frame allotted were given a token of appreciation.

In an exploratory factor analysis, the general rule of thumb is that the ratio of the number of respondents to items (subject to variable ratio) should be greater than five (Arrindell & Van der Ende, 1985). In this study, the ratio fell within the recommended level for questionnaires with eight items. One questionnaire contained 9 items and was slightly underpowered. However, another study in the literature had a ratio of less than 4:1 and was deemed acceptable (MacCallum, Widaman, Preacher, & Hong, 2001). They also concluded that the general rule of thumb for sample size may not be valid or useful.

2) Questionnaires

As explained in the study instrument sections, the five sets of questionnaires were translated into Malay by two lecturers from the Information Management faculty, University Technology MARA (UiTM). They were not involved in this study and are fluent in both Bahasa Malaysia and English. It was then translated back into the English language by another lecturer from UiTM to ensure high face validity. Any differences that existed among the three parties were discussed, and a consensus was achieved.

The translated version was then pre-tested among a group of five smokers with different educational backgrounds and ages. Any questions that were deemed to be difficult to understand were rephrased and discussed again with the translators to identify the best possible wording.

3) Statistical analysis

Double data entry was carried out with subsequent validation to guarantee the quality and consistency of the data. The statistical programme SPSS for Windows version 15.0 was used to carry out the analysis.

Descriptive statistics were computed for demographic features. Means and standard deviations were calculated for continuous variables, and frequency and percentages were calculated for categorical variables. The internal consistency of each part of the questionnaire was tested using Cronbach's alpha reliability coefficients. Cronbach's alpha values ranged from 0 to 1 (greater alpha levels indicate a more reliable scale) (Garson, 2010; Santos, 1999). An alpha value of 0.70 and above is generally reported as acceptable, and some explorative studies took 0.60 to be a suitable cut-off value (Santos, 1999). For test-retest reliability, kappa values were calculated for each categorical variable, and the Spearman's correlation coefficient was used to assess the reliability of Likert scale scores.

Factor analyses were conducted to assess the construct validity of each instrument. The present study used exploratory factor analyses to ascertain that all the items correctly captured the decisional balance, temptations to smoke and stress and coping variables for the Malaysian population using the translated questionnaire. A principal component analysis was employed with varimax rotation. Varimax rotation was the most appropriate extraction method for these variables because the factors were not correlated (Costello & Osborne, 2005).

(Please refer to the results of the validation in chapter 4)

3.7 Nicotine replacement therapy

The type of drug used for this study was nicotine replacement therapy because it has been reported to be well-tolerated and effective as an aid to smoking cessation by many meta-analyses (Fiore, 2008a). Nicorette gum and the Nicotinell patch were chosen because they were the cheapest available type of NRT in our local market.

3.7.1 Administration of nicotine replacement therapy

NRT was given to all the participants for a minimum of two weeks. Compliance with the NRT was considered to be adequate when it was continued for more than two weeks. The dosages given were based on the number of cigarettes each participant smoked per day.

Nicotine gum was given in 2 mg and 4 mg (per piece) doses, depending on each participant's need. Participants who smoked at least 20 cigarettes per day were started on the 4 mg dose of nicotine gum; the dose was tapered down to 2 mg after 2-4 weeks. Meanwhile, those who smoked less than 20 cigarettes per day started with 2 mg for up to 8 weeks. Smokers who were not able to tolerate the gum were supplied with two weekly nicotine patches in doses of 7 mg/24 h, 14 mg/24 h and 21 mg/24 h, depending on the number of cigarettes smoked.

Common side effects of nicotine chewing gum include mouth soreness, hiccups, dyspepsia and jaw aches; these were made known to the participants in advance. These effects are generally mild and transient and can often be alleviated by correcting the participant's chewing technique, which was explained during the counselling sessions.

Nicotine patches were only given to participants who were not able to tolerate the gum for various reasons, e.g., the development of side effects.

Participants were given sufficient medication to last until their next follow-up. They were also required to bring any unused medication to their next follow-up. In addition, each participant was given a smoking cessation plan and counselling session, as recommended by the American smoking cessation guidelines (Anczak & Nogler II, 2003; Fiore, 2008a).

3.7.2 Participant compliance monitoring

Participant compliance was monitored on the basis of the following:

1. Diary

The diary was an important means of reporting information since the last follow-up. It was used as an adjunct to reported compliance with medication and to assess each participant's smoking habits. Participants recorded the amount of gums used per day or the usage of patch, and the number of cigarettes smoked per day. This method reduced recall bias among the participants while simultaneously aiding them in the quitting process by providing a reminder of their daily commitment.

2. Amount of gums/ patches left during follow-up

Participants in both groups were required to bring along their unused gums or patches to the follow-up sessions to be eligible to receive further NRT.

3. Reported compliance during interview

In the case of smokers who did not bring their diary to follow-up session, participants were verbally questioned by the investigator during the follow-up. Reports on the use of NRT, smoking status and relapse status were recorded in the subjects' files.

4. Development of side effects

Smokers who developed side effects and could not tolerate the gum were questioned during the interview sessions. Their side effects were recorded by the investigator.

3.8 Medical ethics and data ownership

This study received ethical approval from University A's ethical committee (Medical Ethics Committee, reference number: 757.51). The ethical approval covered the recruitment of participants, the administration of medication and the use of study instruments and equipment. In University B, a letter requesting permission to conduct the study was sent to the Vice Chancellor. The study was acknowledged by the top management of the University and gained their approval.

In the cover letter and consent form, the procedures and confidentiality of the study were explained. Questionnaires contained some identifying information for ease of follow-up, but this information was secured in a locked cabinet. No-one other than the investigator and assistant in the study were allowed access to the information other than for study-related purposes unless specific consent was given by the participants. This study was completely voluntary and did not affect the work and wellness services received by the participants. Signatures were obtained from the participants after they were informed about the study in detail and agreed to participate.

The results project received a Postgraduate Student Grant (PPP Grant – grant number PS161/2009B) in the amount of RM 30,000.00. The grant was obtained for a period of 2 years months starting from August 2009 and continuing to November 2011.

This portion of the research also received RM 18,000.00 from one of the supervisor's research budgets. Thus, the University of Malaya reserves the right to ownership of this research, and this funding source is acknowledged in all publications from this thesis.

3.9 Statistical Analysis

As soon as each completed questionnaire was received, the investigator screened it for accuracy. Participants who failed to answer any of the questions were contacted to clarify their reasons for not answering. In some circumstances, however, and especially for questionnaires that were mailed at three months and six months, participants who did not answer any parts of the questionnaire were treated as missing values.

All of the study results were recorded using SPSS version 15.0. Data entry was performed by the investigator. To ensure a high level of accuracy, the investigator performed manual double entry of the raw data, in which data entry was undertaken twice, each time as a different variable. Later, variable A was subtracted from variable B. Any results that were not zero (> 0 or < 0) were rechecked from the primary data. In addition, visual inspection of the data was performed on a regular basis, and errors were identified and corrected as needed.

There were no missing data that were necessary to the analysis on the initial surveys. Missing data were only found during follow-up assessments. All missing data were excluded from the analysis using list-wise deletion, which was performed during data transformation and recoding. List-wise deletion was also used in all the other analyses.

The various items from each scale were added or averaged across individual items to obtain a total score for the scale. Most variables in the sociodemographic characteristics were collapsed into categories for ease of analysis. Scores that were added for family support, stress and coping and job content were categorised into two

parts and the median of each score was taken to stratify scores into the categories “high” and “low”.

The results were presented as the means, proportions, odds ratios (OR), hazard ratios and 95% CIs where appropriate. Significant level was preset at an alpha (α) of 0.05. In general, there were four different types of analyses performed. The types of analysis were focussed on the baseline characteristics gathered from demographic variables (e.g., age, number of cigarettes smoked, FTND score) along with all the other variables and analysis, which included 1) pretreatment analysis and results of cessation; 2) time dependent analysis of relapse, risk factors of relapse and sustained cessation; 3) an analysis of the changes in motivation and perception; and 4) an analysis of predictors of TTM variables with respect to relapse. The four analyses are discussed in more depth in the following sections.

3.9.1 Pre-treatment analysis and cessation results

The analysis of baseline characteristics included sociodemographic variables, perceptions about smoking, stress levels, coping mechanisms, family support, job content, stage of change and the contents of the TTM. Simple measures were used, including means, standard deviations, numbers and percentages. When comparing the two universities in terms of sociodemographic characteristics, a chi-squared test was used for all categorical variables. The results of the chi-squared tests were presented as *p*-values.

The outcome results were based on smoking cessation at 1 week, 2 months, 3 months and 6 months. These were based on the participant’s reported cessation, which was confirmed by diary entries and CO ppm measurements. The results were displayed by percentage in a graph. The second part of the outcome results was based on relapse, both at three months and at six months, and it used a descriptive analysis of percentages and numbers. This analysis was meant to divide participants into 4 different categories

of relapsers (quitters without relapse/ sustained quitters, quitters with multiple relapses, quitters with a single relapse, and those who never quit). Finally, to analyse the time to relapse, the investigator used survival analysis statistics, including a Kaplan-Meier analysis, to obtain a graph of survival vs. time to relapse. This was important in identifying the trend of relapse over time.

3.9.2 Risk factors for smoking relapse and predictors of smoking cessation

Timing to relapse and risk factors for relapse

The main analysis of interest to determine risk of relapse was the survival analysis. The investigator used the Kaplan-Meier technique and the Cox proportional hazards (Cox regression) model. A survival analysis using the Kaplan-Meier technique was initially employed to plot the survival graph of the time to relapse. The investigator evaluated potential risk factors for relapse during the first six months of cessation using a multivariate Cox proportional hazards model (Cox regression), in which smoking cessation was coded as "zero" and relapse was coded as "1". The time to relapse (days from quitting to relapsing) was censored at 180 days and was counted in five-day increments. Hazard models were adjusted for age, education level and race, which acted as confounders in a previous study (Cui et al., 2006). All significant predictors in the Cox regression model were then plotted in survival plots to estimate the effects of the risk factors on relapse.

Predictors of cessation

The main analysis of interest in this section involved three parts. The first part was intended to identify potential predictors of smoking cessation at 1 week, 3 months and 6 months. Initially, the dependent variables were evaluated with each independent variable with adjustments for potential confounders. Next, binary logistic regression analyses were conducted using the ENTER method. Variables that did not significantly contribute to the models were excluded. A Hosmer-Lemeshow goodness of fit test was

used to determine whether the predicted probabilities matched. The area under the curve (AUC) was also used to test the discrimination of all prediction models created.

3.9.3 Changes in perception and motivation

To answer the fourth research question on perception and motivation, the author divided the question into two different sections for the purposes of analysis. The first section analysed the perception of smokers and how it changed over the course of the study. Analyses of variances (ANOVAs) were conducted using participants' perceptions of the pros (advantages) and cons (disadvantages) of smoking as the dependent variables to compare sociodemographic characteristics to baseline perceptions. Bonferroni's post hoc test was used to discriminate any significant relationship between the categorical variables. A paired t-test was used to compare perception scores before and after counselling sessions. When testing for significant differences in scores among the groups of quitters and non-quitters as dependent variables, chi-squared tests were used. The results were presented as the mean differences (95% CIs), mean scores and standard deviation. The number and percentages of quitters and non-quitters were shown.

In the subsequent section on participant motivation, presession and postsession stages of change were analysed by chi-squared tests among the relapsers and the group of smokers who never quit. Changes in the motivation of smokers were further categorised into "improved" or "no change/reduction", and Chi squared test/ Fisher's exact test was used. To identify whether the stage of change was able to predict cessation and relapse at 6 months, binary logistic regressions were performed. The stages of change prior to the sessions were entered as independent variables. The results of sustained abstinence at 6 months and relapse at 6 months were used as dependent variables. The sustained abstinence and relapse were coded as "1" in two separate analysis and smokers who "never quit" were coded as "zero" in both analysis.

3.9.4 Transtheoretical measures

In this prospective section, the author tried to identify whether each time period predicted relapse during the next time period, among smokers who had quit at least 24 hours. Univariate logistic regressions involving the assessment of one exposure and one outcome variable were performed on the individual TTM variables and smoking relapse. The variables were adjusted for the number of cigarettes smoked, NRT adherence and number of clinic sessions. Relapse (coded as 1) served as the outcome variable. Three points were examined during follow-ups at 0 months, 3 months and 6 months. Effect size was calculated for each significant variable at this stage, to ensure that the result is not only statistically significant but also meaningful (Cohen, 1988). Generally, effect size is calculated by taking the difference between the two groups (e.g., the mean of treatment group *minus* the mean of the control group) and dividing it by the standard deviation of one of the groups. Subsequently, a multivariate logistic regression analysis was conducted on all these variables, using the ENTER method.Variables that did not significantly contribute to the models were excluded. A Hosmer-Lemeshow goodness of fit test and AUC was subsequently conducted as in the previous predictors of cessation section.

3.10 Summary of methodology

Using a non-probabilistic sample of 185 male smokers who intended to quit and went through a treatment programme, variables associated with smoking cessation and relapse were examined. Survey data were collected prior to the programme and again at 1 week, 3 months and 6 months. The questionnaires utilised in this study have been consistently reported in the literature to have sound psychometric properties. Testing of the Bahasa Malaysia version of the questionnaires used in this study showed that they have good validity and reliability.

The outcome variable for this study on cessation and relapse was assessed at 1 week, 3 months and 6 months. Follow-up assessments at these times were required to test the hypothesis of this study. Self-reporting with the assistance of a diary was used to determine the date of relapse after cessation. The limitations and strengths of methodology shall be discussed in chapter 5.

4.0 Results

4.1 Results of the validation and reliability study

Sociodemographic characteristics

Table 4.1 summarises the demographic characteristics of the study population as for the reliability study. The average age of the participants was 31 years. The majority had received a maximum education level of primary or secondary school and were married, and all participants were male. The mean number of cigarettes smoked per day was 10.2 (SD = 7.09).

Table 4.1 Sociodemographic characteristics of smokers for reliability study

Sociodemographic characteristics	*Frequency (%)*
Marital status	
Single	14 (35.0)
Married	26 (65.0)
Highest level of education completed	
Primary or secondary school	24 (60.0)
Diploma or degree	7 (17.5)
Masters or Ph.D.	9 (22.5)
Current job	
Librarian	10 (25.0)
Lecturer	10 (25.0)
Security guard	9 (22.5)
Policeman	6 (15.0)
Clerk	3 (7.5)
Technician	1 (2.5)
Administration	1 (2.5)
Workplace	
UiTM	17 (42.5)
UM	11 (27.5)
UMMC	4 (10.0)
Bukit Aman Police Station	8 (20.0)
Age	Mean age: 31.1 S.D: 8.9

Reliability test

The item-total correlation and Cronbach's alpha for each item in the smoking decisional balance, temptations in quitting smoking, impacts of smoking, beliefs related to self-efficacy, family support questionnaire, Rhode Island Stress and Coping, worksite environment, home environment and peer influence and smoking history questionnaire, on smoking sections are given in Tables 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8 and 4.9, respectively.

Values for total correlation for all items with the Likert Scale (score ranging from 1 to 5) were significant except one item in the impacts of smoking section (determination to maintain cessation) which had poor Spearman's correlation (r = 0.25), but that item was still included because it was a single item. Overall, items showed fair to good correlation (range: 0.40-0.77). In general, the Cronbach's alpha coefficients were acceptable for the decisional balance (pros = 0.92; cons = 0.69), temptation in quitting smoking (positive social = 0.89; habit/addictive = 0.54; negative/affective = 0.85), family support (0.84) and stress and coping (0.75; 0.83) sections.

As for categorical items, all items showed good kappa values (range: 0.62-0.96) except for the household smokers value (k=0.31), which was excluded from the questionnaire.

Table 4.2 Smoking decisional balance questionnaire

Items	*Cronbach's α*	*Spearman's correlation (test-retest reliability)*
1. Pros of smoking (D1, D3, D5, D7)	0.92	0.70; 0.62; 0.69; 0.81 Total score reliability: 0.84
2. Cons of smoking (D2, D4, D8)	0.69	0.57; 0.51; 0.68 Total score reliability: 0.76

Table 4.3 Temptations in quitting smoking

Items	*Cronbach's α*	*Spearman's correlation (test-retest reliability)*
1. Positive/social temptations (T1, T4, T7)	0.89	0.43; 0.58; 0.58 Average score reliability = 0.66
2. Habit/addictive temptations (T2, T5, T8)	0.54	0.58; 0.35; 0.44 Average score reliability = 0.41
3. Negative/affective temptations (T3, T6, T9)	0.85	0.45; 0.70; 0.56 Average score reliability = 0.66

Table 4.4 Impacts of smoking questionnaire

Items	***Spearman's correlation (test-retest reliability)***
1. Counter-conditioning M1	0.49
2. Self-liberation M2	0.77
3. Reinforcement management M20	0.64
4. Environmental re-evaluation M12	0.44
5. Stimulus control M19	0.52
6. Helping relationship M16	0.38
7. Consciousness-raising M4	0.58
8. Self-re-evaluation M15	0.42
9. Worry about problems associated with quitting M3	0.57
10. Resisting urges to smoke M21	0.59
11. Doubting ability to quit M7	0.49
12. Doubting worth of quitting M23	0.44
13. Determination to maintain cessation M22	0.25

Table 4.5 Beliefs related to self-efficacy

Items	***Spearman's correlation (test-retest reliability)***
1. Self-efficacy to resist temptation B1	0.47
2. Self-efficacy to stay a non-smoker B3	0.41

Table 4.6 Family support questionnaire

Items	***Cronbach's α***	***Spearman's correlation (test-retest reliability)***
F1, F2, F3, F4	0.84	0.64; 0.59; 0.58; 0.69 Total score reliability: 0.74

Table 4.7 Rhode Island Stress and Coping Questionnaire

Items	*Cronbach's α*	*Spearman's correlation (test-retest reliability)*
1. Stress R2, R4, R6, R8, R10, R12	0.75	0.73; 0.71; 0.58; 0.36; 0.66; 0.36 Total score reliability: 0.75
2. Coping R1, R3, R11	0.83	0.73; 0.55; 0.36 Total score reliability: 0.63

Table 4.8 Worksite environment, home environment and peer influence on smoking

Items	***Kappa, k***
1. Worksite W1	0.66
2. Home W2	0.76
3. Peer influence W3	0.89

Table 4.9 Smoking history questionnaire

Items	*Test done for reliability*	*Results*
1. Age of smoking initiation	Pearson's correlation	0.96
2. Age started smoking daily	Pearson's correlation	0.90
3. Number of cigarettes smoked on a typical day	Pearson's correlation	0.85
4. Parent(s) is/are smokers	Kappa, *k*	0.75
5. Household smokers	Kappa, *k*	0.31
6. Number of previous quit attempts in the past year	Kappa, *k*	0.66
7. Longest previous quit attempt	Kappa, *k*	0.69
8. Previous method of quitting	Kappa, *k*	0.66
9. Currently on any quit attempt	Kappa, *k*	0.62
10. Stage of change	Kappa, *k*	0.83
11. FTND score	Kappa, *k*	0.75

Validity Test

Tables 4.10, 4.11 and 4.12 present the results of the exploratory factor analysis. Exploratory factor analysis showed that the first factor was associated with the scales for pros of smoking. All of the items, ranged from 0.85 to 0.91. The second factor was associated with all items of the cons of smoking scale, with the greatest loading factor ranging from 0.51 to 0.89 (Table 4.10).

Table 4.10 Exploratory factor analysis of 8 items regarding the pros and cons of smoking

	Loading on 2 factors	
	Factor 1	Factor 2
D5	.91	
D1	.91	
D3	.89	
D7	.86	
D2		.89
D4		.86
D8		.51

Table 4.11 presents the factor analysis results for the temptations for smoking data. The analysis revealed 3 dimensions for temptations, which was highly correlated with the original English version questionnaire. These factors were: positive/social temptations for factor 1, negative/affective temptations for factor 2 and habit/addictive temptations for factor 3. Only 2 items did not fall into the above groupings: T2 for habit/addictive temptations (factor 3) was shown to reflect factor 1, and an item in factor 2 was also shown to reflect both factor 1 and factor 2.

Table 4.11 Exploratory factor analysis of 8 items regarding temptations for smoking

	Loading on 3 factors		
	Factor 1	Factor 2	Factor 3
T7	.79		
T4	.74		
T2	.74		
T1	.70	.42	
T6		.92	
T9		.83	
T3	.61	.62	
T5			.89
T8			.84

Table 4.12 displays the outcomes of factor analysis for the Rhode Island Stress and Coping Questionnaire data. The results show that 2 factors were loaded: factor 1 is consistent with coping strategies, whereas factor 2 represented stress. Loading factors were in the range of 0.56 to 0.81 and 0.51 to 0.81 for factor 1 and factor 2, respectively. Item R2 was correlated with both factor 1 and factor 2, with the higher score of 0.56 represented by factor 1.

Table 4.12 Exploratory factor analysis of 9 items related to stress and coping

	Loading on 2 factors	
	Factor 1	Factor 2
R3	.81	
R1	.75	
R10		.73
R11	.70	
R8	.70	
R12		.63
R2	.56	.51
R6		.85
R4		.81

4.2 Process evaluation

4.2.1 Recruitment process

The recruitment of participants was considered to be one of the most difficult tasks for this project. Smokers needed to be convinced to join this programme, which offered free counselling sessions and pharmacotherapy.

4.2.1.1 University A

Recruitment in University A was conducted after ethical approval was obtained in May 2009. Participants were recruited by:

1) Wellness Screening Programme

Most of the participants for this study came from University A's Wellness Programme. University A's Wellness Programme is an effort established by the Social and Preventive Medicine Department, Faculty of Medicine in 2008. The yearly health screening includes baseline measurements of general physical parameters (e.g., weight, height, waist circumference, blood pressure), blood collection and analysis (e.g., total cholesterol, triglycerides) and enquiries on medical background and lifestyle practices (diet, smoking and stress). All staff aged 35 years and above were invited for the screening. During the blood screening portion of the Wellness Programme in 2009, the author tried to recruit as many participants as possible from June 2009-August 2009. She spoke with all the participants during the wellness screening daily between 7:30 am to 9:30 am. There were over 1300 participants showed up during the blood screening sessions. Among these 1300 participants, 245 claimed to be smokers. Interested smokers who met the inclusion criteria (and did not meet the exclusion criteria) were asked to give their contact details (e.g., name, valid contact numbers and department of employment).

2) Health Awareness Day

Health Awareness Day was conducted by the Social and Preventive Medicine Department, Faculty of Medicine in University A on June 31st, 2009. This event was open to all staff of University A. Many health booths were set up, including a smoking cessation booth and a general health screening booth (which checked BMI, blood glucose and blood pressure). The investigator recruited interested smokers from both booths by giving a brief explanation of the programme and distributing flyers.

3) Staff e-mail

Invitation letters were sent through the staff e-mail list in July 2009. A short note representing the Wellness Programme was sent, inviting all smokers to this smoking cessation programme. Smokers who were interested were asked to reply to the email with their contact details (i.e., name, contact number and department). A total of 28 participants responded to the invitation e-mail.

4) Letter to Heads of Departments and Units

To increase participation, the researcher sent a total of 35 letters to each Head of Department and Units in the University to:

1. Announce the existence of the programme and to request recommendations of particular staff who might benefit from this programme.
2. Invite all staff who are current smokers.
3. Ask permission from respective Heads to allow time off during working hours to attend such a programme.

The letters were sent through internal mail. Some of the letters were posted in the notice boards of the head of respective Units. Announcements were also made during faculty meetings. There were three Faculty Heads who requested their smoking staff to attend the programme.

5) Individual letter to all male staff

The investigator mailed individual letters to all male staff (2,500) through internal mail regardless of their smoking status. This was done to enhance the participation rate. Staff who did not smoke were asked to ignore the letter. Smoking staff were cordially invited to join the programme. Smokers who were interested in participating in the programme were required to return a reply slip to the investigator with their names, contact numbers and faculty/department. Figure 4.1 displays a summary of participant recruitment at University A.

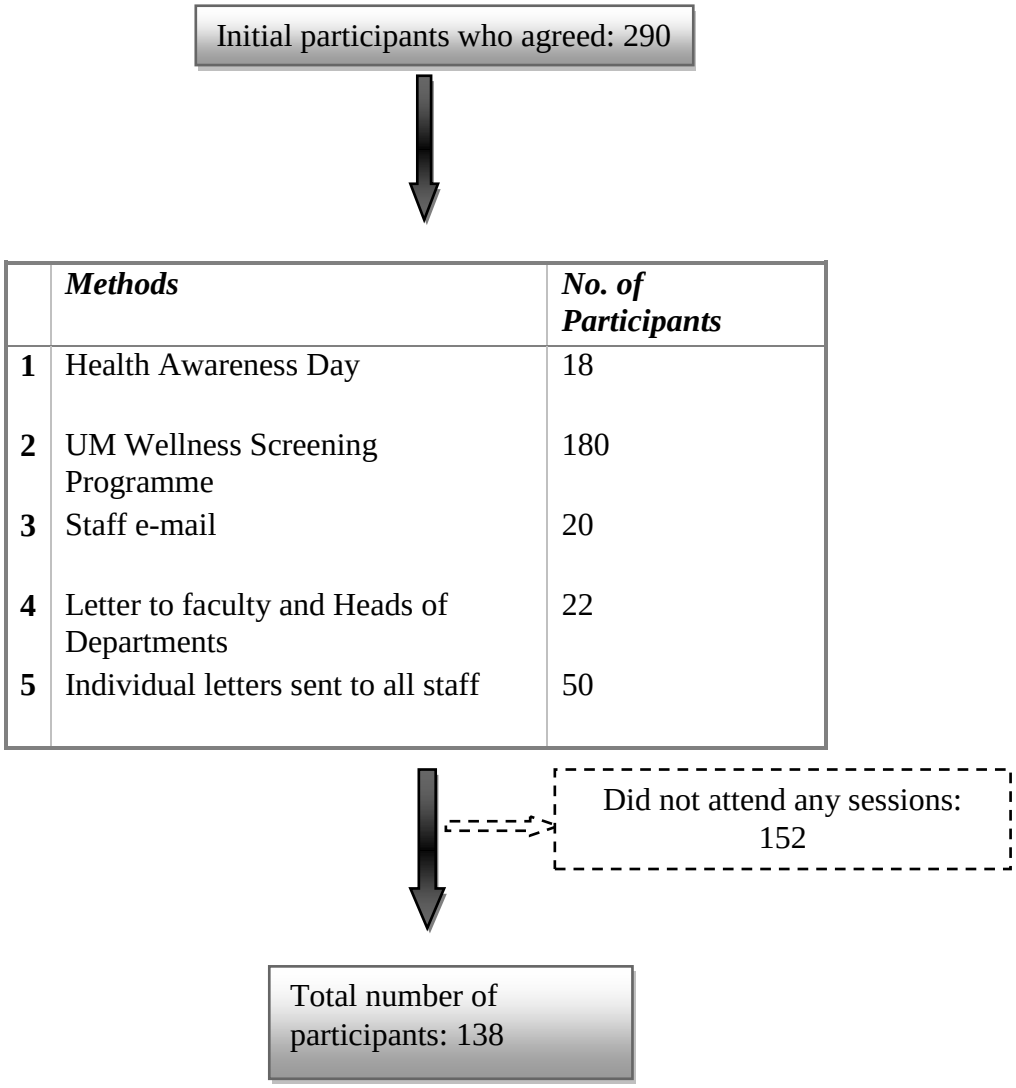


Figure 4.1 Participant recruitment at University A

4.2.1.2 University B

Recruitment at University B was conducted in January 2010-March 2010. Participants were recruited through the following means:

1) Letter to Heads of Departments/Centres

A letter was sent to all Heads of Departments/Centres explaining the programme and its advantages to the staff. Heads of Departments were requested to submit the names of staff smokers who they thought would benefit from this programme.

2) Individual e-mail to all staff

Individual e-mails were sent to all staff, and this staff e-mail was the main medium of communication with all staff at University B. This email reached 85% of the staff, including support staff. This email was used to inform the faculty of any relevant news, and an announcement regarding participation in this smoking cessation programme was sent through this email.

3) ***Announcement through the main university website and the university's newsletter***

The chancellor of the university's corporate communication unit assisted in putting information about the programme on the main university website. An electronic poster was designed and displayed on the website to attract smokers who were interested in a cessation attempt.

Due to the large number of staff and the lack of health promotion activities, the researcher was only able to recruit staff through the staff e-mail and the letters posted to all Heads of Departments. Sending individual letters to all staff was not possible due to lack of manpower. Forty five responses were received from e-mail, 10 responses from letters to the respective Heads of Departments, and three from the main university's website. Out of these respondents, 47 attended the clinic sessions.

4.2.2 Clinic session and questionnaire response rates

4.2.2.1 Clinic session response rates

Figure 4.2 shows the number of clinic sessions attended by the smokers. Forty per cent of the smokers only attended the initial session, 32% attended two sessions within two weeks, 17% joined three sessions, and the remaining 11% attended four or more sessions. When the sessions were grouped into the four categories listed above, smokers with fewer visits were less likely to adhere to NRT ($p < 0.001$). The support group and those who smoked > 10 cigarettes per day were more likely to attend more sessions compared with the professional group ($p = 0.09$) and with those who smoked < 10 cigarettes per day ($p = 0.06$), although these results were not significant.

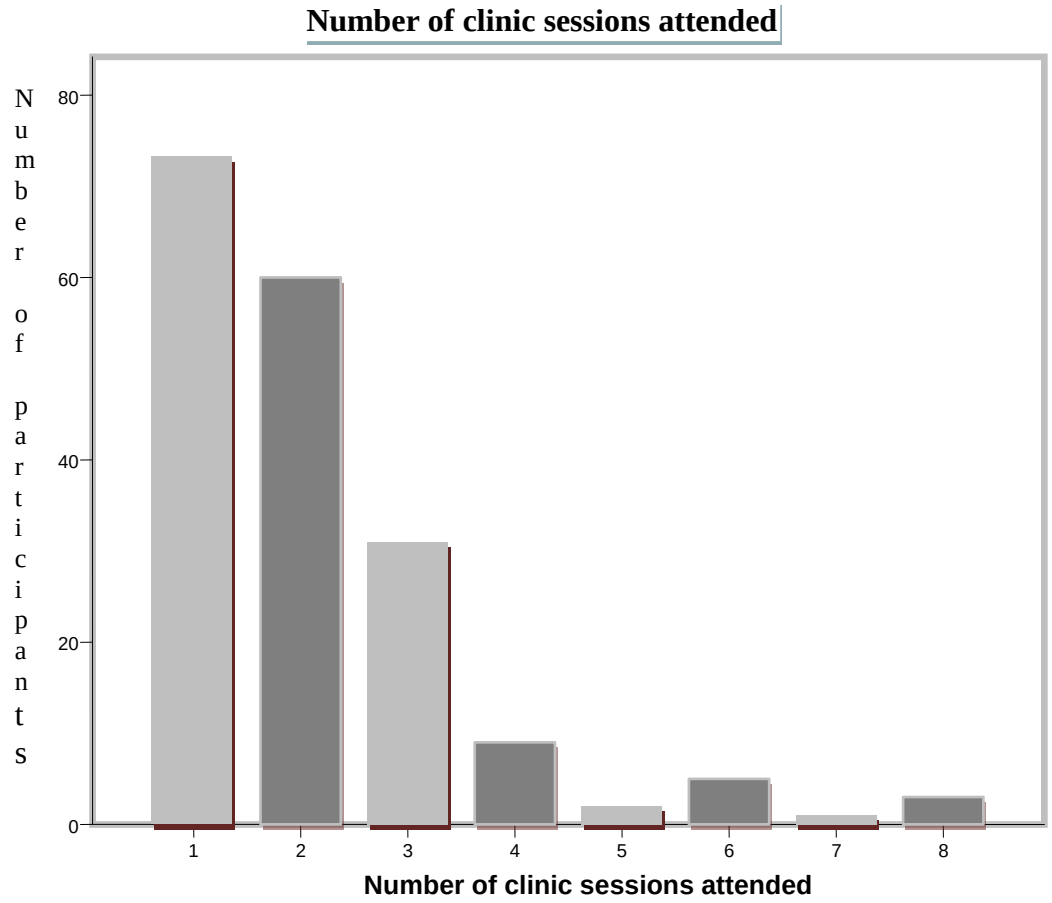


Figure 4.2 Number of clinic sessions attended by participants

4.2.2.2 Questionnaire response rates

All smokers (100%) answered the first set of questionnaires at the zero month time point prior to the smoking cessation sessions. The second set of questionnaires (comprising of Q2 and SSQ) was distributed at three months, one month after the clinic sessions. The Q2 were mailed to all smokers. The smokers were given two weeks to return the questionnaire through internal mail. Only 22 smokers responded initially (12%). Reminders with similar questionnaires were sent, and another 65 smokers responded (35%). The investigator then contacted smokers who failed to answer the questionnaire via telephone (office and mobile phone) and e-mail. Despite these efforts, only a total of 120 smokers answered the questionnaire by the end of the month. Smokers that have quit were visited by the author to confirm their quit status via a CO ppm measurement of less than 6 ppm.

At 6 months, all smokers were contacted again to determine their smoking status and were requested to answer the final questionnaire. Smokers who answered were given a certificate of attendance as a token of appreciation. Thirty per cent of the smokers responded initially, and another 34% responded during the second round after a reminder was sent. After a letter of appeal was sent in addition to multiple phone calls and e-mails, another 26% responded for a total of 166 participants (90% response rate) within a period of one and a half months. All quitters were seen by the researcher at their workplace to confirm the CO ppm results. The readings were between 3-8 ppm. Smokers who failed to be contacted by any of the above means at 3 months or 6 months were considered smokers.

In order to determine that the results for the 65% of smokers who responded were representative of the entire study population, a comparison was made between the respondents and the 35% defaulters by chi-squared analyses of data from the baseline evaluation. Defaulters at 3 months were more likely to have only attended one session

($p < 0.05$) and were more likely to be professional workers ($p < 0.05$). No significant differences were observed with regard to all other baseline results at 6 months.

4.2.3 Use of nicotine replacement therapy (NRT)

Fifty-nine per cent of smokers adhered to NRT, and 41% of smokers were non-adherent. Mean CO ppm measurement obtained during the first visit was 15.5 ppm. Reported reasons for non-adherence during face-to face counselling sessions with the investigator included intolerable side effects (22%), lack of efficacy in smoking cessation (15%) and successful cessation (15%). The majority of the others resumed smoking, (30%) and a few (18%) did not have any valid reasons to discontinue NRT.

4.3 Baseline Results

4.3.1 Sociodemographic characteristics and smoking history

One hundred and eighty five participants, of whom 138 were from University A and 47 were from University B, joined this study. All subjects were male, with mean (SD) age of 35.9 (10.9 years). The majority had completed at least secondary school. Most participants were in the support staff group which was composed of technical workers, clerical workers and labour workers. Less than 10% of participants were in the professional group.

With regard to prior quit attempts, the majority of participants had tried quitting at least once. On average, participants reported that they started smoking at the mean age of 17 (range: 9-42) years. The average number of cigarettes smoked per day was 14 (range: 2-40). One hundred and forty six (80%) participants smoked less than 20 cigarettes per day and 39 (20%) smoked 20 or more cigarettes per day. Sociodemographic variables and smoking history variables as shown in Table 4.13 between University A and B were comparable ($p > 0.05$). When the other variables including family support, environmental influences, stress and coping, job stress, TTM

were analysed based on university subgroups, all results comparing the two were also non-significant.

Table 4.13 Sociodemographic and smoking characteristics

Demographic and smoking characteristics	*Total (n = 185) n (%)*	*University A (n = 138) n (%)*	*University B (n = 47) n (%)*	*Significance (p-value)*
Demographic characteristics				
Age group				
18-30	77 (41.6)	54 (39.1)	23 (48.9)	0.40
31-40	43 (23.2)	31 (22.5)	12 (25.5)	
41-50	43 (23.2)	36 (26.1)	7 (14.9)	
51 and above	22 (11.9)	17 (12.3)	5 (10.6)	
Education level				
Primary school	5 (2.7)	3 (2.2)	2 (4.3)	0.25
Secondary school	107 (57.9)	85 (61.3)	23 (47.8)	
Diploma and above	73 (39.3)	5 (36.5)	23 (47.9)	
Occupational status				
Support staff	175 (93.4)	132 (95.6)	41 (87.2)	0.06
Professionals	13 (6.6)	6 (4.4)	6 (12.8)	
Marital Status				
Single	68 (37.3)	51 (37.0)	18 (38.3)	0.93
Married	113 (61.1)	86 (61.6)	28 (59.6)	
Divorced	4 (1.6)	1 (1.4)	1 (2.1)	
Smoking History				
Number of Cigarettes/day				
< 10	28 (14.6)	21 (15.2)	6 (12.8)	0.44
≥ 10	157 (85.4)	117 (84.8)	41 (87.2)	
Age of smoking initiation				
8-12 years	19 (9.7)	10 (7.2)	8 (17.0)	0.12
13-18 years	120 (65.4)	91 (65.9)	30 (63.8)	
19 and above	46 (24.9)	37 (26.8)	9 (19.1)	
Previous quit attempts within the past year				
0	28 (14.6)	23 (16.7)	4 (8.5)	0.13
≥ 1	157 (85.4)	115 (83.3)	43 (91.5)	
NRT adherence				
Non-adherent	76 (41.1)	55 (39.9)	21 (44.7)	0.34
Adherent	109 (58.9)	83 (60.1)	26 (55.3)	
Counselling sessions attended				
1 session	74 (40.0)	54 (39.1)	20 (42.6)	0.22
2 or more	111 (60.0)	86 (61.9)	27 (57.4)	
FTND score				
≤ 5 (low to med dependence)	51 (27.6)	39 (28.3)	12 (25.5)	0.91
6-7 (high dependence)	52 (28.1)	39 (28.3)	13 (27.7)	
8-10 (very high dependence)	82 (44.3)	60 (43.4)	22 (46.8)	

Table 4.13, continued

Demographic and smoking characteristics	*Total (n = 185) n (%)*	*University A (n = 138) n (%)*	*University B (n = 47) n (%)*	*Significance (p-value)*
Aware of university smoking prohibition rules				
Yes	174 (94.1)	131 (94.9)	43 (91.5)	0.29
No	11(5.9)	7 (5.1)	4 (8.5)	
Smoke on university campus				
Yes	141 (76.2)	101(73.2)	40 (85.1)	0.07
No	44 (23.8)	37 (26.8)	7 (14.9)	

4.3.2 Smoking Perception

Table 4.14 shows a descriptive analysis of perception pretreatment and post-treatment at two months. The results were combined for smokers at both universities. Overall, there was a reduction in scores related to pros of smoking after the treatment sessions for all questions answered with an average score reduction of 0.5. There was a corresponding increase of mean scores related to cons of smoking in all sections of the questionnaire, although the average increase was only 0.1.

Table 4.14 Descriptive analysis of smokers' perception of the pros and cons of smoking

Items	*Presession mean (SD)*	*Postsession mean (SD)*
Aggregate pros of smoking	3.11 (0.84)	2.61 (0.91)
• I am more relaxed and therefore more pleasant when smoking	3.20 (1.06)	2.70 (1.19)
• Smoking helps me concentrate and do better work	3.07 (1.17)	2.50 (1.17)
• Smoking cigarettes relieves tension	3.32 (1.00)	2.89 (1.14)
• The enjoyment I get out of smoking	2.81 (1.03)	2.36 (1.00)
Aggregate cons of smoking	3.67 (0.78)	3.81 (0.81)
• I am embarrassed to have to smoke	2.98 (1.21)	3.03 (1.19)
• My cigarette smoking bothers other people	3.65 (1.13)	3.93 (1.08)
• My long-term health	4.36 (1.08)	4.47 (0.99)

4.3.3 Stress, coping and family support

Results from the stress, coping and family support sections are displayed in Table 4.15. All items were divided into two categories: high and low. The median was taken as the cut-off point for each item. Items were not divided into three categories due to the small sample size of < 50 smokers within each category. More than half of the participants scored low in the stress and coping areas and the majority also had a lack of family and spousal support to quit smoking. The items do not match the total number of smokers, as list-wise deletion was incorporated. Smokers who failed to answer any of the questions for each item were excluded from that particular analysis.

Table 4.15 Baseline results of stress, coping and family support

Items			
Stress	**(mean ± SD)**		2.75 ± 0.72
Low Stress	(≤ 3)	*n* (%)	127 (68.6)
High Stress	(> 3)	*n* (%)	51 (27.6)
Coping	**(mean ± SD)**		3.09 ± 0.60
Low Coping Ability	(≤ 3)	*n* (%)	104 (56.2)
High Coping Ability	(> 3)	*n* (%)	75 (40.5)
Family support	**(mean ± SD)**		12.82 ± 3.76
Good family support	(> 13)	*n* (%)	82 (44.3)
Poor family support	(≤ 13)	*n* (%)	95 (51.4)

4.3.4 Environmental influences

Table 4.16 presents the findings regarding environmental influences on smoking. The hours represent the amount of cigarette exposure within a week. The results showed that more than 90% of smokers were exposed to smoking at work for 1-8 hours. Considering that the majority of participants were married and living with their spouses and children, almost 50% had no exposure to cigarette at home. Other exposure occurred either at home or near the vicinity of the home, e.g., with friends at a coffee shop, housemates who were smokers and visits from extended family members or friends who were smokers. As expected, the majority (71%) claimed that most of their colleagues and friends were smokers.

Table 4.16 Baseline results of environmental influences

Items	*n* (%)
Worksite environment (exposure to cigarette smoke)	
0 hour	15 (8.2)
1-2 hours	61 (33.2)
3-8 hours	68 (36.9)
9 hours or more	40 (21.7)
Home environment (exposure to cigarette smoke)	
0 hour	91 (49.2)
1-4 hours	63 (34.1)
5-14 hours	21 (11.4)
15 hours or more	10 (5.4)
Peer influence (number of smoking friends)	
None	2 (1.1)
Very few	25 (13.5)
Less than half	26 (14.1)
Most are smokers	132 (71.4)

4.3.5 Job stressors

Smokers' baseline results related to job stressors are presented in Table 4.17. The median of the continuous data of the items were calculated prior to categorization, and smokers in this study scored above the median level for all items. Although the original questionnaire was in the form of continuous scores, the items were divided into three categories based on separate tertiles (low, medium and high) for the first seven items as reported elsewhere (Fukuoka et al., 2008; Kouvonen et al., 2005). Job strain was calculated based on Karasek's recommendations (Karasek et al., 1981).

Table 4.17 Baseline results regarding job content questionnaire

Job content items	*n (%)*
Job stressors	
Job decision-making authority (median = 36)	
Low (12-27)	38 (20.5)
Medium (28-39)	93 (50.3)
High (40-48)	54 (29.2)
Job demand (median = 31)	
Low (18-29)	39 (21.1)
Medium (30-33)	76 (41.1)
High (34- 48)	70 (37.8)
Co-worker support (median = 12)	
Low (5-11)	44 (23.8)
Medium (12)	68 (36.8)
High (13-16)	73 (39.5)
Supervisor support (median = 10)	
Low (4-9)	59 (31.9)
Medium (10)	62 (33.5)
High (11-15)	64 (34.6)
Job insecurity (median = 6)	
Low (4-5)	34 (18.9)
Medium (6)	84 (45.4)
High (7-11)	66 (35.7)
Job decision latitude (median = 69)	
Low (30-61)	54 (29.2)
Medium (62-73)	79 (42.7)
High (74-126)	52 (28.1)
Job skill discretion (median = 34)	
Low (18-31)	51 (27.6)
Medium (32-35)	87 (47.0)
High (36-46)	47 (25.4)
Job strain	
Low strain	30 (16.2)
Passive	44 (23.8)
Active	65 (35.1)
High strain	46 (24.9)

4.3.6 Stages of change

The baseline findings related to the stages of change are presented in Table 4.18. Prior to attending the first smoking cessation session, the majority of smokers were in the preparation stage. Smokers who quit for at least 24 hours were considered to be entering

the action phase (Segan et al., 2006). After six months, 41 smokers had quit and were considered to have entered the maintenance stage. Among these, some were still at the action stage (had not achieved 6 months abstinence). The smokers who were still in the action stage developed multiple relapses and had not been able to sustain cessation for at least 6 months. A total of 17 participants were lost to follow up.

Table 4.18 Baseline results related to stages of change presession and postsession

Stages of change	*n (%)*
Presession (0 months)	
Preparation	110 (59.5)
Contemplation	62 (33.5)
Precontemplation	13 (7.0)
Total	185 (100)
Postsessions (6 months)	
Preparation	26 (14.1)
Contemplation	85 (45.9)
Precontemplation	16 (8.6)
Action stage to maintenance stage (quitters) *	41 (22.1)
Missing values	17 (9.1)
Total	185 (100)

*Quitters who quit at 6 months observation period (either in action or maintenance stage)

4.3.7 Transtheoretical model

Table 4.19 displays the scores from the TTM by the smokers and ex-smokers at three different times: 0 month, 3 months after sessions and 6 months at the end of follow up. Full data were available for all the variables for 185 participants. All (100%; n = 185) of the data were collected at 0 month, 65% (n = 120) at 3 months and 90% (n = 166) at 6 months.

Results showed that most of the scores followed linear downward trends from 0 month to 6 months. However, there was a dip noted in the trend for "aggregate temptations," "pros of smoking" and "doubting worth quitting" at 3 months, although the 6-month results were much lower than the results at 0 month.

Table 4.19 Baseline results of Transtheoretical Model

TTM variables	*0 months mean (SD)*	*3 months mean (SD)*	*6 months mean (SD)*
Aggregate temptations	3.48 (0.68)	3.02 (0.75)	3.14 (1.01)
Positive/social temptations	3.88 (0.83)	3.35 (0.99)	3.27 (0.75)
Habit/addictive temptations	3.05 (0.81)	2.64 (0.82)	3.77 (0.79)
Negative/affective temptations	3.55 (0.93)	3.08 (0.97)	3.58 (1.07)
Aggregate behavioural	2.75 (0.68)	3.12 (0.63)	2.88 (0.64)
Counter-conditioning	2.51 (0.99)	3.06 (0.88)	2.86 (0.92)
Self-liberation	3.11 (0.96)	3.81 (0.82)	3.49 (0.94)
Reinforcement management	3.39 (1.12)	3.42 (1.11)	3.22 (1.16)
Stimulus control	2.15 (0.97)	2.46 (0.94)	3.14 (1.11)
Helping relationship	2.61 (1.16)	2.90 (1.17)	2.72 (1.14)
Aggregate experiential	3.21 (0.80)	3.46 (0.76)	3.32 (0.75)
Consciousness-raising	3.69 (0.87)	3.96 (0.75)	3.80 (0.74)
Self re-evaluation	3.01 (1.13)	3.11 (1.09)	3.01 (1.13)
Environmental re-evaluation	2.94 (1.16)	3.14 (1.11)	3.13 (1.11)

Table 4.19, continued

TTM variables	*0 month mean (SD)*	*3 months mean (SD)*	*6 months mean (SD)*
Additional			
Pros of smoking	3.10 (0.84)	2.61 (0.91)	3.27 (0.75)
Cons of smoking	3.67 (0.78)	3.81 (0.81)	3.77 (0.79)
Self-efficacy to resist temptations	3.42 (1.05)	3.65 (1.01)	3.31 (1.14)
Self-efficacy to stay a non-smoker	3.42 (1.05)	4.13 (0.88)	3.89 (0.90)
Worry about problems associated with quitting	2.94 (1.33)	3.01 (1.11)	2.94 (1.33)
Resist urges to smoke	3.02 (0.92)	3.42 (0.91)	3.21 (0.99)
Doubt ability to quit	3.09 (0.92)	2.73 (1.00)	2.71 (1.11)
Doubting worth of quitting	2.68 (1.27)	2.45 (1.41)	2.46 (1.34)
Determination to maintain cessation	3.54 (1.07)	3.92 (0.92)	3.58 (1.05)

4.4 Smoking abstinence and relapse outcome

4.4.1 Abstinence (point abstinence and sustained abstinence)

Of the participants included in the study, 103 smokers continued to abstain from smoking at one week, and 51 smokers had continued cessation at two months. At 6 months, when the smokers were contacted to determine their smoking status, 41 were abstinent, whereas the majority of the others had relapsed. These were referred to point abstinence. The number of smokers who sustained abstinence decreased from 27 participants at three months to 24 by the end of six months.

There was a downward trend noted in Figure 4.3 from 1 week to 6-month abstinence in both lines. However, a dip in point abstinence was shown at two months after the end of the smoking cessation sessions. The value for point abstinence increased at three months by 9.7% but continued to decrease until six months. There was only a slight reduction (1.6%) of sustained abstinence from three months to six months.

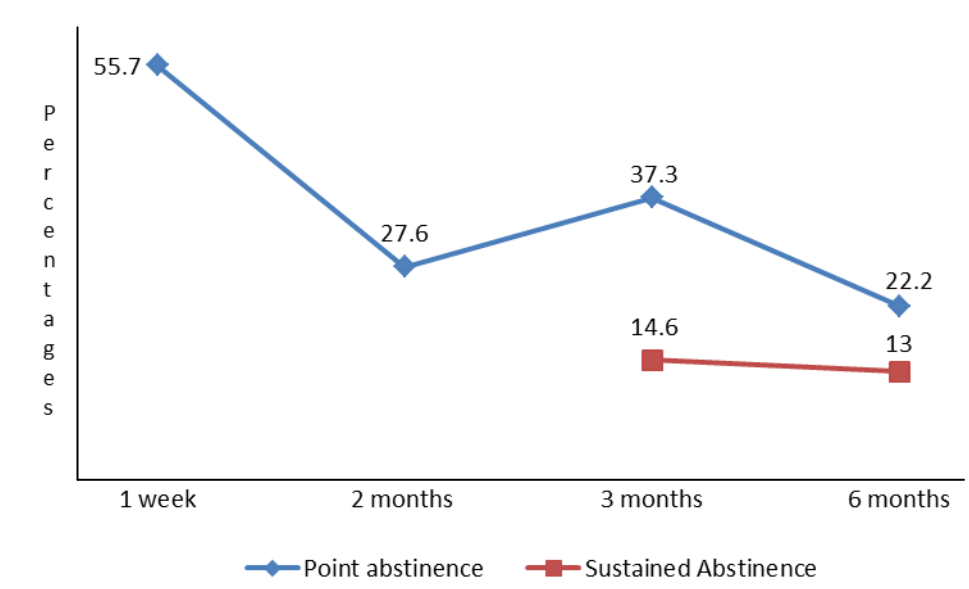


Figure 4.3 Smoking cessation results for point and sustained abstinence

4.4.2 Smoking relapse

Smokers who quit at 3 months and 6 months were divided into 4 categories: quitters without relapse, quitters with multiple relapses, lapsers (quit then relapsed) and never quit. Quitters without relapse were sustained quitters as described in the previous section. The non-sustained quitters were further categorised into quitters with multiple relapses, lapsers (those who once achieved abstinence and later relapsed) and those who had never quit (those who had not achieved 24 hours of abstinence during the 6-month period). The numbers and percentages for these data are displayed in Table 4.20.

The number of quitters with and without relapse decreased point abstinence from 3 months to 6 months by 1.6 % and 13.5%, respectively. Smokers who quit with multiple relapse decline from 22.7% at 3 months to 9.2% at 6 months. In contrast, the number of relapsers increased by 21.1% from 3 months to 6 months. Those in the never quit category reduced gradually within the 6-month period as more smokers quit. The group with the greatest representation at 6 months was the relapser group (42.7%).

Table 4.20 Relapse status

Relapse status	*3 months* *n (%)*	*6 months* *n (%)*
Quitters without relapse	27 (14.6)	24 (13.0)
Quitters with multiple relapses	42 (22.7)	17 (9.2)
Relapsers (quit and relapsed)	40 (21.6)	79 (42.7)
Never quit	76 (41.1)	65 (35.1)
Total	185 (100.0)	185 (100.0)

4.4.3 Timing to relapse and relapse curve

In examining relapse, 120 participants were included. The remaining 65 smokers were not included in the relapse analysis because they never achieved 24 hours of abstinence during the six-month observation. Reports were self-reported during in person interviews or via telephone call interviews. Self-reported smoking status was confirmed by the participant's smoking cessation diaries.

Of the 120 participants, 96 recorded at least one relapse episodes. The number of relapse episodes ranged from one to ten. The majority (79%) of relapsers lapsed more than once within the six month period. The mean number of lapses was 2.9, with a median of 3.0. The number of lapses was divided into two categories, taking the median number of lapses as the cut-off point, i.e., 1-2 lapses and 3 or more lapses. Only one factor was found to be associated with the number of lapses: smokers with higher numbers of lapses were those with higher FTND scores ($X^2 = 8.15$; $p = 0.02$). Smokers with previous quit attempts also tended to have a higher number of lapses, although the result was not significant ($X^2 = 3.42$; $p = 0.06$).

As shown in Figure 4.5, Kaplan Meier analysis was employed to study the dynamic process of relapse rate change. After successfully achieving 24 hours of abstinence, the participant's average time to an initial lapse was 9.43 days. At the end of the study, 20% never relapsed, whereas 80% had a lapse at any point during the study.

The graph in Figure 4.4 can be divided into three phases: the first phase was the period from the quit date to 2 weeks following the quit date, during which the cumulative survival rate (the percentage of participants who did not relapse) quickly decreased from 85% to 40%. The second phase was from the 3rd week to the 4th week, and the survival rate gradually decreased to approximately 25% during this phase. The third phase extended from the 4th week to the end of six-month period (180 days), during which the curve became much flatter. The cumulative survival rate (without relapse) at the end of six months was 20%. During the 6-month period after the initial cessation attempt, approximately 50% of relapses occurred within the first 2 weeks, and the vast majority of relapses occurred during the first month (up to 80%).

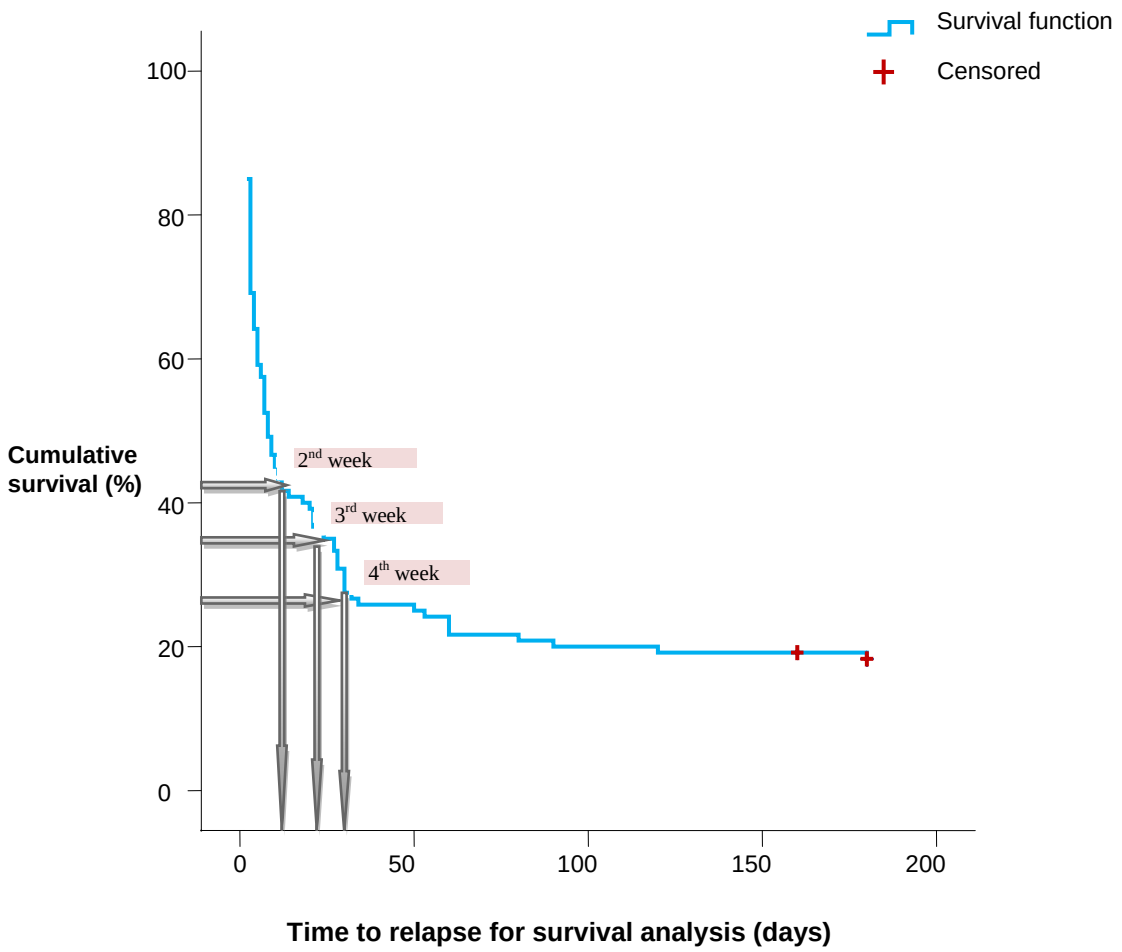


Figure 4.4 The dynamic process of relapse rate over time

4.5 Risk factors for smoking relapse at six months

4.5.1 Survival analysis in identifying risk factors for smoking relapse

Four factors associated with smoking relapse were identified based on survival analysis at 6 months. Compared with the reference group, smokers at University B, those who attended 3 sessions and those with greater co-worker support had a significantly lower risk of relapse within 6 months of quitting. Compared with those with no workplace smoking exposure, smokers who had a much higher exposure to cigarette smoking at the workplace of between 3-8 hours and nine hours or more were more likely to relapse (Table 4.21).

Table 4.21 Risk of smoking relapse at 6 months

Sociodemographic and smoking characteristics	*n (%)*	*Hazard ratio (95% CI)*
Sociodemographic characteristics		
Occupational status		
Support group	113 (94.2)	Ref
Professionals	7 (5.8)	1.27 (0.52-3.10)
Marital status		
Single	43 (35.8)	Ref
Married	75 (62.5)	0.72 (0.41-1.26)
Divorced	2 (1.7)	0.30 (0.04-2.43)
University		
University A	92 (76.7)	Ref
University B	28 (23.3)	0.54 (0.33-0.89) *****
Smoking history		
Number of cigarettes/day		
< 10	23 (19.2)	Ref
≥ 10	97 (80.8)	1.04 (0.60-1.79)
Age of smoking initiation		
8-12 years	14 (11.7)	Ref
13-18 years	80 (66.7)	0.85 (0.45- 1.61)
19 and above	26 (21.7)	0.82 (0.38-1.78)
Previous quit attempts within the past year		
0	12 (10.0)	Ref
≥ 1	108 (90.0)	2.14 (0.84-5.46)
Follow-up variables		
Nicotine replacement therapy adherence		
Adherent	83 (69.2)	Ref
Non-adherent	37 (30.8)	1.36 (0.89-2.09)
FTND score		
≤ 5 (low to medium dependence)	79 (65.8)	Ref
6-7 (high dependence)	22 (18.3)	0.83 (0.48-1.43)
8-10 (very high dependence)	19 (15.8)	1.07 (0.60-1.92)

Table 4.21, continued

Sociodemographic and smoking characteristics	*n (%)*	*Hazard ratio (95% CI)*
No. of sessions attended		
1 session only	32 (26.7)	Ref
2 sessions	42 (35.0)	0.63 (0.37-1.07)
3 sessions	28 (23.3)	0.34 (0.18-0.63)*
4 or more	18 (15.0)	0.77 (0.41-1.44)
Work strain variables		
Decision-making authority at the workplace		
Low	39 (32.5)	Ref
Medium	80 (66.7)	0.45 (0.26-0.77)
High	1 (0.8)	0.19 (0.02-2.10)
Job demands		
Low	28 (23.3)	Ref
Medium	59 (49.2)	1.15 (0.58-2.30)
High	33 (27.5)	1.41 (0.57-3.45)
Co-worker support		
Low	43 (35.8)	Ref
Medium	41 (34.2)	0.05 (0.26-0.94)*
High	36 (30.0)	0.26 (0.12-0.57)**
Supervisor support		
Low	27 (22.5)	Ref
Medium	51 (42.5)	1.58 (0.85-2.95)
High	42 (35.0)	2.06 (1.04-4.06)
Job insecurity		
Low	31 (25.8)	Ref
Medium	39 (32.5)	1.36 (0.47-3.95)
High	50 (41.7)	0.75 (0.06-9.26)
Job decision latitude		
Low	30 (25.0)	Ref
Medium	55 (45.8)	1.45 (0.66-3.20)
High	35 (29.2)	0.88 (0.36-2.35)
Job skill discretion		
Low	21 (17.5)	Ref
Medium	50 (41.7)	0.63 (0.18-2.18)
High	49 (40.8)	1.12 (0.08-15.28)
Job strain		
Low strain	22 (18.3)	Ref
Passive	27 (22.5)	1.85 (0.76-4.51)
Active	46 (38.3)	1.06 (0.433-2.61)
High strain	25 (20.8)	1.52 (0.70-3.28)

Table 4.21, continued

Sociodemographic and smoking characteristics	*n (%)*	*Hazard ratio (95% CI)*
Stress, coping, family support and environmental variables		
Stress level (median 3)		
< 3 –"low"	21 (17.5)	Ref
≥ 3 –"high"	99 (82.5)	0.68 (0.40-1.15)
Coping ability (median 3)		
< 3 –"low"	8 (6.7)	Ref
≥ 3 –"high"	112 (93.3)	0.93 (0.43-2.00)
Worksite environment (exposure to cigarette smoke)		
0 hours	18 (15.0)	Ref
1-2 hours	40 (33.3)	2.12 (0.03- 4.34)
3-8 hours	38 (31.7)	2.72 (1.31-5.67) *****
9 hours or more	24 (20.0)	2.86 (1.34-6.07) *****
Home environment (exposure to cigarette smoke)		
0 hours	63 (52.5)	Ref
1-4 hours	38 (31.7)	0.80 (0.49-1.03)
5-14 hours	24 (20.0)	0.80 (0.40-1.60)
15 hours or more	6 (5.0)	0.67 (0.23-1.90)
Peer influence (number of friends who smoke)		
None	2 (1.7)	Ref
Very few	17 (14.2)	2.79 (0.64-12.23)
Less than half	20 (16.6)	1.43 (0.79-2.60)
Most are smokers	81 (67.5)	1.39 (0.77-2.50)
Family support		
≤ 13–"Poor"	54 (48.9)	Ref
> 13–"Good"	57 (51.1)	0.89 (0.55-1.43)

Derived from Cox Proportional Hazards models and adjusted for age, race and highest educational status
**= p < 0.05*
***= p < 0.01*

4.5.2 Influence of relapse-related factors on the survival curve

Figure 4.5 shows how university type influenced those who quit for at least 24 hours from relapsing. Within a week of the initial quit date, the number of participants who relapsed began to increase at a faster rate among staff at University B than those at University A. The difference in relapse rates reached a maximum at approximately 35 days. After 120 days, the relapse rate of the two groups was similar.

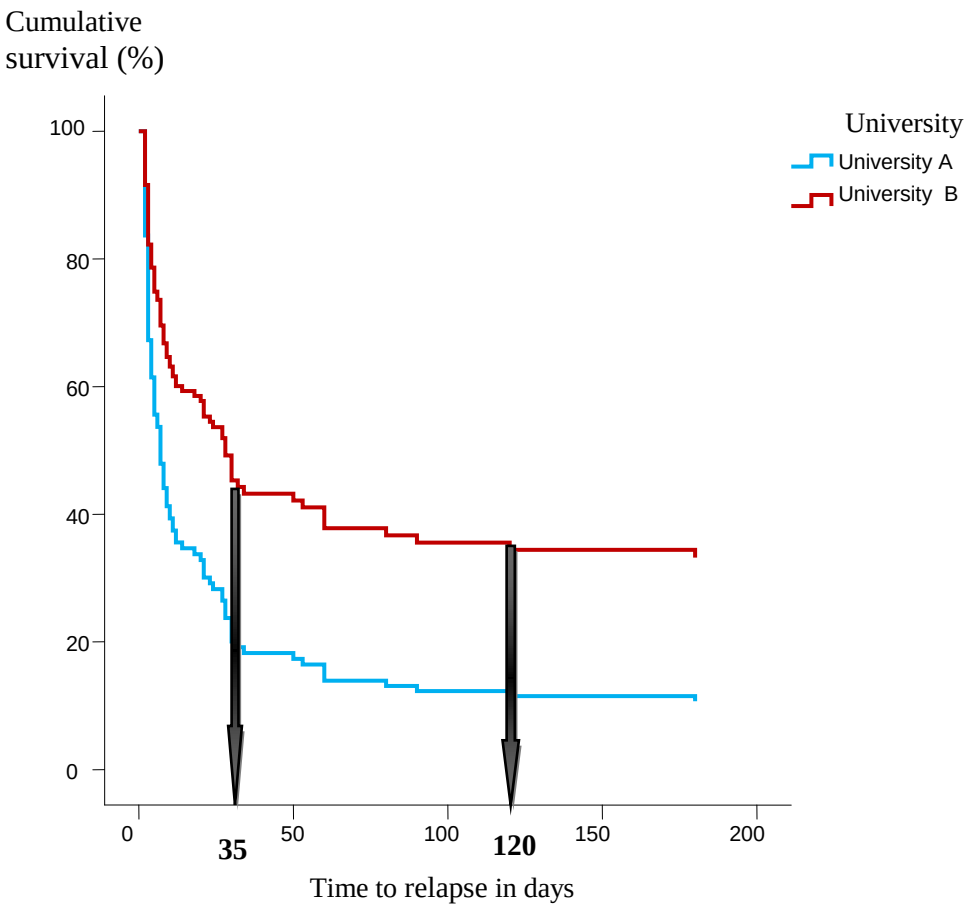


Figure 4.5 University influence on the survival curve

The effect of the number of counselling sessions attended on survival from relapse was quite similar to the effect seen when comparing universities (Figure 4.6). The cumulative survival rate was much greater for smokers who attended 3 sessions. The survival reached a plateau after approximately 60 days in all four groups.

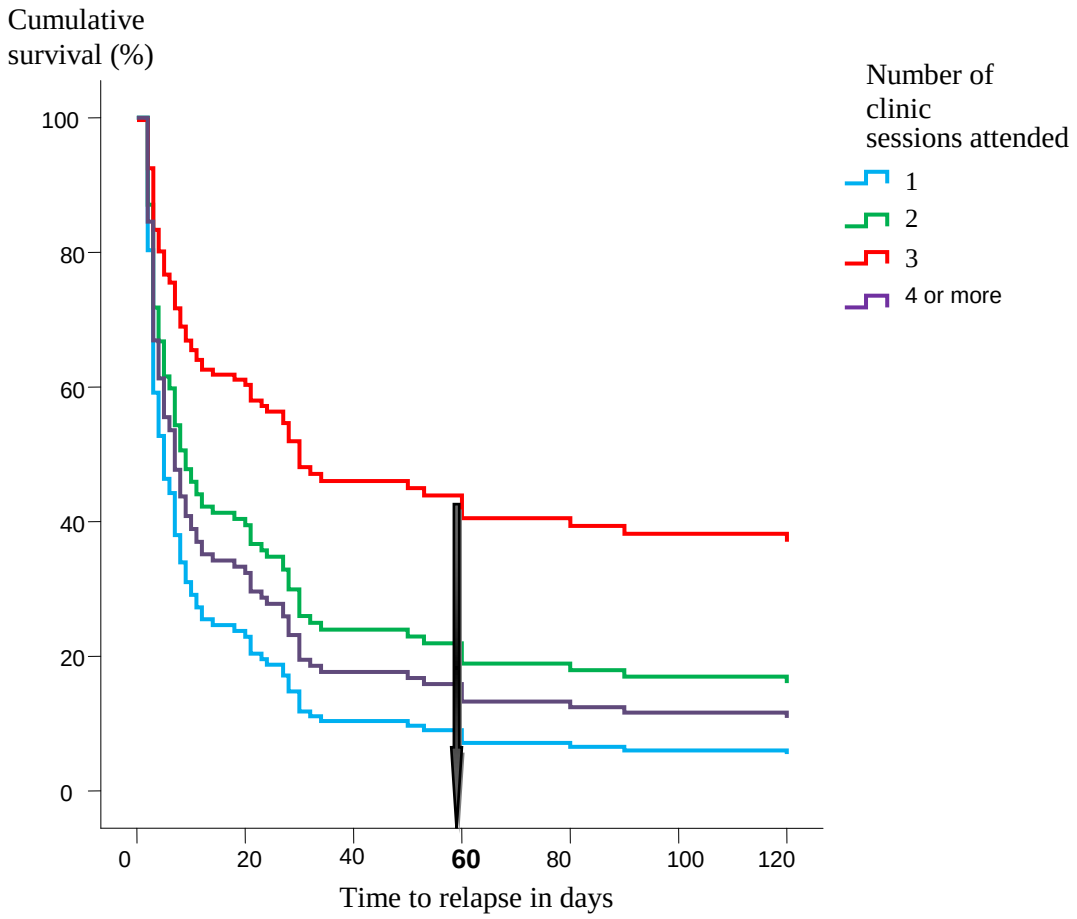


Figure 4.6 Influence of the number of counselling sessions attended by smokers on the survival curve

Figure 4.7 shows that the higher the exposure to cigarette smoking, the greater the number of relapse cases. A large difference was noted for the survival from relapse cases between the no exposure group and the other three groups.

Smokers with workplace exposure of more than three hours demonstrated four different patterns. The highest cumulative survival rate was the rate within the first 12 days when the greatest number relapse cases occurred. After this initial period, the rate was much lower until day 30. The rate gradually declined after day 30 and became stagnant after day 60.

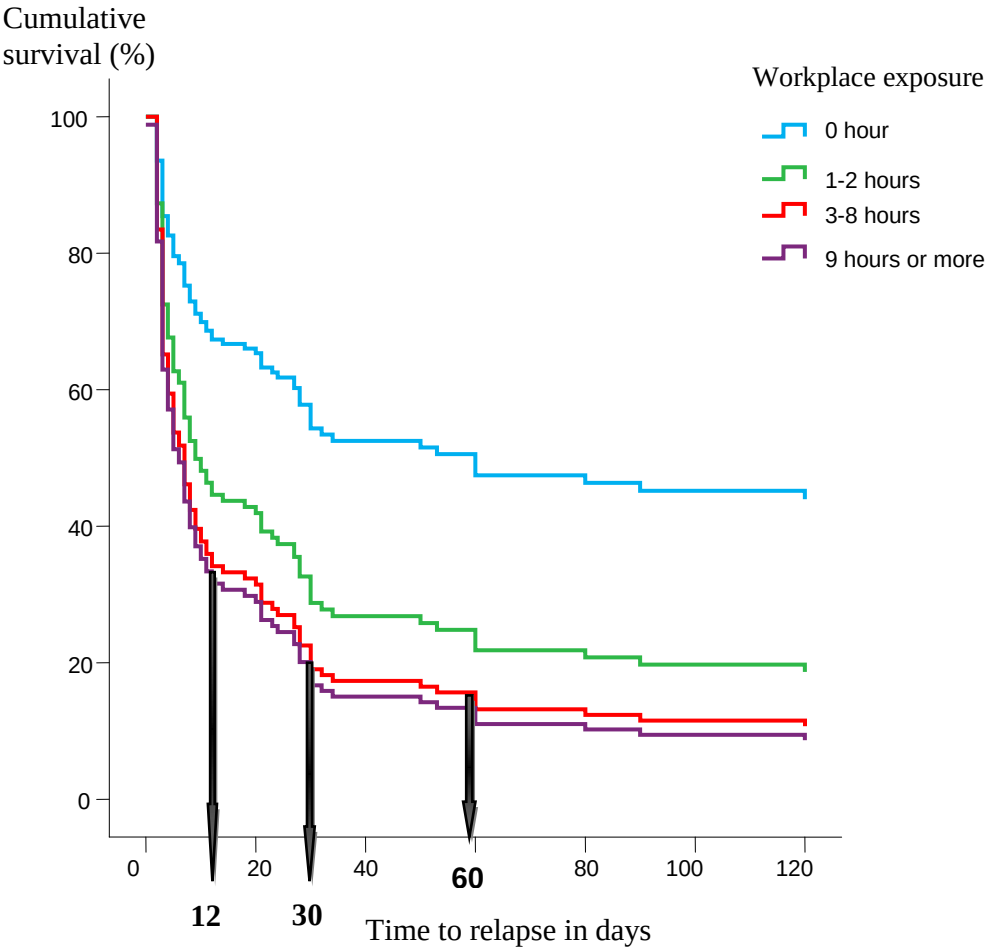


Figure 4.7 Influence of hours of workplace cigarette exposure on the survival curve

The survival curve for co-worker support (Figure 4.8) illustrated that there was a higher survival percentage among those with greater co-worker support in the first 30 days. A greater difference was noted in terms of survival from relapse in the high co-worker support category compared with those in the low and medium support categories.

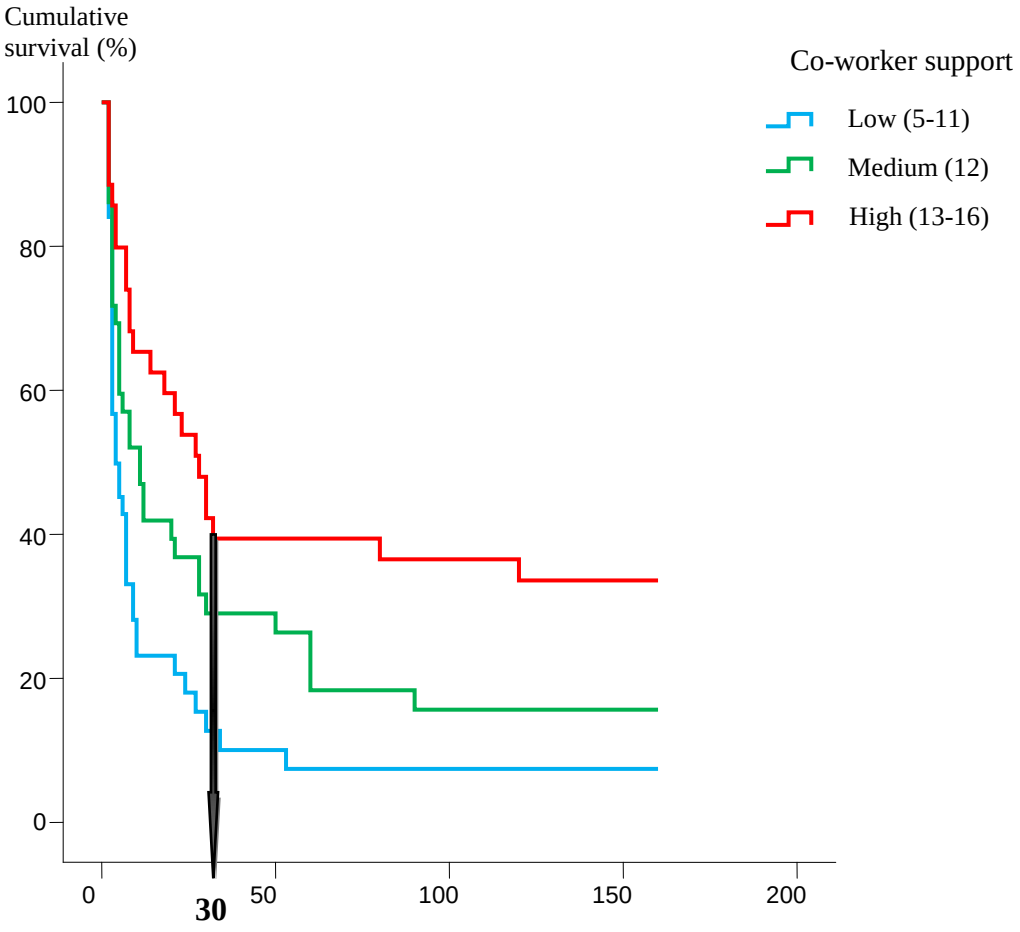


Figure 4.8 Influence of co-worker support on the survival curve

4.6 Predictors of sustained abstinence at 1 week, 3 months and 6 months

4.6.1 Univariate predictors of sustained abstinence

The univariate analyses of data for 1 week, 3 months and 6 months of sustained abstinence are displayed in Table 4.22. Each analysis was adjusted for sociodemographic characteristics, smoking history, number of clinic sessions attended and NRT adherence.

Smokers who quit at 1 week were more likely to be those of lower nicotine dependence and were more likely to have attended more than one session. Smokers in University A (supportive) had higher chance of quitting at 1 week, those with a less supportive work environment of quitting in university B had higher chance of quitting at 3 months. Smokers with less decision-making authority in the workplace also had higher quit rates (at 1 week only). It was also shown that being divorced and being non-Malay increased the chances of quitting at 3 months. Additionally, having a good relationship with co-workers and attending more clinic sessions both at 3 and 6months, substantially helped in maintaining cessation.

The following independent categorical variables were not predictive of success from one week to 6 months: age group, education level, number of cigarettes per day, occupational status, age of smoking initiation, previous quit attempts, NRT adherence, awareness of university rules, smoking on campus, family support, stress/coping and job strain.

Table 4.22 Adjusted analysis of potential predictors of 1 week abstinence, 3 months and 6 months of sustained abstinence

Variables	*Quit for 1 week* *n (%)*	*Quit for 1 week* [a] *OR (95% CI)*	*Sustained cessation for 3 months* *n (%)*	*Sustained cessation for 3 months* [a] *OR (95% CI)*	*Sustained cessation for 6 months* *n (%)*	*Sustained cessation for 6 months* [a] *OR (95%CI)*
Sociodemographic						
Age group						
18-30	45 (43.7)	Ref	9 (33.3)	Ref	7 (29.2)	Ref
31-40	26 (25.2)	1.05 (0.41-2.66)	4 (14.8)	0.36 (0.08-1.69)	4 (16.7)	0.74 (0.19-2.83)
41-50	23 (22.3)	0.48 (0.18-1.31)	9 (33.3)	1.94 (0.55-6.88)	8 (33.3)	1.51 (0.46-4.93)
51 and above	9 (8.7)	0.38 (0.11-1.29)	5 (18.5)	1.53 (0.35-6.68)	5 (20.8)	2.06 (0.54-7.84)
Education level						
Primary school	4 (3.9)	Ref	1 (3.7)	Ref	2 (8.7)	Ref
Secondary school	58 (56.3)	NA	15 (55.6)	1.20 (0.09-15.59)	13 (56.5)	0.29 (0.04-2.14)
Diploma and above	41 (39.8)	NA	11 (40.7)	1.17 (0.09-15.89)	8 (34.8)	0.33 (0.04-2.46)
Occupational status						
Support group	95 (92.2)	Ref	25 (92.6)	Ref	22 (95.7)	Ref
Professionals	8 (7.8)	2.42 (0.56-10.54)	2 (7.4)	0.88 (0.15-5.04)	1 (4.3)	1.19 (0.22-6.55)
Marital status						
Single	37 (35.9)	Ref	5 (18.5)	Ref	5 (20.8)	Ref
Married	64 (62.1)	0.99 (0.46-2.15)	21 (77.8)	1.35 (0.41-4.47)	18 (75.0)	1.18 (0.38-3.67)
Divorced	3 (1.6)	NA	1 (3.7)	23.68 (1.25-450.16)*	1 (4.2)	14.86 (0.99-222.96)
Ethnic group						
Malay	97 (94.2)	Ref	24 (88.9)	Ref	21 (87.5)	Ref
Non-Malay	6 (5.8)	1.99 (0.40-10.02)	3 (11.1)	16.75 (2.10-133.74)**	3 (12.5)	6.27 (1.13-34.89)*

Table 4.22, continued

Variables	*Quit for 1 week* *n (%)*	*Quit for 1 week* [a] *OR (95% CI)*	*Sustained cessation for 3 months* *n (%)*	*Sustained cessation for 3 months* [a] *OR (95% CI)*	*Sustained cessation for 6 months* *n (%)*	*Sustained cessation for 6 months* [a] *OR (95%CI)*
Smoking history						
Number of cigarettes/day						
< 10	14 (13.6)	Ref	5 (18.5)	Ref	4 (17.4)	Ref
≥ 10	89 (86.4)	1.55 (0.58-4.13)	22 (81.5)	0.78 (0.20-3.05)	19 (82.6)	0.68 (0.19-2.41)
Age of smoking initiation						
8-12 years	8 (7.8)	Ref	2 (7.4)	Ref	1 (4.3)	Ref
13-18 years	72 (69.9)	1.19 (0.35-4.04)	19 (70.4)	1.65 (0.27-10.03)	16 (69.6)	1.99 (0.23-17.31)
19 and above	23 (22.3)	0.63 (0.16-2.45)	6 (22.2)	0.23 (0.22- 6.76)	6 (26.1)	1.60 (0.16-15.59)
Previous quit attempts within past year						
0	14 (13.6)	Ref	5 (18.5)	Ref	6 (26.1)	Ref
≥1	89 (86.4)	1.70 (0.59-4.90)	22 (81.5)	0.65 (0.17-2.55)	17 (73.9)	0.45 (0.15-1.37)
FTND score						
Low nicotine dependence	34 (33.0)	Ref	7 (25.9)	Ref	7 (29.2)	Ref
Moderate nicotine dependence	24 (23.3)	0.31 (0.12-0.82)*	9 (33.3)	0.83 (0.23-2.95)	9 (37.5)	1.13 (0.36-3.58)
High nicotine dependence	45 (43.7)	0.69 (0.28-1.74)	11 (40.7)	0.60 (0.19-1.96)	8 (33.3)	0.47 (0.15-1.51)

Table 4.22, continued

Variables	*Quit for 1 week* *n (%)*	*Quit for 1 week* [a] *OR (95% CI)*	*Sustained cessation for 3 months* *n (%)*	*Sustained cessation for 3 months* [a] *OR (95% CI)*	*Sustained cessation for 6 months* *n (%)*	*Sustained cessation for 6 months* [a] *OR (95%CI)*
Follow-up variables						
NRT adherence						
Adherent	70 (68.0)	Ref	22 (81.5)	Ref	19 (79.2)	Ref
Non-adherent	33 (32.0)	5.99 (0.61-58.62)	5 (18.5)	2.27 (0.15-35.47)	5 (20.8)	2.99 (0.25-35.28)
Number of counselling sessions attended						
1 session	30 (29.1)	Ref	4 (14.8)	Ref	4 (16.7)	Ref
2 sessions	48 (46.6)	9.13 (0.94-88.70)	8 (29.7)	9.10 (0.65-127.70)	9 (37.5)	15.44 (1.12-212.59)*
3 sessions	15 (14.6)	2.23 (0.19-25.34)	13 (48.1)	55.11 (2.83-1073.54)*	8 (33.3)	41.99 (2.10-84.18)*
4 or more sessions	10 (9.7)	2.21 (0.19-26.41)	2 (7.4)	5.55 (0.22-140.22)	3 (12.5)	10.46 (0.49-224.32)
Psychosocial variables						
Stress						
Low stress	74 (74.7)	Ref	17 (68.0)	Ref	16 (72.7)	Ref
High stress	25 (25.3)	0.87 (0.36-2.10)	8 (32.0)	1.35 (0.47-3.88)	6 (27.3)	1.03 (0.35-3.03)
Coping						
Low coping	55 (55.6)	Ref	14 (56.0)	Ref	12 (54.5)	Ref
High coping	44 (44.4)	1.57 (0.72-3.45)	11 (44.0)	1.43 (0.49-4.19)	10 (45.5)	1.38 (0.53-3.57)
Family support						
Low family support	47 (48.0)	Ref	11 (42.3)	Ref	12 (52.2)	Ref
High family support	51 (52.0)	1.84 (0.87-3.88)	15 (57.7)	1.46 (0.52-4.07)	11 (47.8)	0.93 (0.36-2.37)

Table 4.22, continued

Variables	*Quit for 1 week* *n (%)*	*Quit for 1 week* [a] *OR (95% CI)*	*Sustained cessation for 3 months* *n (%)*	*Sustained cessation for 3 months* [a] *OR (95% CI)*	*Sustained cessation for 6 months* *n (%)*	*Sustained cessation for 6 months* [a] *OR (95%CI)*
Smoking environment and exposure						
Aware of the university smoking prohibition rule						
Yes	97 (94.2)	Ref	25 (92.6)	Ref	22 (91.7)	Ref
No	6 (5.8)	2.05 (0.39-10.84)	2 (7.4)	1.30 (0.17-9.87)	2 (8.3)	2.14 (0.37-12.34)
Smokes on the university campus						
Yes	76 (73.8)	Ref	22 (81.5)	Ref	20 (83.3)	Ref
No	27 (26.2)	1.50 (0.63-3.57)	5 (18.5)	0.98 (0.27-3.49)	4 (16.7)	0.79 (0.24-2.59)
University						
A (supportive)	91 (88.3)	Ref	15 (55.6)	Ref	16 (66.7)	Ref
B (non-supportive)	12 (11.7)	0.14 (0.06-0.34)**	12 (44.4)	4.35 (1.59-11.88)**	8 (33.3)	1.88 (0.69-5.11)

Table 4.22, continued

Variables	*Quit for 1 week* *n (%)*	*Quit for 1 week* [a] *OR (95% CI)*	*Sustained cessation for 3 months* *n (%)*	*Sustained cessation for 3 months* [a] *OR (95% CI)*	*Sustained cessation for 6 months* *n (%)*	*Sustained cessation for 6 months* [a] *OR (95%CI)*
Smoking environment and exposure						
Worksite environment						
0 hours	6 (5.9)	Ref	1 (3.7)	Ref	1 (4.2)	Ref
1-2 hours	39 (38.2)	3.59 (0.88-14.69)	4 (14.8)	0.81 (0.07-9.26)	5 (20.8)	1.09 (0.11-10.85)
3-8 hours	35 (34.3)	1.92 (0.47-7.80)	12 (44.4)	1.89 (0.19-19.00)	12 (50.0)	2.31 (0.26-20.82)
9 hours or more	22 (21.6)	2.63 (0.59-11.81)	10 (37.0)	2.62 (0.25-27.41)	6 (25.0)	2.03 (0.21-19.73)
Home environment						
0 hours	49 (47.6)	Ref	12 (44.4)	Ref	11 (45.8)	Ref
1-4 hours	37 (35.9)	1.56 (0.67-3.64)	9 (33.3)	0.89 (0.27-2.92)	8 (33.3)	0.93 (0.32-2.69)
5-14 hours	10 (9.7)	0.68 (0.22-2.14)	3 (11.1)	2.29 (0.48-11.00)	3 (12.5)	1.56 (0.36-6.68)
15 hours or more	7 (6.8)	2.63 (0.52-13.30)	3 (11.1)	1.82 (0.31-10.73)	2 (8.3)	1.58 (0.28-8.99)
Peer influence						
None	2 (1.9)	Ref	0 (0)	Ref	0 (0)	Ref
Very few	6 (5.8)	NA	2 (7.4)	NA	3 (12.5)	NA
Less than half	14 (13.6)	NA	4 (14.8)	NA	5 (20.8)	NA
Most are smokers	81 (78.6)	NA	21 (77.8)	NA	16 (66.7)	NA

Table 4.22, continued

Variables	*Quit for 1 week* *n (%)*	*Quit for 1 week* [a] *OR (95% CI)*	*Sustained cessation for 3 months* *n (%)*	*Sustained cessation for 3 months* [a] *OR (95% CI)*	*Sustained cessation for 6 months* *n (%)*	*Sustained cessation for 6 months* [a] *OR (95%CI)*
Job stressors						
Decision-making authority in the workplace						
Low	23 (22.3)	Ref	8 (29.6)	Ref	8 (33.3)	Ref
Medium	57 (55.4)	1.06 (0.46-2.41)	10 (37.0)	0.42 (0.14-1.29)	10 (41.7)	0.46 (0.15-1.43)
High	23 (22.3)	0.55 (0.22-1.37)	9 (33.4)	0.65 (0.20-2.14)	6 (25.0)	0.39 (0.11-1.46)
Job demands						
Low	25 (24.3)	Ref	5 (18.6)	Ref	5(20.8)	Ref
Medium	44 (42.7)	0.65 (0.27-1.55)	13 (48.1)	1.18 (0.34-4.07)	13 (54.2)	1.27 (0.36-4.49)
High	34 (33.0)	0.46 (0.19-1.13)	9 (33.3)	0.72 (0.18-2.80)	6 (25.0)	0.42 (0.09-1.89)
Co-worker support						
Low	22 (21.4)	Ref	1 (3.7)	Ref	1 (4.2)	Ref
Medium	41 (39.8)	1.5 (0.65-3.45)	8 (29.6)	5.72 (0.64-51.45)	7 (29.2)	5.42 (0.57-51.37)
High	40 (38.8)	1.25 (0.54-2.86)	18 (66.7)	15.73 (1.82-136.03)*	16 (66.6)	12.09 (1.35-108.29)*
Supervisor support						
Low	29 (28.2)	Ref	8 (29.6)	Ref	7 (29.1)	Ref
Medium	37 (35.9)	1.54 (0.71-3.36)	9 (33.0)	1.28 (0.42-3.89)	7 (29.1)	0.99 (0.30-3.35)
High	37 (35.9)	1.37 (0.63-3.02)	10 (37.4)	1.02 (0.32-3.24)	10 (41.7)	1.28 (0.39-4.21)

Table 4.22, continued

Variables	*Quit for 1 week* *n (%)*	*Quit for 1 week* [a] *OR (95% CI)*	*Sustained cessation for 3 months* *n (%)*	*Sustained cessation for 3 months* [a] *OR (95% CI)*	*Sustained cessation for 6 months* *n (%)*	*Sustained cessation for 6 months* [a] *OR (95%CI)*
Job stressors						
Job insecurity						
Low	18 (17.5)	Ref	8 (29.6)	Ref	7 (29.2)	Ref
Medium	49 (47.5)	1.28 (0.53-3.08)	12 (44.5)	0.59 (0.19-1.85)	11 (45.8)	0.60 (0.18-2.01)
High	36 (35.0)	1.28 (0.53-3.13)	7 (25.9)	0.22 (0.13-1.61	6 (25.0)	0.43 (0.11-1.64)
Job decision latitude						
Low	31 (30.0)	Ref	8 (29.6)	Ref	8 (33.3)	Ref
Medium	47 (45.6)	0.92 (0.44-1.95)	8 (29.6)	0.49 (0.16-1.51)	7 (29.2)	0.41 (0.12- 1.35)
High	25 (24.4)	0.71 (0.31-1.65)	11 (40.8)	1.11 (0.36-3.44)	9 (37.5)	0.85 (0.26-2.81)
Job skill discretion						
Low	30 (29.2)	Ref	4 (14.8)	Ref	3 (12.5)	Ref
Medium	47 (45.6)	0.72 (0.33-1.56)	13 (48.2)	2.92 (0.71-12.15)	12 (50.0)	3.73 (0.74-18.77)
High	26 (25.2)	0.86 (0.35-2.15)	10 (37.0)	3.61 (0.84-15.52)	9 (37.5)	4.92 (0.96-25.34)
Job strain						
Low strain	17 (16.5)	Ref	2 (7.0)	Ref	2 (8.3)	Ref
Passive job	28 (27.2)	1.63 (0.57-4.72)	9 (33.3)	1.99 (0.42-9.45)	9 (37.5)	9.92 (1.20-82.68)*
Active job	30 (29.1)	0.73 (0.26-1.99)	9 (33.3)	1.09 (0.23-5.11)	8 (33.3)	3.44 (0.41-28.88)
High strain	28 (27.2)	1.26 (0.45-3.48)	7 (26.4)	1.48 (0.33-6.68)	5 (20.8)	3.70 (0.45-30.58)

[a] Adjusted for all the variables in the sociodemographic, smoking history and follow-up variables
* < 0.05; ** < 0.01
NA; One of the group has a 0% quit rate OR cannot be computed

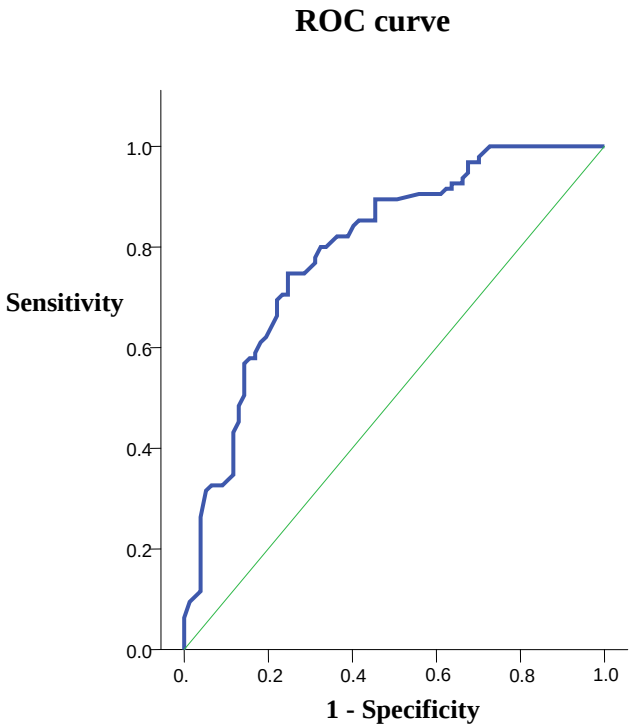
4.6.2 Multivariate predictors of abstinence at 1 week, 3 months and 6 months

All variables from the univariate analysis were included in this multivariate logistic regression. Attending two counselling sessions was associated with a successful quit status at one week Moderate decision-making authority in the workplace, working in University B (less supportive environment of quitting) and moderate FTND scores were protective against quitting (Table 4.23).

Table 4.23 Multivariate logistic regression predicting point abstinence at one week

Variables	*β*	*SE*	*Wald* x^2	*df*	*Odds ratio (95% CI)*	*p-value*[a]
University B	-2.03	0.48	20.49	1	0.13 (0.05-0.32)	< 0.01
Number of counselling sessions attended (2 sessions)	3.39	0.54	7.81	1	29.55 (2.27-312.64)	< 0.01
Number of counselling sessions attended (3 sessions)	1.80	0.54	2.05	1	6.05 (0.51-71.10)	0.15
Number of counselling sessions attended (4 or more)	1.40	0.60	1.20	1	4.04 (0.33-49.17)	0.07
Decision-making authority (Med)	-0.80	0.57	4.44	1	0.45 (0.22-0.95)	0.04
Decision-making authority in the workplace (High)	-0.16	0.59	1.84	1	0.18 (0.12-2.09)	0.17
NRT adherence	1.79	1.22	2.36	1	5.98 (0.61- 58.71)	0.13
Co-worker support (Medium)	1.41	0.52	1.67	1	1.50 (0.66-1.75)	0.41
Co- worker support (High)	1.36	0.49	1.43	1	1.39 (1.30 - 2.62)	0.72
Family support	0.59	0.39	2.36	1	1.80 (0.85-3.82)	0.13
FTND (Moderate)	-1.17	0.51	5.60	1	0.31 (0.12-0.82)	0.02
FTND (High)	-0.39	0.48	0.68	1	0.68 (0.23-1.70)	0.41
Coping	0.47	0.41	1.37	1	1.60 (0.73-3.51)	0.24

[a] Adjusted for all the variables in the model as above



The area under the ROC curves (AUC) =0.79

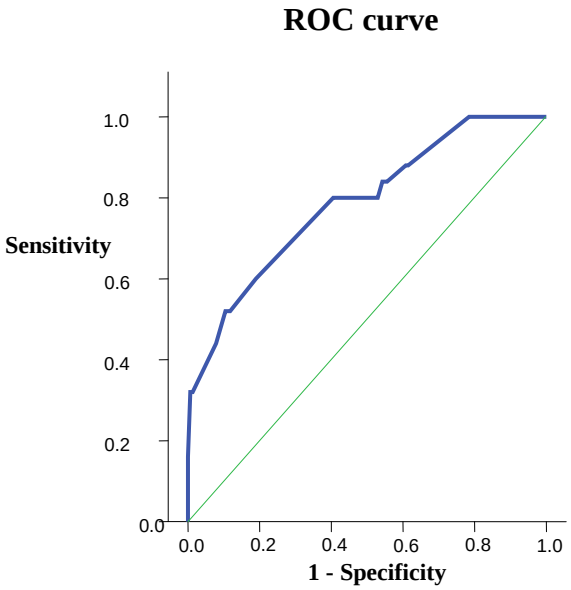
Figure 4.9 ROC curve for one week of abstinence

The results also showed that success at three months was predicted by attending more than one counselling session, working at University B and greater co-worker support (Table 4.24).

Table 4.24 Multivariate logistic regression predicting sustained cessation at three months

Variables	*β*	SE	*Wald* x^2	df	*Odds ratio (95% CI)*	*p-value*[a]
Number of counselling sessions attended (2 sessions)	1.06	0.69	2.33	1	2.87 (0.74 -11.14)	0.13
Number of counselling sessions attended (3 sessions)	2.80	0.73	14.63	1	16.42 (3.91-68.88)	< 0.01
Number of counselling sessions attended (4 or more)	1.37	0.99	0.98	1	3.94 (0.57-27.40)	0.17
Co-worker support (Medium)	1.97	0.52	3.86	1	2.05 (1.03-2.47)	< 0.01
Co-worker support (High)	1.29	0.41	3.38	1	3.28 (2.08-3.92)	0.03
University B	1.19	0.53	6.02	1	3.28 (1.27-8.47)	0.01
Job insecurity (Medium)	-0.02	0.71	0.01	1	0.98 (0.24-3.98)	0.97
Job insecurity (High)	-0.16	0.72	0.72	1	0.85 (0.21-3.49)	0.83
Rhodes Stress	0.35	0.56	0.44	1	1.41 (0.51-3.92)	0.50

[a] Adjusted for all the variables in the model as above



The area under the ROC curves (AUC) =0.79

Figure 4.10 ROC curve for three months of sustained cessation

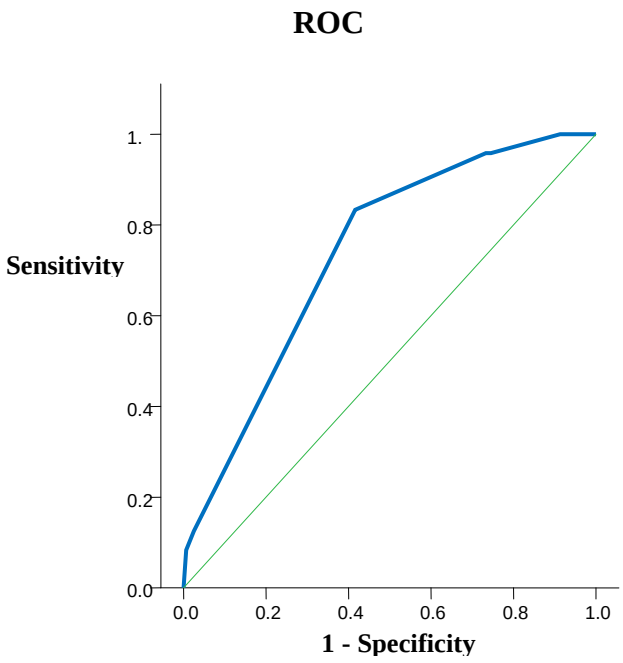
Table 4.25 concludes that only three variables predict sustained cessation at six months. Rates of sustained cessation at six months were significantly higher among the non-Malays compared with the Malays. Similar to the results at one week and three months, attending more counselling sessions and having good co-worker support increased the chance of success. A Receiver Operating Characteristic Curve (ROC) was constructed for each logistic regression model, and the results reported were good, ranging from 0.74-0.79 (Figure 4.9-4.11).

Finally, tests for interactions between marital status and FTND scores (with more than two categories) were performed (data not shown). The results were insignificant (all $p > 0.10$) at all three observation time points.

Table 4.25 Multivariate logistic regression predicting sustained abstinence at six months

Variables	*β*	*SE*	*Wald* x^2	*df*	*Odds ratio (95% CI)*	*p-value*[a]
Number of counselling sessions attended (2 sessions)	1.38	0.67	6.97	1	5.00 (1.52-16.54)	0.04
Number of counselling sessions attended (3 sessions)	2.08	0.71	8.58	1	8.00 (1.99-32.16)	< 0.01
Number of counselling sessions attended (4 or more)	1.56	0.87	3.17	1	4.75 (0.86-26.36)	0.08
Ethnic group	1.84	0.91	4.40	1	6.27 (1.13- 34.89)	0.04
Co-Worker Support (Med)	1.26	0.70	5.62	1	2.08 (1.50- 2.65)	0.02
Co-Worker Support (High)	1.43	0.60	6.72	1	2.50 (2.42-3.15)	0.10

[a] Adjusted for all the variables in the model



The area under the ROC curves (AUC) =0.74

Figure 4.11 ROC curve for six months of sustained abstinence

4.7 Behavioural variables: perception, motivation and the Transtheoretical model

The behavioural component of smoking cessation plays a vital part in smoking cessation attempts. To counteract the addictive effects of nicotine, smokers need to undergo a process of behavioural change. In this section, the investigator covers major components involved in behavioural change based on the TTM and how it is related to abstinence from smoking.

4.7.1 Perception of smokers

4.7.1.1 Perception of smokers in different sociodemographic and smoking backgrounds

To examine the perception of smokers, the author utilised the decisional balance questionnaire (DB) which is part of the Transtheoretical Model. A set of DB questionnaires was administered prior to the first session and again after two months. Overall, participants scored higher in recognising the cons of smoking compared with the pros of smoking by one-way ANOVA analysis. Although, there were no significant differences between any sociodemographic or smoking history variables (all $p > 0.05$) in perception data gathered in the initial session, some were marginally significant. As for example, smokers in the professional work group had greater mean scores for the cons of smoking compared with the support staff work group ($p = 0.06$) and smokers with a higher education level perceived fewer pros of continuing to smoke than the less-educated smokers ($p = 0.07$). In addition, married smokers also perceived more cons of smoking greater than unmarried smokers ($p = 0.08$) (Table 4.26).

Table 4.26 Perception by different sociodemographic backgrounds and smoking history

Characteristics	*Pros of smoking*			*Cons of smoking*		
	mean (SD)	*F*	*p*	*mean (SD)*	*F*	*p*
Demographic characteristics						
Age group						
18-30	3.09 (0.80)	0.16	0.92	3.61 (0.79)	0.78	0.51
31-40	3.12 (0.77)			3.62 (0.70)		
41-50	3.17 (0.84)			3.82 (0.83)		
51 and above	3.02 (1.11)			3.67 (0.78)		
Education level						
Primary school	2.70 (0.45)	2.71	0.07	3.27 (0.64)	1.08	0.34
Secondary school	3.03 (0.87)			3.65 (0.80)		
Diploma and above	3.29 (0.78)			3.75 (0.74)		
Occupational status						
Support group	3.09 (0.84)	0.49	0.48	3.63 (0.78)	3.41	0.07
Professionals	3.27 (0.74)			4.06 (0.58)		
Marital status						
Single	3.09 (0.77)	1.82	0.16	3.55 (0.78)	2.48	0.08
Married	3.14 (0.87)			3.71 (0.76)		
Divorced	2 (1.41)			4.44 (0.51)		
Smoking history						
Number of cigarettes/day						
< 10	2.98 (0.86)	0.82	0.37	3.86 (0.65)	2.26	0.14
≥ 10	3.14 (0.83)			3.62 (0.79)		
Age of smoking initiation						
8-12 years	3.18 (0.99)	0.56	0.57	3.48 (0.69)	1.12	0.32
13-18 years	3.07 (0.82)			3.64 (0.81)		
19 and above	3.22 (0.79)			3.79 (0.70)		
Previous quit attempt within past year						
0	3.04 (0.54)	0.20	0.66	3.62 (0.85)	0.09	0.76
≥ 1	3.13 (0.88)			3.67 (0.76)		
Aware of university smoking prohibition rule						
Yes	3.11 (0.82)	2.05	0.15	3.66 (0.78)	0.38	0.54
No	3.11 (1.12)			3.85 (0.77)		
Smoking on university campus						
Yes	3.12 (0.86)	0.88	0.35	3.60 (0.75)	0.45	0.51
No	3.07 (0.77)			3.89 (0.81)		

4.7.1.2 Changes in perception postsession

The response rate for the second mailed DB was 64%. The results showed a significant difference between pre and post-counselling scores. Smokers who failed to answer the second DB were excluded from analysis.

The mean difference in scores for the overall pros of smoking before and after session attendance was 0.53 points lower after counselling (95% CI = 0.36; 0.71), whereas the mean difference in scores for the overall cons of smoking before and after session attendance was significantly higher at -0.18 points (95% CI = -0.33; -0.02). Eighty-six out of 119 (72.2%) participants had reduced scores for the pros of smoking whereas 79 out of 119 (66.4%) participants had increased scores for the cons of smoking.

4.7.1.3 Changes in perception and their relationship to cessation outcome

After 8 weeks, 46 participants among 119 included in the analysis claimed to have given up smoking, confirmed by CO ppm of < 6. The seven day point prevalence of abstinence was taken as the definition of quitting in this section (refer to section 1.6 on the operational definition). In all, 76 subjects did not adhere to NRT in this section, either due to intolerable side effects or defaulted follow up. Those who adhered to NRT had significantly higher cessation success rates compared with those who were non-adherent after two months (Odds ratio = 2.34; 95% CI: 1.35-3.32).

The changes in DB pre- and post-counselling were analysed and compared with the success rates. Table 4.27 shows the change in the participants' perceptions of the pros and cons of smoking classified into two categories. The first category included participants with a reduced score in the pros and increased scores in the cons. The second category included those with no change in DB.

Among participants with reduced scores for the pros of smoking, 38 out of 86 had quit while 8 out of 33 participants with no change had quit. For those participants

whose perception about the cons of smoking had changed post-counselling, 31 out of 79 had quit compared with 15 out of 40 participants who had no change in perception of the cons of smoking who had quit. The smokers with reduced scores for the pros of smoking were more likely to quit. Although quitters at 2 months had also changed their perception of the cons of smoking, the change was not significant when compared with those who did not quit (Table 4.27).

Table 4.27 Overall changes in decisional balance post-counselling among those who quit at 2 months and those who did not quit after counselling

Decisional balance items	*Quit at 2 months n (%)*	*Did not quit at 2 months n (%)*	*OR (95% CI)*	*p*
Pros of smoking				
Reduced score	38 (82.6)	48 (65.8)	2.47 (1.00-6.00)	0.04
No change/increased score	8 (17.4)	25 (34.2)		
Cons of smoking				
Increased score	31(67.4)	48 (65.8)	1.07 (0.49-2.36)	0.50
No change/reduced score	15 (32.6)	25 (34.2)		

Paired scores for the pros and cons of smoking (pre- and post-counselling) were analysed separately between the quitters and the non-quitters (Table 4.28). Quitters showed significant changes in their perceived pros and cons of smoking after counselling. As for non-quitters, there was only a significant reduction of scores for the pros of smoking but no significant difference in the perceived cons of smoking.

Table 4.28 Paired differences in changes in pros and cons of quitting from 0 to 2 months by quitting status

Items	*0 months (M1) Mean (SD)*	*2 months (M2) Mean (SD)*	*Mean difference (M1—M2) (95% CI)*	*p*
Quitters (*n* = 46)				
Pros of smoking	3.05	2.31	0.74 (0.44; 1.03)	< 0.01
Cons of smoking	3.70	3.96	-0.26 (-0.51; -0.00)	0.05
Non-quitters (*n* = 73)				
Pros of smoking	3.19	2.81	0.38 (0.16; 0.59)	< 0.01
Cons of smoking	3.55	3.68	-0.13 (-0.33; 0.07)	0.19

When comparing the answers given by both groups, there was no significant difference found in perception between those who quit and those who did not quit in their perceived pros and cons of smoking at the baseline evaluation. However, at two months, after going through an educational session, those who quit answered with higher scores for cons of smoking and lower scores for pros of smoking (Table 4.29).

Table 4.29 Differences in pros and cons by smoking status at 2 months after treatment

Items	*Quit at 2 months (M1) n = 46 Mean (SD)*	*Did not quit at 2 months (M2) n = 73 Mean (SD)*	*Mean difference (M1-M2) (95% CI)*	*p*
Precounselling				
Pros of smoking	3.10 (0.87)	3.12 (0.83)	-0.02 (-0.33; 0.22)	0.71
Cons of smoking	3.73 (0.74)	3.63 (0.78)	0.10 (-0.12; 0.38)	0.31
Post-counselling				
Pros of smoking	2.31 (0.87)	2.81(0.87)	-0.50 (-0.82; -0.18)	0.03
Cons of smoking	4.00 (0.78)	3.68(0.81)	0.32 (0.02; 0.62)	0.03

4.7.2 Motivation of smokers

All smokers in the study entered the action stage, remained in their previous stage or advanced or receded through the stages during the six month duration of the study. A total of 127 smokers were analyzed in this section. Smokers who quit at six months observation period were excluded from analysis under the assumption that they had entered the action stage or maintenance stage (Table 4.18).

4.7.2.1 Motivation by different sociodemographic and smoking backgrounds

The results showed that there is no significant difference in motivation across sociodemographic backgrounds. However, smokers with at least one quit attempt within the past year were in a higher motivation stage at the beginning of the programme compared with those who have not attempted to quit in the past year (Table 4.30).

Table 4.30 Initial motivation by different sociodemographic backgrounds and smoking history

Characteristics	*Preparation*	*Contemplation*	*Precontemplation*	
	n (%)	*n (%)*	*n (%)*	*p-value*
Demographic				
Age group				
18-30	48 (43.6)	25 (40.3)	4 (30.8)	0.98[a]
31-40	25 (22.7)	14 (22.6)	4 (30.8)	
41-50	24 (21.8)	16 (25.8)	3 (23.1)	
51 and above	13 (11.8)	7 (11.3)	2 (15.4)	
Education level				
Primary school	2 (1.8)	2 (3.2)	1 (7.7)	0.67[a]
Secondary school	67 (60.9)	33 (53.2)	7 (53.8)	
Diploma and above	41 (37.3)	27 (43.5)	5 (38.5)	
Occupational status				
Support group	99 (90.0)	59 (95.2)	13 (100.0)	0.27[a]
Professionals	11 (10.0)	3 (4.8)	0 (0.0)	
Marital status				
Single	42 (38.2)	23 (37.1)	4 (30.8)	0.97[a]
Married	66 (60.0)	38 (61.3)	9 (69.2)	
Divorced	2 (1.8)	1 (1.6)	0 (0)	

[a] *p* value derived from chi-squared tests
[b] *p* value derived from Fisher's exact test

Table 4.30, continued

Characteristics	*Preparation*	*Contemplation*	*Precontemplation*	
	n (%)	*n (%)*	*n (%)*	*p-value*
Smoking history				
Number of cigarettes/day				
< 10	16 (14.5)	12 (19.4)	0 (0.0)	0.20[b]
≥ 10	94 (85.5)	50 (80.6)	13 (100.0)	
Age of smoking initiation				
8-12 years	14 (12.7)	3 (4.8)	1 (7.7)	0.36[b]
13-18 years	71 (64.5)	44 (71.0)	7 (53.8)	
19 and above	25 (22.7)	15 (24.2)	5 (38.5)	
Previous quit attempts within past year				
0	4 (3.6)	17 (27.4)	6 (46.2)	< 0.01[b]
≥ 1	106 (96.4)	45 (72.6)	7 (53.8)	
NRT adherence				
Non-adherent	66 (60.0)	37 (59.7)	6 (46.2)	0.62[a]
Adherent	44 (40.0)	25 (40.3)	7 (53.8)	
Number of counselling sessions attended				
1 session	44 (40.0)	23 (37.1)	7 (53.8)	0.66[b]
2 sessions	37 (33.6)	19 (30.6)	4 (30.8)	
3 sessions	20 (18.2)	10 (16.1)	1 (7.7)	
≥ 4 sessions	9 (8.2)	10 (16.1)	1 (7.7)	
Aware of the university smoking prohibition rule				
Yes	100 (90.9)	10 (9.1)	13 (100.0)	0.09[b]
No	61 (98.4)	1 (1.6)	0 (0.0)	
Smokes on the university campus				
Yes	79 (71.8)	50 (80.6)	12 (92.3)	0.16[b]
No	31 (28.2)	12 (19.4)	1 (7.7)	

[a] *p* value derived from chi-squared tests
[b] *p* value derived from Fisher's exact test

4.7.2.2 Changes in motivation and their relationship to outcomes

The highest percentage was those that changed from preparation to contemplation, both in the never quit group and in the relapser group, although this change was greater among relapsers. The number of smokers who did not change to the contemplation stage was also greater in the relapser group. The never quit group showed little improvement in the precontemplation stage, with 5% remaining unchanged in behaviour. Chi-squared

tests showed that in all the stages, there was a significant difference between the relapsers and those who never quit ($p < 0.001$) (Table 4.31).

Table 4.31 Changes in the stage of change pre and postsession among relapsers and those who never quit at 6 months

Presession (0 month)	Changes in the stage of change			
	Postsession (6 months)	*Relapser n (%)*	*Never Quit n (%)*	*p*
Preparation	Contemplation	29 (72.5)	20 (71.4)	< 0.001
	Precontemplation	1 (2.5)	5 (17.9)	
	No change (preparation)	10 (25.0)	3 (10.7)	
Contemplation	Preparation	8 (28.6)	3 (16.7)	< 0.001
	Precontemplation	1 (3.5)	6 (33.3)	
	No change (Contemplation)	19 (67.9)	9 (50.0)	
Precontemplation	Preparation	1 (25.0)	1 (11.1)	< 0.001
	Contemplation	3 (75.0)	5 (55.6)	
	No change (Precontemplation)	0 (0.0)	3 (33.3)	
Total n (%)		72 (100.0)	55 (100.0)	

To determine whether there was a significant improvement or reduction in motivation among the smokers after six months, the participants were grouped into two categories: improvement in motivation or no change/reduced motivation (Table 4.32). There were no significant differences between the relapsers and the never quit groups in terms of reduction/improvement in changes in the stage of change after six months (Chi squared test=0.56; $p > 0.05$).

Table 4.32 Changes in the stage of change among relapsers and those who never quit

Changes in the stage of change	*Relapser n (%)*	*Never quit n (%)*	*p*
Improvement in stage of change	11 (15.3)	8 (14.5)	0.91
No change or reduction in the stage of change	61 (84.7)	47 (85.5)	
Total *n* (%)	72 (100.0)	55 (100.0)	

4.7.2.3 Predictors of the stage of change for sustained quitters and relapsers

Table 4.33 shows that the presession stage of change did not predict sustained cessation at six months. However, among relapsers, smokers in the contemplation stage presession were more likely to relapse compared with those in the preparation stage presession.

Table 4.33 Predictors of sustained quitters and relapsers at 6 months

Presession stage (0 month)	*Sustained quitters*[a] *(6 months)*		*Relapsers*[a] *(6 months)*	
	n (%)	*OR (95% CI)*	*n (%)*	*OR (95% CI)*
Preparation	18 (75.0)	ref	40 (55.5)	ref
Contemplation	6 (25.0)	0.42 (0.15-1.23)	28 (38.9)	3.53 (1.29-9.67)*
Precontemplation	0 (0)	NA	4 (5.6)	NA
Total	24 (100)		72 (100)	

*$p < 0.05$
[a]Adjusted for sociodemographic characteristics, smoking history, NRT adherence and clinic session attendance

4.8 Predictors of relapse during action stage of TTM

4.8.1 Univariate analysis for predictors of relapse during action stage of TTM at different time zones

None of the variables predicted relapse from time 0 to time 1 nor from time 0 to time 2 (Table 4.34 and Table 4.35). In contrast, as shown in Table 4.36 (predicting relapse from time 1 to time 2), many significant findings were observed. Smokers who relapsed had significantly greater negative affective temptations compared to smokers who abstained. Aggregate behaviour change processes, especially self liberation, as well as consciousness raising and environmental re-evaluation, were all protective factors against relapse; consciousness raising and environmental re-evaluation were both higher among the quitters. The effect size for these variables ranged from small (0.1-0.3), moderate (> 0.3-0.5) to large effect difference (> 0.5). Large effect differences were observed for self liberation, pros of smoking and doubting ability to quit.

Table 4.34 Effect of time 0 TTM measures on relapse at time 1 (3 months), *n* = 120

TTM variables time 0 (0 month)	*Quit at end of 3months (n = 68)*		*Relapsed (n = 52)*		*Effects of predictors on relapse outcome* [a]
	M	SD	M	SD	OR (95% CI)
Aggregate temptations	3.51	0.65	3.32	0.62	0.99 (0.51-1.95)
Positive/social temptations	3.84	0.78	3.52	3.83	1.21 (0.80-1.82)
Habit/addictive temptations	3.11	0.83	2.97	0.67	0.91 (0.53-1.56)
Negative/affective temptation	3.56	0.91	3.42	0.98	1.08 (0.67-1.75)
Aggregate behavioural	2.81	0.65	2.99	0.81	0.85 (0.45-1.61)
Counter conditioning	2.51	0.96	3.00	1.18	1.07 (0.68-1.67)
Self liberation	3.14	0.94	3.55	1.04	1.27 (0.79-2.03)
Reinforcement management	3.55	1.06	3.45	1.13	0.78 (0.53-1.15)
Stimulus control	2.16	0.93	2.09	0.77	0.73 (0.45-1.18)
Helping relationship	2.69	1.16	3.09	1.30	0.97 (0.67-1.40)
Aggregate experiential	3.33	0.69	3.33	1.19	0.87 (0.52-1.48)
Consciousness Raising	3.78	0.85	3.77	1.33	0.70 (0.43-1.15)
Self Re-evaluation	3.12	0.99	3.18	1.25	1.04 (0.69-1.56)
Environmental re-evaluation	3.10	1.08	3.27	1.19	0.97(0.66-1.40)
Decisional Balance					
Pros of smoking	3.18	0.93	2.96	0.93	1.04 (0.63-1.71)
Cons of smoking	3.61	0.82	4.09	0.86	1.32 (0.07-2.40)
Others					
Self efficacy to resist temptations	3.62	1.07	3.56	1.22	0.88 (0.58-1.33)
Self efficacy to stay a non smoke	3.61	1.06	3.55	1.21	0.91 (0.51-1.63)
Worry about problems associated with quitting	3.02	1.36	3.09	1.58	1.03 (0.74-1.43)
Resist urges to smoke	0.30	0.87	3.64	0.81	1.25 (0.69-2.27)
Doubt ability to quit	3.29	0.94	2.73	0.79	0.84 (0.51-1.38)
Doubt Worth Quitting	2.84	1.28	2.20	1.40	0.88 (0.61-1.27)
Determination To Stay Quit	3.65	1.03	4.00	1.00	1.10 (0.68-1.78)

[a] Derived from simple univariate logistic regression, adjusted for number of cigarettes smoked, NRT and clinic sessions

Table 4.35 Effect of time 0 TTM measures on relapse at time 2 (6 months), *n* = 120

TTM variables time 0 (0 month)	*Quit at end of 6 months (n = 41)*		*Relapsed (n = 79)*		*Effects of predictors on relapse outcome* [a]
	M	*SD*	*M*	*SD*	*OR (95% CI)*
Aggregate temptations	3.38	0.61	3.46	0.73	1.18 (0.65-2.12)
Positive/social temptations	3.75	0.81	3.87	0.85	1.13 (0.69-1.84)
Habit/addictive temptations	2.95	0.77	2.99	0.88	1.02 (0.61-1.69)
Negative/affective temptation	3.39	0.89	3.57	0.94	1.26 (0.80-1.99)
Aggregate behavioural	3.36	0.69	0.27	0.87	0.65 (0.35-1.20)
Counter conditioning	2.66	0.91	2.68	1.07	0.90 (0.60-1.36)
Self liberation	3.20	0.84	3.19	1.06	0.94 (0.61-1.46)
Reinforcement management	3.71	0.93	3.24	1.24	0.71 (0.49-1.02)
Stimulus control	2.32	0.92	2.17	1.00	0.78 (0.51-1.19)
Helping relationship	2.80	1.12	2.74	1.20	0.92 (0.65-1.29)
Aggregate experiential	2.94	0.63	2.79	0.73	0.82 (0.48-1.40)
Consciousness Raising	3.77	0.92	3.71	0.89	0.95 (0.61-1.48)
Self Re-evaluation	3.05	0.95	3.06	1.14	1.01 (0.68-1.47)
Environmental re-evaluation	3.28	1.06	3.04	1.21	0.84 (0.58-1.21)
Decisional Balance					
Pros of smoking	3.04	0.89	3.15	0.88	1.15 (0.72-1.85)
Cons of smoking	3.78	0.76	3.60	0.79	0.19 (0.02-1.88)
Others					
Self efficacy to resist temptations	3.59	0.99	3.41	1.06	0.83 (0.54-1.27)
Self efficacy to stay a non smoke	3.59	0.99	3.41	1.05	0.84 (0.55-1.27
Worry about problems associated with quitting	3.00	1.36	3.18	1.38	1.06 (0.79-1.43)
Resist urges to smoke	3.29	0.84	3.24	0.82	0.75 (0.44-1.26)
Doubt ability to quit	2.98	0.94	3.23	0.88	1.41 (0.88-2.26)
Doubt Worth Quitting	2.78	1.21	2.97	1.34	1.03 (0.74-1.42)
Determination To Stay Quit	3.78	0.99	3.76	1.00	0.89 (0.59-1.35)

[a]Calculated by simple logistic regression, adjusted for number of cigarettes smoked, NRT and clinic sessions

Table 4.36 Effect of time 1 (3 months) TTM measures on relapse outcome at time 2 (6 months), *n* = 120

TTM variables (3 months)	*Quit at end of 6 months (n = 41)*		*Relapsed (n = 79)*		*Effects of predictors on relapse outcome* [a]	*Effect Size*
	M^1	SD^1	M^2	SD	OR (95% CI)	$(M^1-M^2)/SD$
Aggregate temptations	2.65	0.75	2.93	0.86	1.44 (0.86-2.44)	
Positive/social temptations	2.85	1.06	3.12	1.16	1.21 (0.80-1.81)	
Habit/addictive temptations	2.28	0.71	2.69	0.84	1.48 (0.89-2.48)	
Negative/affective temptation	2.71	1.08	2.98	0.99	1.67 (1.04-2.68)*	0.25
Aggregate behavioural processes	3.39	0.84	3.06	0.61	0.48 (0.25-0.92)*	0.39
Counter conditioning	3.09	1.17	3.04	0.92	0.81 (0.52-1.27)	
Self liberation	4.22	0.94	3.59	0.89	0.52 (0.31-0.90)*	0.67
Reinforcement management	3.68	1.14	3.42	1.07	0.69 (0.48-1.00)	
Stimulus control	2.68	1.26	2.39	.50	0.85 (0.56-1.27)	
Helping relationship	3.16	1.53	3.00	1.00	0.75 (0.53-1.07)	
Aggregate experiential processes	3.64	0.79	3.49	0.85	0.65 (0.38-1.10)	
Consciousness raising	4.21	0.73	3.93	0.86	0.51 (0.27-0.94)*	0.38
Self re-evaluation	3.06	1.32	3.37	1.00	1.12 (0.75-1.66)	
Environmental re-evaluation	3.65	1.17	3.19	1.21	0.67 (0.47-0.96)*	0.39
Decisional Balance						
Pros of smoking	2.21	0.81	2.72	0.87	1.99 (1.20-3.28)**	0.63
Cons of smoking	3.91	1.04	3.75	0.88	0.81 (0.50-1.31)	
Others						
Self efficacy to resist temptations	3.53	1.43	3.70	0.67	1.00 (0.69-1.46)	
Self efficacy to abstain	4.58	0.77	4.11	0.97	0.60 (0.35-1.02)	
Worry about problems associated with quitting	3.06	1.26	3.19	1.15	0.99 (0.69-1.41)	
Resisting urges to smoke	3.90	0.94	3.48	0.98	0.45 (0.28-0.78)**	0.45
Doubting ability to quit	1.94	0.85	3.07	0.99	2.63 (1.63-4.25)**	0.75
Doubting worth of quitting	2.13	1.50	2.56	1.37	1.08 (0.80-1.44)	
Determination to maintain cessation	4.42	0.89	3.74	0.94	0.39 (0.22-0.69)**	0.76

***≤0.05; **≤0.01.**

[a]Derived from simple univariate logistic regression, adjusted for number of cigarettes smoked, NRT and clinic sessions

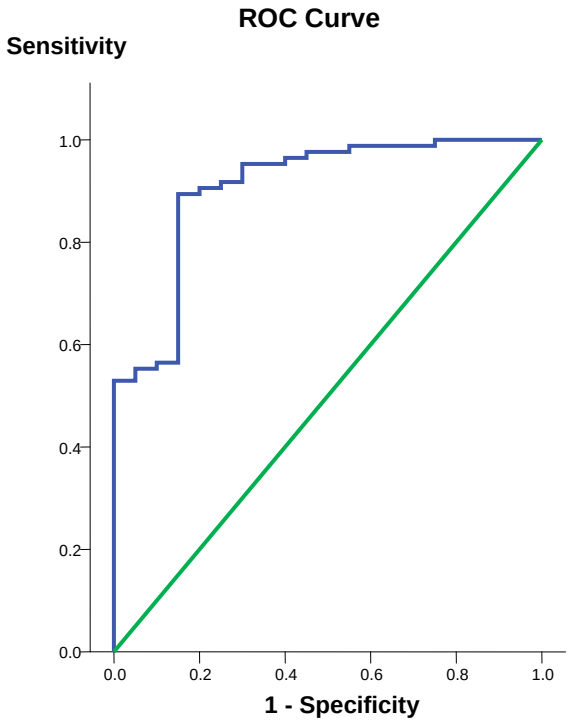
4.8.2 Multivariate analysis for predictors of relapse during action stage of TTM

In the multivariate analysis, 8 variables were included in the final analysis; of these, four were found to contribute significantly to relapse after controlling for the number of cigarettes smoked, NRT, clinic sessions and all other variables. Focus on the pros of smoking and doubting the ability to quit are both associated with relapse, while determination to abstain and self liberation prevent relapse (Table 4.37).

Table 4.37 Multivariate logistic regression for predictors of relapse from time 1 to time 2

Variables	*β*	*SE*	*Wald* x^2	*df*	*Odds Ratio (95% CI)* [a]	*p-value*
Pros of smoking	1.27	0.51	6.13	1	3.56 (1.30-9.75)	0.01
Cons of smoking	0.58	0.40	2.06	1	1.78 (0.81-3.90)	0.15
Positive/social temptations	0.16	0.40	0.16	1	1.17 (0.53-2.59)	0.69
Habit/addictive temptations	-0.77	0.49	2.41	1	0.46 (0.17-1.23)	0.12
Self liberation	1.29	0.59	4.93	1	0.70 (0.40-0.91)	0.03
Doubting ability to quit	1.59	0.42	14.83	1	4.94 (2.19-11.14)	< 0.01
Determination to maintain cessation	-2.20	0.67	10.80	1	0.11 (0.03-0.41)	< 0.01
Aggregate behavioural	-8.58	0.56	2.35	1	0.42 (0.14-1.27)	0.13

[a]Adjusted for number of cigarettes smoked, NRT and clinic sessions



The area under the ROC curve=0.91

Figure 4.12 ROC curve for TTM smoking relapse

4.9 Summary of findings

This research was conducted to determine the factors (behavioural and non-behavioural) associated with smoking cessation and relapse in a group of staff from two universities.

One hundred and eighty-five smokers enrolled in the programme. Eighty per cent of 120 smokers who quit for at least one day relapsed within the six month period of follow up. Variables protective against relapse were also identified. They included: attending more counselling sessions and good co-worker support. In contrast, higher levels of exposure to cigarette smoking by others in the work vicinity facilitate relapse.

The variables that may be associated with relapse were exhibited by survival curves. Overall, three phases were captured. The greatest number of all relapses occurred within the first two weeks of cessation, most during week one. From the third

week to the fourth week, total number of relapses declined substantially. From one month after the initial quit date onwards, very few relapse cases were observed. Significant factors for relapse were displayed as Cox regression survival curves after controlling for confounders.

The point abstinence at one week was 55.7% among the 180 smokers. The success rates for sustained cessation at three months and six months were 14.6% and 13.0%, respectively. Factors that were associated with successful smoking cessation were working at a university with a supportive environment and having less decision-making authority in the workplace at 1 week. Attending more than one clinic session and having good co-worker support was significantly correlated with greater success rates at 3 and 6 months. Other behavioural and non-behavioural variables were insignificant. The researcher utilised constructs of the TTM and the stages of change as a model for the behavioural aspect of the cessation process. The presession stage of change was not found to predict cessation at 3 months or 6 months. As for relapse, being in the contemplation stage presession was correlated with a higher probability of relapse compared with being in the preparation stage. In addition, changes in stage were highly significant when comparing relapsers with non-quitters.

The smokers had significant changes in their perceptions of the advantages of smoking following counselling sessions and treatment. The smokers' scores correlated with perceptions on the disadvantages of smoking increased to some extent after the sessions and treatment, but that result was insignificant. The results also showed that smokers who had reduced perceptions of the pros of smoking were more likely to quit.

The subsequent section on the behavioural component of smoking cessation involved taking the TTM as the theoretical framework for behavioural change. No significant predictors were observed with regards to TTM measures during either the first 3 months or the first 6 months of follow-up. However, as smokers progressed from

Time 1 to Time 2, the smokers who relapsed perceived significantly greater advantages related to smoking and increasingly doubt in ability to quit. In contrast, former smokers with greater self-liberation and determination to maintain cessation were less likely to relapse. The findings suggest that TTM can be used to predict relapse among quitting smokers. An additional stage boundary within the action stage may exist, within the first 6 months of quitting among smokers receiving behavioural and pharmacotherapy; this stage boundary should be further explored.

5.0 Discussion

5.1 Validation of study instruments

5.1.1 Reliability and validation of questionnaires

The following selected scales all showed acceptable and satisfactory internal consistencies and reliabilities: smoking decisional balance, temptations to quit, impacts of smoking, family support, the Rhode Island Stress and Coping Inventory, worksite environment, home environment and peer influences on smoking and the smoking history questionnaire. The analyses of the items supported the internal consistency of the study in all cases except one, and no items were deleted. Nevertheless, the Cronbach's alphas of the two temptation items were high (above 0.8), indicating that the corresponding construct was reliable (Santos, 1999). The entire habit/addictive temptation item could thus be excluded, as was done in another study among adolescents (Plummer et al., 2001). Overall, the results of the validation studies were consistent with the Australian validation of the same questionnaire for smoking relapse, with Cronbach's alpha values ranging between 0.65 and 0.88 (Segan et al., 2006). These results were also similar in Bulgarian adolescent smokers, with Cronbach's alpha values ranging between 0.63 to 0.89 (Anatchkova et al., 2006).

Furthermore, the test-retest reliability results were found to be acceptable across all items under study, as shown by the correlation of > 0.35. The item correlations of > 0.3 indicate the stability of the instrument over time (Garson, 2010).

The results of an exploratory factor analysis showed that the three sets of translated questionnaires—decisional balance, temptations to smoke and stress and coping—were clearly associated with the dimensions under study. Meanwhile, three items were found to be loaded into another factor; two of these items were from the temptations subgroup, whereas one was from the stress and coping subgroup. Although two items from temptations were found to be loaded into another factor, both were of

different factors, and the remaining factors in this subgroup had Cronbach's alpha values between 0.74 and 0.92. This finding may suggest that these items should have been reworded in the questionnaires. As for the stress and coping, although one factor was confounded by another factor, the highest load was in line with the original factor. Nevertheless, other studies have demonstrated that the factor analyses may differ across population groups and but such differences may be less moderate than those seen with the decisional balance items (Anatchkova et al., 2006; Plummer et al., 2001). However, due to the validity of the English version of the questionnaire, the numerous items for each factor and the limitations of this study, no items in the questionnaire were excluded from the current study.

The TTM instrument utilised in this study was a short, standardised form taken from the full version of the TTM that included three subscales for situational temptations, 8 out of 10 of the change processes, the pros and cons of smoking, and the stages of change (Fava et al., 1995). To accommodate for current smoking status, a modification was made to the questionnaire to inquire about the respondent's opinion "currently" instead of "during the past month", following the example of Segan et al. (2006). Moreover, it was felt that this change was appropriate for future studies designed to assess current attitudes during smoking cessation and relapse. Finally, two of the experiential change processes, dramatic relief and social liberation, were not measured, as these two measures were not found to predict smoking relapse (Prochaska et al., 1985).

A major limitation of this validation test was that the sample size was rather small for the following reasons: 1) due to the nature of the questionnaires used in this study, which involved behaviours involved in smoking and quitting, the investigator felt that it was impossible to test non-smokers and ex-smokers and 2) it was difficult to recruit smokers for this reliability study. Many smokers turned down the invitation to

participate due to the large number of questions to answer. 3) the construct stage of change was not measured in this study because to do so would have required a greater sample size, as each participant would have to have been assessed and subdivided according to their current stage of motivation. Nevertheless, in the present study, to overcome this limitation, only participants who were in the preparation stage were invited to ensure the homogeneity of the sample. It would be advantageous for future TTM validation studies to include smokers in other stages of change. Such a design might enable researchers to conduct a principal component analysis and exploratory model testing of the entire construct. Lastly, the sample was rather homogenous in terms of ethnicity as all of the smokers were Malay; testing was not conducted among other ethnic groups (e.g., Chinese and Indian Malaysians).

Assessing the reliability and validity of the translated version of the questionnaires was important for the development of tailored interventions based on individual needs. This measure may be utilised for smoking intention, smoking cessation and smoking relapse studies. The items should be able to convey both the breadth of the construct and its psychometric properties, and the translated version accomplishes both goals. The results of the internal consistencies were good, with values between 0.65-0.9, and test-retest reliabilities were all above 0.4.

In conclusion, the present study demonstrated that the Bahasa Malaysia version of the TTM questionnaires is a reliable and valid tool to assess smoking behaviours among Bahasa Malaysia-speaking adult smokers. Nevertheless, the current study only offers preliminary findings. More research is required to validate the TTM questionnaire in larger and more diverse population groups. In addition, the questionnaire would be a more meaningful tool if the differences in psychometric properties across the stages of change could be measured in future studies. Moreover, translation and validation of other TTM-related behavioural questionnaires is warranted in this region.

5.2 Participant recruitment, clinic response and NRT adherence

5.2.1 Participant recruitment

During the recruitment process, the investigator faced many challenges that led to a lower-than-expected sample size. The investigator tried all possible means to gather adequate subjects for the study. Among the outreach programmes, face-to-face contact during recruitment was found to be the most effective means of gathering participants. This was followed by individually addressed formal letters and letters to the Heads of Department of each work unit. Common email distribution was noted to be the least effective method of recruitment, barely reaching 50% of all staff at University A. This was most likely because only administrative and academic staff have frequent access to the internet at their workplace, support and technical staff rarely open their e-mail, and some workers are not even provided internet access. In the future, it would be of interest to examine all forms of recruitment attempts in detail and to identify the most effective one. Such a process may save time, effort and money, particularly in health promotion programmes with limited funding and support.

Despite the aggressive outreach efforts and publicity, the sample size of 138 was still insufficient. This resulted in the extension of the study to the second university. Extending the study to the second university should not have introduced any harm in terms of information bias, as the methods used were virtually identical. This was in the form of identical content of counselling sessions and a standardised supply of NRT.

The recruitment and participation rate was quite disappointing at University B compared to University A. Other studies were able to obtain better participation rates when the top management of the workplace required all smokers to be involved in such programmes, although such an approach increased the likelihood of including a greater percentage of less motivated smokers (Nishiura et al., 2009; Tanaka et al., 2006). This study concludes that having a written and highly enforced no-smoking policy may lead

to higher participation rates of smokers in cessation programmes. However, there was no significant difference between both universities in quitting success after similar cessation programme was implemented. In addition, no difference was noted between participants from the two universities in terms of awareness of the smoking restrictions.

Barriers to the recruitment of participants were identified from informal interviews with smokers among the staff during the recruitment process. Firstly, not all smokers were motivated to quit. Some smokers only attended the sessions at the request of the Head of Department or due to influence from their colleagues. Secondly, this was a new programme introduced into universities with no previous success rate in such endeavours. It was not able to convince the smokers or their supervisors/ Heads of Departments. Lastly, approximately 10% of smokers preferred unassisted cessation, and therefore declined the free smoking cessation service.

The reasons listed above indicate that the support of the Head of Department and university are essential to any smoking cessation programme. The support of colleagues (both smoking and non-smoking colleagues) is also likely to be an important factor influencing the participation of smokers in such clinics. This finding is further discussed in section 5.3.

5.2.2 Clinic response

A total of 60% of the subjects attended two or more clinic sessions follow-up, a rate that is slightly lower compared with other smoking cessation studies, which reported rates between 70-80% (El-Khorazaty et al., 2007). This 60% attendance rate could be partly due to the time required during working hours to attend the counselling sessions. Although the top management provided full support for this programme, eight participants claimed that their superiors would not allow them to leave their workplaces during working hours, especially if the university branch where they worked was

outside the main campus. Notably, some participants came from campuses that were approximately 10 km away from the site of the counselling sessions.

Hence, work schedules that conflict with the operating hours of a study can form a barrier to participation (Janson, Alioto, & Boushey, 2001). Researchers are therefore advised to alleviate these logistic problems by accommodating participants' work schedules or providing extended study hours (McQuiston & Uribe, 2001).

5.2.3 Questionnaire response

The questionnaire response rate at three months was quite low (65%). Smokers who could not be reached were technical and odd-job workers. Many of these smokers were unable to be contacted because the wrong phone number had been given or because they did not answer phone calls and emails. A few refused by claiming to have busy schedules. Others answered the phone calls but later did not complete the questionnaires.

Nevertheless, at six months, the response rate increased for unknown reasons that may have been related to a certificate of attendance given after the last questionnaire was completed. A recent study showed that some types of incentives, particularly financial incentives, significantly increase attendance in smoking cessation programmes (Kim et al., 2011). This trend should be investigated in future research to find ways to increase participation and achieve higher response rates.

5.2.4 NRT adherence

In general, it has been shown previously that most smokers discontinue NRT prematurely for reasons other than achieving abstinence, including resuming smoking, experiencing side effects and deeming the NRT to be ineffective. Only 10% quit due to successful smoking cessation (Burns & Levinson, 2008). Similar findings are reported here. The face-to-face counselling sessions revealed that an important reason smokers did not adhere to NRT was intolerable side effects. Most of the NRT-related side effects

were considered mild (Barrueco et al., 2005), but smokers may not tolerate even mild symptoms or may worry that such symptoms indicate adverse reactions. The product labels that emphasise such side effects may cause extra concern for NRT consumers. Moreover, a minority of participants claimed that the NRT was ineffective. Such participants were more likely to be heavy smokers, who were more addicted and would only benefit from frequent use of the gum. This frequent gum chewing is occasionally a nuisance to the smokers and may result in jaw pain.

The most common reason reported for NRT discontinuation was to continue smoking. The NRT label strictly warns against smoking while on NRT, and this guideline was emphasised during follow-up sessions. Nevertheless, the use of NRT during a short smoking relapse has been shown to be safe (Carpenter, Hughes, Solomon, & Callas, 2004) and has been reported to prevent progressing to full-blown relapse (Shiffman et al., 2006). Although this effect was not observed in this study, the warning package on NRT may require re-evaluation to ensure better compliance.

5.3 Baseline results

5.3.1 Sociodemographic characteristics and smoking history

The characteristics of the smokers in this study were quite different from those of participants in other studies of workplace cessation programmes (Chong, Ingram, McClelland, Lopez, & De Zapien, 2000; Cruse, Forster, Thurgood, & Sys, 2001; Eriksen, 2005). Other studies have concentrated on blue-collar and white-collar workers and workers of low socioeconomic status, whereas our study was opened to all staff of the universities involved. The sample was thus composed of academic teaching staff, technical workers, managerial workers, clerical workers and labourers. The only similarity of the present study to previous studies was in terms of the socioeconomic status of the participants, as 57.2 % had completed only high school. The higher number of less-educated smokers in our country (Zarihah et al., 2007) might explain the higher

percentage of individuals of lower socioeconomic status who attended the programme. Another explanation could be related to the busy schedule of the professional group, e.g., lecturers and top administrators, which may have hindered them from agreeing to be followed up as required.

The mean number of cigarettes smoked in this population group is similar to that reported in two local studies, with the highest being between 10-20 cigarettes per day (Ezat et al., 2008; Wee, Shahab, Bulgiba, & West, 2011). Other factors such as higher participation among those with previous quit attempts and among those with early smoking initiation were also comparable. Nevertheless, the ages of smokers in the present study were slightly different from the earlier studies of Ezat and Selahuddeen et al. (2008) and Wee and Shahab et al. (2011), as the investigator here managed to capture the younger age group of less than 40 years old. Thus, we may suggest that conducting a workplace smoking cessation programme has the advantage of influencing the younger groups of smokers in quitting. Possible reasons could relate to the ease of attendance when conducted within the workplace vicinity and the role of positive peer/co-worker influence in attempting to quit.

5.2.2 Stress, coping, family support, environmental influences and job stress

The baseline results which indicated a low level of overall stress and low coping ability should be discussed. The low level of stress is expected since the majority of smokers were married, and it was previously revealed that married individuals were found to be less stressed compared to the unmarried ones (Bindu, Sharma, Suman, & Marimuthu, 2011). This could be due to their involvement in stronger social relationships, which may be associated with more health-promoting behaviours and fewer risk-taking behaviours. Another hypothesis of baseline low stress level could be due to the hypothetical effect of cigarette smoking, which acts as a coping mechanism of stress. Hence, the results of low baseline coping skills may indicate why these smokers end up

taking cigarettes as a means of stress-relief, although it contrasted with the general notion of low stress level being associated with high coping ability (Keyes, Barnes, & Bates, 2011). With regards to baseline support, the majority had a lack of family support and spousal support to quit smoking, although most participants were married.

Exposure to ETS may occur at home, in social settings, or at work. The baseline results of this study population showed that exposure to cigarettes occurred most often at the workplace instead of at home. This finding supports the earlier work of Hammond, where 29% of workers were exposed to cigarettes at work as compared to only 12% exposure at home (Hammond, 1999). Furthermore, based on the current study, due to high numbers of smoking colleagues, it can be suspected that smokers are comfortable socializing with their own circle of smoking friends, instead of among the non-smokers; the reasons behind this should be explored in the future across different ethnic and cultural background. The baseline findings on ETS conclude that the most effective means of targetting these smokers to quit is by reducing social influences and by enforcing smoking restrictions and total workplace bans (Verdonk-Kleinjan et al., 2009).

The 24.9% prevalence of job strain in this two local universities is comparable to a local study among office workers (Maizura, Retneswari, Moe, Hoe, & Bulgiba, 2010), although this study was only among the smokers willing to quit. Nevertheless, the advantage the investigator had was the inclusion of a wide group of job categories. Considering the work involved in university settings, job types included academic teaching staff, technical workers, managerial workers, clerical workers and labourers. As a result, it did not differ much from studies in Europe, e.g. among white-collar workers' Whitehall study (22%) (Lallukka et al., 2008).

5.2.3 Stage of change, smoking perception, and transtheoretical model

Approximately 60% of the smokers who joined the programme were in the preparation stage (planning to quit within the next month). This finding is consistent with the investigator's initial assumption of receiving highly motivated smokers into the programme. Nevertheless, the investigator still received a considerable number of smokers (33.5%) in the contemplation stage, as was found in other studies (Erol & Erdogan, 2008; Pisinger et al., 2005). It is assumed that some individuals who attended the cessation sessions were persuaded by their peers or superiors to make a quit attempt. This peer influence may also imply that many smokers who may not anticipate a quit attempt soon may consider quitting if they acquire extra support and accessibility. Thus, these less-motivated smokers would probably not have been reached by the conventional smoking cessation clinics and campaigns.

In this study, most smokers scored above three in cons of smoking domain. This finding showed that smokers were aware of the disadvantages of continuing to smoke. Nonetheless, the scores did not differ much to those who had initial positive beliefs towards smoking (pros of smoking). The reported greater mean decrease in pros post sessions as compared to the increase in cons post sessions could relatively be due to the smokers' ability to gain new knowledge during the counseling sessions with regards to the positive effects of smoking. This may indicate that there is a small gap in the current health promotion education activities available locally, putting less emphasis on this area. Thus, this additional information had allowed them to think critically in weighing the disadvantages of smoking over its advantages, which might have contributed to the behavioural change. The changes in pros and cons might also mean that most smokers had progressed in their motivation stage during the treatment phase, as was revealed in previous studies (Etter & Perneger, 1999; Yalçınkaya-Alkar & Karanci, 2007). The studies reported that as smokers progressed from precontemplation

to contemplation and from contemplation to preparation, they reported having an increase in cons, but no significant reduction in pros. Although the investigator did not analyze this relative to the stage of change (due to reasons e.g., very small number of smokers in the extreme precontemplation stage, and inadequate sample in other stages), it is suspected that smokers who changed their perception had also changed their motivation. Futhermore, the general baseline overview of smoking perception might give us an early clue on the importance of perception as an agent of change. The results of this in relation to cessation shall be discussed in the outcome sections.

The results for all TTM variables are in line with that of perception, as pros and cons of smoking are included in the TTM variable. The lower means in all negative parameters (e.g., aggregate temptations, pros of smoking, worry about problems associated with quitting, doubt in ability to quit and worth of quitting) at 3 months had increased slightly at 6 months, revealing a significant trend. This can be seen as the opposite of the positive parameters whereby the spike was noted at the 3-month period and gradually reduces at 6-month. The overall changes in the TTM variables are expected as smokers that tried quitting moved across the motivation stages, although it was shown to be non-causal when followed up over a longer period of 1 and 2 years (Herzog, Abrams, Emmons, Linnan, & Shadel, 1999). In addition, the trend that occurred might be related to the lenght of abstinence, as was shown in a previous study (Segan et al., 2006). Nonetheless, what remains unclear is the sudden opposite increase or reduction in the mean TTM measures that follows at 6 months. The investigator suspects that this unusual phenomenon could be caused by a reversion to the previous smoking behaviour, which might occur among relapsers. The section on relapse shall be discussed in subsequent sections.

5.3 Outcome measures

5.3.1 Smoking relapse and timing to relapse

The percentage of 65.9% smokers from the 120 who achieved at least 24 hours of abstinence does not differ substantially from the percentages seen in other studies, which range from 65-90% (Cui et al., 2006; Van Zundert et al., 2009). However, the considerably high relapse rate could be attributed to our proactive recruitment approaches, which may have captured less-motivated smokers. In addition, three sessions may be inadequate to further motivate former smokers. As such, most smokers did not continue follow-up counselling after they quit, despite being encouraged to do so.

The smoking relapse process is dynamic (Witkiewitz & Marlatt, 2007), and no single model can fully encompass it (Shiffman et al., 1996). Understanding the process of relapse can be useful in analysing the critical period for health professionals to follow up their patients. Being able to precisely identify this time period may improve cessation rates. The relapse curve in this study, which was a reverse "J" shape, was similar to the curves found in other tobacco and substance abuse studies (Kirshenbaum et al., 2009), indicating that a reduction in the addictive nature of nicotine slowed the progression of relapse after a certain point following treatment. This is due particularly to reductions in withdrawal symptoms and declines in cravings (Allen, Bade, Hatsukami, & Center, 2008; Piasecki, 2006).

Other studies have shown that the majority of relapses occurred during the period beginning the first few weeks after quitting and ending several months later (Hughes, Keely, & Naud, 2004; Piasecki et al., 2002). The highest of relapse occurred within the first two weeks after quitting (Swan et al., 1993; Swan, Ward, & Jack, 1996). Studies among the elderly population with an age median of 55 years found that the period three to four months following treatment was the critical time for preventing

relapse (Cui et al., 2006). The present study supported these findings in an Asian population, showing that the relapse cases were highest within the first two weeks (14 days) of quitting. However, the findings of this study contrasted with those of Cui et al. (Cui et al., 2006) because in this study, the relapse cases reached 90% within two months instead of three to four months. Thus, it can be inferred that the relapse cases observed here were slightly different from those seen in Western countries. This finding may be due to sociodemographic differences, including differences in age, motivation, external environment and cultural beliefs. Further research on this topic is warranted in this geographic region.

Our results may indicate that the most important point of follow-up in terms of preventing smoking relapse is during the first two weeks, extending to two months postcessation. The survival curve shown indicates that at least three clinic follow-ups are needed for optimal cessation success. The first follow-up should be within a few days after the quit date; the second session can be between weeks 1 and 2, in which a high relapse cases percentage was noted; the third follow-up should be between weeks 2 and 3. Moreover, health professionals are encouraged to follow-up with smokers who have recently quit for up to two months postcessation. This approach may provide external support in enhancing the motivation of smokers to effectively sustain cessation.

Knowing that the relapse rate has been shown to be profoundly high during the first few weeks postcessation (Hughes et al., 2004; Piasecki et al., 2002), the investigator presumed a lack of physician support in the early cessation weeks could worsen the problem. Further investigation is needed to clarify this issue. Furthermore, to prevent from relapse during the earlier weeks of cessation, future studies may benefit from prolong use of NRT or supplying smokers with additional self-help materials (Agboola et al., 2010).

5.3.2 Quit rates

The cessation rate of 22% at six months was comparable to the rates found in other local studies in smoking cessation clinics of between 17.3% to 31.8% (Ezat et al., 2008; Wee, Shahab, et al., 2011). This rate is also comparable to success rates of other workplace cessation programmes of between 20-50% (Nerín et al., 2005) and is greater than the rate of cessation in the general cohort (< 10%) without any particular smoking cessation programme (Fukuoka et al., 2008; Ota et al., 2010).

This finding emphasises the advantages of such a workplace programme. Nevertheless, it was shown that the point abstinence rate differs from the sustained abstinence rate, and a lower sustained abstinence rate was noted. The difference observed between point abstinence and sustained abstinence was due to cases of relapse in smokers who had achieved at least 24 hours of abstinence. Moreover, the percentage of quitters was noted to diminish with the passage of time. This is consistent with the findings of other studies, which also showed a reduction pattern from three months to six months or more (Cruse et al., 2001; Nerin et al., 2004). Some smokers were also not able to withstand the addiction phase during the first few weeks of quitting (Piasecki, 2006).

The sudden increase in the cessation rate from 2 months to 6 months was an unexpected finding with no clear explanation. Nonetheless, it can be assumed that after the end of the counselling sessions (from two months onwards) and the termination of the NRT supplies, smokers began to quit on their own. This is not unexpected, as at that point, they were well equipped with essential knowledge on how to quit smoking with or without medication from the counselling sessions. In addition, this observation can be explained by their behavioural changes and self-determination and will be discussed in later sections.

5.4 Risk factors for smoking relapse and their influence on the survival curve

5.4.1 Number of clinic sessions

This study contributed to our limited knowledge of the factors contributing to smoking relapse. The first important finding was that smokers who attended the clinic sessions more than once had a lower risk of relapse within six months. The relationship between relapse and clinic attendance has been examined in very few other studies. One such study was performed in the United States and reported similar results (Cui et al., 2006). However, we can also relate the greater number of clinic sessions to the higher rate of success in maintaining smoking abstinence (Fiore, 2008a), which in turn reduced the number of relapses.

Other local and international studies have suggested the importance of more clinic sessions (Ezat et al., 2008) and face-to-face appointments in achieving a higher abstinence rate (Foulds et al., 2006). Furthermore, it could be suggested that the number of sessions attended could reflect a participant's motivation to quit, which is also a crucial factor in preventing relapse. This suggestion is consistent with the findings reported in the motivation section of our study.

5.4.2 Environmental tobacco smoke

Although smoking cessation programmes are a vital component of tobacco control, health promotion activities and smoke-free initiatives are also important (Bolliger, 2009; Joossens & Raw, 2006) and deserve greater merit when all three are combined. A recent systematic review revealed that smoke-free policies exert a large effect on smoking cessation, with an increase in cessation rates of 6.4% (Hopkins et al., 2010). In our study, it was noted that compared with University B, University A had a more supportive environment that included various health promotion activities in addition to the smoking ban that was already in place. However, this study yielded an interesting result, in which smokers in a more supportive environment (University A) had a greater

likelihood of relapse. The investigator suggests two possible reasons for this phenomenon. First, it is possible that the smoke-free initiatives in place at University A were of low intensity and were given less priority. To support this theory, the investigator found that although the majority of participants knew about the ban on smoking, it did not hinder them from smoking in the campus vicinity.

Secondly, the earlier relapse cases seen at University A could be explained by differences in socioeconomic status. A higher proportion (64%) of participants from University A were in the lower socioeconomic group compared with University B (41%), although this result was not significant ($p = 0.1$). Similar results were found in a recent study in Denmark, whereby smokers with low economic statuses were more prone to relapse (Pisinger, Aadahl, Toft, & Jørgensen, 2011). Vangeli et al. (2008) reported that smokers with higher socioeconomic statuses had a greater likelihood of being more worried about their health, and this concern may in turn protect against relapse (Vangeli & West, 2008).

Regarding the relationship between hours of exposure to environmental tobacco smoke (ETS) and relapse, the investigator found that an increase in the number of hours of exposure to workplace smoking was correlated with earlier relapse. The data gathered from this study on the influence of environmental exposure on relapse were consistent with other studies in this area (Carter & Tiffany, 1999; Niaura et al., 1988). Although these studies found positive associations between environment and relapse, they did not examine the influence of relapse on the duration of exposure. The investigator hypothesised that extended exposure to the smell of cigarettes may increase the urge to smoke and may act as an external stimulus to initiate smoking after a short period of abstinence. Although the investigator did not study the relationship between smoking urges and extended exposure to smoking accessories and the sight and smell of cigarettes, other studies have shown that these exposures may be related to an increase

in temptation (Shiffman et al., 1996) and cravings (Conklin et al., 2008). Interestingly, when the investigator examined the effect of peer influence on relapse, no significant association was found. This finding might suggest that the greater relapse cases among those with longer cigarette exposure at work is not necessarily due to the influence of close colleagues, as the exposure could also come from the influence of other smokers within the vicinity. Hence, this area warrants further investigation in future research.

5.4.3 Job stressors

Another important finding was that positive support from co-workers reduced the likelihood of smoking relapse, similar to the finding that positive support from co-workers predicts successful cessation. The reason for this may be related to the reason that co-worker support predicts cessation and thus may be protective against relapse. To support this, Cu et al. (2006) reported that negative influences from other smokers are a risk factor for relapse. The result indicates the importance of the influence of co-workers and colleagues in providing external moral support to maintain sustained cessation. Nevertheless, this finding should be interpreted with caution. We suspect that if a smoker's co-workers were smokers as well (a factor that was not investigated in this study), the results could differ, as having smoking co-workers was previously shown to predict relapse (Wewers & Ahijevych, 1991). The difference in terms of relapse prediction between support from smoking vs. non-smoking co-workers could be an area of future study.

Other findings on the influence of job stressors such as job strain and decision latitude on relapse were insignificant in the current study, unlike in previous studies (Wewers & Ahijevych, 1991). Engagement in an alternate activity may be beneficial to smokers who are trying to quit. However, job strain and job demands are very complex phenomena, and it is doubtful that these results can be compared across different jobs and socioeconomic backgrounds. Other obstacles in using job stressors to predict

relapse include the lack of a standard method of assessing job demands as well as the uncertainty regarding which types of job demands are protective against relapse (e.g., the optimal level of decision latitude).

5.4.4 Other factors

A study among veteran smokers reported that a younger age of smoking initiation and a history of schizophrenia were risk factors for smoking relapse; however, none of the smokers in the present study was schizophrenic (Cui et al., 2006). Only a few of the smokers had diabetes or hypertension, and these diseases were controlled in most cases by either diet or medication The small number of smokers with these conditions limits the ability to assess comorbid conditions and their relation to relapse. Moreover, the veteran study was based on the participant's ability to recall the relapse event, which is subject to recall bias, especially in older participants with comorbid conditions. In the present study, the recall bias was greatly reduced by the introduction of the smoking cessation diaries. Finally, results may differ significantly in a non-Caucasian population with different cultural norms. Nevertheless, it may be of interest to study smoking relapse among different comorbid conditions in Asian populations in the future.

The literature has shown that an increased level of general stress has been associated with smoking relapse. (1995) found that relapsers scored significantly higher on stress items (mean scores = 20.3) compared with smokers and quitters (mean scores = 18.3 and 17.7, respectively). This was not found in the present study, as it was shown that stress level (high or low) was not predictive of relapse.

Although this study proposed that clinic-based smoking cessation programmes are a good method of increasing cessation rates and preventing smoking relapse, they may not be a viable option worldwide. This is especially the case in low and middle-income countries, where funding is often a major concern. Such countries may benefit from a more comprehensive approach to tobacco control to cover a larger population.

This approach would entail complete bans on cigarette advertising, increases in taxation and the establishment of quitline services (Abdullah & Husten, 2004). Clean indoor air restrictions are moderately feasible in developing countries as they would increase both the number of smokers attempting to quit and the number of successful quitters and may prevent subsequent relapse, as seen in this study.

5.5 Factors contributing to sustained abstinence

5.5.1 Nicotine dependence

Predictors of successful cessation found in our study that were supported by previous studies include low nicotine dependence and the number of clinic sessions attended. Similar to the results from our study, lower nicotine dependence was found to predict abstinence among smokers involved in proactive quitline services (Myung et al., 2008). The number of cigarettes smoked was not found to be positively correlated with higher cessation rates in the present study, although it was significant in the quitline study (Myung et al., 2008). Nonetheless, assessing smokers based on their Fagerstrom test of nicotine dependence (FTND) score is a better method of assessing dependence because addiction to nicotine involves both physical and psychological dependence, which are summed up in the FTND parameters (Dijkstra & Tromp, 2002).

A local study in government cessation clinics drew contrasting conclusions, postulating that nicotine dependence by FTND score is not a good predictor of cessation and reporting that strong motivation is an important success factor (Wee, West, et al., 2011). Such differences may be related to the ethnicity of the study population (a majority of the participants in this study were Malay compared with the mixed ethnicity of the population of the study by Wee and associates (2011). In addition, most participants attending cessation services in government clinics are presumed to be more self-motivated than those who attend their own in-house workplace cessation programme because such programmes have extra support from employers and

colleagues. It is also possible that the difference in motivation, if adequately strong, might act as a mediator to a successful quit attempt regardless of the degree of nicotine dependence. The motivational component of this study will be explained in later sections.

5.5.2 Number of clinic sessions

Our study also found that more clinic sessions correlated with higher success rates. Findings indicate that clinic session attendance was a strong predictor of successful cessation, as it was noted to be strongly significant at one week, three months and six months. The finding that attending more than one session increased the chance of success was in agreement with one local study conducted in eight Malaysian government cessation clinics, which found that smokers who attended cessation clinics at least four times were more likely to quit (Ezat et al., 2008). Although our study included only a minimum of two intensive sessions with one follow-up session, the intensity of the programme likely added an advantage in producing a similar success rate. Furthermore, another study suggested that the amount of contact time and the number of sessions are not important factors in cessation rates provided that essential effective elements are incorporated to assist and motivate the smokers (Rabius et al., 2007).

5.5.3 Ethnicity

Non-Malay descent predicted a successful quit attempt at the six month time point. This outcome, however, must be interpreted with caution, as there were very few non-Malays in the sample. During the interviews, non-Malay smokers (who were predominantly Indian) were observed to be more determined in their quit attempt and received greater family support than their Malay counterparts. Wee et al. (2011) also found a significant difference with regard to ethnicity and smoking cessation among Malaysian smokers. However, in their findings, Chinese smokers had a significantly greater chance of being

successful, but there was no difference when comparing Indians and Malays. Further studies with larger sample sizes that are more representative of the Malaysian population are needed to clarify this issue. It would also be of interest to measure and document the cross-cultural aspects (e.g., motivational aspects, traditional methods, cultural perspectives, religious factors) of the cessation attempts among these ethnic groups, as this may provide insight into ways to improve the cessation rates in a multi-ethnic group.

5.5.4 Workplace environment and environmental tobacco smoke

Previous studies concluded that a supportive work environment with smoking bans and anti-smoking activities may enhance employee success in smoking cessation (Fichtenberg & Glantz, 2002; Tanaka et al., 2006). This study revealed similar findings in the first week after the initial cessation date. Working in a more supportive environment may have increased participant motivation, especially when their other smoking colleagues who smoked also sought assistance in quitting. No significant evidence was found to support this theory. However, during the clinical observations and counselling interviews, it was observed that smokers from University A came to the cessation counselling session in groups of three or four from the same department or unit. Some were less motivated than others in the group, although such differences were not explored. The participants claimed that quitting was much easier with the support of their colleagues. Some even started changing their lifestyles and habits within the same group by removing smoking cues from the office together, discouraging each other from visiting the usual “smoking pit” and starting to get involved in sports activities together during lunch breaks. At University B, however, smokers tended to receive less support from their smoking colleagues, as most were seen to come alone to the appointments and quit individually.

The results at three months and six months conflicted with each other, as it was shown that working at University B was predictive of a more successful quit attempt than working at University A. Such differences may be linked to the high relapse rates at University A, which was discussed in the relapse section.

Another factor that was found not to be significant was the environmental influence variable or environmental tobacco smoke (ETS), i.e., exposure to other people smoking. This result may indicate that the external environment plays a role in quitting in this study population but was not sufficient to produce a significant outcome, as other factors such as physician support and motivation to quit may dominate (Lancaster & Stead, 2005a).

5.5.5 Job stressors

With regard to the variables related to job characteristics, our study represents the first attempt to examine the relationship between job stressors and smoking cessation among Malaysian smokers and fills an important gap in the current scientific knowledge about smoking cessation in Asian countries. The 25% prevalence of job strain in the two local universities is comparable to a local study among office workers (Maizura et al., 2010), although the current study population only included smokers who were willing to quit. Nevertheless, the inclusion of a wide group of job categories was an advantage of our study. Job types in this university setting included academic teaching staff, technical workers, managerial workers, clerical workers and labourers and thus did not differ greatly from studies conducted in Europe, e.g., among white-collar workers as in the Whitehall study, of 22% of job strain prevalence (Lallukka et al., 2008).

To our knowledge, few studies have tried to examine the relationship between workplace social support and smoking cessation. Our study found a strong association between co-worker support and smoking cessation and is consistent with a few other studies that have studied general social support (Nollen, Catley, Davies, Hall, &

Ahluwalia, 2005). However, there have also been studies conducted in workplaces that found no significant association between social support and smoking cessation, both in Western (Albertsen et al., 2004) and non-Western regions (Fukuoka et al., 2008). These inconsistencies might be due to differences in measurements of social support or the definition of social support. Social support is a general term and is more related to a positive relationship with immediate co-workers or friends; it is not explicitly related to support for quitting smoking.

When attempting to quit, it is possible that receiving support from non-smoking colleagues or ex-smokers could be more beneficial than support from smokers. This theory is based on a study of the Quit and Win campaign in Canada in which quitters were found to have received social support from their non-smoking friends (Gomez-Zamudio et al., 2004). This finding may also suggest that good social support among co-workers entails both maintaining good interpersonal relationships and being supported by positive health influences. This hypothesis calls for further studies.

In this study, high job strain (characterised by high demand and low decision latitude) was not a predictive factor for smoking cessation. This finding is consistent with other studies that found no association between smoking cessation and high job strain (Fukuoka et al., 2008; Ota et al., 2010). Nonetheless, we found that men with passive jobs (characterised by low demand and low decision latitude) were more likely to quit compared with those with low-strain jobs (characterised by low demand and high decision latitude). We may speculate that a worker with a passive job would have more time to think about quitting and therefore may put extra effort into trying to quit. In addition, it has been shown that people working in passive jobs have, on average, a higher number of health complaints (e.g., high blood pressure and ill health) when compared with those in low-strain jobs (Karasek & Theorell, 1994). Hence, this may be a motivating factor in quitting among this group.

However, the findings of a recent prospective cohort study among Finnish public sector employees contrast with our observations. Their results supported the hypothesis that low-strain workers have a higher likelihood of quitting. The association was also much stronger for the light smokers compared with the moderate/heavy smokers (Kouvonen et al., 2009). The study however, included 77% female workers. Even after controlling for sex, such a difference might not be totally accounted for by statistical analysis.

One weakness of the studies being discussed is the different measures of job demand and job strain that were utilised. Therefore, the results might not be directly comparable, and it may therefore be difficult to arrive at a definite conclusion.

5.5.6 Other factors

Nicotine replacement therapy (NRT) in conjunction with behavioural therapy has been shown to be more effective than behavioural therapy alone in many studies (Mitrouska, Bouloukaki, & Siafakas, 2007), and NRT compliance was found to be a significant predictor of success in previous studies. The present study did not find NRT adherence to be an important predictive factor in quitting. There are a number of possible reasons for this. First, many smokers in our study were not able to comply with NRT as directed due to intolerable side effects. Secondly, some smokers quit both cigarettes and NRT after one week and refused to be dependent on NRT after a few days. Lastly, smokers who only attended the first session were supplied with just two weeks of NRT, which placed them in the non-compliance group. These factors hindered the assessment of the effectiveness of combined therapy (NRT and counselling vs. counselling alone) and NRT compliance as predictors of success. The most effective study design for such a measurement would be a randomised controlled trial.

The findings of the present study on pretreatment stress were consistent with a meta-analysis by Hittmans et al. (2003). They found that a lifetime history of depression

does not appear to be an independent risk factor for cessation failure. This finding has also been supported by recent evidence from the Veterans Administration of Normative Aging Study (Kinnunen et al., 2006), which contrasted with earlier studies (Anda et al., 1990; Breslau, Fenn, et al., 1993) in which smokers with more frequent negative moods and depressive symptoms were less likely to quit. Although our study did not examine depressive moods, smoking cessation itself produces mood disturbance due to withdrawal symptoms and affective symptoms (Niaura, Shadel, Britt, & Abrams, 2002), which are important stressors. Symptoms such as depressed mood, anxiety, nervousness, restlessness, irritability, fatigue and drowsiness are more pronounced during cessation and will normally return to baseline within a month of abstinence (Anda et al., 1990). This finding may explain why no such difference was observed in the present study in terms of stress at three months and six months, although the stressors may have subsided by then. Depressive moods thus no longer act as an aggravating factor in failing to quit. Factors related to depression and quitting were not measured in this study and should be investigated in the future.

Psychosocial variables such as family support and marital status did not predict cessation in this study, although Western studies have suggested that partner influence and social support interventions may be of some benefit in producing higher success rates (May & West, 2000). A possible reason that the current study did not find such a correlation could be that the majority of smokers from this study were married to non-smokers or were still living with their families. Another possibility involves the inadequacy of the specific assessments of pertinent psychosocial factors that are particularly relevant to Malaysian smokers. For example, measures of religious belief and cultural differences may play an important role in smoking cessation.

Other factors that were found to be positively correlated with successful cessation rates in other studies such as age group (Li L et al., 2010), previous quit

attempts (Etter, 2004) and education level (Lee & Kahende, 2007) were not found to be correlated to a successful attempt in this study. Reasons for this discrepancy could be related to the homogeneity of the sample in this study, as the majority of participants were from lower education levels and socioeconomic statuses. The discrepancy could also be partly related to differences in the culture and ethnicity of the smokers compared with smokers from Western societies, who have different perceptions and norms. Even among smokers with different motivation levels who share similar backgrounds, results may differ (Ezat et al., 2008; Wee, West, et al., 2011). Furthermore, some international studies have also reported non-significant results with regard to these factors (Abdullah et al., 2006; Macy et al., 2007).

5.6 Perception of smokers

5.6.1 Perception by different sociodemographic and smoking backgrounds

The results showed that smokers who were interested in quitting did not vary in their initial perception with regard to education level, occupational status, marital status, ethnicity or age group. Although the highly educated and professional groups perceived the danger of continuing to smoke to a greater degree than did the less-educated and support staff groups, the difference was not statistically significant. A recent local study in a larger sample found supportive evidence that knowledge of smoking-related effects increases across educational level (Lim et al., 2009). This was similar to findings in other international studies (Malmstadt et al., 2001; Scarinci, Robinson, Alfano, Zbikowski, & Klesges, 2002).

Smoking has been shown to be linked to cigarette use in other cross-sectional and longitudinal studies (Collins LM et al., 1987; Lo, Blaze-Temple, Binns, & Ovenden, 1993). Those studies suggested that the knowledge of the health effects of smoking did not influence the age of smoking initiation. Although the nature of this study could not correlate the knowledge smokers had regarding the health effects of

smoking with their age of smoking initiation, this study found that there was no significant difference in the current number of cigarettes smoked and the number of previous cessation attempts among smokers with different DB (decisional balance) and perception.

5.6.2 Changes in perception after the smoking cessation programme

Decisional balance involves weighing the importance of a set of positive and negative aspects before engaging in a particular behaviour (Prochaska, 1994). Cross-sectional studies have shown that scores in the cons of smoking domain increase linearly from the precontemplation stage to the action stage, whereas scores in the pros of smoking domain dropped significantly from the precontemplation stage to the contemplation stage, but increase again once smokers reach the action stage (Yalçınkaya-Alkar & Karanci, 2007). However, when the data were examined across time, the results differed. In a longitudinal study among self-initiated smokers, the results showed that the scores in the cons domain differed significantly between the precontemplation and contemplation stages and from the contemplation stage to the preparation stage, but the scores in the pros domain did not follow these trends. There was no significant difference observed in the scores for the pros of smoking domain between the 3 stages (Etter & Perneger, 1999).

The majority of smokers in the present study were in the contemplation and preparation stages at the beginning of the study, and 27% entered the action stage by end of two months. The results showed that smokers had actually changed their perceptions on both the pros and cons of smoking post-counselling. Perceptions on the pros of smoking were reduced while perceptions on the cons of smoking increased significantly. The difference observed can likely be attributed to an increase in motivation after the educational and counselling sessions, but this was not measured in

this study. In other words, this finding highlighted the idea that self-initiated smokers differ from smokers who are given extra external motivation.

5.6.3 Changes in perception and their relationship to cessation outcomes

Recently, changes in decisional balance (DB) have increasingly been discussed in addictive behaviour interventions. Among at-risk college students who are heavy drinkers, results showed that a brief explanation of the advantages and disadvantages of decreasing drinking significantly changed their drinking habits post-counselling (Collins SE & Carey, 2005; LaBrie, Pedersen, Earleywine, & Olsen, 2006).

This observation has not been substantially explored in smoking cessation. A recent smoking cessation study found that greater changes in DB were associated with abstinence for up to 12 months (Collins SE, Eck, Torchalla, Schroter, & Batra, 2010). Another study among chronic obstructive pulmonary disease (COPD) patients also supported the finding of the present study that a change in perception following counselling can change an individual's behaviour, which may lead to success in a quit attempt. The COPD study concluded that confrontational counselling was an important factor and mediator in alleviating risk perceptions and self-efficacy (Kotz, Huibers, West, Wesseling, & van Schayck, 2009). In addition to teaching smokers the benefits and risks of quitting, the comprehensive counselling of our study was also meant to target the factors of risk perception, self-efficacy and risk denial. As such, our results have shown that such counselling increased the perception of the risks and benefits of smoking cessation. This change in perception is related to improved cessation outcomes.

Understanding the relationship between smoking status and the perceptions of smokers before and after the programme has implications for the further development of smoking cessation programmes. Health education and promotion studies suggest that fear arousal alone may not be sufficient to change people's behaviour. The combination

of several approaches is more likely to result in a positive outcome and assist smokers in removing their barriers to cessation and changing their perceptions of quitting (Witte & Allen, 2000; Wong & Cappella, 2009). Smoking cessation programmes should address not only the adverse effects of tobacco use but also the positive attitudes that individuals have about smoking.

5.7 Motivation of smokers

5.7.1 Motivation by different sociodemographic and smoking backgrounds

Previous studies have examined motivations for quitting, and the data suggested that the prime reason for quitting is health-related concerns. Nonetheless, Vengeli and West (2008) recently discovered that there seems to be a vast difference in quitting motivations among different socioeconomic backgrounds. Smokers with higher socioeconomic status were found to be concerned about future health problems, whereas lower socioeconomic statuses were more likely to worry about cost and immediate health concerns. Furthermore, in Denmark it was found that quitting smoking is being favoured by those in lower socioeconomic categories due to financial reasons (i.e., cigarettes being expensive) (Pisinger et al., 2011). This contrasts with our results, as we found no significant difference among sociodemographic characteristics, including socioeconomic status. The investigator noted that the reasons of quitting (financial, health) highlighted by the smokers during personal sessions were similar in the professional and support groups of workers.

Our positive finding in relation to higher motivation among those with previous quit-attempt was expected, as it is consistent with previous findings (Etter, 2004). Most smokers with a history of an earlier quit attempt in our study were in the preparation stage of quitting at baseline. Thus, we may assume that previous attempters anticipated the obstacles that they would face during the quitting process, and some even had real-

life experience post quitting. This notion puts them at a greater motivation level compared to smokers trying to quit for the first time.

5.7.2 Changes in motivation stage and their relationship to outcomes

At six months, 39% of smokers had reverted back to the contemplation stage, after initially being in the preparation stage. Isolated cases changed from either the contemplation (6%) or preparation (5%) stage to the precontemplation stage, which could be due to the smokers' feeling of despair and hopelessness after failing to quit. The unpleasant experience of battling the addictive nature of nicotine may have impaired their motivation to quit in the future.

Furthermore, although there were significant differences in motivation change among those who had previously quit but relapsed and those who had never quit, the increase/reduction in motivation between the two groups showed no significant difference. We can conclude from this that the relapsers do not differ much with regards to motivation in quitting to those who had never quit. Another important lesson that we may take from here is that smokers in any stage do make changes in behavioural after going through counselling sessions, although the changes may be negative due to other influence such as addiction. Hence, we suggest that the counselling sessions need to be reinforced many times during the process of quitting, as a smoker's intention to quit may change over a short period of time, often as short as one week to one month (Hughes, Keely, Fagerstrom, & Callas, 2005). In addition, healthcare providers may still target the relapsers in the future, but possibly with a different approach. Such an approach could operate by enhancing the motivation of smokers during the critical period of follow-up in which smokers are prone to relapse and by emphasising the psychological aspects of behavioural change as they relate to relapse.

5.7.3 Predictors of stage of change for quitters and relapsers

The motivation stage pretreatment did not predict sustained abstinence at six months. This finding is consistent with the Inter99 study, a large interventional study in Denmark, where 84% of smokers achieved abstinence after a smoking cessation intervention had no serious quit plans earlier on (Pisinger et al., 2005). When examined against point abstinence, smokers in a higher motivation group had higher cessation rates. However, some of the smokers with point abstinence had only achieved short-term abstinence and were still prone to relapse. Given this fact, point abstinence is not a good measure of abstinence compared with sustained abstinence. Therefore, the investigator suggests that motivation merely predicts abstinence, which may reflect the possibility that participation in a smoking cessation programme can nullify preprogramme motivation.

A systematic review revealed that the "stage of change" model is strongly valid when applied to motivation to quit using tobacco (Spencer, Pagell, Hallion, & Adams, 2002). However, recent evidence has shown that stage of change-based interventions may not be promising, as smokers in the precontemplation and contemplation stages showed no difference in quitting success compared with those in the preparation stage (Aveyard, Massey, Parsons, Manaseki, & Griffin, 2009). This finding is consistent with our own. Two possible reasons may explain why the "stage of change" model did not predict a successful quit attempt in our study. Firstly, the inaccuracy of the prediction could be due to our proactive recruitment strategy. The less motivated smokers made quick stage transitions when given appropriate counselling and pharmacological assistance. Secondly, the "stage of change" concept was initially designed for self-quitters and may not be entirely applicable for smokers enrolled in an intensive assisted smoking cessation programme. Nevertheless, among relapsers, the initial motivation stage did appear to play a role in determining later relapse. Smokers with lower

presession motivation (those in the contemplation stage) were three times more likely to relapse compared with those in a higher motivational stage (e.g., the preparation stage). The rapid stage transition from the contemplation stage to the action stage may imply that smokers who were less prepared to attempt cessation may be more susceptible to relapse. As such, these smokers might not be able to withstand the challenges experienced during the quitting process.

5.8 Predictors of relapse during action stage of TTM

In this study, the investigator hypothesised that smoking-related cognitions obtained from the Transtheoretical Model are able to predict smoking relapse after a serious quitting attempt among adult Malaysian smokers.

5.8.1 Transitions between different time zones

Predictors of relapse were identified between baselines, three and six months of abstinence. TTM was not found to predict relapse among treatment-facilitated smokers during the first three months or from the initial measure to the six-month outcome. There were no clear reasons for the differences observed. However, the initial three months involved support from counselling sessions, which may have enhanced the motivation of the former smokers. Likewise, the smokers' perceptions and behaviours were assumed to change throughout the process of quitting, especially after receiving appropriate counselling (Yasin, Retneswari, Moy, et al., 2011c). The behaviour therapy received, therefore, explains why initial TTM measures cannot predict the outcome at six months.

Furthermore, the use of NRT prevents cravings and smoking urges (Fiore, 2008a). Both effects might have masked the smokers' personal characteristics. Alternatively, between three and six months, smokers may have behaved in a natural way. The determination and motivation during that period were self-mediated, without external support from any medical personnel. It is important to mention, however, that

the structure of change described by Prochaska (1992) encompasses both treatment-facilitated and self-initiated change; we could argue that the effects of TTM on relapse differ between the two.

5.8.2 Processes of change

This study contrasts Segan's study (2006) with regards to aggregate behavioural processes of no significance, except for that of self liberation. The differences between the results our study and that of Segan's could be explained by the fact that self liberation (e.g., convincing yourself that you can quit if you wish to) acts as a coping strategy, and thus, self liberation is more evident early on when cravings are still frequent (Segan et al., 2006).

We found two experiential processes associated with relapse. Environmental re-evaluation and consciousness raising were found to be protective against relapse but not against self re-evaluation. This finding is similar to the results of a recent study, where smokers who relapsed demonstrated frequent experiential processes, including self re-evaluation (Sun X, Prochaska, Velicer, & Laforge, 2007). There is also some similarity with the findings of Prochaska and associates (1985), suggesting that self re-evaluation may lead to subsequent relapse. The present study's results may suggest that individuals who relapse have less awareness of the impact of smoking on the surrounding environment. In addition, we could also presume that these individuals may not have sufficient preparation, in terms of knowledge and motivation, prior to their quitting attempt. However, once a quitter relapsed, there was no difference in guilt compared to those who maintained abstinence. This finding could suggest that those relapsing were less serious in their attempts to quit. Nonetheless, no significant behavioural processes were observed in the multivariate analysis, similar to the findings by Segan and associates (Segan et al., 2006).

5.8.3 Decisional balance

With regards to decisional balance, only the perceived pros of smoking was found to be of significant importance when predicting relapse. The investigator presumed that the construct perhaps did not account for the gains associated with quitting. The author observed an important point in her follow-up sessions and clinical work; once a former smoker had successfully passed the phase of cravings and urges, he began to recognise the satisfaction of freedom from cigarettes. In addition, the investigator noted that the ex-smokers were more worried about the problems associated with quitting, rather than those related to continued smoking, although not significant in any observation points. In contrast, smokers who quit for a short while but relapsed, regardless of the motivation provided, were unable to withstand the cravings and also eliminated the perceived advantages associated with abstinence from smoking.

Negative motivation (doubting ability to quit) was also found to predict relapse. Conversely, positive motivation (determination to maintain cessation) was a protective factor against relapse. Both measures were only significant during the three- to six-month time frame. These differences could indicate that as smokers progressed from three to six months their motivation and desire to quit increased.

5.8.4 Self-efficacy

Segan's (2006) study of quitline users found a significant difference in self-efficacy. Our findings, however, were not significant. This difference could possibly be related to the nature of this study, where the smokers did not depend entirely upon self-efficacy; they received assistance (NRT and counselling) in quitting. In this study, the investigator suspects that 24 hours to relapse may not be a sufficient period of time to measure changes in self-efficacy. It is best if a continuous measurement of self-efficacy at each point during subsequent relapses is maintained. Furthermore, although self-efficacy will strengthen with time, in the earlier phase of quitting, self-efficacy could be

masked by other factors, such as the role of NRT, cravings, urges and external temptations (Piasecki, 2006). However, further study is needed to test the role of self-efficacy in relapse during different time phases.

5.8.5 Temptations

The findings on aggregate temptations suggesting an association with relapse had earlier been popularised by Marlatt and Gordon (1985) in the area of alcohol relapse (Larimer & Palmer, 2004). It was postulated that high-risk situations and temptations contribute to relapse in addictive behaviours. It is also consistent with the later findings of Piasecki's view on relapse proneness, suggesting that stressors from temptations act as one of the three pertinent features of the relapse process; the other two are cravings and fatigue (Piasecki et al., 2002). Nevertheless, in the multivariate predictor analysis, none contributed to relapse in the three different time periods. This result may be due to the aggressive counselling sessions that taught participants methods to address all three aspects of temptation, to the extent that they no longer are important factors in quitting and relapse.

The data produced from our study led us to question the effectiveness of current practices in relapse prevention. Various interventions being utilised in the area, including nicotine fading (Prochaska, Velicer, Fava, Rossi, & Tsoh, 2001), nicotine replacement therapy (Velicer, Prochaska, & Redding, 2006), proactive telephone calls (Prochaska, Velicer, Fava, Ruggiero, et al., 2001) and increased numbers of clinic sessions (Velicer, Prochaska, Fava, Laforge, & Rossi, 1999), have failed to increase the cessation rate from the 25% to 30% breakthrough rate (Sun X et al., 2007). Whether the major strategies applied in relapse prevention have accounted for the behavioural changes of smokers and quitters throughout the action stage remains unanswered.

5.9 Study limitations and strengths

5.9.1 Study limitations

This study has several limitations with regards to internal and external validity.

5.9.1.1 Internal validity

The second part of the analysis was conducted with only a subset of participants who responded to both Decisional balance questionnaires (DBQs), which may limit the generalisations of our study. The probability of participants not returning the questionnaire could be influenced by smokers with lower educational attainment or errant smokers who gained the least from the sessions.

This study may show that improving the normal unstructured smoking counselling to focus on the pros and cons of smoking (or quitting) is associated with changes in cessation outcome. However, the best study design would be a randomised controlled trial (RCT). One arm may be given counselling on cessation while another group is given no counselling. An RCT was not conducted due to poor response from the second university and the lack of manpower. Nevertheless, the use of a prospective cohort in this study has its own advantages, which have been explained earlier.

The duration of this study is limited to only six months. In future research, it may be of interest to examine this relationship over an extended period of time. One to two years would be more beneficial for relapse assessment of the smokers after they reach the maintenance stage. Nonetheless, the duration of the study period for thesis completion is a limitation beyond control.

There were some limitations in the section on TTM predictors of during action stage. First, three monthly assessments of changes in TTM measures may be inadequate to assess the changes in behaviour throughout the relapse process. Additionally, although previous studies have shown the existence of boundaries at one week and one month (Borland & Balmford, 2005; Segan et al., 2006), in the present study, the author

was unable to locate the exact cut-off point that occurs within six months. The cut-off point cannot be identified because the results were analysed at three different points in time. The author has only concluded that there exist some changes in the data collected by TTM measures administered after the smokers underwent appropriate counselling. In the future, studies should consider using electronic diaries, recording the current emotion during each relapse episode (Shiffman et al., 2006). This may help to measure the exact time of behaviour change, prior to relapse and afterwards. Furthermore, for researchers to determine the points that define the stage boundaries, it is may be necessary to follow-up with smokers more frequently. Lastly, smokers participating in this study were most likely less motivated than smokers who quit without assistance; thus, our results could not be generalised to self-initiated quitters.

The sample size used might be rather small to detect certain significant associations. As such, the associations found may have been missed due to small sample size. For example, our study did not identify any association with the effect of age initiation with relapse, as was found in a previous study (Cui et al., 2006), nor did it support the relationship between relapse and prior quit attempts (Zhou et al., 2009). However, the sample sizes were adequate to estimate smoking cessation and relapse, as was calculated earlier.

The exact time of quitting and relapse was not validated biochemically, especially during the three-month and six-month follow-up periods, as the results of the continued smokers were self-reported either through mail or telephone calls. This may lead to some information bias. Nevertheless, recent studies have assessed self-reported smoking behaviour, which was found to be reliable and useful (Ezat et al., 2008; McLeish, Zvolensky, & Bucossi, 2007), and the difference in reported abstinence between self-reported results and biochemical validation was found to be negligible (Patrick et al., 1994; Pisinger et al., 2005). Alternatively, research with more financial

support may opt for electronic diaries to record exact behaviors during each lapse episode by real-time monitoring (Shiffman et al., 2006). This may provide a more accurate and valid assessment, in addition to reducing information bias.

5.9.1.2 External validity

There were some limitations in the study recruitment. This study only utilised smokers who were willing to quit using non-probabilistic sampling. As noted earlier, due to the number of samples required and the nature of the study, probabilistic sampling was not feasible. Thus, use of this non-probabilistic sampling method is subject to bias. The results were therefore limited to smokers who intended to quit, and they may not capture smokers with very poor motivation. However, to ensure higher external validity, deliberate effort to obtain representative samples was made by inviting staff from all departments into the study, regardless of educational background, work position and age. In addition, smoking colleagues recommended their other smoking colleagues to participate via snowball sampling.

Furthermore, this study may not capture smokers who achieved abstinence without help or medication and then relapsed. Some additional obstacles and challenges detected during our face-to-face counselling were lack of awareness of the top management in allowing smokers to attend the clinic sessions, poor perception and knowledge of quitting/relapse among the smokers, the addictive nature of tobacco and indirect influence from smoking colleagues. These factors should be considered by health/non-health providers when attempting to implement such a programme. Nonetheless, some of these constraints may not be clear and warrant further research (e.g., cost, acceptability, feasibility).

This study predominantly utilised male workers as subjects. Although all smokers were invited, no female smokers showed up for treatment. We suspect this might be due to the small number of female smokers in the country (Zarihah et al.,

2007). Furthermore, it may also be related to cultural taboos among female smokers in the country that deter them from seeking assistance in quitting. Similarly, the study sample had a relatively homogenous group of smokers (primarily of Malaysian ethnicity). Chinese smokers were not recruited into the study, although similar efforts were made. This is probably due to the lower number of smoking Chinese workers in a university setting and the low prevalence of Chinese who are smokers. However, the investigator managed to recruit a few Indian smokers. Consequently, this may limit the representation of the general Malaysian working population. In addition, although the universities consisted of various educational backgrounds and job categories, results may not be generalised to unemployed smokers and adolescents.

The next limitation involved the study sites. The investigator was not able to extend the study to the third public University in Kiang Valley due to time limitations and the problem of accessibility. However, it was assumed that workers from the last public university would have similar background characteristics due to similar wages, the nature of the work and the university location. Nonetheless, generalisation to other workplaces should be treated with caution; much depends on the nature of the work involved in a particular workplace setting, which may show slight variations. Some psychosocial considerations, such as the health-conscious nature, the difference in perception and educational status and information accessibility, should also be taken into consideration.

Another limitation was the inability to generalise the sample findings to clinic-based and hospital-based settings. At these places, there is a mixed variety of smokers. Some were referred from specialist clinics while others were self-referrals. In our case, the vast majority of smokers were healthy, motivated smokers who volunteered at their own will. In addition, the sample may not capture smokers who achieved abstinence and relapsed without help or medication.

5.9.2 Study strengths

Our study possessed several strengths. First, this study is the first published study in Malaysia to investigate the predictors of success for smokers in a smoking cessation programme conducted in a non-clinic-based setting. Most previous local studies were conducted in community settings or within the available smoking cessation services in the government clinics. Our study also had the advantage of addressing various categories of staff in university settings with an intensive smoking cessation effort. The efforts and clinics were conducted by the investigator herself according to international recommendation guidelines of effective smoking cessation services. Next, this study was one of the few studies to date that examined the effect of psychosocial work with a real workplace cessation programme. Most of the other studies that had smoking cessation programmes in place were intervention studies, as shown in a systematic review by Albertsen et al (2006), with controlled conditions and results that may differ from a real-life situation.

Furthermore, this is one of the few studies within the Asian countries, whether in the clinic or at a workplace setting, to investigate the risk factors for smoking relapse. Although relapse is one of the major problems faced by any smokers attempting to quit, it has received very little attention. This is because most studies have been directed to find the most effective methods for smoking cessation without noting the importance of studying relapse. With regards to the TTM model, very few published studies have looked into smoking relapse, especially those in non-Western regions.

The other strength of our study is the study designs employed. It consists of both a prospective cohort study design and a prognostic research design. These are much more reliable compared to studies involving retrospective recall of former smokers (Choi, Okuyemi, Kaur, & Ahluwalia, 2004; Vangeli, Stapleton, & West, 2010). Such retrospective recall is unreliable and subject to bias (Gilpin & Pierce, 1994). From the

prospective study designs, the sequences of the physical and behavioural changes that occur during the process of smoking cessation and its relapse were captured. The changes in health behaviour are important for health care providers and counsellors to understand the inner conflicts that smokers and former smokers face with time. These may allow them to monitor the progress of the smokers more effectively, and appropriate counselling methods could be employed based on the behavioural changes. Despite the fact that prospective studies are not superior to randomised controlled trials on the level of evidence, this nonetheless allowed the investigator to examine various aspects of smoking cessation and the relapse process. This might be difficult to obtain in randomised controlled studies.

Administration of the questionnaire was also given in a controlled environment in the clinic. Smokers who did not understand were allowed to ask for further clarification. Moreover, no smokers had previously joined a cessation programme or obtained advice from a cessation clinic. This reduces the pre-existing knowledge of smoking cessation. Nevertheless, some background knowledge may exist. This is because many smokers might have obtained knowledge through the internet, newspapers and previous clinic visits/ hospital admissions. This, however, cannot be controlled.

The sessions were similar in both universities and were conducted by the same researcher (the main investigator herself). The small-group presentation sessions were also two-way communication sessions where smokers exchanged ideas and worries about quitting. These were conducted in such a manner as to allow the least educated to comprehend the messages being conveyed. Thus, having the same researcher and similar materials available for both universities reduced providers' bias, which is an added advantage in this study. In addition, the programme was conducted in multiple sessions, which allowed close monitoring of the smokers, especially in the first two

months. This is crucial in ascertaining more accurate dates of relapse among quitters. These multiple sessions were also a very good reinforcement for the smokers and former smokers to maintain smoking abstinence.

The duration of six months of follow-up and the use of medication covered the optimal abstinence period of six months, as in other established studies in the area of smoking cessation (Boutou et al., 2008; Nerin et al., 2004). Due to the small number of participants, the smokers were closely followed up by the investigator. Calls or text messages were sent to the smokers individually to remind them of their appointments.

Lastly, the objective measurement of CO ppm was used to verify their quit status at the earlier months of cessation and at six months; quit status was not explicitly based on self-reporting. Although reported results from diaries and during interviews are considered adequate in determining smoking status during follow-up (Pisinger, Vestbo, Borch-Johnsen, & Jørgensen, 2005b), objectively confirmed results can reduce information bias. Further information bias was also controlled as much as possible; for recall bias, participants were given a diary, and a standardised study protocol was maintained during the active phase and follow-ups.

6.0 Conclusions, Recommendations and Suggestions for Future Work

6.1 Section-based conclusions

Overall, this study clearly demonstrates that conducting a small-scale intensive programme for smokers may return a potentially good outcome on cessation rate and may reach individuals with busy working hours.

6.1.1 Time frame and risk factors for smoking relapse

Based on the results, to capture the critical period of relapse, three post-cessation clinic follow-up visits are sufficient; the first should occur at one week post-cessation, and the others should follow every two weeks afterwards. In addition, this study also reported that frequently attending clinic sessions, both pre- and post-cessation, proved to potentially reduce relapse among former smokers. To prevent further relapse, it was also shown that employers need to enforce strict smoke-free workplace initiatives, as this may reduce exposure to cigarette smoking from work colleagues.

6.1.2 Predictors of smoking cessation

The results concluded that individuals who complied with treatment and attended more cessation sessions had a higher probability of achieving success with combined medical and behavioural therapy. This study did not find that job strain is an important consideration when implementing a workplace smoking cessation programme. Nevertheless, it highlights the importance of a good workplace social support in facilitating quitting.

6.1.3 Motivation

This study found that it is possible to recruit participants in any motivation stage using active recruitment processes and support from top workplace management. It was also noted that the motivation of a smoker can be changed within a short period of time. Smokers with lower motivation may achieve sustained abstinence, as cessation was shown to be achievable among smokers without initial quitting plans. Nonetheless,

smokers with moderate to low motivation should be monitored with extra caution, as they have an increased risk for developing relapse.

6.1.4 Perception

The initial perceptions of smokers on smoking changed from pre- to post-counselling. Their perceptions of the cons of smoking increased, and their perceptions of the pros of smoking decreased after intensive small-group and individual counselling sessions. These changes in perception were discovered to be associated with a higher likelihood of smoking cessation after two months of treatment among this study population.

6.1.5 Action stage of the TTM

The findings suggest that TTM can be used to predict relapse among quitting smokers receiving behavioural and pharmacotherapy. An additional stage boundary within the action stage may exist, within the first six months of quitting among smokers; this stage boundary should be further explored. The smokers who relapsed perceived significantly greater advantages related to smoking and increasingly doubt in ability to quit. In contrast, former smokers with greater self-liberation and determination to maintain cessation were less likely to relapse.

6.2 Results-based recommendations

The results of this study have implications for the improvement of smoking cessation programmes. It is suggested that healthcare providers and programme implementers design an appropriate programme by emphasising the importance of extra follow-up during the first two weeks post-cessation, as the probability of slipping into relapse is profoundly high. Furthermore, smokers should be made aware that relapse is the largest outcome in the quitting process; this should be emphasised to smokers during smoking cessation counselling. They should be taught ways to prevent such an event from occurring and how to counter the problem if it occurs.

Our findings show that the number of counselling sessions should be taken into account throughout the smoking cessation process and that patients should be informed of these facts to enforce abstinence. With regards to job stressors, although more research is necessary to establish the association between job stress, work environment, social support and smoking cessation, the results of this study will be useful for employers and health providers in establishing supportive measures that may encourage workplace smoking cessation. In addition, the study demonstrated the need to involve top management in supporting such a programme to produce higher participation rates, which should be emphasised in any workplace cessation programme.

Motivation has been cited in many studies as an important drive for smokers involved in a quit attempt. Based on the importance of motivation, it is suggested that all smokers, irrespective of motivation, should be offered assistance in quitting.

Change in perception is associated with improved quit rates highlights the importance of appropriate smoking cessation counselling. The counselling has the capacity to change the perception of the smoker, which may then facilitate maintaining smoking abstinence. In this regard, it is highly recommended that health professionals provide appropriate counselling sessions, with the aim of changing the perceptions of smokers towards quitting. They are also advised to provide adequate information to smokers on the advantages and disadvantages of smoking and quitting while trying to explore their concerns on the matter. This might be best performed in a one-on-one counselling basis or in group counselling with smokers of similar addiction levels and educational backgrounds.

Lastly, there is an unclear stage boundary that exists within the Action Stage of TTM, and further research is required to explore other predictors that may affect relapse at different time points. The knowledge of the relationship between TTM and relapse during the action stage will be helpful for health professional to develop strategies and

tailoring interventions that may allow relapsed smokers and former smokers to successfully progress through the action stage and achieve the maintenance stage of quitting. The specific stages and behaviours that the smokers and relapsers go through should be understood by all health professionals involved in quit-smoking assistance to provide more effective counselling. Emphasising smoking cessation counselling, especially with reference to issues of misconceptions regarding smoking benefits (pros of smoking), enhanced motivation to abstain and prioritisation of self liberation, may assist former smokers in preventing relapse.

6.3 Other related recommendations: Lessons learnt from this research

6.3.1 Government policy makers

The investigator hopes that the results of this study may be used as a stepping-stone for the government to look into the issue of smoking relapse more seriously as an effort to promote sustained cessation. Anti-smoking messages, including pamphlets, posters, billboards, newsletters, television advertisements and radio addresses, should place new emphasis on assisting former smokers in preventing relapse and motivating quit attempters in maintaining abstinence. Current health promotions and anti-smoking activities should not entirely concentrate on preventing uptake and quitting smoking and should instead concentrate on how to extend information to the public on the dangers of relapse and how to prevent its occurrence.

Thus far, the psychological aspect of quitting has received very little attention. It has not been highlighted that smokers require motivation to quit and that they should have sufficient knowledge for quitting. Changing the perceptions of smokers, the ways to motivate smokers and the steps involved in a quit attempt constitute important knowledge that should be acquired by health professionals. To ensure this is possible, the training of healthcare providers is essential. This training could start from inserting a separate syllabus in smoking cessation during undergraduate medical and nursing

schools. For existing healthcare professionals and the health psychologists involved in direct patient care (in smoking cessation clinics or otherwise), a minimum two-day training session is warranted to enhance their knowledge and skills in every aspect of smoking cessation and smoking relapse.

In addition to the journal publications and conference meetings that have resulted from this dissertation, the investigator would also like to see the results of this study be used as a guideline for health professionals, in either hospital- or clinic-based settings. Hence, the investigator shall soon communicate the results to the Ministry of Health via bulletins or health reviews. This is to be submitted to the Health Education and Promotion unit in Putrajaya. From there, it will be distributed to government hospitals, health clinics and smoking cessation clinics across the country. The bulletins may include "Smoking relapse and effective timing for follow-up post cessation", " What is the content of a good counselling in assisting smokers to quit?" and "Psychology of quitting and preventing relapse: a model-based psychological approach". These are to be formulated from the results of this research.

In addition, government smoking cessation services should not be limited to clinic-based and hospital-based settings. The provision of mobile smoking cessation services and smoking cessation programmes in government workplaces should be initiated. Follow-up of patients in these clinics should entail both pre-cessation and post-cessation follow-up, as both are similarly important in maintaining smoking abstinence.

6.3.2 Workplace management

The investigator suggests that other workplaces should conduct structured workplace smoking cessation programmes, as they have great potential to increase the overall cessation rate, to improve the health of the workers and to reduce the work consequences related to tobacco use. Implementing such a programme may have an

advantage over clinic-based smoking cessation in capturing smokers who have a lack of motivation, as was shown from this research.

Enforcement of attendance in a smoking cessation programme should be made compulsory for all smoking employees. They should be given a basic understanding of all issues related to smoking (e.g., the risks and benefits of quitting, how to make a quit attempt, how to maintain smoking abstinence and prevent relapse and post-cessation effects). It may also be an advantage if some credit hours are given to smokers who attend such programmes. Moreover, appropriate incentives or rewards could be introduced to smokers who eventually quit.

To provide effective smoking cessation programmes, training sessions on "How to assist smokers in quitting", "How to conduct smoking cessation clinics" and "Psychological components in quitting" should be made compulsory to all nurses and doctors involved in patient care in company health clinics. Other than providing smokers with an effective smoking cessation service, informal advice on quitting smoking should also be given to smokers by making health talks available.

Moreover, team building should be conducted more frequently to improve interpersonal relationships among co-workers. A quit-smoking support group at the workplace that serves as a means of peer support in quitting could be another potential solution.

Issues related to environmental tobacco smoke should be looked into in greater detail, as exposure to others smoking is an important determinant of relapse among quitters. Although most workplaces have banned smoking, enforcement is still loose. Therefore, the author recommends that this policy should be one of the most important agendas in the workplace health management unit. Workplace enforcement policies should be tightened, and stricter penalties for smokers who smoke in the work vicinity should be implemented. In addition, more signboards, bulletins and anti-smoking

campaigns are highly recommended. However, all of the above suggestions may require certain adjustments according to the availability of resources (e.g., the availability of funds and staff).

6.4 Suggestions for future work

The findings from this research represent a promising area for future work and development in relapse prevention and smoking cessation in Malaysia and neighbouring countries. Several possible areas of future research and improvement resulting from this study have been depicted along the way. First, future studies should address interventions with different approaches in behavioural therapy. Adding a separate component for educating smokers in-depth on the risks and benefits of continuing smoking and quitting may be beneficial in improving the overall outcomes and preventing relapse. Our study demonstrated the importance of educating smokers on the risks and benefits of quitting, in addition to the continuous educational mass campaign from the government. In this regard, this study fill the gaps of smoking relapse in the establishment of future smoking cessation programmes. It can potentially be applicable to other developing countries in Southeast Asia and the region.

Next, we did not examine variables related to other aspects of smoking relapse and cessation, such as smoking policies, workplace resources, life stressors, health and psychiatric morbidities and religious and cultural factors. We also do not know how much these factors are associated with smoking relapse and whether they can influence our findings in relation to smoking relapse, cessation and smoking perception. Furthermore, the nature of a person's work and their capability to handle withdrawal symptoms are subjective and vary between individuals; thus, these factors may have some impacts on smoking relapse and, consequently, abstinence. These issues should be addressed further.

In view of this and previous research, the investigator suggests that researchers look into the issue of the work environment and smoking cessation in further detail. Several research questions arise, such as: How does physical workload affect smoking cessation? What are the effects of workplace factors, such as noise, chemical exposures and biological hazards, on smoking cessation? How might ETS at the workplace play a further role in smoking cessation? Do changes in job stressors influence smoking cessation? These questions need to be addressed.

Next, the investigator suggests that future studies should have a greater sample size and should include a wider range of occupations from other governmental and non-governmental agencies. This will increase the generalisation of the study, and many more factors that influence cessation and relapse could be potentially identified. In addition, it would also be of interest to study smoking cessation and relapse among smokers with poor motivation to quit, smokers who quit without support, smokers in ethnic minority groups and smokers with specific diseases (e.g., psychiatric patients). These groups of smokers are expected to have dissimilar addiction levels and different coping mechanisms when handling the processes of quitting and relapse.

Lastly, conducting an additional qualitative study to assess the behaviour component that occurs during the process of smoking relapse in particular is a good area for future research. With this, the researchers shall be able to understand and comprehend the processes with greater depth and within the perspectives of the smokers. To conclude, all of these recommendations should be considered in any future smoking relapse and smoking cessation studies.

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Supplementary

Instrumentations: Participant's questionnaires

Questionnaire 1 (Q1) – At start of treatment
Bahasa Malaysia version.

Tarikh_____

Nama: _____NoTel:_____

I/C:_____Jabatan:_____

PEFR: _____ Co ppm: _____

Berat badan: _____ Tinggi: _____

Soalan Latar belakang

1) Apakah tahap pembelajaran anda yang paling tinggi?
   a)____ Sekolah rendah b)____ Sekolah Menengah
   c) ____Kolej/Universiti (Diploma / Degree / Masters/ PHD)

2) Apakah status perkahwinan anda?
   a) Bujang b) Berkahwin c) Duda/janda e) Telah Bercerai

3) Warganegara: _____ Agama: _____

4) Sekiranya warganegara, apakah bangsa anda?
   a) Malay b) Chinese c) Indian d) Others_____

5) Berapa kalikah *dalam seminggu* anda bersenam? (lebih daripada 20 minit setiap kali)
   a) Tidak pernah b) 1 kali c) 2-4 kali d) 5 kali

6) Berapa hidangankah anda makan buah-buahan dan sayur-sayuran dalam seminggu?
   a) 0-5 b) 6-10 c) 11-14 d) 15-20 e) > 20

7) Adakah anda minum arak? Ya/ Tidak

8) Adakah anda menghidap apa-apa penyakit di bawah?

a) Penyakit paru-paru atau jantung; Ya/ Tidak

b) Penyakit kronik yang lain; Ya/ Tidak

Sila nyatakan sekiranya "Ya": _____

c) Penyakit Kemurungan atau apa-apa penyakit jiwa yang lain: Ya/ Tidak

13) Nyatakan kategori pekerjaan anda?

a) Kakitangan sokongan b) Profesional/ Pengurusan

14) Adakah anda mengetahui peraturan merokok di tempat kerja anda? Ya/ Tidak

15) Adakah anda merokok di tempat kerja? Ya/ Tidak

16) Apakah jenama rokok yang anda biasa hisap? _____

Sejarah Merokok

1. Pada umur berapakah anda mula merokok? _____tahun

2. Pada umur berapakah anda mula merokok setiap hari? _____tahun

3. Berapakah batang rokok anda merokok pada hari kebiasaan? _____ batang

4. Adakah ibu/bapa anda seorang perokok? (bulatkan) Ya/Tidak

5. Selain ibubapa anda, adakah sesiapa lagi dalam rumah anda merokok?

(bulatkan) Ya/ Tidak

Sekiranya "Ya", sila nyatakan siapa_____

6. Adakah anda pernah mencuba untuk berhenti merokok?

a) Tidak pernah b) 1 kali c) 2-5 kali d) 6 atau lebih

Sekiranya anda pernah cuba untuk berhenti merokok, apa metod untuk berhenti merokok?

a) Bahan rujukan b) Terapi gantian nikotin

c) Pertolongan jururawat, doktor atau kaunselor d) Hypnosis, akupunktur, kaset, ubat tradisional e) Lain-lain (agama, ubat zyban) f) Tiada

7. Adakah anda menggunakan apa-apa metod untuk berhenti merokok?
   Ya/Tidak (bulatkan);
   Sekiranya "Ya", sila nyatakan metod*:*
   _____

Stage of Change Profile

8. Adakah anda bersungguh-sungguh terfikir untuk berhenti merokok?

   a) Ya, dalam masa 30 hari lagi b) Ya, dalam masa 6 bulan lagi

   c) Tidak terfikir untuk berhenti

9. Pada tahun lepas, berapa kalikah anda cuba untuk berhenti merokok sekurang-kurangnya 24 jam? _____kali

Family Support Questionnaire/ Soal selidik Sokongan Keluarga

Berapa kerapkah anda dan pasangan anda:

1= Tidak pernah 2= Hampir tidak pernah 3= Kadang- kadang
4= Selalu 5= Sangat kerap

Silakan tandakan hanya satu (x) untuk setiap ayat berikut:

No.	*Questions*	*1*	*2*	*3*	*4*	*5*
1	Menggalakkan antara satu sama lain untuk menjauhi rokok					
2	Berbincang tentang bahaya merokok terhadap kesihatan					
3	Menasihati antara satu sama lain untuk tidak merokok					
4	Berkongsi pendapat untuk kekal menjadi seorang yang tidak merokok atau untuk berhenti merokok					

Pengaruh rokok di tempat kerja, persekitaran dan rumah

Sila baca dan bulatkan hanya satu jawapan.

1. Renungkan tentang 7 hari yang lepas, berapa jam dalam seminggukah anda terdedah kepada asap rokok orang lain di tempat kerja?

   a) 0 jam b) 1-2 jam c) 3-8 jam d) 9 jam atau lebih

2. Renungkan tentang 7 hari yang lepas, berapa jamkah dalam seminggu anda terdedah kepada asap rokok orang lain di rumah?

   a) 0 jam b) 1-4 jam c) 5-14 jam d) 15 jam dan lebih

3. Berapa ramaikah rakan-rakan anda yang merokok? Bolehkah anda katakan

   a) Tiada b) Sedikit c) Kurang daripada separuh d) Kebanyakan

Rhode Island Stress and coping Questionnaire

Pada bulan yang lepas, **berapa kerapkah** kenyataan-kenyataan di bawah adalah benar tentang kehidupan anda? Sila tandakan kekerapan dengan menggunakan skala di bawah:

1= Tidak Pernah 2=Jarang- jarang 3= Kadang-kadang 4= Kerap
5= Berulang-ulangkali

No.	Questions	1	2	3	4	5
1	Saya boleh menghadapi situasi – situasi yang sukar					
2	Saya rasa berbesar diri/ berkuasa					
3	Saya boleh bertahan menghadapi masalah-masalah yang tidak diduga					
4	Saya rasa tertekan dengan kejadian-kejadian yang tidak dijangka					
5	Saya rasa lebih tertekan (stress) daripada biasa					
6	Saya rasa tidak cukup masa untuk menyelesaikan kerja harian saya					
7	Saya telah ditekan oleh orang lain					
8	Saya mengambil kerja lebih daripada apa yang saya mampu hadapi					
9	Saya tiada masa untuk berehat					

Job Content Questionnaire

Sila **bulatkan** jawapan yang betul.

Soalan	Sangat tidak setuju	Tidak Setuju	Setuju	Sangat Setuju
1. Pekerjaan saya memerlukan saya mempelajari perkara baru	1	2	3	4
2. Pekerjaan saya melibatkan kerja yang berulang-ulang	1	2	3	4
3. Pekerjaan saya memerlukan kreativiti	1	2	3	4
4. Pekerjaan saya membenarkan saya membuat keputusan sendiri.	1	2	3	4
5. Pekerjaan saya memerlukan kemahiran yang tinggi	1	2	3	4
6. Semasa bekerja saya diberi banyak kebebasan untuk membuat keputusan sendiri.	1	2	3	4
7. Semasa bekerja saya berupaya melakukan berbagai perkara yang berbeza-beza.	1	2	3	4
8. Saya mempunyai banyak hak untuk menentukan pekerjaan saya.	1	2	3	4
9. Saya berpeluang untuk mengembangkan kebolehan saya.	1	2	3	4
10. Pekerjaan saya memerlukan saya bekerja dengan sangat pantas.	1	2	3	4
11. Pekerjaan saya memerlukan saya bekerja bersungguh-sungguh.	1	2	3	4
12. Saya tidak diminta/disuruh untuk melakukan kerja-kerja secara berlebihan.	1	2	3	4
13. Saya mempunyai masa yang cukup untuk menyiapkan kerja saya.	1	2	3	4
14. Saya bebas daripada tekanan-tekanan yang dibuat oleh orang lain.	1	2	3	4
15. Pekerjaan saya dijamin baik.	1	2	3	4
16. Rakan-rakan sekerja saya berkemampuan dalam melakukan kerja mereka.	1	2	3	4
17. Rakan-rakan sekerja saya mengambil berat tentang saya.	1	2	3	4
18. Rakan-rakan sekerja saya adalah peramah.	1	2	3	4
19. Rakan-rakan sekerja saya membantu bagi memastikan kerja-kerja disiapkan.	1	2	3	4
20. Penyelia saya mengambil berat mengenai kebajikan orang bawahannya.	1	2	3	4
21. Penyelia saya memberikan perhatian terhadap apa yang saya katakan.	1	2	3	4

Job Content Questionnaire, continued

Soalan	Sangat tidak setuju	Tidak Setuju	Setuju	Sangat Setuju
22. Penyelia saya memberi bantuan dalam memastikan kerja-kerja saya dapat disiapkan.	1	2	3	4
23. Penyelia saya berjaya mengajak orang lain bekerja bersama-sama.	1	2	3	4

24. Berapa stabilkah kerja anda?

1) tetap dan stabil 2) bermusim 3) kerap tergendala

4) bermusim dan kerap tergendala 5) Lain-lain

25. Dalam tempoh setahun yang lepas berapa kerapkah anda berdepan dengan masalah kehilangan pekerjaan?

1) Tidak pernah 2) sekali 3) Lebih dari sekali 4) Sentiasa

5) Diberhentikan

26. Kadangkala seseorang itu kehilangan pekerjaan tetap mereka. Adakah kemungkinan anda akan kehilangan pekerjaan anda sekarang dalam beberapa tahun lagi?

1) Tidak mungkin 2) Sedikit kemungkinan 3) Berkemungkinan

4) Berkemungkinan besar

27. Adakah anda kerja shift: ya/ tidak

Sekiranya Shift, berapa jam dalam sehari? _____

Berapa jam dalam seminggu? _____

Questionnaire 1 (Q1): (English version)

Name: _____ Tel No:_____

I/C:_____Jabatan:_____

PEFR: _____ Co ppm: _____ Wght: _____

a. Socio demographic, medical and occupational history questionnaire

1) What level of education did you complete?

a)____Primary school; b)____Secondary school; c)____Tertiary education

Diploma / Degree / Masters/ PHD

2) What is your marital status? (please circle)

a) Single b) married c) widowed d) divorced

3) What nationality are you? _____ Religion:_____

4) If Malaysian, which racial status do you identify yourself? (please circle one)

b) Malay b) Chinese c) Indian d) Others_____

5) How many times do you exercise per week? (minimum of 20 minutes each)

a) Never b) 1 per week c) 2-4 per week d) 5 per week

6) How many servings of fruits and vegetables do you typically eat in a week?

a) 0-5 b) 6-10 c) 11-14 d) 15-20 e) > 20

7) Do you drink alcohol? Yes/ No

8) Do you suffer from any of the following diseases?

a) Respiratory disease or cardiac disease; yes/no

b) Other chronic diseases; yes/no

c) History of depression or any psychiatric illness; yes/no

13) What type of work category are you in?

a) support group c) professional/ management

14) Are you aware of your workplace smoking rules? (aware/ not aware);

15) Do you smoke at your workplace? (yes/no);

16) What brand of cigarette do you smoke?_____

b. Smoking History

1. At what age did you begin smoking? _____ years

2. At what age did you begin to smoke regularly (smoke every day)? _____ years

3. How many cigarettes did you smoke on the average day? _____numbers

4. Do both/ either of your parents smoke? Yes/ No (circle one)

5. Besides your parents does anyone in your household smokes? Yes/ No

   If yes, who? _____

6. Have ever attempted to quit smoking?

   a) Never b) Once c) 2-5 times d) 6 or more times

   If yes, how many days was the longest period of free from smoking in the previous quit attempt?

   a) < 1 day b) 1-7 days c) > 1 week d) > 1 month e) > 6 months

   b)

7. Methods of quitting used to cutback smoking?

   a) Self/help materials

   b) b) Nicotine patch or gums

   c) Assistance from nurse, counsellor, doctor;

   d) Hypnosis, acupuncture, tapes, herbs.

   e) Others (prayer, zyban- smoking pills)

   f) None

8. Are you currently using any methods to quit or cutback on smoking? Yes/ No

   If, yes, please specify: _____

Stage of Change Questionnaire:

9 Are you seriously thinking of quitting smoking?

a) Yes, within the next 30 days b) Yes, within the next 6 months

c) No, not thinking of quitting

10. In the last year, how many times have you tried to quit smoking at least 24 hours?

_____

Family support questionnaire/ Soal selidik sokongan keluarga

How often do you and your partner:

1= Never 2= Almost never 3= Sometimes 4= Fairly often
5= Very often

Please tick (X) only 1 box for each question

No.	Questions	1	2	3	4	5
1	Encourage each other to stay away from cigarettes					
2	Discuss how smoking is unhealthy					
3	Remind each other to avoid cigarette smoking					
4	Sharing ideas on how to stay a non-smoker or quit cigarettes					

Worksite environment, home environment and peer influence on Smoking

Please read carefully and circle only 1 answer.

4. Thinking about the past 7 days, about how many hours in a week were you exposed to other people's tobacco smoke at work?

b) 0 h b)1-2 h c) 3-8 h d) 9 h or more

5. Thinking about the past 7 days, about how many hours in a week were you exposed to other people's tobacco smoke at home?

a) 0 h b)1-4 h c) 5-14 h d) 15 h and more

6. How many of your friends are smokers? Would you say

a) None b) A few c) Less than half d) Most

Rhode Island stress and coping questionnaire

In the last month, **how often** was each of the following statements true of your own life? Please rate the frequency using the following scale:

1= Never 2=Seldom 3= Occasionally 4= Often 5= Repeatedly

No.	Questions	1	2	3	4	5
1	I was able to cope with difficult situations					
2	I felt overwhelmed					
3	I was able to cope with unexpected problems					
4	I felt stressed by unexpected events					
5	I felt that I had more stress than usual					
6	I felt there was not enough time to complete my daily tasks					
7	I was pressured by others					
8	I took on more than I could handle					
9	I had no time to relax					

Job Content Questionnaire

Please circle the correct answer.

Questions	strongly disagree	disagree	agree	strongly agree
1. My job requires that I learn new things	1	2	3	4
2. My job involves a lot of repetitive work	1	2	3	4
3. My job requires me to be creative	1	2	3	4
4. My job allows me to make a lot of decisions on my own	1	2	3	4
5. My job requires a high level of skill	1	2	3	4
6. On my job, I am given a lot of freedom to decide how I do my work	1	2	3	4
7. I get to do a variety of things on my job	1	2	3	4
8. I have a lot to say about what happens on my job	1	2	3	4
9. I have an opportunity to develop my own special abilities	1	2	3	4
10. My job requires working very fast	1	2	3	4
11. My job requires working very hard	1	2	3	4
12. I am not asked to do an excessive amount of work	1	2	3	4
13. I have enough time to get the job done	1	2	3	4
14. I am free from conflicting demands others make	1	2	3	4
15. My job security is good	1	2	3	4
16. People I work with are competent in doing their jobs	1	2	3	4
17. People I work with take a personal interest in me	1	2	3	4
18. People I work with are friendly	1	2	3	4
19. People I work with are helpful in getting the job done	1	2	3	4
20. My supervisor is concerned about the welfare of those under him	1	2	3	4
21. My supervisor pays attention to what you are saying	1	2	3	4
22. My supervisor is helpful in getting the job done	1	2	3	4
23. My supervisor is successful in getting people to work together	1	2	3	4

24. How steady is your work?

1. Regularly and steady 2. Seasonal 3. Frequent layoffs

4. Both seasonal and frequent layoffs 5. Other

25. During the past year, how often were you in a situation where you faced job loss?

1. Never 2. Faced possibility once 3. faced possibility more than once

4. Constantly 5. Laid off

26. Sometimes people permanently lose jobs they want to keep. How likely is it that during the next couple of years you will lose your present job with your employer?

1. Not at all likely 2. Not too likely 3. Somewhat likely

4. Very likely

Formulas for JCQ scale scores

	Possible range
Job skill discretion = [q1 + q3 + q5 + q7 + q9 + 5 - q2] x 2.	12-48
Job decision-making authority = [2(q4 + q6 + q8)] x 2.	12-48
Job demands = 3(q10 + q11) + 2(15 - q13 - q14 - q15).	12-48
Co-worker support = q17 + q18 + q19 + q20.	4-16
Supervisor support = q21 + q22 + q23 + q24.	4-16
Job insecurity = q25 + q27 + q26 + 5 - q16.	3-12

Job decision latitude = skill discretion + decision-making authority. 24-96
Combine skill discretion scale and decision-making authority scale to create a new scale: Job decision latitude (range 24-96).
Q12 was not included in the analysis as was the measure on physical work load.

Questionnaire 2 (Q2) – At start of treatment, 3 months and 6 months

Bahasa Malaysia version

Nama:_____ I.D:_____Tarikh: _____

Silakan tandakan hanya satu (x) untuk setiap ayat berikut:

Bahagian 1: Tindakan untuk Merokok

Sila tandakan sejauh manakah **KEPENTINGAN setiap kenyataan** di bawah **mempengaruhi tindakan anda untuk merokok atau tidak** berdasarkan 5 skala di bawah:

1= Tidak penting 2= Sedikit Penting 3= Sederhana Penting
4= Sangat Penting 5= Teramat Penting

No.	*Soalan*	*1*	*2*	*3*	*4*	*5*
1	Saya rasa lebih tenang dan menyeronokkan apabila merokok					
2	Saya malu untuk meneruskan tabiat merokok					
3	Merokok membantu saya untuk menumpukan perhatian dan melakukan kerja yang lebih baik					
4	Apabila saya merokok, ianya menganggu orang lain					
5	Merokok mengurangkan rasa tekanan (tension) saya					
6	Keseronokan yang saya perolehi daripada merokok					
7	Kesihatan jangka panjang saya					

Bahagian 2: Soal selidik godaan-godaan untuk merokok

Kami ingin mengetahui **sebanyak mana dalam situasi-situasi berikut anda tergoda untuk merokok**.

1= Tidak tergoda langsung 2= Kurang tergoda 3= Sederhana tergoda
4= Sangat tergoda 5= Teramat sangat tergoda

No.	*Questions*	*1*	*2*	*3*	*4*	*5*
1	Dengan kawan semasa parti/ jamuan					
2	Sebaik sahaja saya bangun dari tidur pada waktu pagi					
3	Apabila saya berasa risau dan tertekan					
4	Sewaktu minum dengan kawan-kawan sambil berbual dan berehat					
5	Apabila saya tersedar bahawa berhenti merokok adalah sangat sukar untuk saya.					
6	Apabila saya rasa sangat marah tentang sesuatu atau seseorang					
7	Apabila saya bersama pasangan saya atau kawan rapat yang merokok					
8	Apabila saya tersedar saya telah tidak merokok untuk seketika					
9	Apabila sesuatu perkara tidak terjadi sepertimana yang saya inginkan dan saya merasa kecewa					

Section 3: Impacts of Smoking

Untuk setiap kenyataan di bawah, sila nyatakan **berapa kerap** in **sedang berlaku** kepada anda.

1= Tidak pernah 2= Jarang-jarang 3= Kadang- kadang
4= Selalu 5= Sangat Kerap

No.	*Questions*	*1*	*2*	*3*	*4*	*5*
1	Apabila saya rasa teringin untuk merokok, saya akan ubah fikiran saya					
2	Saya beritahu diri saya sendiri bahawa saya akan berjaya untuk tetap berhenti merokok					
3	Saya risau tentang penambahan berat badan dan masalah lain yang akan saya hadapi sekiranya saya berhenti					
4	Saya memikirkan tentang kebaikan berhenti merokok					
5	Saya meragui samada berhenti merokok adalah berbaloi					
6	Saya mengeluarkan barang-barang daripada rumah dan tempat kerja yang mengingatkan saya tentang rokok					
7	Saya berfikir tentang cara untuk berhenti merokok					
8	Saya berfikir tentang bahaya perbuatan merokok pada alam sekitar					
9	Keperluan saya terhadap rokok menyebabkan saya rasa kecewa dengan diri saya sendiri					
10	Ada seseorang yang saya boleh harapkan apabila saya menghadapi masalah dengan merokok					
11	Saya meragui kebolehan saya untuk berhenti merokok					
12	Saya mencari tempat di mana saya tidak boleh merokok					
13	Orang lain memberi sokongan sekiranya saya tidak merokok					

Section 3, continued

No.	*Questions*	*1*	*2*	*3*	*4*	*5*
14	Saya tahan keinginan untuk merokok					
15	Saya berazam untuk kekal tidak merokok					
16	Saya meragui sama ada berhenti merokok adalah berbaloi					

Section 4. Self efficacy related belief (Borland)

Kenyataan-kenyataan di bawah menerangkan tentang pemikiran, perilaku dan pengalaman berkaitan dengan merokok. Untuk setiap kenyataan di bawah, sila nyatakan **keyakinan anda untuk berbuat demikian.**

1= Langsung tidak 2= Sedikit 3= Sederhana 4= Sangat

5= Teramat sangat

No.	*Questions*	*1*	*2*	*3*	*4*	*5*
1	Saya akan berupaya untuk tetap berhenti merokok					
2	Saya akan mencari ganti untuk semua yang saya perolehi daripada merokok					

Questionnaire 2 (Q2): English version

Name:_____IC:_____Date: _____

Section 1: Smoking Decisional Balance Questionnaire

The following statements represent different opinions about smoking. Please rate HOW IMPORTANT each statement is to your decision to smoke according to the following 5 point scale:

1= Not important; 2= Slightly important; 3= Moderately important;
4= Very important; 5= Extremely important

Please tick (X) only 1 box for each question

No.	Soalan	1	2	3	4	5
1	I am more relaxed and therefore more pleasant when smoking					
2	I am embarrassed to have to smoke					
3	Smoking helps me concentrate and do better work					
4	My cigarette smoking bothers other people					
5	Smoking cigarettes relieves tension					
6	The enjoyment I get out of smoking					
7	My long term health					

Section 2: Temptations to Smoke Questionnaire

Listed below are situations that led some people to smoke. We would like to know HOW TEMPTED you may be to smoke in each situation. Please answer the following questions using the following five point scale.

1= Not at all tempted 2= Not very tempted 3= Moderately tempted
4= Very tempted 5= Extremely tempted

Please tick (X) only 1 box for each question

No.	Questions	1	2	3	4	5
1	With friends at a party					
2	When I first get up in the morning					
3	When I am extremely anxious and stressed					
4	Over coffee while talking and relaxing					
5	When I realize that quitting smoking is an extremely difficult task for me					
6	When I am very angry about something or someone					
7	With my spouse or close friend who is smoking					
8	When I realize I haven't smoked for a while					
9	When things are not going the way I want and I am frustrated					

Section 3: Impacts of Smoking

The following statements describe the thoughts, behaviours and experiences related to smoking. For each item tell us **how often** this is **currently** happening to you.

1= Never; 2= Seldom; 3= Ocassionally; 4= Often; 5= Repeatedly

Please tick (X) only 1 box for each question

No.	Questions	1	2	3	4	5
1	When I am tempted to smoke I think about something else					
2	I tell myself that I am going to succeed in staying quitting					
3	I worry about putting on weight or other problems quitting might cause					
4	I think about the benefits of quitting smoking					
5	I question whether quitting is worthwhile					
6	I remove things from my home or work that remind me of smoking					
7	I think about how to quit					
8	I think about the harm smoking can do to the environment					
9	My need for cigarettes makes me feel disappointed in myself					
10	I have someone I can count on when I'm having problems with smoking					
11	I doubt my ability to quit					
12	I seek out places where I cannot smoke					
13	Other people support me if I don't smoke					
14	I resist urges to smoke					
15	I am determined to stay quit					
16	I doubt whether quitting is worth the effort					

Section 4. Self efficacy Related Belief

The following statements describe the thoughts, behaviours and experiences related to smoking. For each item tell us **how confident you are to do that.**

1= Not at all; 2= Slightly; 3= Moderately; 4= Very; 5= Extremely

Please tick (X) only 1 box for each question

No.	Questions	1	2	3	4	5
1	I will be able to stay quit					
2	I will find replacements for everything I got from smoking					

Questionnaire 3 (Q3) – At start of treatment, 3 months and 6 months

Fagerstrom Test

Bahasa Malaysia vesion

No. Peserta: _____ Tarikh: _____

Nama:_____

1. Berapa cepatkah anda menghisap rokok anda yang pertama selepas bangun dari tidur?
   a) Dalam masa 5 minit (3)
   b) 6 hingga 30 minit (2)
   c) 31 hingga 60 minit (1)
   d) Selepas 60 minit (0)

2. Adakah anda menghadapi kesukaran menahan diri daripada merokok di tempat-tempat yang dilarang merokok, contohnya di rumah ibadat, di perpustakaan, di panggung wayang dan sebagainya?
   a) Ya (1)
   b) Tidak (0)

3. Menghisap rokok yang manakah yangpaling sukar untuk anda tinggalkan?
   a) Yang pertama di sebelah pagi (1)
   b) Yang Lain (0)

4. Berapakah batang rokok yang anda hisap dalam sehari?
   a) 10 atau kurang (0)
   b) 11 hingga 20 (1)
   c) 21 hingga 30 (2)
   d) 31 atau lebih (3)

5. Adakah anda lebih banyak merokok dalam jam pertama selepas bangun berbanding dengan waktu-waktu lain sepanjang hari?
   a) Ya (1)
   b) Tidak (0)

6. Adakah anda merokok walaupun anda sakit menyebabkan anda terpaksa berbaring di atas katil sepanjang hari?
   a) Ya (1)
   b) Tidak (2)

Questionnaire 3 (Q3)

Fagerstrom Test (English version)

ID number: _____ Date: _____

Name:_____

1. How soon after you wake up do you smoke your first cigarette?
   a. After 60 minutes (0)
   b. 31-60 minutes (1)
   c. 6-30 minutes (2)
   d. Within 5 minutes (3)

2. Do you find it difficult to refrain from smoking in places where it is forbidden e.g. in schools, hospitals, restaurants, at the library, in cinema, etc.?
   a. No (0)
   b. Yes (1)

3. Which cigarette would you hate most to give up?
   a. The first one in the morning? (1)
   b. All others? (2)

4. How many cigarettes do you smoke per day?
   a. 10 or less (0)
   b. 11-20 (1)
   c. 21-30 (2)
   d. 31 or more (3)

5. Do you smoke more frequently during the first hours after waking than during the rest of the day?
   a. Yes (1)
   b. No (2)

6. Do you smoke if you are so ill that you are in bed most of the day?
   a. Yes (1)
   b. No (2)

Smoking Status Questionnaire (SSQ) – Followup at 3 months and 6 months

(Bahasa Malaysia version)

No. peserta: Tarikh:

Nama:

1. Pernahkah anda mencuba untuk berhenti merokok sejak temujanji terakhir?

   Ya/ Tidak

2. Sekiranya "tidak" untuk no. 1; Fikirkan tentangkan tabiat merokok anda seminggu yang lepas: Berapa batangkah anda merokok pada hari kebiasaan sekarang? _____ rokok

3. Sekiranya "ya" untuk no. 1, bilakah tarikh berhenti merokok?

4. Sekiranya anda telah berhenti, adakah anda kembali merokok setelah berhenti sejak temujanju terakhir yang lepas? Ya/ Tidak

5. If yes for no.4, please specify the following

   Sekiranya "ya" untuk no, 4, sila nyatakan yang berikut:

   a) Tarikh berhenti merokok?_____
   b) Tarikh kembali merokok setelah berhanti? _____
   c) Jumlah hari paling lama berhenti? _____
   d) Jumlah hari paling singkat berhenti? _____

   (Maklumat di atas boleh diperolehi daripada Quit Smoking Diary)

Smoking Status Questionnaire (SSQ) (English version)

ID number: Date:

Participant's name:

1) Have you quit smoking since the last follow-up? Yes/ No

2) If No for no. 1;
   Think about your smoking over the past week: How many cigarettes do you smoke on a typical day now? _____ cigarettes

3) If Yes for no.1, when was the quit date? _____

4) If you have quit before, did you develop relapse after quitting since the last follow-up? Yes/ No

5) If yes for no.4, please specify the following
   a) Date of last quit: _____
   b) Date of relapse: _____
   c) Length of longest quit: _____
   d) Length of shortest quit: _____

   (All these can be summarized from the Quit Smoking Diary)

Investigator's sheets and telephone script – Followup at 3 months and 6 months

Sheet 1; Filled up during each counselling session *and* a copy of the diary needs to be attached.

Participant's name: Current weight:

ID number: Date:

Co ppm measurement: _____

BP measurement: _____

1) Have you quit smoking for at least 24 hours since I last saw you?
   a.Yes (__days) b. No c. Not currently smoking

2) Think about your smoking over the past week: How many cigarettes do you smoke on a typical day now?_____ cigarettes

3) How many cigarettes did you smoke yesterday? _____ cigarettes

4) When was the last time you smoked, even if it was just a puff?
   _____ hours ago _____quit _____ length of quit

5) Did you cut back on your smoking or switch to lighter brands since I last saw you?
   a. Yes b. No
   Describe: _____

6) Aside from the things we did and discussed, did you use any of the following for quitting smoking since we last met?

   a) Other reading; b) Assistance from nurse, counsellor, doctor
   c) Hypnosis, acupuncture, tapes or herbs; d) None; Others?
   _____

7) Compliance to treatment; the no. of pills left in the envelope: _____

8) Development of side effects: Yes/No
if yes please state: _____

9) Use of diary a) ≥ 80% b) 50-70% c) ≤50%

Sheet 2; Telephone call script follow-up at 3 months and six months (Confirmation of quit status)

No. of calls (circle): 1/ 2/ 3/ 4

I. Introduce name, work position and where calling from?

II. Have you smoked at all in the last month?
1. Yes (use calendar on exact date)
2. No

If no, how much do you currently smoke? _____

Please tell me about your smoking in the last 1 month/ since we met?

In the past month, have you changed your smoking behaviour at all?

Have you cut down or increased the number of cigarettes you smoke?

111. How many times did you relapse from our last follow up till now?

Do you have any other particular query regarding smoking, which I may be able to help?

Closing Script:

Thank you for your time and co-operation. If you have any other problems regarding smoking cessation problems and this study, please do not hesitate to call me Dr Siti Munira at 0192515325

Appendix A: Structure and contents of quit smoking sessions

1) Initial session was being conducted in groups of 3-4 participants.

1 Explanation regarding structure of programme.

1. There were one group counselling and at least three individual sessions that takes place at week 1, 2, 4 and subsequent 2 weeks duration until 2 months.
2. Phone-calls as reminders of appointments and to check on smoking status at 3 months and six months
3. Participants may contact the investigator via phone call for additional advices.
4. Participants who relapse after 4 months will be offered a second trial course of NRT

2 Filling up of questionnaires and consent as per protocol.

3 General Talk on Quit Smoking techniques:

1. Preparation to Quit- This deals with both physiological and psychological aspects of smoking cessation and addiction.
2. General epidemiology and pathophysiology of smoking
3. Benefits and harm of smoking- health, self esteem, financial etc.
4. Benefits of quitting and disadvantage of continuing smoking.
5. Target Quit Date- how to use the diary and self monitoring techniques on reduction of nicotine.
6. Medication- This was explained in detail on how to administer NRT gums and patches and the dangers and side- effects that may occur following its administration.

2) Subsequent individual sessions (consisting of at least two sessions)

1st initial individual session (after the group session)

- Assess participant's willingness for quit attempt using the questionnaires given.
- Physical examination: Co ppm and Weight
- Distribution of Quit smoking diaries

2nd visit individual session

- Physical examination: Co ppm and Weight
- Assessment of quit smoking diaries and smoking status
- Cognitive coping skills- what, how and when, common coping thoughts, self talk, positive addictions, scheduling pleasant activities, change of routine.
- Managing withdrawal symptoms- withdrawal and misconceptions
- Relapse Prevention- how to remain an ex-smoker, high risk situations and how to cope.
- Habit Change- belief and desire, skill to change, plan of action for each individual. Self management- common signals, strategies for self-management (avoid and alter).

3rd visit individual session

- Assessment of quit smoking diaries and smoking status
- How to mantain quit- cues to avoid, circle of friends
- Other strategies- lifestyle balance and changes
- Problem post cessation. e.g. weight gain, relapse.

3) ***Telephone sessions at 3 months and 6 months***

- To assess smoking and relapse status.
- Smokers who had quit, were required to perform the CO ppm measurement

Appendix B: Contents of quit smoking diary

Bahasa Malaysia version

1 IKRAR

Saya_____ berikrar dengan sesungguhnya bahawa saya akan berhenti merokok untuk selama-lamanya.

Tarikh yang ditetapkan untuk saya berhenti merokok adalah pada _____.

Tandangan, Saksi,

_____ _____

2 SEBAB-SEBAB UNTUK BERHENTI MEROKOK

Sebab-sebab utama saya mahu berhenti merokok ialah:

- _____
- _____
- _____

3 HALANGAN UNTUK BERHENTI MEROKOK

Saya bimbang sekiranya saya berhenti merokok saya akan

1. _____
2. _____
3. _____

4 CATATAN KENAPA SAYA MASIH MEROKOK SELEPAS TARIKH BERHENTI

Tarikh	Masa	Situasi	Kenapa

5 PETUA 12 M e.g. minum air banyak-banyak, mandi lebih kerap, membasuh tangan, melengah-lengah, menarik nafas panjang, mengunyah sesuatu seperti kismis etc.

6 TARIKH TEMUJANJI (temujanji seterusnya)

No.	Tarikh	Masa

7 DAIRI HARIAN (dilampirkan)

Appendix B: Contents of quit smoking diary (English version)

1 **PLEDGE TO QUIT**

I, _____promise that I will quit smoking forever.

The date that suggested to quit smoking is on _____

Signature Witness

_____ _____

2 **REASONS TO QUIT**

The main reasons I would like to quit are:

- _____
- _____
- _____

3 OBSTACLES TO QUITTING

I am worried if I quit smoking, I will

1. _____
2. _____
3. _____

4 REASONS WHY I CONTINUE TO SMOKE AFTER QUITTING

Date	Time	Situation	Reasons

5 12 TIPS: (e.g. drink plenty of water, shower more often, wash hands, procastinate from smoking, take a deep breath, chewing on something, like raisins etc)

6 NEXT APPT DATE

No.	Date	Time

7 DAILY DIARIES (example as attached)

Appendix C: Informed Consent and Patient Information Sheet

Appendix D: Medical ethical committee and support letters from universities

Appendix E: Published journal articles and research awards