

The Relation Between Number of Smoking Friends and Adult Smoking Cessation Outcomes

by

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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## Abstract

**Background:** It is a basic principle of life that behaviour is guided by the social context. It matters to us whether significant others share with us the same likes and dislikes, and when they do not, that discrepancy is a source of potential for change in our individual beliefs, attitudes, and ultimately our behaviour. It is the importance of the social context that is the foundation for the research presented in this dissertation, which focuses on the relation between friends' smoking behaviour and individual smoking behaviour.

**Objectives:** The objectives of this dissertation are to: (1) examine whether smokers report a greater number of smoking friends than chance would predict, (2) examine whether smokers' number of smoking friends and changes in their number of smoking friends over time are related to demographic characteristics and variables that predict smoking cessation outcomes, (3) examine whether smokers' number of smoking friends and changes in their number of smoking friends over time are related to smoking cessation outcomes, and (4) examine whether any relation between changes in number of smoking friends over time and smoking cessation outcomes is explained by changes in smokers' social and subjective norms towards smoking.

**Respondents:** Data were drawn from the International Tobacco Control Policy Evaluation Project Four Country Survey, a random-digit dial parallel prospective longitudinal cohort survey of nationally representative samples of adult smokers in Australia, Canada, the United Kingdom, and the United States. Samples included a Wave 1 cross-sectional sample (N=8,812), and a Wave 1-Wave 2 longitudinal sample (N=6,321).

**Methods:** Number of smoking friends was measured by asking smokers how many of their five closest friends smoke. Change in number of smoking friends over time was the difference between smokers' number of smoking friends at Wave 1 and Wave 2. Smoking cessation outcomes tested included: (1) intentions to quit at Wave 1 and Wave 2, (2) quit attempts between Wave 1 and Wave 2, (3) abstinence for at least one month at Wave 2 among everyone, and (4) abstinence for at least one month at Wave 2

among smokers who attempted to quit (successful quit attempts). Changes in respondents' subjective and social norms towards smoking between Wave 1 and Wave 2 were also measured.

**Results:** Smokers reported a significantly higher number of smoking friends than would have been expected by chance at Wave 1. There were also significant differences in smokers' number of smoking friends. Notably, smokers who were male, younger, had low education, and lower incomes had more smoking friends. These groups were also more likely gain and less likely to lose smoking friends over time. Smokers with characteristics that made them unlikely to quit smoking, i.e., higher nicotine dependence, also had more smoking friends. Smokers with fewer smoking friends at Wave 1 were more likely to intend to quit at Wave 1 and more likely to succeed in their attempts to quit. Smokers who lost smoking friends over time compared to smokers who experienced no change in their number of smoking friends were more likely to intend to quit at Wave 2, attempt to quit, be abstinent at Wave 2, and succeed in their attempts to quit. There was some evidence that change in subjective norms partially mediated the relation between changes in number of smoking friends and attempts to quit.

**Conclusions:** These findings suggest that the majority of smokers live in social contexts where smoking is heavily concentrated, and that there are demographic differences in smokers' number of smoking friends and changes in their number of smoking friends over time. Overall, changes in number of smoking friends over time was a more significant and consistent predictor of smoking cessation outcomes than number of smoking friends at Wave 1. This finding agrees with theories of behaviour change that suggest that changes in the context are important when predicting behavioural change. Future studies of the predictors of quitting should consider how factors that change over time are related to quitting, particularly the number of people who smoke in smokers' social contexts. Smoking cessation interventions should consider the challenges faced by smokers who live in contexts where smoking is heavily concentrated when attempting to quit. These challenges may include a higher number of smoking friends, difficulties avoiding smokers during their quit attempts, and making social contacts with non-smokers to support their desired non-smoking status.

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# **1.0 Introduction and Rationale**

## ***1.1 Introduction***

Tobacco use is the leading cause of preventable disease in western countries. Half of tobacco users will die of a smoking related disease, and without serious intervention it is estimated that smoking could kill 1 billion people worldwide this century (Doll, Peto, Boreham, & Sutherland, 2004; Mathers & Loncar, 2006; Peto et al., 1996).

Smoking is causally linked to a number of diseases and health effects including, lung cancer, esophagus cancer, stomach cancer, pancreatic cancer, stroke, coronary heart disease, hip fractures, reproductive effects in women, chronic obstructive pulmonary disease, blindness, and periodontitis (US Surgeon General, 2010). Secondhand smoke (SHS) has been also been shown to cause disease and death in children and adults, including lower respiratory disease, middle ear disease, and sudden infant death syndrome in children, and lung cancer and coronary heart disease in adults (International Agency for Research on Cancer, 2004; US Surgeon General, 2010). No amount of smoking or exposure to SHS has been shown to be safe and abstinence from smoking is the only way to avoid the health consequences (Bjartveit & Tverdal, 2005; US Surgeon General, 2010).

For current smokers, quitting smoking can reduce the risk of smoking related diseases, including cancers and cardiovascular diseases, with the benefits of quitting on reduction in risk for most diseases increasing over time (US Surgeon General, 2010). However, despite the health effects of smoking, and that the majority of smokers regret ever starting to smoke, very few smokers manage to successfully quit (Centers for Disease Control and Prevention, 2011a; Fong et al., 2004; Hughes & Keely, 2004). For example, in 2010 in the United States, although 52.4% of smokers made an attempt to quit smoking, only 6.2% successfully quit (Centers for Disease Control and Prevention, 2011a). Thus, because quit success rates remain very low, it is important to consider the factors that may contribute to successful quitting.

There is nearly universal agreement that the primary reason that smokers have difficulty quitting smoking is because of nicotine in cigarettes, and studies show that nicotine dependence is one of the most consistent predictors of long-term smoking abstinence (Benowitz, 2010; Jarvis, 2004; US Surgeon General, 1988; Vangeli, Stapleton, Smit, Borland, & West, 2011). However, differences in smoking prevalence and cessation rates by country (Lopez, Collishaw, & Piha, 1994; World Health Organization, 2011), and within countries by gender (Hitchman & Fong, 2011), and socioeconomic status (Cavelaars, Kunst, Geurts, & Crialesi, 2000; Jarvis & Wardle, 2006), suggest that the social context affects smoking behaviour (Cummings, Fong, & Borland, 2009). There is also evidence that individual smoking behaviour, and intensity of smoking varies across social situations, with smokers being more likely to smoke in some situations compared to others (Farkas, Gilpin, Distefan, & Pierce, 1999; Shiffman et al., 2002; Shiffman & Rathbun, 2011). Shiffman et al., (2002) note that nicotine addiction does not fully account for this situational variability in individual smoking behaviour, and others note that the environmental context can play a role in nicotine self-administration (Caggiula et al., 2002). Thus, there seems to be evidence to suggest that the social context may lead to differences in smoking behaviour across groups and within individuals.

## ***1.2 Rationale***

It is a basic principle of life that behaviour is guided by the social context. The social context has been recognized as an important factor to consider when studying individual behaviour; however, the study of the individual within their social context is by no means a new endeavour (Markus & Hamedani, 2007). Whether defined by the immediate people that surround the individual or the broader social worlds that people construe themselves within, early social psychologists recognised the importance of the social context. Indeed, for Gordon Allport, the study of social psychology by definition involved understanding ‘how the thought, feeling, and behaviour of individuals are influenced by the actual, imagined, or implied presence of others’ (Allport, 1985, p. 3).

Contemporary social psychologists have also remarked on the importance of considering the social context in the study of the individual. In her writings on socio-cultural psychology Hazel Markus emphasized that the ‘cultural and the psychological [individual] are most productively analysed and understood together’ (Markus & Hamedani, 2007, p. 3). Baumeister and Leary (1995) also emphasize the importance of considering people’s basic motivations to form and maintain positive relationships with other people when studying individual behaviour. And, Levine and Moreland (2006) explicitly discuss the mistake of concentrating too much on the individual while ignoring the social context, stating that ‘observers may be fooled into thinking they have been seeing a strictly individual phenomenon, when in fact that phenomenon was heavily influenced by past or present group experience’ (p. 1). Levine and Moreland, (2006) then went on to discuss studies from the social psychological literature where individual behaviours were influenced by people in their social context, including smoking in adolescent peer groups.

Theories to predict individual behavioural change also typically account for the social context and other people, even if its inclusion is somewhat implicit and indirect. For example, Ajzen's Theory of Planned Behaviour (Ajzen, 1991) states that a person’s subjective norms towards a behaviour can influence their intentions to engage or not engage in the behaviour. Subjective norms are the beliefs that

people hold regarding whether important people in their life think they should or should not engage in a given behaviour. Subjective norms, similar to other normative beliefs, often emerge from informal interactions with our social worlds (Horne, 2001). For example, if a smoker believes that her friends think she should quit, she will likely hold a negative subjective norm towards smoking, and will be more likely to intend to quit. Ajzen (1991) also recognised that the people around us may influence our own self-efficacy for behavioural change, stating that self-efficacy comes not only from individual experience, but also from observing the efforts of other people attempting to change their behaviours. For example, if a smoker has observed many of his friends attempt to quit smoking and fail, he may come to believe that quitting smoking is too difficult to even attempt. Additionally, Fishbein's revised Reasoned Action Approach, the Integrated Model of Behavioral Prediction (Fishbein, 2000, 2008; Fishbein & Yzer, 2003), added descriptive norms (what other people do) to the perceived norms component of the theory to further recognize the importance of other people, and improve predictions of behavioural intentions. A meta-analysis also showed that adding descriptive norms to the Theory of Planned Behaviour accounted for additional variance in models predicting behavioural intentions (Rivis, 2003).

One striking example of the relation between individual behaviour and the social context is the high rate of smoking among lower socioeconomic groups compared to higher socioeconomic groups (Cavelaars et al., 2000; Jarvis & Wardle, 2006).<sup>1</sup> For example, in England, where socioeconomic status is classified by occupational group, smoking prevalence in 2009 among routine and manual workers was 28% compared to 14% in managerial and professional workers (The NHS Information Centre: Lifestyle Statistics, 2011). Some studies and researchers have suggested that the lower rates of successful smoking cessation among lower socioeconomic status smokers may be caused by the higher number of smokers in their social contexts (Hiscock, Bauld, Amos, Fidler, & Munafò, 2011; Jarvis, 2004; Kotz & West, 2009;

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<sup>1</sup> Tobacco use is increasingly concentrated in low socioeconomic status individuals in the countries studied in this dissertation. However, this is not the case in all countries.

Rose, Chassin, & Presson, 1996; Wiltshire, Bancroft, Parry, & Amos, 2003). At the same time, others have urged the need to take new approaches to tobacco control research to further understand the social context's impact on smoking among low socioeconomic status groups, including the use of anthropological methods and deeper consideration of the socio-cultural contexts in which tobacco use occurs (Goldade, Burgess, Olayinka, Whembolua, & Okuyemi, 2012; Unger et al., 2003).

Previously secret tobacco industry documents also reveal the tobacco industry's concerns with the influence of the social context on individual smoking behaviour. The tobacco industry initiated the Social Costs/Social Values project (1979-1989), and its sub-committee, the Social Acceptability Working Party, to address the decreasing social acceptability of smoking, and its effect on profitability (Glantz, Landman, & Cortese, 2008). Specific tobacco industry documents also provide interesting accounts of the industry's concerns with how the social context could motivate smokers to quit. One document entitled, *Smokers and Non-Smokers Peaceful Coexistence Today and Tomorrow*, profiles the industry's concern with the 'guilt-laden' smoker, who 'is often surrounded by non-smokers, is isolated and lacks identification with their peer group, begins to doubt self-image, is less able to withstand non-smokers pressure, and wants to quit smoking' (R. Wells & Wells, 1989, p. 2072670052).

Despite the potential role that other smokers in the social context may play in smoking cessation among adults, relatively little research has focused in on how a smoker's social contacts, particularly a smoker's number of smoking friends, may impact different smoking cessation outcomes (intentions, attempts, quitting). One researcher noticing this paucity remarked that 'although it seems an important socio-cultural factor, there is surprisingly little information about the role of smoking among one's friends as a factor in adult cessation' (Biener, Hamilton, Siegel, & Sullivan, 2010, p.547). Additionally, the lack of research on the role of smoking friends in adult smoking cessation is particularly sparse if it is compared to the immense literature that exists on smoking friends and adolescent smoking (e.g., Alexander, Piazza, Mekos, & Valente, 2001; Ennett & Bauman, 1993; Go, Green, Kennedy, Pollard, &

Tucker, 2010; Mercken, Snijders, Steglich, Vartiainen, & de Vries, 2010; Pollard, Tucker, Green, Kennedy, & Go, 2010).

Although a few studies have examined the relation between adult smokers' number of smoking friends and smoking cessation outcomes, nearly no studies have considered the relation between changes in a smoker's number of smoking friends/social contacts over time and smoking cessation outcomes, with the exception of a study on smoking in social networks by Christakis and Fowler (2008). Theories of behaviour change, such as Robert West's PRIME theory (West, 2006), suggest that for a smoker to quit smoking, changes in important factors related to smoking cessation should have to occur, such as a smoker's motivation to quit, a reduction urges/cravings to smoke, smoker identity etc., (Thaler & Sunstein, 2008; West & Sohal, 2006). Additionally, when attempting to change smoking behaviour, policies and interventions focus on the need to produce a change in the smoker's social environment, health knowledge, attitudes towards smoking, price of cigarettes etc., Thus, despite the fact that interventions to encourage people to quit smoking and the theories that support them emphasize the importance of change, there is very little research on the relation between changes in adult smokers' number friends/social contacts who smoke and smoking cessation outcomes.

Because (1) it is recognised that it is important to consider the behaviour of the individual within the social context, (2) one important aspect of the social context that has been emphasized is relationships with other people, (3) theories of behaviour change have indeed recognised the processes through which the behaviour of others and perceptions of their behaviour may influence an individual's behaviour, (4) tobacco use is increasingly concentrated in certain demographic groups and social contexts (i.e., low socioeconomic status), and (5) there is a current lack of research on the role of number of smoking friends, and changes in number of smoking friends in adult smoking cessation outcomes, this dissertation will examine the relation between smokers' number of smoking friends, changes in the number of smoking friends over time, and smoking cessation outcomes in nationally representative samples of adult smokers from four countries.

## **2.0 Literature Review**

### ***2.1 Number of smoking friends and smoking cessation outcomes: Adults***

#### **2.1.1 Number of smoking friends and smoking status**

Research on the relation between a smoker's number of smoking friends and their smoking behaviour started from the observation that smokers tend to be friends with other smokers. The observation that people tend to have friends who are similar to themselves is by no means new, and not unique to smoking behaviour. In their study of friendship in two housing projects Lazarfield and Merton, 1954 observed that people tended to form friendships with similar others, and called this tendency 'homophily.' Baseline homophily is the degree of homophily that would be expected if friendships were random and not related to individuals' similar behaviours, characteristics, values, etc., whereas inbreeding homophily refers to homophily above baseline (Lazarfield & Merton, 1954; McPherson, Smith-Lovin, & Cook, 2001). For example, if the smoking prevalence in a population is 20% and people were asked to report how many of their five closest friends smoke, the expected group mean for baseline homophily would be one smoking friend out of five, whereas anything over one would indicate inbreeding homophily.

A recent study of adult smokers conducted by Christakis and Fowler (2008) in the United States found evidence of inbreeding homophily among smokers using a unique dataset from the Framingham Heart Study. They used data on smoking behaviour of the Framingham community and the social connections they had with each other over 32 years (1971 to 2003). Using social networking methods, they observed that smokers who continued to smoke for the 32 year period had more social connections to other smokers (friends, spouses, co-workers), and that smokers who continued to smoke tended to move to the periphery of social networks over time, becoming increasingly isolated from non-smokers. Although Christakis and Fowler (2008) have been heavily criticized for concluding that their study

showed that individual smoking behaviour could be influenced and could influence the smoking behaviour of others in a social network (Cohen-Cole & Fletcher, 2008; Shalizi & Thomas, 2011), the study does demonstrate that over the 32 year period, people who continued to smoke had more social contacts with smokers compared to people who did not smoke.

Very few population studies have examined the relation between number of smoking friends and adult smoking status. However, one study of women in five European countries found a relation between number of smoking friends and smoking status, such that women who currently smoked had more smoking friends than former and never smokers (Li et al., 2010; Oh et al., 2010). Another cross-sectional study of a national sample of smokers in Australia found that smokers who had quit in the last two years reported having fewer smoking friends than those who were currently smoking (Siahpush, Borland, & Scollo, 2003).

### **2.1.2 The relation between number of smoking friends and adult smoking cessation outcomes: Longitudinal studies among adults**

Most studies that have examined the relation between smoking status and number of smoking friends have focused on adolescents. A 2010 review on the relation between peer smoking and adolescent smoking reported consistent evidence of a positive association between adolescent and peer group smoking, stating that both socialisation (influence of peer group smoking on smoking status of individuals) and selection (selecting or de-selecting friends by smoking status) contributed to the association, with both reviews adding that peer selection seemed to contribute more (Seo & Huang, 2012; Simons-Morton & Farhat, 2010). Very few studies have investigated the relation between number of smoking friends on smoking cessation outcomes in adults, and the few that have, have generally not examined it as a focal predictor variable. Longitudinal studies that have investigated the relation between number of smoking friends and smoking cessation outcomes are summarized below. Compared to the literature on smoking friends and adolescent smoking behaviour, the literature on smoking friends and

adult smoking behaviour is underdeveloped, with no formal synthesis or meta-analyses in the published literature.

Population studies have generally reported mixed results on the relation between number of smoking friends and adult smoking cessation outcomes. A longitudinal cohort sample of adult smokers from the state of Massachusetts in the United States found a bivariate relation between having a majority vs. minority of friends that smoke, such that, smokers with a majority of non-smoking friends were more likely to attempt to quit, and remain abstinent for three months (Biener et al., 2010). However, the relations were not significant in multivariate models. Another study using the same dataset did however find that having a majority of smoking friends predicted transitioning from lighter to heavier smoking among very light smokers over a four year period in a multivariate model (Levy, Biener, & Rigotti, 2009). Similar to the Biener et al., (2010) study, a study of Danish adults found that having fewer smoking friends significantly predicted being abstinent from smoking for one year or more 10 years later in a bivariate analysis, but not in the multivariate model (Osler & Prescott, 1998). A study using a subsample (n=289) of the International Tobacco Control Project Four Country Survey of smokers who were quit at baseline for less than 30 days, found that smokers who had more smoking friends were more likely to have relapsed from their quit attempt approximately 1 year later (Herd, Borland, & Hyland, 2009). Although there have been no systematic reviews of the effect of number of smoking friends on adult smoking cessation, a systematic review that combined adolescent and young adult data (12 - 23 years at baseline recruitment and 14 - 29 years old at follow-up), found that smokers with no smoking friends were more likely to have quit smoking (Cengelli, O'Loughlin, Lauzon, & Cornuz, 2011). Another study of young adults, found that smokers with more smoking friends were more likely to be heavier smokers five years later, and because they found a relation between having lower education and having more friends who smoke, proposed that number of smoking friends may explain the relation between education and smoking behaviour (Rose et al., 1996). It is difficult to compare the studies above because the

covariates included in the models varied, and the outcome measures are different. However, generally, there was a trend towards smokers with more smoking friends being less likely to quit smoking.

Longitudinal clinic-based cessation/intervention studies have also examined the relation between having more smoking friends and smoking cessation outcomes (Japuntich et al., 2011; Mermelstein, Cohen, Lichtenstein, Baer, & Kamarck, 1986; Richmond, Kehoe, & Webster, 1993). Overall, these studies suggest that having more smoking friends may increase the chance of lapses and relapse after quitting. Using a sample of smokers from a clinical trial of smoking cessation aids, Japuntich et al., (2011) found that having a higher proportion of smoking friends predicted lapses after a quit attempt (smoking a single cigarette after quitting); however, it was not related to initial attempts to quit smoking, transition to relapse, or abstinence at six months. Mermelstein et al., (1986) found that having more smoking friends significantly increased the chance of relapse from quitting at one year. Similarly, a review of factors associated with relapse in early studies of smoking cessation suggested that having other smokers in one's social network seemed to predict relapse among quitters (Curry & McBride, 1994).

In addition to the studies that have examined the effects of having smoking friends on adult smoking cessation outcomes, other longitudinal studies have investigated the effects of living with other smokers (Chandola, Head, & Bartley, 2004; Hyland et al., 2004; Hymowitz et al., 1997). Overall, these studies suggest that smokers who live with other smokers are less likely to successfully quit smoking. In a representative cohort sample of adults in Britain, Chandola et al., (2004) found that smokers who lived in a household with fewer smokers were more likely to be quit at follow-up for two years, with some evidence of clustering of quitting within households. In a longitudinal cohort study of adult smokers from 20 American and two Canadian cities (Community Intervention Trial for Smoking and Cessation, COMMIT), Hymowitz et al., (1997) found that smokers who did not live with other smokers at baseline were more likely to be abstinent for six months at follow-up five years later. However, Hyland et al., (2004) did not find that living with other vs. no smokers at baseline predicted being abstinent from smoking for six months in the 13 year follow-up of the COMMIT study (likely because smokers in the

household was measured 13 years before follow-up and the number of household smokers could have undergone significant change in those 13 years).

In a longitudinal internet panel study of smokers from five Western countries, Zhou et al., (2009) found no relation between making attempts to quit smoking and reporting that others often smoked in their presence, but did find that smokers who reported that others did not smoke in their presence were more likely to be successful in their attempts to quit (quit for three months).

The specific effect of having a smoking spouse has also been investigated. In the same population study of Danish adults discussed previously, Osler and Prescott (1998) found that having a non-smoking spouse was related to being abstinent for one year in the multivariate analysis (while controlling for smoking friends). A study by Homish and Leonard, (2005) also found some evidence of spousal influence on smoking status.

Qualitative studies of tobacco use in low socioeconomic contexts provide revealing accounts of how other people's smoking behaviour may affect the smoking behaviour of individuals. These studies emphasize that smoking behaviour is embedded in the social context, and note theorists that see smoking as a 'shared way of relating and acting in particular social contexts' (Hargreaves et al., 2010, p. 464; Stead, MacAskill, MacKintosh, Reece, & Eadie, 2001). Qualitative studies also find that smokers cite that other smokers in their social context are a barrier to quitting, and that a lack of other smokers in their social context provide them with motivation to quit (Hargreaves et al., 2010; Wiltshire, Bancroft, Amos, & Parry, 2001; Baha, 2010).

## ***2.2 Mechanisms***

This section begins with a discussion of the issue of causality when observing the relation between individual and group behaviour, and then goes on to discuss two selected mechanisms that may explain any relation between number of smoking friends and smoking cessation outcomes. Similar to

peer influences on adolescent smoking, there is no single theory on how smoking friends may influence smoking behaviour in adults (Pollard et al., 2010).

The two mechanisms that will be discussed below have been shown to be related to behaviour change and smoking cessation outcomes at different stages of the smoking cessation process: norms towards smoking, and cues to smoke.

### **2.2.1 A note on causality**

Because this dissertation examines the relation between an individual's smoking behaviour and the smoking behaviour of their friends, the issue of establishing causality when studying the relation between individual and group behaviour is discussed below. However, because it was not the objective of this dissertation to establish causality, but to determine the presence of the relation between number of smoking friends, changes in number of smoking friends, and smoking cessation outcomes, the issue of causality will be described below, but not dealt with in-depth.

Manski (1993, 1995) describes three possible effects that may lead to the observation of a relation between individual and group behaviour: endogenous, contextual, and/or correlated effects. These effects are discussed below in terms of how they may explain the relation between an individual's smoking behaviour and the smoking behaviour of their friends.

Manski (1993, 1995) explains that the relation between individual and group behaviour could be due to endogenous effects. Within endogenous effects, there are selection and socialization effects (Christakis & Fowler, 2008; Simons-Morton, 2007; Simons-Morton & Farhat, 2010). Selection refers to the idea that people select friends who are similar to themselves and de-select those who are different. For example, people may select and de-select friends whose smoking behaviour is similar to their own. It is also possible that smokers may select non-smokers as friends if they are trying to quit, and that smokers who do not intend to quit could de-select friends who are attempting to quit. Socialization refers to the idea that people influence their friends to engage in similar behaviour, i.e., a smoker may be induced to

quit because their friend quit. The problem of distinguishing between socialization and selection is often referred to as the endogeneity problem (Shalizi & Thomas, 2011).

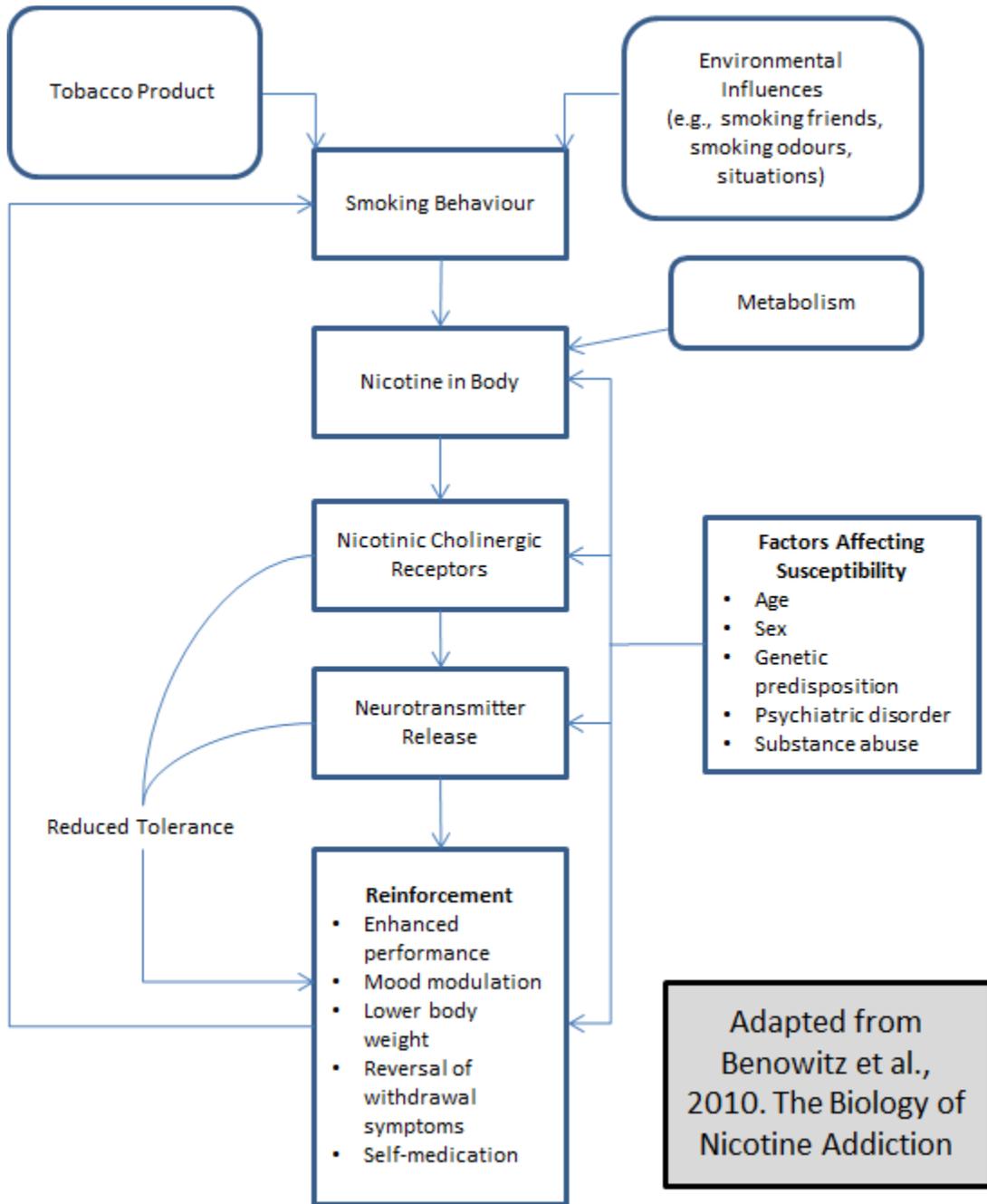
Contextual effects may also explain the relation between individual and group behaviour (Manski, 1993, 1995). Contextual effects refer to something in the social context that a person and their group are exposed to that may lead them to engage in similar behaviour. Contextual effects and endogenous effects both assume some sort of social phenomenon. For example, a relation between an individual's smoking behaviour and the behaviour of their friends may be observed because they are both exposed to the same tobacco control policies, i.e., free cessation aids, smoke-free policies.

Correlated effects assume that an individual and their social group engage in similar behaviours because they share other similar characteristics (Manski, 1993, 1995). For example, an individual and their friends may share genetic factors that make them more susceptible to smoking behaviour (Benowitz, 2010).

### **2.2.2 Smoking friends as cues to smoke**

Cravings/urges to smoke during a quit attempt predict relapse to smoking (Cummings, Jaén, & Giovino, 1985). Smokers are more likely to experience cravings to smoke in the presence of cigarettes, smoking odour, and other smoking related objects (e.g., ashtray)(Carter & Tiffany, 1999; Payne, Schare, Levis, & Colletti, 1991). Theories on the biology of nicotine addiction also state that aspects of the environment/situations where smoking normally occurs, including smoking friends, can become associated with smoking pleasures (i.e., conditioning occurs), and that these situations cue cravings to smoke, increasing the chance of relapse from a quit attempt, see **Figure 1** (Benowitz, 2010). Because smokers with more smoking friends may be surrounded by other smokers or smoking objects more often, and for longer periods of time, they may be more likely to continue smoking, or relapse from a quit attempt if they are cued to smoke by their social context. In contrast, smokers and quitters with fewer

smoking friends, and those who are able to avoid smoking friends/change their social context after they quit, may be less likely to continue smoking, and more likely to successfully quit.



**Figure 1:** The Biology of Nicotine Addiction

Because situations and fleeting environmental cues, such as an ashtray, or the odour of a friend's cigarette, can lead to urges to smoke, researchers have employed techniques to study whether smoking and relapse from quitting are more likely to occur in certain contexts. Ecological momentary assessment (EMA) allows the association between day-to-day momentary exposure to potential smoking cues and occurrences of smoking to be studied by taking measures in real-time (Shiffman, 2005). Subjects in EMA studies carry palmtop computers; subjects are asked to record the situations that specific events occur in (lapses to smoking or temptations to smoke), and they are also prompted by random and timed beeps to make entries about their current situation (if they are smoking, if others are smoking, emotional state, location, efficacy to stay quit if attempting to quit, etc.), (Shiffman, 2005). Studies using EMA have found that smokers smoke at a higher rate when they are around others who are smoking, and that smoking is suppressed when smokers are with others who are not smoking compared to when they are alone (Shiffman & Rathbun, 2011). Shiffman and Rathbun, 2011 also found that the presence of other smokers seemed to undermine effects of smoking restrictions on the rate of smoking. Other studies have also found that smoking, and lapse/relapse to smoking was likely to be preceded by the presence of others smoking (O'Connell, Shiffman, & Decarlo, 2011; Shiffman et al., 1996, 2002). In addition to other smokers acting as cues, Shiffman and Rathbun, 2011 theorized that the presence of others not smoking may create an implicit non-smoking norm, and suggested that it may be an important mechanism for how smoking prevalence and norms influence smoking behaviour. Another study noted that exposure to other smokers when quitting may be risky for relapse because not only do they cue smoking, but they also can provide a ready source of cigarettes (Shiffman, 1982). Researchers have also tried to study if the presence of other smokers is associated with relapse in population surveys. A longitudinal internet panel study of smokers in five Western countries from the ATTEMPT cohort study found that smokers who reported that others smoked around them (proposed measure for nicotine cues in the environment) were more likely to have relapse from a quit attempt (Zhou et al., 2009).

### **2.2.3 Smoking friends as a source of norms**

In everyday life, much of people's behaviour and their interactions with others are guided by the norms that they hold on how they should act. Whether it is to form a queue and wait, or deciding what utensil to eat with (or to use no utensil), the norms people hold operate as 'cultural phenomena that prescribe and proscribe behaviour in specific circumstances' (Hechter & Opp, 2001, p.11). And, although norms are not often formally defined or explicit, they can still regulate behaviour. Furthermore, the threat of sanctions for violations of norms can be very powerful even if punishments are not formal; indeed, the threat of an uncomfortable feeling of wrong doing or disapproval from close others can drive people to great lengths to conform (Cialdini & Goldstein, 2004).

Norms can come from several sources. Subjective norms are the beliefs that individuals hold about whether or not they think that the people who are important to them think that they ought or ought not to engage in a given behaviour. Social norms are the beliefs that individuals hold about whether or not they think society approves of a given behaviour. Labels given to types of norms sometimes differ, however the above labels for norms will be used within this dissertation.

Ajzen's Theory of Planned Behaviour predicts that a person's subjective norms towards a given behaviour will predict their intentions to engage in the behaviour (Ajzen, 1991). Meta-analyses of studies have shown that the Theory of Planned Behaviour predicts a variety of intentions and behaviours (Ajzen, 1991; Armitage & Conner, 2001; McEachan, Conner, Taylor, & Lawton, 2011). A person's number of smoking friends may also predict behaviour change if their number of smoking friends is related to their subjective norms towards smoking. Research does indeed suggest that smokers with fewer smoking friends may hold negative subjective norms towards smoking because they may have less contact with smokers and pro-smoking norms, and more contact with non-smokers and anti-smoking norms (Christakis & Fowler, 2009; Ellickson, 2001; Horne, 2001; Levine & Moreland, 1990; McPherson et al., 2001). And, one study found that smokers who had a lower number of smokers among their social contacts were more likely to hold negative subjective norms towards smoking (more likely to believe that

people who are important to them think they should not smoke) (van den Putte, Yzer, & Brunsting, 2005). If smokers with fewer smoking friends do indeed have more negative subjective norms towards smoking, they may come to believe that people think they 'ought' to quit smoking, and will be motivated to quit to align their behaviour with the subjective norms they hold. Indeed, two studies found that smokers who hold more negative subjective norms towards smoking are more likely to intend to quit (Hosking et al., 2009; Moan & Rise, 2005). In addition to the influence that a smoker's number of smoking friends may have on their subjective norms towards smoking, research suggests that *changes* in smoker's number of smoking friends (proportion of smoking and non-smoking friends) may lead to changes in their subjective norms (Levine & Moreland, 1990, 2006). For example, if a smoker's friends quit smoking, it is likely that the smoker's subjective norms towards smoking would become more negative, and increase their motivation to quit. Because smokers with more smoking friends may be more likely spend more time with other smokers, it may also be that any norms they hold towards smoking would be active/salient more often, and have more influence on their behaviour (Ajzen, 1991).

Although there is evidence to suggest that a person's number of smoking friends and changes in their number of smoking friends may be related to their subjective norms towards smoking, it is uncertain whether a smoker's number of smoking friends and changes in their number of smoking friends might be related to their social norms towards smoking. By definition, social norms are a person's perception of whether society approves of a given behaviour, rather than important others in people's lives.

Accordingly, research on the sources of social norms, and changes in social norms has generally focused on the influences of macro-level contextual factors, such as the implementation of smoke-free laws rather than a smoker's number of smoking friends (Brown, Moodie, & Hastings, 2009; Thrasher, Pérez-Hernández, Swayampakala, Arillo-Santillán, & Bottai, 2010). Thus, it is unlikely that social norms would explain any relation between number of smoking friends, changes in number of smoking friends, and smoking cessation outcomes.

Previous research suggests that norms, and other motivational variables (enjoyment of smoking, wanting to quit), affect attempts to quit smoking, but not the success of quit attempts (Borland et al., 2010; Smit, Fidler, & West, 2011; Vangeli et al., 2011). Thus, it is likely that any effect of number of smoking friends and changes in number of smoking friends exerted on norms will likely only affect smokers' intentions to quit and attempts to quit smoking, and not the success of quit attempts. Additionally, because it is important to distinguish between different types of norms, and because theory and research suggests that subjective norms motivate behaviour change (Ajzen, 1991), it is likely that any effect of smoking friends on smoking cessation outcomes would be exerted through norms would be exerted through subjective norms rather than social norms towards smoking.

#### **2.2.4 Other mechanisms**

There are other mechanisms that could lead to the relation between number of smoking friends, changes in number of smoking, and smoking cessation outcomes. A few of these mechanisms are mentioned below.

Smokers with fewer smoking friends may have more social support to quit smoking (Westmaas, Bontemps-Jones, & Bauer, 2010). A smoker's number of smoking friends may also be related to the amount and type of health information to which they have access to (Valente, 2011). Indeed, social network theories of health communication suggest that smokers' connections to smokers and non-smokers may determine the health information, such as the harms of smoking, cessation aids, etc., to which they have access (Valente, 2011). Smokers with more smoking friends may also have a stronger smoking identity and identify themselves more with smoking and smokers, and less with quitting and non-smokers. Indeed, one study found that smokers with more smoking friends had a more difficult time separating themselves from the 'smoker prototype' (Gibbons & Eggleston, 1996). A cross-sectional study of smokers in England (Fidler & West, 2009) found that smokers who said that liking being a smoker (measure of smoker identity) kept them smoking, were less likely to have made an attempt to quit

in the past year. Research and theory also suggest that social/self-identity can predict intentions and behaviour (Moan & Rise, 2005; Terry, Hogg, & White, 2000, 1999; West, 2006, 2009).

### **2.2.5 Mechanisms: Summary**

In summary, a smoker's number of smoking friends may influence smoking cessation through a number of mechanisms, and it is likely that each of these mechanisms affects a different stage of the smoking cessation process. Any influence of number of smoking friends on norms towards smoking would most likely affect smokers' motivations to intend to quit and attempts to quit. Moreover, if smokers do indeed act as cues to smoke, it is likely that any effect of a smoker's number of smoking friends on cues to smoke would be related to the quit attempt success/relapse. Thus, it is possible that a smoker's number of smoking friends and changes in their number of smoking friends over time would be related to quit intentions, quit attempts, and quit success, albeit through different mechanisms.

## **2.3 Summary**

Overall, the research on the relation between number of smoking friends and smoking cessation outcomes is still unclear. The current evidence seems to point to at least a bivariate relation between having fewer smoking friends and being more likely to successfully quit, with some evidence of a relation in multivariate models. Additionally, previous research has only considered the relation between number of smoking friends at baseline and subsequent smoking cessation; no studies to date have examined how changes in smokers' number of smoking friends over time may be related to intentions to quit, quit attempts, and quit success.

There are also several gaps in the research. No studies have empirically examined the mechanisms that may explain/mediate the relation between changes in number of smoking friends and smoking cessation outcomes. Additionally, relatively little is known about the average number of smoking friends that adult smokers have, and how their number of smoking friends may change over time, and how this may vary by demographic group and smoking behaviour. If a smoker's number of

smoking friends does indeed have an effect on smoking cessation outcomes, identifying the demographic groups of smokers that are most impacted by this social contextual factor will be important.

To address the above, this dissertation will investigate the relation between number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes. This dissertation will also attempt to address identified gaps in the research. Data for this dissertation will be drawn from Wave 1 and Wave 2 of the International Tobacco Control Policy Evaluation Project Four Country Survey (ITC Four Country Survey). The ITC Four Country Survey is a random-digit dial parallel prospective longitudinal cohort survey of nationally representative samples of smokers in Australia, Canada, the United Kingdom, and the United States. Wave 1 of the survey was conducted between October and December 2002. Wave 2 of the survey was conducted between May and September 2003. The mean amount of time between the two surveys was 6.7 months.

## 3.0 Research Objectives, Questions, and Hypotheses

### 3.1 *Research objectives*

The primary objectives of this dissertation are to:

1. Examine whether smokers report a greater number of smoking friends than chance would predict.
2. Examine whether smokers' number of smoking friends and changes in their number of smoking friends over time is related to demographic characteristics and variables that have been shown to predict smoking cessation outcomes.
3. Examine whether smokers' number of smoking friends and changes in their number of smoking friends over time is related to smoking cessation outcomes, including: intentions to quit smoking, attempts to quit smoking, quitting, and success of a quit attempt.
  - a. Determine whether adding number of smoking friends and changes in number of smoking friends over time to base models predicting smoking cessation outcomes significantly improves the base models.
4. Examine one mechanism that may explain the relation between changes in number of smoking over time and smoking cessation outcomes: examine whether the relation between changes in number of smoking friends, and smoking cessation outcomes may be mediated by changes in smokers' norms towards smoking.

### ***3.2 Research questions***

For consistency, the research questions will be examined in the order given below throughout this dissertation (description of analyses, results, and discussion). Using data from Wave 1 and Wave 2 of the ITC Four Country Surveys conducted in Australia, Canada, the United Kingdom, and the United States, this dissertation will investigate the following questions:

**1) Number of smoking friends and smoking prevalence:**

- a) Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence across the four countries?
- b) Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence within demographic groups (age, sex, and education) across the four countries?

**2) Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables:**

- a) What are the demographic characteristics and smoking cessation predictor variables (variables that have been shown to predict smoking cessation outcomes) at Wave 1 that are related to number of smoking friends at Wave 1?
  - i) Secondary objective: Do correlates of number of smoking friends at Wave 1 differ by demographics across countries (age, sex, and education)?
- b) What are the demographic characteristics, and smoking cessation predictor variables at Wave 1 that are related to reporting changes in number of smoking friends between Wave 1 and Wave 2?
  - i) Secondary objective: Do correlates of changes in number of smoking friends between Wave 1 and Wave 2 differ by demographics across countries (age, sex, and education)?

**3) Number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes:**

- a) Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 1?
- b) Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 2?
- c) Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and intentions to quit smoking at Wave 2?
- d) Is there a relation between number of smoking friends at Wave 1, and attempts to quit smoking between Wave 1 and Wave 2?
- e) Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and attempts to quit smoking between Wave 1 and Wave 2?
- f) Is there a relation between number of smoking friends at Wave 1 and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?
- g) Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?
- i) Secondary objective: Does any relation between number of smoking friends at Wave 1, or changes in number of smoking friends between Wave 1 and Wave 2, and smoking cessation outcomes differ by country, demographics (age, sex, and education), or smoking behaviour (intentions to quit smoking at Wave 1, and heaviness of smoking index)?
- h) Does adding number of smoking friends at Wave 1, and/or changes in number of smoking friends between Wave 1 and Wave 2 improve the base model to predict smoking cessation outcomes?

**4) Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by changes in norms:**

- a) Do changes in subjective norms between Wave 1 and Wave 2 mediate the relation between change in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?
- b) Do changes in social norms between Wave 1 and Wave 2 mediate the relation between change in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?

### ***3.3 Research hypotheses***

#### **3.3.1 Number of smoking friends and smoking prevalence**

##### **1) Number of smoking friends and smoking prevalence:**

- a) *Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence across the four countries?*

Across the four countries, smokers are expected to report a greater number of smoking friends than would be expected by chance based on smoking prevalence. This is expected because previous research in adolescents and adults suggests that smokers are more likely to be friends with other smokers (see Section 2.1.2). Research on stigmatization of smokers also suggests that non-smokers may choose to avoid smokers, making friendship between smokers and non-smokers unlikely (Goffman, 1963; Levine & Moreland, 1990, 2006; Stuber, Galea, & Link, 2008).

- b) *Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence within demographic groups (age, sex, and education) across the four countries?*

Within countries, smokers are expected to report a greater number of smoking friends than would be expected by chance based on smoking prevalence across all demographic groups (age, sex, and education).

### **3.3.2 Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables**

#### **2) Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables:**

*a) What are the demographic characteristics and smoking cessation predictor variables at Wave 1 that are related to number of smoking friends at Wave 1?*

For demographic characteristics, it is expected that smokers from demographic groups with higher smoking prevalence will report more smoking friends because people are generally friends with people from similar demographic groups (Blieszner & Adams, 1992; McPherson et al., 2001). Thus, smokers from groups with higher smoking prevalence (younger smokers, smokers with low education, and smokers with lower incomes) may have a higher chance of forming friendships with smokers. For smoking cessation predictor variables, it is expected that the smoking cessation predictor variables that are related to a lower likelihood of quitting will be related to having more smoking friends because having more smoking friends may be related to a lower likelihood of quitting (as predicted in this dissertation). Thus, based on previous research on predictors of smoking cessation outcomes it is expected that smokers with no intention to quit, who have not made an attempt to quit in the previous year, who are heavier smokers, who report a shorter time ever off smoking, and who worry less about the future health damages of smoking will be more likely to report a higher number of smoking friends (Hyland et al., 2006).

*i) Secondary objective: Do correlates of number of smoking friends at Wave1 differ across countries by demographics (age, sex, and education)?*

Demographic differences in the correlates of number of smoking friends at Wave 1 across countries were not expected. Country differences were not expected because smoking prevalence is generally similar across the four countries, and smoking prevalence was expected to be related to number of smoking friends at Wave 1.

- b) *What are the demographic characteristics, and smoking cessation predictor variables at Wave 1 that are related to changes in number of smoking friends between Wave 1 and Wave 2?*

Smokers from demographic groups with higher rates of smoking cessation and lower smoking prevalence are expected to report a greater likelihood of losing smoking friends, whereas smokers belonging to demographic groups with lower rates of smoking cessation and higher smoking prevalence are expected to report a greater likelihood of gaining smoking friends (or, no change in number of smoking friends). Thus, smokers with lower education, lower income, and who are younger are expected to be more likely to gain smoking friends, and less likely to lose smoking friends over time (Caleyachetty, Lewis, McNeill, & Leonardi-Bee, 2012; Jarvis & Wardle, 2006; Kotz & West, 2009; Shields, 2005). This is expected because people are generally friends with people who come from similar demographic groups, and the smoking prevalence/cessation rate of their demographic group may be reflected in changes in their number of smoking friends (Blieszner & Adams, 1992; McPherson et al., 2001). There are no strong hypotheses regarding the smoking cessation predictor variables that will be related to changes in number of smoking friends. There is currently a lack of research in this area. However, it is expected that if smoking cessation predictor variables are related to changes in number of smoking friends, that the relation will be in the direction such that characteristics that predict quit intentions, quit attempts and quitting smoking will predict losing smoking friends over time. Thus, for example, lighter smokers (those with lower nicotine dependence) would be expected to be more likely to lose smoking friends.

- i) *Secondary objective: Do correlates of changes in number of smoking friends between Wave 1 and Wave 2 differ by demographics across countries (age, sex, and education)?*

Demographic differences in the correlates of changes in number of smoking friends across countries were not expected because smoking prevalence and cessation rates across demographic groups are generally similar across the four countries.

### 3.3.3 Number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes

#### 3) Number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes:

- a) *Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 1?*
- b) *Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 2?*
- c) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and intentions to quit smoking at Wave 2?*
- d) *Is there a relation between number of smoking friends at Wave 1, and attempts to quit smoking between Wave 1 and Wave 2?*
- e) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and attempts to quit smoking between Wave 1 and Wave 2?*
- f) *Is there a relation between number of smoking friends at Wave 1 and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?*
- g) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?*

Overall, number of smoking friends at Wave 1 and changes in number of smoking friends between Wave 1 and Wave 2 are expected to predict smoking cessation outcomes.

Smokers with fewer smoking friends at Wave 1 are expected to be *more* likely to:

- Have intentions to quit at Wave 1
- Have intentions to quit at Wave 2

- Report that they made an attempt to quit between Wave 1 and Wave 2 at Wave 2
- Report being abstinent from smoking for at least one month at Wave 2 (among everyone, and among smokers who made an attempt to quit)

Smokers who lose smoking friends between Wave 1 and Wave 2 (compared to those who experience no change) are expected to be *more* likely to:

- Have intentions to quit at Wave 2
- Report that they made an attempt to quit between Wave 1 and Wave 2 at Wave 2
- Report being abstinent from smoking for at least one month at Wave 2 (among everyone, and among smokers who made an attempt to quit)

Smokers who gain smoking friends between Wave 1 and Wave 2 (compared to those who experience no change) are expected to be *less* likely to:

- Have intentions to quit at Wave 2
- Report that they made an attempt to quit between Wave 1 and Wave 2 at Wave 2
- Report being abstinent from smoking for at least one month at Wave 2 (among everyone, and among smokers who made an attempt to quit)

The above results were expected based on: (1) previous research on the relation between number of smoking friends and smoking cessation outcomes in adults (see Section 2.1.2), and (2) several mechanisms that may lead to a relation between number of smoking friends, change in number of smoking friends, and smoking cessation outcomes (see Section 2.2). All stages of the smoking cessation process are predicted to be related to number of smoking friends and changes in number of smoking friends because the mechanisms proposed in Section 2.2 may affect different stages of the process (i.e., norms may affect intentions and attempts, and smoking friends as cues to smoke may affect the success of quit attempts). However, because previous research shows that only a very narrow range of variables consistently predict the success of quit attempts, it is expected that the relation between number of smoking friends at Wave 1 and changes in number of smoking friends between Wave 1 and Wave 2, and

smoking cessation outcomes will be weakest for abstinence from smoking for at least one month among smokers who attempted to quit.

Changes in number of smoking friends between Wave 1 and Wave 2 is expected to be a stronger predictor of smoking cessation outcomes than number of smoking friends at Wave 1. Changes in number of smoking friends is expected to be a stronger predictor because research and theory on health behaviour and quitting suggests that it is changes/dynamic factors in the environment that motivate behavioural change (losing smoking friends), and at times, lead to failure to maintain new behaviours, i.e., relapse (Larabie, 2005; Shiffman, 2005; West, 2006). Dynamic factors may include exposure to ‘affective or situational stimuli’ that trigger cravings to smoke during a quit attempt, sometimes leading to a lapse back to smoking and potential relapse (Shiffman, 2005).

- i) *Secondary objective: Does any relation between number of smoking friends at Wave 1 or changes in number of smoking friends between Wave 1 and Wave 2 on smoking cessation outcomes differ by country, demographics (age, sex, and education), or smoking behaviour (intentions to quit smoking at Wave 1, and heaviness of smoking index)?*

*Country differences.* No differences were expected in the relation between number of smoking friends at Wave 1, changes in number of smoking friends between Wave 1 and Wave 2, and smoking cessation outcomes across countries.

*Demographic differences.* There were no strong hypotheses regarding demographic differences in the relation between number of smoking friends, changes in number of smoking friends, and smoking cessation outcomes. However, differences were tested based on previous research findings that suggest that the social context may have a stronger impact on the smoking behaviour of different demographic groups. The demographic differences that might be found are discussed below:

- *Age.* The relation may be stronger for younger smokers because socializing and peer interactions may be more important motivators for smoking and non-smoking behaviour (Fidler & West, 2009).
- *Sex.* The relation may be stronger for women because they may be more likely to smoke for social reasons and may be more sensitive to social pressure to quit. Homish and Leonard, (2005) did indeed find that women's smoking behaviour compared to men's smoking behaviour was more influenced by having a smoking spouse, and another study found that women's intentions to quit compared to men's intention's to quit were more influenced by subjective norms (Dohnke, Weiss-Gerlach, & Spies, 2011). Additionally, studies among adolescents have found that girls' smoking habits are more influenced by their friends than boys' smoking habits (Griffin, Botvin, Doyle, Diaz, & Epstein, 1999; Mercken et al., 2010). However, one study found the opposite, that men were more likely to be influenced than women by social pressure to quit (Westmaas, Wild, & Ferrence, 2002).
- *Education.* The relation may be stronger for smokers with low education because they may be more likely to deeply construe themselves within their social networks; social class has been shown to be related to how people construe themselves with their close others, such that, the 'working class' are more likely to be interdependent (inserted densely in structured social networks) compared to the middle class (Stephens, Markus, & Townsend, 2007). Thus, smokers with low education may be more likely to be influenced by their friends' smoking because they tend to be more deeply connected to their social networks. Additionally, other research has shown that people with higher education are more likely to be 'social entrepreneurs,' i.e., the first ones in their group to change their behaviour (Ellickson, 2001); thus, smokers

with higher education may be more likely to quit than smokers with low education even if they have a high number of smoking friends.

*Smoking behaviour differences (intentions to quit smoking and heaviness of smoking index).* Differences by smoking behaviour might emerge because a smoker's number of smoking friends and changes in their number of smoking friends may only have an effect on smoking cessation outcomes to the extent that smokers have intentions to quit, and are lighter smokers (have lower nicotine dependence and more volitional control over their smoking behaviour) (Ajzen, 1991).

*h) Does adding number of smoking friends at Wave 1, and changes in number of smoking friends between Wave 1 and Wave 2 improve the base models that were used to predict smoking cessation outcomes (intentions to quit, quit attempts, and abstinence – among everyone and among smokers who attempted to quit)?*

Adding number of smoking friends at Wave 1 to the base models predicting smoking cessation outcomes is expected to significantly improve the base models used for predicting smoking cessation outcomes. Adding changes in number of smoking friends to the base models predicting smoking cessation outcomes is also expected to significantly improve the base models predicting smoking cessation outcomes. However, improvements to the base models are expected to be greatest for adding changes in number of smoking friends.

### **3.3.4 Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by changes in norms**

**4) Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by changes in norms:**

a) *Do changes in subjective norms between Wave 1 and Wave 2 mediate the relation between changes in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?*

Changes in subjective norms are expected to mediate the relation between changes in number of smoking friends and intentions to quit at Wave 2, and attempts to quit smoking at Wave 2 because (1) changes in number of smoking friends are expected to be related to changes in subjective norms, and (2) theories of behaviour change suggest that subjective norms influence intentions and motivate behavioural change (see Section 2.2.3). Changes in subjective norms are not expected to mediate the relation between changes in number of smoking friends and abstinence from smoking because research suggests that motivational factors (i.e., norms) predict attempts to quit, but not the success of quit attempts (abstinence) (Borland et al., 2010; Vangeli et al., 2011).

b) *Do changes in social norms between Wave 1 and Wave 2 mediate the relation between change in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?*

Changes in social norms are not expected to mediate the relation between changes in number of smoking friends and smoking cessation outcomes because changes in number of smoking friends are not expected to be related to changes in social norms (see Section 2.2.3). Additionally, sanctions for violations of social norms (i.e., smoking) may not be felt as strongly when they come from society at large (social norms) compared to important people in smokers' lives (subjective norms) (Cialdini & Trost, 1998).

## **4.0 Methods**

### ***4.1 The International Tobacco Control Policy Evaluation Four Country Project (ITC Four Country Survey)***

#### **4.1.1 The ITC four country survey and the ITC project**

The ITC Four Country Survey is a nationally representative random-digit dial (RDD) longitudinal cohort survey of adult smokers in Australia, the United Kingdom, Canada, and the United States that began with Wave 1 in 2002. The ITC Four Country Survey is designed to evaluate the psychosocial and behavioural impact of the policies of the Framework Convention on Tobacco Control. The ITC Four Country Survey is part of the wider International Tobacco Control Policy Evaluation Project (ITC) that consists of parallel cohort surveys of smokers and non-smokers in 20 countries.

The main sections of the ITC Project Surveys contain measures related to: smoking behaviour, knowledge of the health effects of smoking, cigarette warning labels, tobacco advertising and promotion, anti-tobacco campaigns, price and taxation of tobacco products, nicotine replacement therapy (NRT)/cessation, smoking restrictions/secondhand smoke, psychosocial questions (beliefs about smoking, perceived risk and health worry), measures of individual differences (e.g., number of five closest friends who smoke), and questions regarding demographics. Further details on the ITC Project are available elsewhere, including the survey questionnaires (Fong et al., 2006; ITC Project, 2012).

#### **4.1.2 Respondents**

*Respondents.* Respondents were drawn from Wave 1 and Wave 2 of the ITC Four Country Survey. Wave 1 was conducted between October and December of 2002, and Wave 2 was conducted between May and September of 2003. There was a mean of 6.7 months between the two surveys. Two samples of respondents from the ITC Four Country Survey were used in this dissertation: the cross-

sectional sample of all current smokers at Wave 1 (N=8,930), and the Wave 1 – Wave 2 longitudinal sample (N=6,682) of respondents who were current smokers at Wave 1 and who were followed-up with, and successfully completed the survey at Wave 2. Current smoking was defined as having smoked at least 100 cigarettes in their lifetime and having smoked at least once in the last 30 days. There has been some controversy as to whether the definition of a current smoker should require 100 lifetime cigarettes; however, for self-report population health surveys of adults the measure is considered to have ‘pragmatic utility’ (Bondy, Victor, & Diemert, 2009). Respondents with missing data or ‘don’t know’ responses on key variables were assigned missing values and not included in the final analyses of this dissertation. However, for variables where a large number of ‘don’t know’/no answer responses were given these responses were retained (i.e., quit intentions and household income). For the cross-sectional sample, 118 cases were deleted due to missing data. For the longitudinal sample, 361 cases were deleted due to missing data. Final sample sizes for this dissertation were (N= 8,812) for the cross-sectional Wave 1 sample, and (N=6,321) for the Wave 1 – Wave 2 longitudinal sample.

### **4.1.3 Survey protocol**

*Survey.* Surveys were conducted using Computer Assisted Telephone Interviewing (CATI). Respondents were recruited into the Wave 1 main survey with a 10-minute phone call. Respondents who agreed to participate were then re-contacted to complete the Wave 1 main survey. Table 1 presents the statistics on the recruitment survey and Table 2 presents statistics on the Wave 1 main survey (Thompson et al., 2006). Response rates were calculated using American Association for Public Opinion Research Response Rate #4 (AAPOR#4) (Council of American Survey Research Organizations, 1982; ITC Project, 2004). Survey compensation was \$15AUD, \$15CDN, \$10USD, or a £7 voucher for Boots<sup>2</sup> (compensation amounts were standardized across countries). Compensation for the survey was mailed to respondents after the recruitment survey (before they completed the main survey).

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<sup>2</sup> Boots is a health and beauty shop (drugstore) in the United Kingdom.

**Table 1:** Wave 1 Recruitment Survey Rates

	Australia	Canada	United Kingdom	United States
Number recruited	2,566	2,507	2,730	2,500
Cooperation rate	78.8%	82.3%	78.7%	83.2%
Response rate AAPOR#4	45.8%	49.5%	37.8%	25.6%
Mean survey length (min)	9.1	11.8	10.3	13.2

**Table 2:** Wave 1 Main Survey Statistics

<i>Wave 1 Main Survey Statistics</i>				
	Australia	Canada	United Kingdom	United States
No. from recruitment survey	2,566	2,507	2,730	2,500
Refused	3.7%	4.5%	6.5%	4.7%
Non-contact	6.5%	7.3%	5.6%	9.8%
Follow-up rate	89.8%	88.2%	87.9%	85.5%
Number of completed interviews	2,305	2,214	2,401	2,138
Mean survey length (min)	38.7	43.4	38.6	44.6

*Wave 1 – Wave 2 retention rates.* The Wave 1 – Wave 2 follow-up completion rates were 81% in Australia, 76% in Canada, 78% in the United Kingdom, and 63% in the United States.

*Sampling.* The ITC Four Country Survey uses random-digit dialling to select respondents within strata from the population of each country. The Next Birthday Method was used to select respondents from households with more than one smoker (Binson, Canchola, & Catania, 2000).

*Survey weights.* The ITC Four Country Survey was designed to be nationally representative of the population of smokers in each of the four countries. Survey weights were computed using estimated population values from national benchmark surveys. Survey weights incorporated gender, age, and region. All analyses in this dissertation were weighted unless otherwise stated. Frequencies presented in tables were unweighted unless otherwise stated. The analyses that used the Wave 1 cross-sectional sample used the rescaled Wave 1 cross-sectional weights, and the analyses that used the Wave 1 – Wave 2 sample used the rescaled Wave 1 – Wave 2 longitudinal weights that adjusted for attrition.

Further details on ITC Four Country Survey methodology (including technical reports on weight construction and attrition) and the conceptual framework of the survey are available elsewhere (Fong et al., 2006; ITC Project, 2004, 2011; Thompson et al., 2006).

## ***4.3 Measures***

### **4.3.1 Key predictor variables**

*Number of smoking friends at Wave 1 and Wave 2.* Number of smoking friends was measured at Wave 1 and Wave 2. Respondents were asked: Of the five closest friends or acquaintances that you spend time with on a regular basis, how many of them are smokers (0, 1, 2, 3, 4, or 5)? Number of smoking friends was treated as a categorical variable unless otherwise noted. ‘Number of five closest friends who smoke’ is a common measure in the adolescent smoking literature (Kobus, 2003) and it has been used in some studies of adult smoking (Biener et al., 2010). A version of the measure seems to have first emerged in the literature when researchers began to study the observation that adolescents who smoked tended to belong to similar groups (Palmer, 1970).

A study by Thrasher et al. (2011) conducted cognitive testing on the measure used in this dissertation (i.e., the measure of five closest friends from the ITC Four Country Survey). The measure was tested among samples of 20 adult smokers from six countries of the ITC Project, including Australia and the United States (two of the countries included in this dissertation). The testing in Australia and the United States indicated that about 50% of respondents included family members in their response (family members included in five closest friends or acquaintances). The testing also indicated that respondents had spent time with approximately 77% of the people they thought about when answering the question about their five closest friends at least once a week. Cross-country comparisons indicated that the measure was reasonably valid across the 6 countries. To summarize, the cognitive testing suggested that respondents likely thought about important people in their lives whom they spent time with on a

weekly/regular basis when answering the question, and thus, the validity of the measure was quite high by this standard.

The use of a base of 5 close friends/acquaintances for this measure may be questionable. However, using a base of 5 close friends seems appropriate because research from the United States suggests that adults have between 3.0 and 7.8 close friends, and that older adults have an average of 6 friends in their networks (Blieszner & Adams, 1992). Furthermore, because the measure also asked about acquaintances it is likely that most respondents would have had a base of at least five close friends or acquaintances to include in their response.

*Change in number of smoking friends between Wave 1 and Wave 2 (friend change).* Friend change was calculated as the difference between number of smoking friends reported at Wave 1 and number of smoking friends reported at Wave 2. Three different variables to represent friend change were then categorized (see Table 3): a ‘non-collapsed’ categorical variable, a ‘collapsed’ categorical variable, and a dichotomized variable. The non-collapsed version ranged from a loss of 5 friends to no change to a gain of 5 friends, and was used to examine different degrees of friend change. The collapsed version of the variable (no change vs. loss vs. gain) was used to simplify the presentation of the results, and aid the interpretability of results where friend change was set as the dependent variable. The dichotomized version of friend change (loss vs. gain/no change) was used in the analyses that tested whether subjective norms and social norms mediated the relation between friend change and smoking cessation outcomes. The dichotomized friend change variable combined gain in smoking friends and no change in smoking friends into one category based on results that showed losses in smoking friends were more consistently related to smoking cessation outcomes than gains (compared to no change).

**Table 3:** Variables to Represent Change in Number of Smoking Friends Between Wave 1 and Wave 2

Change in Number of Smoking Friends Between Wave 1 and Wave 2	Non-Collapsed Friend Change	Collapsed Friend Change	Dichotomized Friend Change
Loss of 5	-5	-1	0
Loss of 4	-4		
Loss of 3	-3		
Loss of 2	-2		
Loss of 1	-1		
No Change	0	0	1
Gain of 1	1	1	
Gain of 2	2		
Gain of 3	3		
Gain of 4	4		
Gain of 5	5		

### 4.3.2 Smoking cessation outcome variables

*Intentions to quit smoking (at Wave 1 for current smokers and at Wave 2 for continuing smokers).*

Smokers were asked: Are you planning to quit smoking (in next month, in next six months, beyond six months, or are you not planning to quit)? Intention to quit was coded as: intention to quit within the next six months vs. otherwise. This coding of quit intentions was used based on research by (DiClemente et al., 1991). DiClemente et al., (1991) showed that smokers who were considering quitting in the next 30 days (preparing to quit) or the next six months (contemplating quitting) were more likely to engage in quit related behaviours in the following six months compared to smokers who were not seriously considering quitting in the next six months (pre-contemplation stage of quitting). Intentions to quit smoking was chosen as an outcome variable because intentions have been shown to be a consistent predictor of making attempts to quit smoking (Hyland et al., 2006; Vangeli et al., 2011).

*Quit attempts at Wave 2.* At Wave 2, respondents were asked: Have you made any attempts to stop smoking since (last survey date time)? Quit attempts between Wave 1 and Wave 2 were categorised as made an attempt to quit vs. no attempt to quit.

*Abstinence from smoking for at least one month at Wave 2.* Based on smoking status at Wave 2, smokers were defined as abstinent from smoking for at least one month vs. otherwise at Wave 2, i.e., at Wave 2 their smoking status was quit for one month or more. Abstinent for at least one month was chosen as the outcome because smokers would no longer meet a common definition of a smoker (Mills, Stephens, & Wilkins, 1994). Additionally, because there was only an average of 6.7 months between Wave 1 and Wave 2, it would have been difficult to set the abstinence outcome for a longer period (i.e., 6 months).

### **4.3.3 Demographics at Wave 1**

*Country, sex, and age group.* The four countries included in the analyses were: Australia, Canada, United Kingdom, or the United States. Sex was categorized as: female or male. Age group was categorized as: 18-24, 25-39, 40-54, or 55 years or more.

*Ethnicity.* Ethnicity was defined as white (majority group) vs. non-white (minority group) in Canada, the United Kingdom, and the United States. In Australia, ethnicity was defined as English language spoken in the home (majority group) vs. language other than English spoken in the home (minority group). These categorizations were used based on methods for categorizing ethnicity in each country's census.

*Education.* Education was measured as highest level of education achieved. Education was categorized as: low=high school or less; medium=technical, trade school, or community college (some or completed), or some university; and high=at least a university degree.

*Annual household income.* Household income was categorized as low, moderate, or high. For respondents in the USA, Canada, and Australia annual household income was categorized as: low = under

\$30,000, moderate = \$30,000-\$59,999, and high = \$60,000 or higher. For respondents in the UK, income was categorized as: low = under £30,000, moderate = £30,000-£44,999, and high = £45,000 or higher.

*Employment outside the home.* Respondents were asked if they were currently employed outside the home. Response options were yes vs. no.

#### **4.3.4 Smoking cessation predictor variables at Wave 1**

The smoking cessation predictor variables that were included as covariates in the base models were chosen based on the findings of a study conducted by Hyland et al., (2006). Hyland et al., (2006) examined predictors of quit attempts and quitting using data from Waves 1 and 2 of the ITC Four Country Survey (the same data and waves that were used in this dissertation).

*Smoking status for current smokers.* Smoking status was derived from a series of questions that asked respondents about their current smoking behaviour. Smoking status was categorised as daily smoker vs. otherwise (weekly or monthly).

*Heaviness of Smoking Index (HSI).* HSI is a composite measure of nicotine dependence, consisting of cigarettes per day (0-10, 11-20, 21-30, or >30), and minutes to first cigarette after waking (<5, 6-30, 31-60, or >60) with values ranging from 0 to 6 (Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989). HSI was treated as a continuous variable in all regression analyses.

*Quit attempt in last year.* Quit attempt in last year was treated as a binary variable (yes vs. no).

*Intentions to quit smoking at Wave 1.* Intentions to quit was included as a smoking cessation predictor variable to predict smoking cessation outcomes at Wave 2, in addition to being treated as a dependent variable in cross-sectional analyses. Smokers were asked: Are you planning to quit smoking (in next month, in next six months, beyond six months, not planning to quit)? Intentions to quit was coded as: intention to quit within the next six months vs. otherwise.

*Longest quit attempt.* Longest quit attempt ever/longest time off smoking was categorised as: never, one week or less, more than one week but less than six months, or six months or more.

*Outcome expectancy of quitting.* Respondents were asked: How much do you think you would benefit from health and other gains if you were to quit smoking permanently in the next six months...not at all, slightly, moderately, very much, or extremely? Outcome expectancy of quitting was treated as a continuous variable in all analyses.

*Worried smoking will damage health.* Respondents were asked: How worried are you, if at all, that smoking will damage your health in the future...not at all worried, a little worried, moderately worried, or very worried? Worried about the health damages of smoking was treated as a continuous variable in all analyses.

#### **4.3.5 Norms: Subjective and social norms**

*Subjective norms at Wave 1.* Respondents were asked: Please tell me whether you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree that people who are important to you believe that you should not smoke. Subjective norms at Wave 1 was treated as a continuous variable in all regression analyses.

*Change in subjective norms between Wave 1 and Wave 2.* Change in subjective norms between Wave 1 and Wave 2 was calculated similarly to the dichotomized friend change variable (see Table 3). A subjective norm change variable was created where 0 = no change in subjective norms towards smoking, 1 = increase in positive subjective norms towards smoking (decrease in agreement that people who are important to you think that you should not smoke), and -1 = decrease in positive social norms towards smoking (increase in agreement that people who are important to you believe that you should not smoke.). This variable was then dichotomized (no change or gain in positive subjective norms towards smoking vs. loss in positive subjective norms towards smoking).

*Social norms at Wave 1.* Respondents were asked: Please tell me whether you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree that society disapproves of smoking. Social norms was treated as a continuous variable in all regression analyses.

*Change in social norms between Wave 1 and Wave 2.* Change in social norms between Wave 1 and Wave 2 was calculated similarly to the dichotomized friend change variable (see Table 3). A social norm change variable was created where 0 = no change in social norms towards smoking, 1 = increase in positive social norms towards smoking (decrease in agreement that society disapproves of smoking), and -1 = decrease in positive social norms towards smoking (increase in agreement that society disapproves of smoking). This variable was then dichotomized (no change or gain in positive social norms towards smoking vs. loss in positive social norms towards smoking).

## 5.0 Description of Analyses

All analyses were conducted using SAS version 9.2. All analyses were weighted unless otherwise noted. Sample frequencies presented in all tables are unweighted unless otherwise noted.

### 5.1 Characteristics of the sample

The results of these analyses are presented in Section 6.1. This section describes the analyses that were conducted to examine the characteristics of the sample.

*Respondents.* Two samples of respondents were used in this dissertation: the Wave 1 cross-sectional sample, and the Wave 1 – Wave 2 longitudinal sample of continuers (respondents that completed the Wave 1 and Wave 2 surveys). The characteristics of the Wave 1 cross-sectional sample that was used for the analyses in Section 5.2 were examined, followed by the characteristics of the Wave 1 – Wave 2 longitudinal sample that was used in the analyses from Section 5.3 onwards.

*Statistical analyses.* Unweighted frequencies and unweighted percentages were generated for the measures used for the Wave 1 cross-sectional sample, and the Wave 1 – Wave 2 longitudinal sample.

### 5.2 Number of smoking friends and smoking prevalence

The results of these analyses are presented in Section 6.2. This section describes the analyses that were conducted to examine the following research questions:

#### 1) Number of smoking friends and smoking prevalence:

- a) *Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence across the four countries?*
- b) *Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence within demographic groups (age, sex, and education) across the four countries?*

The number of smoking friends that smokers would be expected to report by chance will be referred to as the *hypothesized mean* number of smoking friends. The mean number of smoking friends reported by smokers in the ITC Four Country Survey will be referred to as the *reported mean* number of smoking friends. The hypothesized mean and the reported mean number of smoking friends will be compared in these analyses.

*Respondents.* The cross-sectional sample of all current smokers at Wave 1 of the ITC Four Country Survey was used for these analyses, (N=8,812). These are the only analyses in this dissertation that used the cross-sectional sample of all current smokers at Wave 1. The entire sample was used to ensure that the sample was as representative as possible of the smokers in the population in each country. Representativeness of the sample was important for these analyses because the objective was to compare the reported mean number of smoking friends across countries and demographic groups in the ITC Four Country Survey to the hypothesized mean number of smoking friends that would be expected based on the population prevalence of smoking. Details follow here on how the hypothesized mean number of smoking friends was calculated for each country and how it was compared to the mean number of smoking friends.

*Hypothesized mean number of smoking friends.* The hypothesized mean number of smoking friends was calculated based on current smoking prevalence for each country and each demographic group within each of the four countries. Current smoking prevalence data (as opposed to daily smoking prevalence) were used for calculating all hypothesized means because it was the most readily available across the four countries. Prevalence data were drawn from data on current smoking prevalence for the year closest to the time that the ITC Four Country Survey Wave 1 survey was conducted (2002). The hypothesized mean was calculated overall for each country, and for each demographic group based on the smoking prevalence for the population of each demographic group, e.g., the hypothesized mean number of smoking friends for smokers with low education in Canada was calculated based on the current smoking prevalence for the population of people with low education in Canada.

It is acknowledged that this method assumes that smokers report their number of friends from their same demographic group (sex, age, and level of education). However, it was quite reasonable for the purposes of these analyses to assume that people's closest friends would be similar in education level, age, and sex because people tend to form friendships with similar others (Blieszner & Adams, 1992; Byrne, Clore, & Worchel, 1966; Lazarfield & Merton, 1954; McPherson et al., 2001).

*Calculating the hypothesized mean number of smoking friends.* The number of smoking friends (out of five closest friends) reported by each person is binomial (i.e., chance of selecting either a smoking or non-smoking friend for each of their five closest friends).<sup>3</sup> Thus, the hypothesized mean number of smoking friends out of a person's five closest friends where  $m=5$  (the base number of smoking friends), and  $p$ =the population prevalence of smoking would be:

$$m(p)$$

For example, in a population with a smoking prevalence of 30%, the hypothesized mean number of smoking friends out of a person's five closest friends would be  $5(0.30) = 1.5$ .

### **Calculating the hypothesized and reported mean number of smoking friends at the country level**

*Australia.* Prevalence data for Australia were obtained from the Centre for Behavioural Research in Cancer for 2001 (Scollo & Winstanley, 2008). Because the age and education categories that smoking prevalence data were published for in Australia were not the same as the standard age and education categories of the ITC Four Country Survey data, adjustments were made to make them as comparable as possible to the Australian smoking prevalence data. Education was re-categorised into four categories and age group was re-categorised into five categories.

*Canada.* Prevalence data for Canada were obtained from the 2002 Health Canada Canadian Tobacco Use Monitoring Survey (CTUMS) (Health Canada, 2002). Because the age categories that smoking prevalence data were published for in Canada were not the same as the standard age categories

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<sup>3</sup> This method assumes selection of friends from the population 'with replacement.'

of the ITC data, adjustments were made to make them as comparable as possible to the Canadian prevalence data. One limitation was that the prevalence data published by CTUMS included smokers 15 years and older in the calculations of prevalence by sex and level of education. Thus, because the ITC dataset only includes smokers 18 years and over, the expected mean number of smoking friends calculated from the smoking prevalence data were not entirely comparable to the reported mean number of smoking friends in the ITC Canada survey.

*United Kingdom.* Because smoking prevalence data for the UK were published separately for each country, the analyses were restricted to England. Thus, only the ITC England sample was used in these analyses. Prevalence data for England were obtained from the Office for National Statistics General Household Survey (Office for National Statistics, 2001). Because the age categories that smoking prevalence data were published for in England were not the same as the standard age categories of the ITC data, adjustments were made to the ITC standard age categories to make them as comparable as possible to the England smoking prevalence data. Additionally, because England publishes smoking prevalence data by occupation instead of by education, comparisons of the mean number of smoking friends reported by respondents with low, moderate, and high education in the ITC England sample were compared to the hypothesized mean number of smoking friends calculated from routine and manual, intermediate, and managerial and professional occupations.

*United States.* Prevalence data for the United States were obtained from the National Health Interview Survey for 2002 (Centers for Disease Control and Prevention, 2011b). Because the age and education categories that smoking prevalence data were published for in the United States were not the same as the standard age and education categories that the ITC data is categorised with, adjustments were made to the ITC standard age and education categories to make them as comparable as possible to the United States smoking prevalence data. One limitation was that the United States only publishes smoking prevalence data by education for current smokers 25 and over. To overcome this limitation, comparisons of the hypothesized mean to the reported mean by education for the United States were restricted to

smokers 25 and over (smokers 18-24 years old in the ITC United States sample were excluded from the calculation of the reported mean number of smoking friends by level of education in the United States).

*Statistical analyses.* Weighted and unweighted descriptive statistics were generated followed by the weighted reported mean number of smoking friends within each country overall, and within each country by demographic group (age, sex, and education). The hypothesized mean number of smoking friends was then calculated for each country overall, and within each country by demographic group.

To determine whether there was evidence that smokers reported a greater number of smoking friends than would be expected by chance, the mean number of smoking friends reported by smokers across each of the four countries and within each demographic group was compared to the hypothesized mean,  $m(p)$ . To compare the means, a z-score was generated to test the difference between the hypothesized mean and the reported mean. The hypothesized mean was treated as the population/theoretical mean ( $\mu$ ), and the reported mean was treated as the score to be standardized ( $x$ ). The standard deviation was calculated based on the sample size ( $n$ ) that the reported mean ( $x$ ) and the variance was calculated based on the hypothesized mean  $[m(p)/(1 - p)]$ . The weighted mean and weighted sample size were used in these calculations, thus the z-score was calculated as:

$$z - score = \frac{x - \mu}{\sqrt{[(m(p))(1 - p)]/n}}$$

For example, where the population prevalence of smoking is 30% ( $p = 0.30$ ) in a sample of  $n = 200$ , the reported mean number of smoking friends out smokers' five closest friends is 1.7 ( $x = 1.7$ ), and the hypothesized mean number of smoking friends is  $\mu = 5(0.30)$ , then the z - score would equal 2.76. Using a z-score table to check the significance of the difference between  $x$  and  $\mu$ , this would be significant at the  $p = 0.05$  level, demonstrating that the reported mean number of smoking friends is significantly greater than the hypothesized mean. In other words, smokers report a greater number of smoking friends than chance would predict.

$$z - score = \frac{1.7 - 1.5}{\sqrt{[(5(0.30))(1 - 0.30)]/200}}$$

### ***5.3 Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables***

The results of these analyses are presented in Section 6.3. This section describes the analyses that were conducted to examine the following research questions:

#### **2) Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables**

*a) What are the demographic characteristics and smoking cessation predictor variables (variables that have been shown to predict smoking cessation outcomes) at Wave 1 that are related to number of smoking friends at Wave 1?*

*i) Secondary objective: Do correlates of number of smoking friends at Wave 1 differ by demographics across countries (age, sex, and education)?*

*b) What are the demographic characteristics, and smoking cessation predictor variables at Wave 1 that are related to changes in number of smoking friends between Wave 1 and Wave 2?*

*i) Secondary objective: Do correlates of changes in number of smoking friends between Wave 1 and Wave 2 differ by demographics across countries (age, sex, and education)?*

#### **5.3.1 Number of smoking friends at Wave 1 and demographic characteristics and smoking cessation predictor variables**

*Respondents.* All analyses used the Wave 1 – Wave 2 longitudinal sample, (N=6,321).

*Statistical analyses.* The mean number of smoking friends was generated for each demographic characteristic and each smoking cessation predictor variable. The bivariate relation between number of smoking friends at Wave 1 and each of the demographic characteristics and smoking cessation predictor

variables at Wave 1 was then examined in linear regression analyses with number of smoking friends at Wave 1 set as the continuous dependent variable. The relation between the demographic characteristics and the smoking cessation predictor variables at Wave 1, and number of smoking friends at Wave 1 was then examined in a multivariate linear regression analysis. The multivariate model adjusted for all demographics characteristics and smoking cessation predictor variables, and set number of smoking friends at Wave 1 as the continuous dependent variable.

*Differences across countries.* To examine differences across countries in the demographic predictors (sex, age, education) of number of smoking friends at Wave1, country x demographic variable interactions were tested in the multivariate model.

### **5.3.2 Changes in number of smoking friends between Wave 1 and Wave 2 and demographic characteristics and smoking cessation predictor variables**

*Respondents.* All analyses used the Wave 1 – Wave 2 longitudinal sample, (N=6,321).

*Statistical analyses.* The collapsed version of the friend change variable (loss vs. no change vs. gain) was used for all the analyses in this section. The collapsed version was used because it simplified the presentation of the descriptive statistics, and it allowed the friend change variable to be set as the dependent variable in the multinomial logistic regression analyses.<sup>4</sup> Multinomial logistic regression allows the dependent variable to have more than two levels, and is used when it is not desirable to sort the dependent variable in an ordinal fashion. Frequencies for collapsed friend change were first examined by demographic characteristics and smoking cessation predictor variables at Wave 1. The bivariate relation between the collapsed friend change and each of the demographic characteristics and smoking cessation predictor variables at Wave 1 was then tested in separate multinomial models, adjusting for number of

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<sup>4</sup> Using the non-collapsed version of the friend change variable as a dependent variable would have been problematic because it is an 11 level variable ranging from -5 to 0 to +5, and it would have not been desirable to treat it as an ordinal outcome variable.

smoking friends at Wave 1. It was imperative to adjust for number of smoking friends at Wave 1 in these models because whether smokers reported a loss, no change, or a gain in number of smoking friends was heavily dependent on their number of smoking friends at Wave 1. No change in number of smoking friends was set as the comparison group in the multinomial logistic regression model, allowing loss and gain in number of smoking friends to be compared to no change in number of smoking friends. The relation between friend change collapsed and demographic characteristics and smoking cessation predictor variables at Wave 1 was then tested in multivariate analyses, adjusting for all demographic characteristics and smoking cessation predictor variables, and number of smoking friends at Wave 1.

*Differences across countries.* To examine differences across countries in the demographic predictors (sex, age, education) of changes in number of smoking friends between Wave 1 and Wave 2, country x demographic variable interactions were tested in the multivariate models.

#### ***5.4 Number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes***

The results of these analyses are presented in Section 6.4. This section describes the analyses that were conducted to examine the following research questions:

- 3) Number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes:**
  - a) *Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 1?*
  - b) *Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 2?*
  - c) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and intentions to quit smoking at Wave 2?*

- d) *Is there a relation between number of smoking friends at Wave 1, and attempts to quit smoking between Wave 1 and Wave 2?*
- e) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and attempts to quit smoking between Wave 1 and Wave 2?*
- f) *Is there a relation between number of smoking friends at Wave 1 and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?*
- g) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?*
- i. *Secondary objective: Does any relation between number of smoking friends at Wave 1, or changes in number of smoking friends between Wave 1 and Wave 2, and smoking cessation outcomes differ by country, demographics (age, sex, and education), or smoking behaviour (intentions to quit smoking at Wave 1, and heaviness of smoking index)?*
- h) *Does adding number of smoking friends at Wave 1, and/or changes in number of smoking friends between Wave 1 and Wave 2 improve the base model to predict smoking cessation outcomes?*

## **5.4.1 Intentions to quit smoking at Wave 1 and Wave 2**

### **5.4.1.1 Base model: Predictors of intentions to quit smoking at Wave 1 (cross-sectional analysis)**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* Intention to quit smoking at Wave 1 was set as the dependent variable in a logistic regression analyses. Demographic characteristics and smoking cessation predictor variables (except for intentions to quit smoking at Wave 1) were included as covariates.

#### **5.4.1.2 Number of smoking friends at Wave 1 and intentions to quit smoking at Wave 1 (cross-sectional analysis)**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* Intention to quit smoking at Wave 1 was set as the dependent variable in a logistic regression analyses. Demographic characteristics and smoking cessation predictor variables (except for intentions to quit smoking at Wave 1) were included as covariates. Number of smoking friends at Wave 1 (categorical) was the key independent variable.

#### **5.4.1.3 Base model: Predictors of intentions to smoking at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses. Respondents who reported being quit smoking at Wave 2 were not included because they had quit, and were therefore not asked if they intended to quit at Wave 2, (N=5,739).

*Statistical analyses.* Intention to quit smoking at Wave 2 was set as the dependent variable in a logistic regression analysis. Demographic characteristics and smoking cessation predictor variables were included as covariates.

#### **5.4.1.4 Number of smoking friends at Wave 1 and intentions to quit smoking at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses. Respondents who reported being quit smoking at Wave 2 were not included because they were already quit, and were therefore not asked if they intended to quit at Wave 2, (N=5,739).

*Statistical analyses.* Intentions to quit smoking at Wave 2 was set as the dependent variable in a logistic regression analysis. Demographic characteristics and smoking cessation predictor variables were included as covariates. Number of smoking friends at Wave 1 (categorical) was the key independent variable.

### **5.4.1.5 Changes in number of smoking friends between Wave 1 and Wave 2 and intentions to quit smoking at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses. Respondents who reported being quit smoking at Wave 2 were not included because they were already quit and were therefore not asked if they intended to quit at Wave 2, (N=5,739).

*Statistical analyses.* Intention to quit smoking at Wave 2 was set as the dependent variable. Two logistic regression analyses models were used. The first model set non-collapsed friend change as the independent variable, and the second set collapsed friend change as the independent variable. Demographic characteristics, smoking cessation predictor variables, and number of smoking friends at Wave 1 were adjusted for in both models. To aid in the interpretation of the results, the individual predicted probabilities of the outcome (intention to quit) were generated for each person based on the model. The group means of the individual predicted probabilities of quitting were then generated for the key independent variables: number of smoking friends at Wave 1 by non-collapsed friend change, and number of smoking friends at Wave 1 by collapsed friend change. Interpretation of the predicted probabilities focused on the patterns of the group means.

## **5.4.2 Quit attempts at Wave 2**

### **5.4.2.1 Base model: Predictors of attempts to quit smoking at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* Reports of quit attempts between Wave 1 and Wave 2 at Wave 2 was set as the dependent variable (attempt vs. no attempt to quit). Demographic characteristics and smoking cessation predictor variables were included as covariates.

### **5.4.2.2 Number of smoking friends at Wave 1 and quit attempts at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* Reports of quit attempts between Wave 1 and Wave 2 at Wave 2 was set as the dependent variable (attempt vs. no attempt to quit). Demographic characteristics and smoking cessation predictor variables were included as covariates. Number of smoking friends at Wave 1 was included as the key independent variable.

### **5.4.2.3 Changes in number of smoking friends between Wave 1 and Wave 2 and quit attempts at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* Reports of quit attempts between Wave 1 and Wave 2 at Wave 2 was set as the dependent variable (attempt vs. no attempt to quit). Two logistic regression analyses models were used. The first model set non-collapsed friend change as the independent variable, and the second set collapsed friend change as the independent variable. Demographic characteristics, smoking cessation predictor variables, and number of smoking friends at Wave 1 were adjusted for in both models. To aid in the interpretation of the results, the individual predicted probabilities of the outcome (reporting a quit attempt) were generated for each person based on the model. The group means of the individual predicted probabilities of quitting were then generated for the key independent variables: number of smoking friends at Wave 1 by non-collapsed friend change, and number of smoking friends at Wave 1 by collapsed friend change. Interpretation of the predicted probabilities focused on the patterns of the group means.

## **5.4.3 Abstinence from smoking for at least one month at Wave 2 among everyone**

### **5.4.3.1 Base model: Predictors of abstinence from smoking for at least one month among everyone**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* Abstinent for at least one month was set as the dependent variable (abstinent at least one month vs. not abstinent or abstinent for less than one month). Demographic characteristics and smoking cessation predictor variables were included as covariates.

#### **5.4.3.2 Number of smoking friends at Wave 1 and abstinence for at least one month at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical Analyses.* Abstinent for at least one month was set as the dependent variable (abstinent for at least one month vs. not abstinent or abstinent for less than one month at Wave 2). Demographic characteristics and smoking cessation predictor variables were included as covariates. Number of smoking friends at Wave 1 was included as the key independent variable.

#### **5.4.3.3 Changes in number of smoking friends between Wave 1 and Wave 2 and abstinence for at least one month at Wave 2 among everyone**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* Abstinent for at least one month was set as the dependent variable (quit for at least one month vs. not quit or quit for less than one month at Wave 2). Two logistic regression analyses models were used. The first model set non-collapsed friend change as the independent variable, and the second set collapsed friend change as the independent variable. Demographic characteristics, smoking cessation predictor variables, and number of smoking friends at Wave 1 were adjusted for in both models. To aid in the interpretation of the results, the individual predicted probabilities of the outcome (abstinent for at least one month) were generated for each person based on the model. The group means of the individual predicted probabilities by abstinence were the generated for the key independent variables: number of smoking friends at Wave 1 by non-collapsed friend change, and number of smoking friends at Wave 1 by collapsed friend change. Interpretation of the predicted probabilities focused on the patterns of the group means.

## **5.4.4 Abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit**

### **5.4.4.1 Base model: Predictors of abstinence from smoking for at least one month among smokers who attempted to quit**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses. However, only smokers who reported making an attempt to quit were included, (N=2,308).

*Statistical analyses.* Abstinence for at least one month was set as the dependent variable (abstinent for at least one month vs. not abstinent or abstinent for less than one month at Wave 2). Demographic characteristics and smoking cessation predictor variables were included as covariates.

### **5.4.4.2 Number of smoking friends at Wave 1 and abstinence for at least one month at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses. However, only smokers who reported making an attempt to quit were included, (N=2,308).

*Statistical analyses.* Abstinence for at least one month was set as the dependent variable (abstinent for at least one month vs. not abstinent or abstinent for less than one month at Wave 2). Demographic characteristics and smoking cessation predictor variables were included as covariates. Number of smoking friends at Wave 1 was included as the key independent variable.

### **5.4.4.3 Changes in number of smoking friends between Wave 1 and Wave 2 and abstinence for at least one month at Wave 2**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses. However, only smokers who reported making an attempt to quit were included, (N=2,308).

*Statistical analyses.* Abstinence for at least one month was set as the dependent variable (abstinent for at least one month vs. not abstinent or abstinent for less than one month at Wave 2). Two

logistic regression analyses models were used. The first model set non-collapsed friend change as the independent variable and the second set collapsed friend change as the independent variable.

Demographic characteristics, smoking cessation predictor variables, and number of smoking friends at Wave 1 (categorical) were adjusted for in both models. To aid in the interpretation of the results, the individual predicted probabilities of the outcome (abstinent for at least one month) were generated for each person based on the model. The group means of the individual predicted probabilities of abstinence were then generated for the key independent variables: number of smoking friends at Wave 1 by non-collapsed friend change, and number of smoking friends at Wave 1 by collapsed friend change.

Interpretation of the predicted probabilities focused on the patterns of the group means.

#### **5.4.5 Interactions by country, demographic group, and smoking behaviour**

Differences in the relation between number of smoking friends at Wave 1, friend change, and smoking cessation outcomes were examined by country, demographic group (age, sex, and education), and smoking behaviour (intentions to quit smoking at Wave 1, and heaviness of smoking index).

*Statistical analyses.* Differences in the relation between number of smoking friends at Wave 1 and smoking cessation outcomes by demographics and smoking behaviour were tested by adding an interaction term (number of smoking friends at Wave 1 x interaction variable) to the multivariate models. Differences in the relation between friend change and smoking cessation outcomes by demographics and smoking behaviour were tested by adding an interaction term (friend change collapsed x interaction variable) to the multivariate models (each separately). Interactions for friend change were only tested using the collapsed version of the friend change variable (no change vs. loss vs. gain) because it would have been problematic to test the interaction with the non-collapsed version.

Because just two significant interactions were found for all of the analyses described above, only these two interactions are discussed in the results section (Section 6.4). The method outlined by Jaccard, 2001 for testing logistic regression interactions was used to examine the significant interactions.

#### **5.4.6 Comparisons of the base models to models with friends at Wave 1 and friend change between Wave 1 and Wave 2**

To determine whether adding number of smoking friends at Wave 1, and friend change (non-collapsed and collapsed) significantly improved upon the base models predicting smoking cessation outcomes, model comparisons were conducted using the chi-square difference test. The base models predicting smoking cessation outcomes were compared to the models with number of smoking friends at Wave 1 added, and then the base models including number of smoking friends at Wave 1 were compared to the models including the friend change variables (non-collapsed and collapsed, each separately). Table 4 presents the model comparisons that were conducted.

**Table 4: Model Comparisons**

Cross-Sectional Intentions to Quit Smoking at Wave 1	
Base model predicting quit intentions at Wave 1	
Base model vs. Base model plus number of smoking friends at Wave 1	
Intentions to Quit at Smoking at Wave 2	
Base model predicting quit intentions at Wave 2	
Base model vs. Base model plus number of friends at Wave 1	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (non-collapsed)	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (collapsed)	
Quit Attempts at Wave 2	
Base model predicting quit attempts at Wave 2	
Base model vs. Base model plus number of friends at Wave 1	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (non-collapsed)	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (collapsed)	
Abstinence from smoking for at least one month at Wave 2 (everyone)	
Base model predicting abstinence for at least one month at Wave 2	
Base model vs. Base model plus number of friends at Wave 1	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (non-collapsed)	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (collapsed)	
Abstinence from smoking for at least one month at Wave 2 (among smokers who attempted to quit)	
Base model predicting abstinence for at least one month at Wave 2	
Base model vs. Base model plus number of friends at Wave 1	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (non-collapsed)	
Base model plus number of smoking friends at Wave 1 vs. Base model plus number of smoking friends at Wave 1, and friend change (collapsed)	

## ***5.5 Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by changes in norms***

The results of these analyses are presented in Section 6.5. This section describes the analyses that were conducted to examine the following research questions:

### **4) Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by norms**

a) *Do changes in subjective norms between Wave 1 and Wave 2 mediate the relation between change in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?*

b) *Do changes in social norms between Wave 1 and Wave 2 mediate the relation between change in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?*

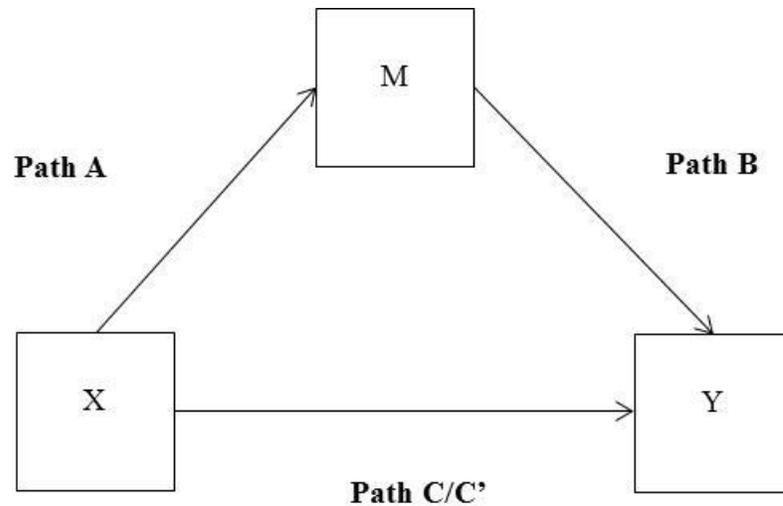
*Method used to test mediation.* The method to test mediation described by Baron and Kenny, (1986) was used. To test mediation using the Baron and Kenny, (1986) method, the steps below were taken to test paths A, B, C, and C' in the mediation model. Figure 1 presents the model and paths that were tested where  $x$ =independent variable,  $m$ =mediator, and  $y$ =dependent variable.

1. Test *path C* to determine whether there is a significant relation between  $x$  and  $y$  (controlling for covariates). If there is a significant relation between  $x$  and  $y$ , then there is an effect/relation to be mediated.
2. Test *path A* to determine if  $x$  is related to  $m$ . Test in regression equation treating  $x$  as the independent variable and  $m$  as the outcome (controlling for covariates).
3. Test *path B* to determine if  $m$  is related to the outcome  $y$ . Test in regression equation where  $x$  and  $m$  are included as independent variables along with other covariates. Variable  $x$  must be included to establish that  $m$  and  $y$  are not only correlated because they are both related to  $x$ .

4. Test *path C'* to determine if *m* fully mediates the  $x \rightarrow y$  relation. If *m* fully mediates the  $x \rightarrow y$  relation adjusting for *m*, then the relation between *x* and *y* should be zero.

If all four steps are satisfied, there is evidence that *m* fully mediates the relation between *x* and *y*, i.e., the relation between *x* and *y* may be explained by *m*. However, if all four steps are not met this does not signify that *m* does not mediate the  $x \rightarrow y$  relation. If the first three steps are met, there is evidence for partial mediation, and if only steps 2 and 3 are met there is still some evidence for mediation (Kenny, Kashy, & Bolger, 1998; Zhao, Lynch Jr., & Chen, 2010).

*Sobel Test.* After the mediation analysis was conducted, the Sobel (1982) test was used to further determine whether the mediation was significant.



**Figure 2: Mediation**

### 5.5.1 Intentions to quit smoking at Wave 2

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses. Respondents who reported being quit smoking at Wave 2 were not included because they had quit, and were therefore not asked if they intended to quit at Wave 2, (N=5,739).

*Statistical analyses.* All analyses controlled for demographic characteristics and smoking cessation predictor variables. The tests for mediation described above were conducted to determine whether the relation between friend change and intentions to quit at Wave 2 was mediated by change in subjective/social norms. In the mediation model,  $x$  was dichotomized friend change,  $m$  was change in subjective/social norms between Wave 1 and Wave 2 (dichotomized), and  $y$  was intentions to quit smoking at Wave 2. Subjective/social norms at Wave 1 were controlled for in all analyses that included  $m$  (change in subjective/social norms), and number of smoking friends at Wave 1 was controlled for in all analyses that included  $x$  (dichotomized friend change).

### 5.5.2 Quit attempts at Wave 2

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* All analyses controlled for demographic characteristics and smoking cessation predictor variables. The tests for mediation described above were conducted to determine whether the relation between friend change and attempts to quit at Wave 2 was mediated by change in subjective/social norms. In the mediation model,  $x$  was dichotomized friend change,  $m$  was change in subjective/social norms between Wave 1 and Wave 2 (dichotomized), and  $y$  was attempts to quit smoking at Wave 2. Subjective/social norms at Wave 1 was controlled for in all analyses that included  $m$  (change in subjective/social norms), and number of smoking friends at Wave 1 was controlled for in all analyses that included  $x$  (dichotomized friend change).

### **5.5.3 Abstinence from smoking for at least one month at Wave 2 among everyone**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample was used in these analyses, (N=6,321).

*Statistical analyses.* All analyses controlled for demographic characteristics and smoking cessation predictor variables. The tests for mediation described above were conducted to determine whether the relation between friend change and abstinence from smoking at Wave 2 was mediated by change in subjective/social norms. In the mediation model,  $x$  was dichotomized friends change,  $m$  was change in subjective/social norms between Wave 1 and Wave 2 (dichotomized), and  $y$  was abstinence from smoking at Wave 2. Subjective/social norms at Wave 1 was controlled for in all analyses that included  $m$  (change in subjective/social norms), and number of smoking friends at Wave 1 was controlled for in all analyses that included  $x$  (dichotomized friend change).

### **5.5.4 Abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit**

*Respondents.* The Wave 1 – Wave 2 longitudinal sample were used in these analyses. However, only smokers who reported making an attempt to quit were included, (N=2,308).

*Statistical analyses.* All analyses controlled for demographic characteristics and smoking cessation predictor variables. The tests for mediation described above were conducted to determine

whether the relation between friend change and abstinence from smoking at Wave 2 was mediated by change in subjective/social norms. In the mediation model,  $x$  was dichotomized friend change,  $m$  was change in subjective/social norms between Wave 1 and Wave 2 (dichotomized), and  $y$  was abstinence from smoking at Wave 2 among smokers who attempted to quit. Subjective/social norms at Wave 1 was controlled for in all analyses that included  $m$  (change in subjective/social norms), and number of smoking friends at Wave 1 was controlled for in all analyses that included  $x$  (dichotomized friend change).

## 6.0 Results

### 6.1 Characteristics of the sample

#### 6.1.1 Characteristics of the Wave 1 cross-sectional sample

The characteristics of the Wave 1 sample are presented in Table 5. Overall, there were more women than men in the sample, particularly in the United Kingdom. Most respondents were between 25 and 54 years old, and had low education. In Australia, a larger majority of the sample had low education. Most respondents reported that of their five closest friends, that 2, 3, or 5 of them were smokers.

**Table 5:** Characteristics of the Wave 1 Cross-Sectional Sample, (N=8,812, unweighted)

Country	Australia (N=2,257)		Canada (N=2,161)		United Kingdom <sup>a</sup> (N=2,329)		United States (N=2,065)	
	n	%	n	%	n	%	n	%
Sex								
Female	1194	52.9	1179	54.6	1327	57.0	1145	55.4
Male	1063	47.1	982	45.4	1002	43.0	920	44.6
Age group								
18-24	377	16.7	336	15.5	200	8.6	317	15.4
25-39	837	37.1	689	31.9	757	32.5	637	30.8
40-54	743	32.9	753	34.8	786	33.7	709	34.3
55-max	300	13.3	383	17.7	586	25.2	402	19.5
Education								
Low	1512	67.0	1009	46.7	1507	64.7	909	44.0
Moderate	448	19.8	865	40.0	540	23.2	893	43.2
High	297	13.2	287	13.3	282	12.1	263	12.7
Number of smoking friends at Wave 1								
0	269	11.9	257	11.9	290	12.5	252	12.2
1	300	13.3	260	12.0	291	12.5	256	12.4
2	421	18.7	437	20.2	453	19.5	376	18.2
3	488	21.6	431	19.9	425	18.2	400	19.4
4	279	12.4	293	13.6	313	13.4	250	12.1
5	500	22.2	483	22.4	557	23.9	531	25.7

### **6.1.2 Characteristics of the Wave 1 – Wave 2 longitudinal sample**

The characteristics of the Wave 1 – Wave 2 longitudinal sample are presented in Table 6 (unweighted frequencies and percentages). Demographic differences of note include the higher proportion of women compared to men, the higher number of smokers with low education, and the higher proportion of non-white respondents in the United States and the lower proportion of non-white respondents in the United Kingdom. For the smoking cessation predictor variables, most smokers (90%) were daily smokers, slightly more than half did not make an attempt to quit in the last year (more so in the United Kingdom), about 20% had never made an attempt to quit, about 34% had quit for more than six months at one point, the majority had no intention to quit (more so in the United Kingdom), most thought they would benefit from quitting, and most worried about the future health damages of smoking. Most respondents reported that of their five closest friends, that 2, 3, or 5 of them were smokers. Between Wave 1 and Wave 2, approximately 40% of respondents experienced no change in their number of smoking friends, and approximately 30% gained, and 30% lost smoking friends. For the smokers who reported a different number of smoking friends at Wave 2 compared to Wave 1, the difference between Wave 1 and Wave 2 was most often 1 or 2 smoking friends, very few smokers lost or gained 4 or 5 smoking friends.

**Table 6:** Characteristics of Wave 1 - Wave 2 Longitudinal Sample, (N=6,321, unweighted)

Country	Australia (N=1,748)		Canada (N=1,595)		United Kingdom (N=1,714)		United States (N=1,264)		
	Variable	N	%	N	%	N	%	N	%
<b>Sex</b>									
Female	942	53.9	885	55.5	982	57.3	740	58.5	
Male	806	46.1	710	44.5	732	42.7	524	41.5	
<b>Age group</b>									
18-24	252	14.4	201	12.6	113	6.6	149	11.8	
25-39	639	36.6	513	32.2	509	29.7	342	27.1	
40-54	621	35.5	583	36.6	622	36.3	480	38.0	
55-max	236	13.5	298	18.7	470	27.4	293	23.2	
<b>Education</b>									
Low	1169	66.9	717	45.0	1109	64.7	516	40.8	
Moderate	355	20.3	657	41.2	394	23.0	573	45.3	
High	224	12.8	221	13.9	211	12.3	175	13.8	
<b>Income</b>									
Low	477	27.3	451	28.3	517	30.2	449	35.5	
Moderate	594	34.0	567	35.5	586	34.2	453	35.8	
High	571	32.7	465	29.2	486	28.4	291	23.0	
No answer	106	6.1	112	7.0	125	7.3	71	5.6	
<b>Ethnicity</b>									
Non-white, other language	211	12.1	169	10.6	74	4.3	259	20.5	
White, English only	1537	87.9	1426	89.4	1640	95.7	1005	79.5	
<b>Employed outside the home</b>									
No	627	35.9	542	34.0	602	35.1	485	38.4	
Yes	1121	64.1	1053	66.0	1112	64.9	779	61.6	
<b>Smoking status</b>									
Daily	1577	90.2	1461	91.6	1599	93.3	1155	91.4	
Weekly/Monthly	171	9.8	134	8.4	115	6.7	109	8.6	

**Table 6 (continued):** Characteristics of Wave 1 - Wave 2 Longitudinal Sample, (N=6,321, unweighted)

<i>Sample Characteristics of Wave 1 - Wave 2 Longitudinal Sample (N=6,321, unweighted)</i>								
Country	Australia (N=1,748)		Canada (N=1,595)		United Kingdom (N=1,714)		United States (N=1,264)	
Variable	n	%	n	%	n	%	n	%
Heaviness of smoking								
0 - low dependence	281	16.1	234	14.7	216	12.6	180	14.2
1	190	10.9	158	9.9	204	11.9	128	10.1
2	265	15.2	293	18.4	314	18.3	200	15.8
3	438	25.1	411	25.8	581	33.9	376	29.7
4	311	17.8	315	19.7	262	15.3	196	15.5
5	190	10.9	141	8.8	105	6.1	126	10.0
6 - high dependence	73	4.2	43	2.7	32	1.9	58	4.6
Attempt to quit in past year								
No attempt	977	55.9	859	53.9	1131	66.0	710	56.2
Attempt	771	44.1	736	46.1	583	34.0	554	43.8
Longest attempt to quit								
Never Attempted	297	17.0	265	16.6	373	21.8	245	19.4
<1 week	289	16.5	261	16.4	257	15.0	214	16.9
>1 week but < 6 months	550	31.5	504	31.6	513	29.9	374	29.6
>6 months	612	35.0	565	35.4	571	33.3	431	34.1
Quit intentions								
No intention	621	35.5	728	45.6	482	28.1	432	34.2
Intention	1127	64.5	867	54.4	1232	71.9	832	65.8
Benefit if quit in 6 months								
Not at all	98	5.6	81	5.1	145	8.5	70	5.5
Slightly	202	11.6	195	12.2	251	14.6	142	11.2
Moderately	331	18.9	312	19.6	381	22.2	209	16.5
Very much	560	32.0	549	34.4	548	32.0	430	34.0
Extremely	557	31.9	458	28.7	389	22.7	413	32.7
Worried smoking will damage health								
Not all worried	213	12.2	170	10.7	250	14.6	141	11.2
A little worried	445	25.5	353	22.1	399	23.3	300	23.7
Moderately worried	544	31.1	527	33.0	506	29.5	415	32.8
Very worried	546	31.2	545	34.2	559	32.6	408	32.3

**Table 6 (continued):** Characteristics of Wave 1 - Wave 2 Longitudinal Sample, (N=6,321, unweighted)

Country	Australia (N=1,748)		Canada (N=1,595)		United Kingdom (N=1,714)		United States (N=1,264)	
	n	%	n	%	n	%	n	%
Number of smoking friends at Wave 1								
0	228	13.0	201	12.6	227	13.2	174	13.8
1	236	13.5	208	13.0	230	13.4	166	13.1
2	341	19.5	316	19.8	331	19.3	240	19.0
3	376	21.5	328	20.6	319	18.6	247	19.5
4	221	12.6	213	13.4	234	13.7	152	12.0
5	346	19.8	329	20.6	373	21.8	285	22.5
Friend change between Wave 1 and Wave 2								
No change	713	40.8	628	39.4	689	40.2	471	37.3
-5	5	0.3	1	0.1	12	0.7	9	0.7
-4	14	0.8	23	1.4	18	1.1	15	1.2
-3	57	3.3	61	3.8	58	3.4	54	4.3
-2	137	7.8	125	7.8	149	8.7	118	9.3
-1	291	16.6	313	19.6	307	17.9	237	18.8
1	330	18.9	260	16.3	287	16.7	207	16.4
2	128	7.3	128	8.0	120	7.0	100	7.9
3	49	2.8	39	2.4	50	2.9	30	2.4
4	11	0.6	8	0.5	16	0.9	18	1.4
5	13	0.7	9	0.6	8	0.5	5	0.4
Friend change between Wave 1 and Wave 2								
No change	713	40.8	628	39.4	689	40.2	471	37.3
Loss	504	28.8	523	32.8	544	31.7	433	34.3
Gain	531	30.4	444	27.8	481	28.1	360	28.5

## ***6.2 Number of smoking friends and smoking prevalence***

This section presents the results of the analyses described in Section 5.2. Results are given for the following research questions:

### **1) Number of smoking friends and smoking prevalence:**

- a) *Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence across the four countries?*
- b) *Do smokers report a greater number of smoking friends than would be expected by chance based on smoking prevalence within demographic groups (age, sex, and education) across the four countries?*

*Presentation of results.* Tables 7 - 10 show the results for each country: Table 7 (Australia), Table 8 (Canada), Table 9 (United Kingdom), and Table 10 (United States). For each country the tables show current smoking prevalence in column one, followed by unweighted sample size, weighted sample size, reported mean number of smoking friends, the standard error of the mean, the lower and upper 95% confidence interval of the mean, the hypothesized mean number of smoking friends, the difference between the reported mean and the hypothesized mean, and the z- score test for the difference between the reported and hypothesized mean.

*Australia* (Table 7). There was evidence that smokers reported smoking friends at greater than chance levels in Australia. Overall, and within demographic groups (age, sex, and education), the reported mean number of smoking friends was significantly higher than the hypothesized mean number of smoking friends. Younger smokers and smokers with low education reported the highest number of smoking friends.

*Canada* (Table 8). There was evidence that smokers reported smoking friends at greater than chance levels in Canada. Overall, and within demographic groups (age, sex, and education), the reported mean number of smoking friends was significantly higher than the hypothesized mean number of

smoking friends. Younger smokers and smokers with low education reported the highest number of smoking friends.

*United Kingdom* (Table 9). There was evidence that smokers reported smoking friends at greater than chance levels in the United Kingdom. Overall, and within demographic groups (age, sex, occupation), the reported mean number of smoking friends was significantly higher than the hypothesized mean number of smoking friends. Younger people, and those who did routine/manual work reported the highest number of smoking friends.

*United States* (Table 10). There was evidence that smokers reported smoking friends at greater than chance levels in the United States. Overall, and within demographic groups (age, sex, and education), the reported mean number of smoking friends was significantly higher than the hypothesized mean number of smoking friends. Younger smokers and smokers with low education reported the highest number of smoking friends.

*Summary of results.* Evidence that smokers reported smoking friends at greater than chance levels was found across all countries and within all demographic groups. Demographic groups with higher smoking prevalence generally reported the highest number of smoking friends (younger smokers and smokers with low education). The difference between the reported number of smoking friends and the hypothesized mean was consistently largest for younger smokers across all countries.

**Table 7:** Australia - Smoking Prevalence by Sex, Age, and Education, and Reported Mean Number of Smoking Friends Compared to Hypothesized Mean, (N=2,257)

Variable	Prevalence of Current Smoking	n <sup>a</sup>	n <sup>b</sup>	Reported Mean Number of Smoking Friends	SE	95% CI of Mean		Hypothesized Mean	Difference Between Reported Mean and Hypothesized Mean	z-scores <sup>c</sup>
						LCI 95%	UCI 95%			
<b>Sex</b>										
Female	21%	1194	1011	2.76	0.05	2.65	2.86	1.05	1.71	64.85
Male	25%	1063	1242	2.94	0.05	2.84	3.04	1.25	1.69	56.85
<b>Age group</b>										
18-24	29%	377	383	3.59	0.08	3.43	3.75	1.45	2.14	40.86
25-29	31%	267	267	3.32	0.09	3.14	3.50	1.55	1.77	27.95
30-39	29%	570	541	2.93	0.07	2.80	3.07	1.45	1.48	34.92
40-59	23%	856	853	2.47	0.06	2.34	2.59	1.15	1.32	40.97
60>	10%	187	209	2.33	0.14	2.06	2.60	0.5	1.83	37.30
<b>Education</b>										
Less than high school <sup>d</sup>	27%	920	962	2.99	0.06	2.87	3.10	1.35	1.64	49.97
High school	21%	592	567	2.91	0.08	2.75	3.06	1.05	1.86	49.57
Trade qualification	27%	342	361	2.85	0.09	2.67	3.03	1.35	1.50	27.96
University/some	13%	403	362	2.45	0.08	2.29	2.61	0.65	1.80	48.12
<b>Overall</b>	<b>23%</b>	<b>2257</b>	<b>2252</b>	<b>2.86</b>	<b>0.04</b>	<b>2.78</b>	<b>2.93</b>	<b>1.15</b>	<b>1.71</b>	<b>86.23</b>
<sup>a</sup> unweighted sample size										
<sup>b</sup> weighted sample size										
<sup>c</sup> z-scores calculated with weighted sample size										
<sup>d</sup> less than high school combines prevalence for two categories, year 9 or less (24%) and year 10 and 11 (30%)										

**Table 8:** Canada - Smoking Prevalence by Sex, Age, and Education, and Reported Mean Number of Smoking Friends Compared to Hypothesized Mean, (N=2,161)

Variable	Prevalence of Current Smoking	n <sup>a</sup>	n <sup>b</sup>	Reported Mean Number of Smoking Friends	SE	95% CI of Mean		Hypothesized Mean	Difference Between Reported Mean and Hypothesized Mean	z-scores <sup>c</sup>
						LCI 95%	UCI 95%			
<b>Sex<sup>d</sup></b>										
Female	20%	1179	995	2.77	0.05	2.66	2.88	1.00	1.77	67.98
Male	23%	982	1161	2.95	0.05	2.85	3.05	1.15	1.80	59.88
<b>Age group</b>										
18-19	28%	74	72	3.68	0.16	3.38	3.99	1.40	2.28	19.56
20-24	31%	262	235	3.56	0.09	3.38	3.74	1.55	2.01	31.48
25-34	27%	430	459	3.07	0.08	2.91	3.23	1.35	1.72	35.93
35-44	24%	552	571	2.79	0.07	2.64	2.93	1.20	1.59	39.08
45-54	21%	460	458	2.64	0.09	2.47	2.81	1.05	1.59	37.50
55 >	13%	383	362	2.40	0.09	2.22	2.58	0.65	1.75	45.58
<b>Education<sup>d</sup></b>										
Low	24%	1009	1026	3.12	0.05	3.01	3.23	1.20	1.92	63.85
Moderate	21%	865	853	2.76	0.06	2.64	2.88	1.05	1.71	55.23
High	13%	287	278	2.26	0.11	2.05	2.47	0.65	1.61	36.22
Overall	21%	2161	2157	2.87	0.04	2.79	2.94	1.05	1.82	92.70
<sup>a</sup> unweighted sample size										
<sup>b</sup> weighted sample size										
<sup>c</sup> z-scores calculated with weighted sample size										
<sup>d</sup> for smokers 15+ for education and sex										

**Table 9:** United Kingdom (England only)<sup>a</sup> - Smoking Prevalence by Sex, Age, and Education, and Reported Mean Number of Smoking Friends Compared to Hypothesized Mean, (N=1,927)

Variable	Prevalence of Current Smoking	n <sup>b</sup>	n <sup>c</sup>	Reported Mean Number of Smoking Friends	SE	95% CI of Mean		Hypothesized Mean	Difference Between Reported Mean and Hypothesized Mean	z-scores <sup>d</sup>
						LCI 95%	UCI 95%			
Sex										
Female	25%	1091	957	2.82	0.06	2.70	2.93	1.25	1.57	53.41
Male	28%	836	963	3.09	0.06	2.97	3.21	1.40	1.69	48.66
Age group										
18-19 <sup>e</sup>	28%	33	62	4.23	0.16	3.92	4.55	1.40	2.83	16.21
20-24	37%	125	199	3.62	0.13	3.36	3.89	1.85	1.77	18.37
25-34	34%	404	464	3.27	0.08	3.11	3.44	1.70	1.57	29.86
35-49	29%	700	584	2.88	0.07	2.75	3.02	1.45	1.43	37.41
50-59	25%	363	289	2.45	0.10	2.25	2.64	1.25	1.20	23.52
60>	16%	302	321	2.41	0.11	2.18	2.63	0.80	1.61	34.06
Occupation										
Routine and manual	32%	1221	1200	2.99	0.05	2.89	3.10	1.60	1.39	46.61
Intermediate	27%	448	469	3.03	0.08	2.87	3.20	1.35	1.68	35.91
Managerial and professional	19%	258	250	2.62	0.11	2.40	2.84	0.95	1.67	30.53
Overall	27%	1927	1920	2.95	0.04	2.87	3.04	1.35	1.60	70.89
<sup>a</sup> Northern Ireland, Scotland, and Wales excluded										
<sup>b</sup> unweighted sample size										
<sup>c</sup> weighted sample size										
<sup>d</sup> z-scores calculated with weighted sample size										
<sup>e</sup> 16 and over, 18-19 includes 16 and 17 year olds										

**Table 10:** United States - Smoking Prevalence by Sex, Age, and Education, and Reported Mean Number of Smoking Friends Compared to Hypothesized Mean, (N=2,065)

Variable	Prevalence of Current Smoking	n <sup>a</sup>	n <sup>b</sup>	Reported Mean Number of Smoking Friends	SE	95% CI of Mean		Hypothesized Mean	Difference Between Reported Mean and Hypothesized Mean	z-scores <sup>c</sup>
						LCI 95%	UCI 95%			
<b>Sex</b>										
Female	20%	1145	963	2.94	0.05	2.84	3.05	1.00	1.94	67.35
Male	25%	920	1103	2.94	0.06	2.82	3.06	1.23	1.71	59.09
<b>Age group</b>										
18-24	29%	317	311	3.71	0.08	3.54	3.88	1.43	2.28	39.91
25-44	26%	922	982	3.03	0.06	2.92	3.15	1.29	1.75	56.08
45-64	23%	687	654	2.55	0.08	2.40	2.70	1.14	1.42	38.70
65>	9%	139	119	2.33	0.17	2.00	2.67	0.47	1.87	31.38
<b>Education<sup>d</sup></b>										
Less than high school	31%	195	203	3.32	0.13	3.06	3.58	1.53	1.79	24.85
High school	28%	531	548	2.84	0.08	2.69	3.00	1.40	1.45	33.83
Some college, no bachelor's	22%	773	782	2.73	0.07	2.60	2.87	1.08	1.66	50.46
Bachelor's degree or higher	10%	249	222	2.51	0.12	2.27	2.74	0.50	2.01	44.55
<b>Overall</b>	<b>22%</b>	<b>2065</b>	<b>2066</b>	<b>2.94</b>	<b>0.04</b>	<b>2.86</b>	<b>3.02</b>	<b>1.115</b>	<b>1.83</b>	<b>89.25</b>
<sup>a</sup> unweighted sample size										
<sup>b</sup> weighted sample size										
<sup>c</sup> z-scores calculated with weighted sample size										
<sup>d</sup> education prevalence for 25 years and over only										

## ***6.3 Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables***

This section presents the results of the analyses described in Section 5.3. Results are given for the following research questions:

### **2) Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables**

- a) *What are the demographic characteristics and smoking cessation predictor variables at Wave 1 that are related to number of smoking friends at Wave 1?*
  - i) *Secondary objective: Do correlates of number of smoking friends at Wave 1 differ by demographics across countries (age, sex, and education)?*
- b) *What are the demographic characteristics, and smoking cessation predictor variables at Wave 1 that are related to changes in number of smoking friends between Wave 1 and Wave 2?*
  - i) *Secondary objective: Do correlates of changes in number of smoking friends between Wave 1 and Wave 2 differ by demographics across countries (age, sex, and education)?*

### **6.3.1 Number of smoking friends at Wave 1 and demographic characteristics and smoking cessation predictor variables**

*Descriptive statistics and bivariate models* (Table 11). The following demographic characteristics were related to reporting a higher number of smoking friends at Wave 1: being from the United Kingdom vs. Australia, male, younger age, lower education, and lower income. The following smoking cessation predictor variables were related to reporting a higher number of smoking friends (relative to comparison group): daily smoking, heavier smoking, attempts to quit in the last year, reporting a shorter time ever off smoking, and having no intention to quit.

*Multivariate analysis* (Table 12). Smokers from Canada, the United States, and the United Kingdom reported more smoking friends at Wave 1 than smokers from Australia. Other demographics characteristics that were related to having more smoking friends at Wave 1 included: being male, younger, lower education, and lower income. For smoking cessation predictor variables, the following were related to having more smoking friends (relative to comparison group): being a daily smoker, heavier smoking, never having made a quit attempt that lasted longer than six months, having no intention to quit smoking, and having a lower outcome expectancy of the benefits of quitting.

**Table 11:** Predictors of Number of Smoking Friends at Wave 1 – Bivariate Model, (N=6,321)<sup>a</sup>

Parameter	n	Mean Number of Smoking Friends <sup>b</sup>	Standard Error of Mean	95% CI of Mean		Estimate	Standard Error	Pr >  t	95% CI of Estimate	
Country*										
Australia	1748	2.77	0.04	2.68	2.85					
Canada	1595	2.80	0.04	2.71	2.89	0.04	0.06	0.5273	-0.08	0.16
United Kingdom	1714	2.87	0.04	2.79	2.96	0.13	0.06	0.0343	0.01	0.26
United States	1264	2.81	0.05	2.71	2.92	0.06	0.07	0.349	-0.07	0.20
Sex*										
Female	3549	2.75	0.03	2.69	2.81					
Male	2772	2.87	0.03	2.81	2.94	0.11	0.05	0.0145	0.02	0.20
Age group**										
18-24	715	3.58	0.06	3.47	3.70					
25-39	2003	3.00	0.04	2.92	3.07	-0.59	0.07	<.0001	-0.73	-0.45
40-54	2306	2.67	0.04	2.60	2.75	-0.91	0.07	<.0001	-1.05	-0.77
55-max	1297	2.29	0.05	2.18	2.39	-1.30	0.08	<.0001	-1.46	-1.14
Education**										
Low	3511	2.93	0.03	2.87	2.99					
Moderate	1979	2.76	0.04	2.68	2.84	-0.18	0.05	0.0004	-0.28	-0.08
High	831	2.40	0.06	2.28	2.52	-0.54	0.07	<.0001	-0.68	-0.40
Household income**										
Low	1894	2.95	0.04	2.87	3.03					
Moderate	2200	2.84	0.04	2.76	2.91	-0.11	0.06	0.063	-0.22	0.01
High	1813	2.63	0.04	2.55	2.71	-0.31	0.06	<.0001	-0.43	-0.19
No answer	414	2.95	0.09	2.77	3.13	0.03	0.10	0.7597	-0.17	0.24
Ethnicity										
White, English only	5608	2.82	0.02	2.77	2.87					
Non-white, non-English	713	2.75	0.07	2.61	2.89	-0.07	0.08	0.3864	-0.21	0.08
Employed outside home										
Yes	4065	2.84	0.03	2.79	2.90					
No	2256	2.76	0.04	2.68	2.84	-0.08	0.05	0.1057	-0.18	0.02
<sup>a</sup> unweighted frequencies										
<sup>b</sup> weighted means										
*significant at p<0.05										
**significant at p<0.0001										

**Table 11 (continued):** Predictors of Number of Smoking Friends at Wave 1 – Bivariate Model, (N=6,321)<sup>a</sup>

Parameter	n	Mean Number of Smoking Friends <sup>b</sup>	Standard Error of Mean	95% CI of Mean		Estimate	Standard Error	Pr >  t	95% CI of Estimate	
Smoking status**										
Daily	5792	2.84	0.02	2.79	2.89					
Weekly/monthly	529	2.48	0.08	2.33	2.63	-0.37	0.08	<.0001	-0.52	-0.21
Heaviness of smoking**										
0 - low dependence	911	2.55	0.06	2.44	2.67	0.07	0.01	<.0001	0.04	0.10
1	680	2.75	0.07	2.60	2.89					
2	1072	2.83	0.06	2.72	2.94					
3	1806	2.81	0.04	2.72	2.89					
4	1084	2.92	0.05	2.81	3.02					
5	562	2.90	0.08	2.75	3.06					
6 - high dependence	206	3.24	0.12	3.00	3.47					
Attempt to quit in past year*										
No attempt to quit	3677	2.76	0.03	2.70	2.82					
Attempt to quit	2644	2.88	0.04	2.81	2.95	0.13	0.05	0.006	0.04	0.22
Longest quit attempt**										
Never attempted	1180	2.97	0.05	2.87	3.07					
<1 week	1021	2.95	0.06	2.83	3.06	-0.01	0.08	0.882	-0.16	0.14
>1 week but < 6 months	1941	2.84	0.04	2.76	2.92	-0.13	0.07	0.057	-0.26	0.00
>6 months	2179	2.64	0.04	2.56	2.71	-0.34	0.07	<.0001	-0.47	-0.21
Quit intentions (Wave 1)**										
No intention	4058	2.89	0.03	2.83	2.94					
Intention	2263	2.68	0.04	2.61	2.75	-0.22	0.05	<.0001	-0.31	-0.12
Outcome expectancy										
Not at all	394	3.02	0.09	2.84	3.21	-0.02	0.02	0.327	-0.06	0.02
Slightly	790	2.78	0.06	2.65	2.91					
Moderately	1233	2.78	0.05	2.68	2.88					
Very much	2087	2.83	0.04	2.75	2.90					
Extremely	1817	2.79	0.04	2.70	2.88					
Worried smoking will damage health										
Not all worried	774	2.96	0.07	2.83	3.10	-0.04	0.02	0.089	-0.08	0.01
A little worried	1497	2.86	0.05	2.77	2.95					
Moderately worried	1992	2.68	0.04	2.60	2.76					
Very worried	2058	2.85	0.04	2.77	2.93					
<sup>a</sup> unweighted frequencies										
<sup>b</sup> weighted means										
*significant at p<0.05										
**significnat at p<0.0001										

**Table 12:** Predictors of Number of Smoking Friends at Wave 1 – Multivariate Model,  
(N=6,321)<sup>a</sup>

Parameter	n	Mean Number of Smoking Friends <sup>b</sup>	Standard Error of Mean	95% CI of Mean		Estimate	Standard Error	t Value	Pr >  t	95% CI of Estimate	
Intercept	6321	2.81	0.02	2.77	2.86	3.92	0.14	27.43	<.0001	3.64	4.20
Country*											
Australia	1748	2.77	0.04	2.68	2.85						
Canada	1595	2.80	0.04	2.71	2.89	0.12	0.06	2.06	0.0396	0.01	0.24
United Kingdom	1714	2.87	0.04	2.79	2.96	0.21	0.06	3.50	0.0005	0.09	0.33
United States	1264	2.81	0.05	2.71	2.92	0.14	0.07	2.12	0.0342	0.01	0.27
Sex*											
Female	3549	2.75	0.03	2.69	2.81						
Male	2772	2.87	0.03	2.81	2.94	0.11	0.05	2.43	0.0150	0.02	0.20
Age group**											
18-24	715	3.58	0.06	3.47	3.70						
25-39	2003	3.00	0.04	2.92	3.07	-0.53	0.07	-7.41	<.0001	-0.67	-0.39
40-54	2306	2.67	0.04	2.60	2.75	-0.93	0.07	-12.50	<.0001	-1.08	-0.78
55-max	1297	2.29	0.05	2.18	2.39	-1.47	0.09	-17.06	<.0001	-1.64	-1.30
Education**											
Low	3511	2.93	0.03	2.87	2.99						
Moderate	1979	2.76	0.04	2.68	2.84	-0.18	0.05	-3.47	0.0005	-0.28	-0.08
High	831	2.40	0.06	2.28	2.52	-0.40	0.07	-5.61	<.0001	-0.54	-0.26
Household income**											
Low	1894	2.95	0.04	2.87	3.03						
Moderate	2200	2.84	0.04	2.76	2.91	-0.13	0.06	-2.30	0.0218	-0.24	-0.02
High	1813	2.63	0.04	2.55	2.71	-0.31	0.06	-4.91	<.0001	-0.43	-0.19
No answer	414	2.95	0.09	2.77	3.13	-0.04	0.10	-0.45	0.6545	-0.2	0.15
Ethnicity											
White, English only	5608	2.82	0.02	2.77	2.87						
Non-white, non-English	713	2.75	0.07	2.61	2.89	-0.06	0.07	-0.86	0.3911	-0.21	0.08
Employed outside home											
Yes	4065	2.84	0.03	2.79	2.90						
No	2256	2.76	0.04	2.68	2.84	-0.01	0.05	-0.03	0.9757	-0.10	0.10
<sup>a</sup> unweighted frequencies											
<sup>b</sup> weighted means											
*significant at p<0.05											
**significnat at p<0.0001											

**Table 12 (continued):** Predictors of Number of Smoking Friends at Wave 1 – Multivariate Model,

(N=6,321)<sup>a</sup>

Parameter	n	Mean Number of Smoking Friends <sup>b</sup>	Standard Error of Mean	95% CI of Mean		Estimate	Standard Error	t Value	Pr >  t	95% CI of Estimate	
Smoking status*											
Daily	5792	2.84	0.02	2.79	2.89						
Weekly/monthly	529	2.48	0.08	2.33	2.63	-0.19	0.09	-2.18	0.0292	-0.36	-0.02
Heaviness of smoking**											
0 - low dependence	911	2.55	0.06	2.44	2.67	0.09	0.02	5.24	<.0001	0.05	0.12
1	680	2.75	0.07	2.60	2.89						
2	1072	2.83	0.06	2.72	2.94						
3	1806	2.81	0.04	2.72	2.89						
4	1084	2.92	0.05	2.81	3.02						
5	562	2.90	0.08	2.75	3.06						
6 - high dependence	206	3.24	0.12	3.00	3.47						
Attempt to quit in past year											
No attempt to quit	3677	2.76	0.03	2.70	2.82						
Attempt to quit	2644	2.88	0.04	2.81	2.95	0.10	0.05	1.91	0.0557	0.00	0.21
Longest quit attempt*											
Never attempted	1180	2.97	0.05	2.87	3.07						
<1 week	1021	2.95	0.06	2.83	3.06	-0.10	0.08	-1.16	0.2442	-0.26	0.07
>1 week but < 6 months	1941	2.84	0.04	2.76	2.92	-0.12	0.07	-1.61	0.1076	-0.26	0.03
>6 months	2179	2.64	0.04	2.56	2.71	-0.14	0.07	-2.09	0.0368	-0.27	-0.01
Quit intentions (Wave 1)*											
No intention	4058	2.89	0.03	2.83	2.94						
Intention	2263	2.68	0.04	2.61	2.75	-0.17	0.05	-3.41	0.0007	-0.28	-0.07
Outcome expectancy*											
Not at all	394	3.02	0.09	2.84	3.21	-0.05	0.02	-2.06	0.0392	-0.09	0.00
Slightly	790	2.78	0.06	2.65	2.91						
Moderately	1233	2.78	0.05	2.68	2.88						
Very much	2087	2.83	0.04	2.75	2.90						
Extremely	1817	2.79	0.04	2.70	2.88						
Worried smoking will damage health											
Not all worried	774	2.96	0.07	2.83	3.10	-0.03	0.03	-1.14	0.2544	-0.08	0.02
A little worried	1497	2.86	0.05	2.77	2.95						
Moderately worried	1992	2.68	0.04	2.60	2.76						
Very worried	2058	2.85	0.04	2.77	2.93						
<sup>a</sup> unweighted frequencies											
<sup>b</sup> weighted means											
*significant at p<0.05											
**significant at p<0.0001											

### **6.3.2 Change in number of smoking friends between Wave 1 and Wave 2 and demographic characteristics and smoking cessation predictor variables**

*Descriptive statistics.* Table 13 presents the proportion of respondents who reported a loss, no change, or gain in number of smoking friends between Wave 1 and Wave 2 by demographic characteristics, smoking cessation predictor variables, and number of smoking friends at Wave 1. Note that these descriptive statistics do not account for the number of smoking friends that respondents reported at Wave 1, and that the ‘bivariate’ and multivariate analyses that follow adjust for number of smoking friends at Wave 1. Because the proportion of respondents reporting loss, no change, or a gain in smoking friends is dependent on number of smoking friends at Wave 1, the frequencies will not be commented on here.

**Table 13:** Descriptive Statistics for Change in Number of Smoking Friends Between Wave 1 and Wave 2 (gain, no change, or loss), (N=6,321)<sup>a,b</sup>

Variable	Loss					No Change					Gain				
	n	%	SE	95% CI of Percent		n	%	SE	95% CI of Percent		n	%	SE	95% CI of Percent	
Country															
Australia	504	29.7	1.22	27.4	32.1	713	39.3	1.29	36.8	41.8	531	31.0	1.23	28.5	33.4
Canada	523	34.6	1.37	31.9	37.3	628	37.4	1.36	34.7	40.0	444	28.1	1.28	25.5	30.6
United Kingdom	544	30.9	1.28	28.4	33.4	689	41.7	1.39	39.0	44.4	481	27.4	1.23	25.0	29.8
United States	433	35.8	1.56	32.7	38.8	471	35.1	1.52	32.1	38.1	360	29.1	1.48	26.2	32.0
Sex															
Female	1095	31.3	0.87	29.6	33.0	1445	39.8	0.92	38.0	41.6	1009	28.9	0.86	27.2	30.5
Male	909	33.5	1.01	31.5	35.5	1056	37.6	1.03	35.6	39.6	807	28.9	0.96	27.0	30.8
Age group															
18-24	220	32.4	2.02	28.4	36.3	289	39.5	2.08	35.5	43.6	206	28.1	1.90	24.4	31.8
25-39	656	33.1	1.18	30.8	35.4	782	38.9	1.22	36.5	41.3	565	28.0	1.12	25.8	30.2
40-54	722	32.0	1.10	29.8	34.1	889	37.4	1.13	35.2	39.6	695	30.6	1.10	28.5	32.8
55-max	406	32.4	1.45	29.5	35.2	541	39.7	1.50	36.7	42.6	350	28.0	1.39	25.2	30.7
Education															
Low	1096	32.2	0.90	30.5	34.0	1362	38.1	0.93	36.3	40.0	1053	29.6	0.86	27.9	31.3
Moderate	629	32.0	1.20	29.7	34.4	785	38.7	1.25	36.3	41.2	565	29.3	1.18	26.9	31.6
High	279	34.8	1.90	31.0	38.5	354	40.6	1.94	36.8	44.4	198	24.6	1.72	21.2	28.0
Household income															
Low	586	31.5	1.23	29.1	33.9	750	37.8	1.26	35.3	40.2	558	30.7	1.23	28.3	33.1
Moderate	719	32.8	1.13	30.6	35.0	842	38.2	1.18	35.8	40.5	639	29.0	1.09	26.9	31.2
High	572	32.9	1.26	30.4	35.4	752	40.6	1.31	38.1	43.2	489	26.5	1.16	24.2	28.7
No answer	127	32.8	2.69	27.5	38.0	157	36.0	2.70	30.7	41.3	130	31.2	2.59	26.1	36.3
Ethnicity															
Non-white, other language	226	32.9	2.02	28.9	36.8	264	35.7	2.04	31.7	39.7	223	31.4	1.98	27.5	35.3
White, English only	1778	32.4	0.71	31.0	33.8	2237	39.0	0.74	37.6	40.5	1593	28.5	0.68	27.2	29.9
Employed outside home															
No	667	30.3	1.10	28.1	32.4	921	39.9	1.16	37.6	42.2	668	29.8	1.08	27.7	32.0
Yes	1337	33.6	0.85	31.9	35.2	1580	38.0	0.86	36.3	39.7	1148	28.4	0.81	26.8	30.0
<sup>a</sup> unweighted frequencies															
<sup>b</sup> weighted percentages															

**Table 13 (continued):** Descriptive Statistics for Change in Number of Smoking Friends Between Wave 1 and Wave 2 (gain, no change, or loss), (N=6,321)<sup>a,b</sup>

Variable	Loss					No Change					Gain				
	n	%	SE	95% CI of Percent		n	%	SE	95% CI of Percent		n	%	SE	95% CI of Percent	
Smoking status															
Daily	1838	32.6	0.70	31.2	34.0	2298	38.8	0.73	37.3	40.2	1656	28.6	0.67	27.3	30.0
Weekly	166	31.1	2.28	26.6	35.6	203	37.1	2.38	32.4	41.8	160	31.8	2.33	27.3	36.4
Heaviness of smoking index															
0 - low dependence	283	30.4	1.73	27.0	33.8	373	40.4	1.86	36.7	44.0	255	29.3	1.73	25.9	32.7
1	202	30.2	2.05	26.2	34.2	261	37.2	2.13	33.0	41.4	217	32.6	2.09	28.5	36.7
2	337	33.6	1.67	30.3	36.8	423	37.7	1.66	34.5	41.0	312	28.7	1.55	25.7	31.7
3	589	32.8	1.26	30.4	35.3	707	38.4	1.29	35.9	40.9	510	28.8	1.21	26.4	31.1
4	360	34.8	1.66	31.6	38.1	413	37.7	1.68	34.4	41.0	311	27.5	1.53	24.5	30.5
5	177	33.6	2.28	29.2	38.1	229	37.8	2.25	33.4	42.3	156	28.5	2.15	24.3	32.7
6 - high dependence	56	24.6	3.23	18.2	30.9	95	49.8	3.93	42.1	57.5	55	25.7	3.38	19.0	32.3
Attempt to quit in past year															
No attempt to quit	1137	31.5	0.87	29.8	33.2	1481	39.2	0.91	37.4	41.0	1059	29.3	0.85	27.7	31.0
Attempt to quit	867	33.8	1.06	31.7	35.9	1020	37.9	1.07	35.8	40.0	757	28.3	1.00	26.3	30.2
Longest quit attempt															
Never attempted	379	32.9	1.57	29.8	36.0	467	38.3	1.60	35.1	41.4	334	28.8	1.51	25.9	31.8
<1 week	318	32.6	1.69	29.3	35.9	396	37.4	1.71	34.0	40.8	307	30.0	1.63	26.8	33.2
>1 week but <6 months	600	31.3	1.21	29.0	33.7	770	39.4	1.27	36.9	41.9	571	29.2	1.17	26.9	31.5
>6 months	707	33.2	1.14	31.0	35.5	868	38.7	1.17	36.4	41.0	604	28.0	1.08	25.9	30.2
Quit intentions (Wave 1)															
No intention	1293	32.3	0.83	30.7	33.9	1610	39.2	0.87	37.5	40.9	1155	28.5	0.80	26.9	30.0
Intention	711	32.8	1.15	30.6	35.1	891	37.6	1.15	35.3	39.8	661	29.6	1.10	27.5	31.8
Outcome expectancy															
Not at all	119	32.0	2.63	26.8	37.1	156	39.1	2.74	33.7	44.4	119	29.0	2.53	24.0	33.9
Slightly	256	33.1	1.91	29.3	36.8	302	36.3	1.92	32.6	40.1	232	30.6	1.89	26.9	34.3
Moderately	401	33.7	1.55	30.7	36.8	501	39.0	1.57	35.9	42.1	331	27.3	1.43	24.5	30.1
Very much	658	32.3	1.18	30.0	34.6	838	39.8	1.23	37.4	42.3	591	27.9	1.11	25.7	30.1
Extremely	570	31.8	1.24	29.3	34.2	704	37.9	1.29	35.4	40.4	543	30.4	1.23	28.0	32.8
Worried smoking will damage health															
Not all worried	234	31.4	1.91	27.7	35.2	305	37.7	1.93	34.0	41.5	235	30.8	1.87	27.2	34.5
A little worried	489	33.4	1.38	30.7	36.1	572	37.5	1.43	34.7	40.3	436	29.1	1.33	26.5	31.7
Moderately worried	605	30.9	1.18	28.6	33.2	807	39.4	1.23	37.0	41.8	580	29.7	1.17	27.4	31.9
Very worried	676	33.7	1.20	31.3	36.0	817	39.0	1.23	36.6	41.5	565	27.3	1.12	25.1	29.5
Number of smoking friends at Wave 1															
0						467	53.3	1.95	49.5	57.1	363	46.7	1.95	42.9	50.5
1	163	18.8	1.49	15.9	21.7	294	33.0	1.80	29.5	36.5	383	48.2	1.94	44.4	52.0
2	322	26.0	1.42	23.2	28.8	416	32.6	1.50	29.7	35.6	490	41.4	1.59	38.2	44.5
3	484	36.8	1.52	33.8	39.7	437	33.2	1.48	30.3	36.1	349	30.0	1.50	27.1	33.0
4	401	47.3	1.98	43.4	51.2	188	24.8	1.77	21.3	28.3	231	27.9	1.77	24.4	31.4
5	634	47.1	1.55	44.1	50.1	699	52.9	1.55	49.9	55.9					
<sup>a</sup> unweighted frequencies															
<sup>b</sup> weighted percentages															

*Bivariate models.* Table 14 and Table 15 present the results of the bivariate multinomial logistic regression analyses that tested the relation between change in number of smoking friends between Wave 1 and Wave 2, and demographic characteristics and smoking cessation variables, adjusting for number of smoking friends at Wave 1. Table 14 shows the results of the bivariate models comparing respondents who experienced no change vs. a gain in number of smoking friends, with gain set as the predicted event. The following characteristics were related to a greater likelihood of reporting a gain vs. no change in number of smoking friends: younger age, lower education, lower income, and being more worried that smoking will damage health. Table 15 shows the results of the bivariate model comparing respondents who experienced no change vs. a loss in number of smoking friends with loss in smoking friends set as the predicted event. The following characteristics were related to a greater likelihood of reporting a loss compared to no change in number of smoking friends: being from the United States or Canada vs. Australia, older age, higher education, and being employed outside the home. Note: refer back to Table 13 for the percent of respondents who reported no change, loss, and gain in number of smoking friends

**Table 14:** Wave 1 Predictors of Change in Number of Smoking Friends Between Wave 1 and Wave 2, Bivariate Model, Event = gain (gain vs. no change), (N=6,321)

Parameter	Pr > ChiSq	Exp(Est)	95% LCI	95% UCI
<b>Country</b>				
Australia	ref	1.00	1.00	1.00
Canada	0.5751	0.95	0.78	1.15
United Kingdom	0.1116	0.86	0.71	1.04
United States	0.6652	1.05	0.85	1.29
<b>Sex</b>				
Female	ref	1.00	1.00	1.00
Male	0.0923	1.13	0.98	1.30
<b>Age group**</b>				
18-24	ref	1.00	1.00	1.00
25-39	0.0255	0.76	0.59	0.97
40-54	0.017	0.74	0.58	0.95
55-max	<.0001	0.52	0.40	0.69
<b>Education**</b>				
Low	ref	1.00	1.00	1.00
Moderate	0.261	0.91	0.78	1.07
High	<.0001	0.61	0.49	0.77
<b>Household income*</b>				
Low	ref	1.00	1.00	1.00
Moderate	0.2222	0.90	0.75	1.07
High	0.0002	0.70	0.58	0.84
No answer	0.6654	1.07	0.79	1.45
<b>Ethnicity</b>				
Non-white, other language	ref	1.00	1.00	1.00
White, English only	0.175	0.86	0.69	1.07
<b>Employed outside the home</b>				
No	ref	1.00	1.00	1.00
Yes	0.5801	1.04	0.90	1.21
<b>Smoking status</b>				
Daily	ref	1.00	1.00	1.00
Weekly	0.8177	1.03	0.79	1.34
Heaviness of smoking	0.8489	1.00	0.95	1.04
<b>Attempt to quit in past year</b>				
No attempt	ref	1.00	1.00	1.00
Attempt	0.57	1.04	0.90	1.21
<b>Longest attempt to quit</b>				
Never attempted	ref	1.00	1.00	1.00
<1 week	0.7189	1.05	0.82	1.33
>1 week but < 6 months	0.5076	0.93	0.76	1.15
>6 months	0.0688	0.83	0.67	1.02
<b>Quit intentions (Wave 1)</b>				
No intention	ref	1.00	1.00	1.00
Intention	0.9613	1.00	0.86	1.17
Outcome expectancy	0.9972	1.00	0.94	1.06
Worried smoking will damage health*	0.044	0.93	0.87	1.00
*significant at p<0.05				
**significant at p<0.0001				

**Table 15: Wave 1 Predictors of Change in Number of Smoking Friends Between Wave 1 and Wave 2, Bivariate Model, Event = loss (loss vs. no change), (N=6,321)**

Parameter	Pr > ChiSq	Exp(Est)	95% LCI	95% UCI
<b>Country*</b>				
Australia	ref	1.00	1.00	1.00
Canada	0.0309	1.23	1.02	1.49
United Kingdom	0.5464	0.94	0.78	1.14
United States	0.0053	1.34	1.09	1.64
<b>Sex</b>				
Female	ref	1.00	1.00	1.00
Male	0.1094	1.12	0.98	1.28
<b>Age group*</b>				
18-24	ref	1.00	1.00	1.00
25-39	0.086	1.24	0.97	1.58
40-54	0.0153	1.35	1.06	1.72
55-max	0.0044	1.46	1.13	1.90
<b>Education*</b>				
Low	ref	1.00	1.00	1.00
Moderate	0.5533	1.05	0.90	1.23
High	0.0435	1.24	1.01	1.52
<b>Household income</b>				
Low	ref	1.00	1.00	1.00
Moderate	0.3684	1.08	0.91	1.29
High	0.3071	1.10	0.92	1.32
No answer	0.6723	1.07	0.79	1.45
<b>Ethnicity</b>				
Non-white, other language	ref	1.00	1.00	1.00
White, English only	0.3643	0.90	0.72	1.13
<b>Employed outside the home*</b>				
No	ref	1.00	1.00	1.00
Yes	0.0317	1.17	1.01	1.36
<b>Smoking status</b>				
Daily	ref	1.00	1.00	1.00
Weekly	0.3792	1.12	0.87	1.43
Heaviness of smoking	0.4926	0.99	0.94	1.03
<b>Attempt to quit in past year</b>				
No attempt	ref	1.00	1.00	1.00
Attempt	0.3016	1.08	0.94	1.24
<b>Longest attempt to quit</b>				
Never attempted	ref	1.00	1.00	1.00
<1 week	0.9934	1.00	0.79	1.27
>1 week but < 6 months	0.6336	0.95	0.78	1.17
>6 months	0.312	1.11	0.91	1.35
<b>Quit intentions (Wave 1)</b>				
No intention	ref	1.00	1.00	1.00
Intention	0.08	1.14	0.99	1.32
Outcome expectancy	0.765	0.99	0.94	1.05
Worried smoking will damage health	0.6696	1.02	0.95	1.09
*significant at p<0.05				
**significant at p<0.0001				

*Multivariate models.* Tables 16 and 17 present the results of the multinomial logistic regression analyses examining the predictors of experiencing a loss, gain, or no change in number of smoking friends between Wave 1 and Wave 2, adjusting for demographic characteristics and smoking cessation predictor variables, and number of smoking friends at Wave 1. Table 16 shows the results of the multivariate model comparing respondents who experienced no change vs. a loss in number of smoking friends with loss in smoking friends set as the predicted event. The following characteristics were related to a greater likelihood of reporting a loss compared to no change in number of smoking friends: being from the United States vs. Australia, older age, being employed outside the home, and having a higher number of smoking friends at Wave 1. Table 17 shows the results of the multivariate model comparing respondents who experienced no change vs. a gain in number of smoking friends, with gain in smoking friends set as the predicted event. The following characteristics were related to a greater likelihood of reporting a gain vs. no change in number of smoking friends: being male, younger age, lower education, lower income, being less worried about the future health damages of smoking, and having a lower number of smoking friends at Wave 1. Note: refer back to Table 13 for the percent of respondents who reported no change, loss, and gain in number of smoking friends.

**Table 16: Wave 1 Predictors of Friend Change Between Wave 1 and Wave 2, Multivariate Model, Event = loss, (loss vs. no change), (N=6,321)**

Parameter	Pr > ChiSq	Exp(Est)	95% LCI	95% UCI
<b>Country*</b>				
Australia	ref	1.000	1.00	1.00
Canada	0.0693	1.20	0.99	1.45
United Kingdom	0.3619	0.91	0.75	1.11
United States	0.0087	1.33	1.07	1.64
<b>Sex</b>				
Female	ref	1.00	1.00	1.00
Male	0.2079	1.10	0.95	1.26
<b>Age group*</b>				
18-24	ref	1.00	1.00	1.00
25-39	0.0608	1.27	0.99	1.62
40-54	0.0093	1.40	1.09	1.81
55-max	0.0002	1.72	1.29	2.30
<b>Education</b>				
Low	ref	1.00	1.00	1.00
Moderate	0.7205	0.97	0.82	1.14
High	0.2459	1.14	0.92	1.41
<b>Household income</b>				
Low	ref	1.00	1.00	1.00
Moderate	0.7097	1.04	0.86	1.25
High	0.6258	1.05	0.86	1.29
No answer	0.4977	1.11	0.82	1.52
<b>Ethnicity</b>				
Non-white, other language	ref	1.00	1.00	1.00
White, English only	0.8932	0.98	0.78	1.24
<b>Employed outside the home*</b>				
No	ref	1.00	1.00	1.00
Yes	0.0252	1.21	1.02	1.43
<b>Smoking status</b>				
Daily	ref	1.00	1.00	1.00
Weekly	0.8451	1.03	0.78	1.36
Heaviness of smoking	0.3056	0.97	0.93	1.03
<b>Attempt to quit in past year</b>				
No attempt	ref	1.00	1.00	1.00
Attempt	0.1198	1.14	0.97	1.34
<b>Longest attempt to quit</b>				
Never attempted	ref	1.00	1.00	1.00
<1 week	0.6034	0.93	0.72	1.21
>1 week but < 6 months	0.2492	0.87	0.69	1.10
>6 months	0.9085	0.99	0.80	1.23
<b>Quit intentions (Wave 1)</b>				
No intention	ref	1.00	1.00	1.00
Intention	0.2824	1.09	0.93	1.29
Outcome expectancy	0.5683	0.98	0.92	1.05
Worried smoking will damage health	0.7146	1.02	0.94	1.10
Number of smoking friends at Wave 1**	<.0001	1.40	1.34	1.47
*significant at p<0.05				
**significant at p<0.0001				

**Table 17: Wave 1 Predictors of Friend Change Between Wave 1 and Wave 2, Multivariate Model, Event = gain, (gain vs. no change), (N=6,321)**

Parameter	Pr > ChiSq	Exp(Est)	95% LCI	95% UCI
Country				
Australia	ref	1.00	1.00	1.00
Canada	0.7867	0.97	0.80	1.19
United Kingdom	0.3408	0.91	0.75	1.11
United States	0.6802	1.05	0.84	1.30
Sex*				
Female	ref	1.00	1.00	1.00
Male	0.0377	1.17	1.01	1.36
Age group**				
18-24	ref	1.00	1.00	1.00
25-39	0.1404	0.83	0.65	1.06
40-54	0.08	0.80	0.62	1.03
55-max	<.0001	0.49	0.37	0.66
Education*				
Low	ref	1.00	1.00	1.00
Moderate	0.1929	0.89	0.75	1.06
High	0.0003	0.64	0.50	0.82
Household income*				
Low	ref	1.00	1.00	1.00
Moderate	0.0983	0.85	0.71	1.03
High	0.0002	0.67	0.54	0.82
No answer	0.8178	1.04	0.76	1.41
Ethnicity				
Non-white, other language	ref	1.00	1.00	1.00
White, English only	0.5462	0.93	0.74	1.17
Employed outside the home				
No	ref	1.00	1.00	1.00
Yes	0.7195	1.03	0.87	1.22
Smoking status				
Daily	ref	1.00	1.00	1.00
Weekly	0.9744	1.01	0.75	1.34
Heaviness of smoking	0.5344	0.98	0.93	1.04
Attempt to quit in past year				
No attempt	ref	1.00	1.00	1.00
Attempt	0.9915	1.00	0.84	1.18
Longest attempt to quit				
Never attempted	ref	1.00	1.00	1.00
<1 week	0.701	1.05	0.81	1.37
>1 week but < 6 months	0.7528	0.96	0.76	1.22
>6 months	0.2885	0.89	0.71	1.11
Quit intentions (Wave 1)				
No intention	ref	1.00	1.00	1.00
Intention	0.5154	1.06	0.89	1.25
Outcome expectancy	0.9803	1.00	0.93	1.08
Worried smoking will damage health*	0.0293	0.91	0.84	0.99
Number of smoking friends at Wave 1**	<.0001	0.64	0.61	0.67
*significant at p<0.05				
**significant at p<0.0001				

*Summary of results.* Overall, it was primarily demographic characteristics that predicted changes in number of smoking friends; the only smoking cessation predictor variable that was found to predict changes in number of smoking friends was worry about the future health damages of smoking. Smokers who were male, younger, had lower education, and who had lower incomes were more likely to gain smoking friends, as were smokers who worried less about the future health damages of smoking. In contrast, smokers who were from Australia vs. the United Kingdom, who were older, and who were employed outside the home were more likely to lose smoking friends. Tests of interactions indicated that across countries there were no significant differences in the number of smoking friends reported by respondents by sex, age, or level of education. Similarly, tests of interactions also indicated that across countries, there were no significant differences in changes in number of smoking friends by sex, age, or level of education.

#### ***6.4 Number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes***

This section presents the results of the analyses described in Section 5.4. Please note that (1) a table summarizing the main results of this section can be found in Section 6.4.6, and (2) that the full multivariate regression tables for the models presented in this section can be found in the Appendix (Section 8.0). Also, please note that for the analyses presented in this section: (1) all frequencies presented are unweighted, and (2) all percentages of respondents reporting the key outcomes are weighted (e.g., percent of smokers who attempted to quit). Results are given for the following research questions in this section:

##### **3) Number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes:**

- a) *Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 1?*

- b) *Is there a relation between number of smoking friends at Wave 1, and intentions to quit smoking at Wave 2?*
- c) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and intentions to quit smoking at Wave 2?*
- d) *Is there a relation between number of smoking friends at Wave 1, and attempts to quit smoking at Wave 2?*
- e) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and reports of attempts to quit smoking between Wave 1 and Wave 2?*
- f) *Is there a relation between number of smoking friends at Wave 1 and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?*
- g) *Is there a relation between changes in number of smoking friends between Wave 1 and Wave 2, and abstinence from smoking for at least one month at Wave 2 (among everyone, and among smokers who attempted to quit to test the relation with quit attempt success)?*
  - i) *Secondary objective: Does any relation between number of smoking friends at Wave 1, or changes in number of smoking friends between Wave 1 and Wave 2, and smoking cessation outcomes differ by country, demographics (age, sex, and education), or smoking behaviour (intentions to quit smoking at Wave 1, and heaviness of smoking index)?*
- f) *Does adding number of smoking friends at Wave 1, and/or changes in number of smoking friends between Wave 1 and Wave 2 improve the base model to predict smoking cessation outcomes?*

## **6.4.1 Intentions to quit smoking at Wave 1 and Wave 2**

### **6.4.1.1 Base model: Predictors of intentions to quit smoking at Wave 1**

*Multivariate analysis.* Table 18 presents the results of the multivariate analysis testing the relation between the demographic and smoking cessation predictor variables included in the base model, and

intentions to quit at Wave 1. Overall, smokers who were more likely to have intentions to quit at Wave 1 were more likely to (relative to the comparison group): be from Canada vs. Australia and less likely to be from Australia vs. United Kingdom, be male, be 55 years or older, be weekly or monthly smokers, be lighter smokers (lower nicotine dependence), have attempted to quit in past year, report a longer previous attempt to quit, have a positive outcome expectancy of quitting, and be more worried about the future health damages of smoking.

**Table 18:** Base Model: Predictors of Intentions to Quit Smoking at Wave 1, (N=6,321)

Parameter	n	% Intend to Quit (Wave1)	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Country</b>						
Australia	1748	35.5	ref	1.00	1.00	1.00
Canada	1595	46.4	<.0001	1.59	1.33	1.90
United Kingdom	1714	29.5	0.017	0.80	0.66	0.96
United States	1264	34.1	0.188	0.88	0.72	1.07
<b>Sex</b>						
Female	3549	35.1	ref	1.00	1.00	1.00
Male	2772	37.4	0.005	1.21	1.06	1.38
<b>Age group</b>						
18-24	715	38.2	ref	1.00	1.00	1.00
25-39	2003	40.0	0.227	1.15	0.92	1.45
40-54	2306	35.2	0.442	1.10	0.87	1.39
55-max	1297	30.0	0.033	1.34	1.02	1.74
<b>Education</b>						
Low	3511	33.7	ref	1.00	1.00	1.00
Moderate	1979	39.5	0.200	1.11	0.95	1.29
High	831	40.4	0.349	1.10	0.90	1.36
<b>Household income</b>						
Low	1894	32.7	ref	1.00	1.00	1.00
Moderate	2200	39.0	0.131	1.14	0.96	1.36
High	1813	38.9	0.393	1.09	0.90	1.32
No answer	414	26.2	0.234	0.83	0.61	1.13
<b>Ethnicity</b>						
Non-white, other language	5608	36.7	ref	1.00	1.00	1.00
White, English only	713	36.3	0.308	1.12	0.90	1.39
<b>Employed outside the home</b>						
No	4065	32.3	ref	1.00	1.00	1.00
Yes	2256	38.4	0.242	1.10	0.94	1.28
<b>Smoking status</b>						
Daily	5792	35.7	ref	1.00	1.00	1.00
Weekly/Monthly	529	44.4	0.024	1.35	1.04	1.75

**Table 18 (continued):** Base Model: Predictors of Intentions to Quit Smoking at Wave 1, (N=6,321)

Parameter	n	% Intend to Quit (Wave1)	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Heaviness of smoking</b>						
0 - low dependence	911	37.2	0.002	0.93	0.88	0.97
1	680	43.7				
2	1072	39.8				
3	1806	36.4				
4	1084	33.4				
5	562	28.6				
6 - high dependence	206	27.6				
<b>Attempt to quit past year</b>						
No attempt	3677	25.4	ref	1.00	1.00	1.00
Attempt	2644	50.7	<.0001	2.38	2.05	2.75
<b>Longest attempt to quit</b>						
Never attempted	1180	18.5	ref	1.00	1.00	1.00
<1 week	1021	35.6	0.257	1.17	0.90	1.52
>1 week but < 6 months	1941	40.1	0.023	1.32	1.04	1.67
>6 months	2179	43.7	<.0001	1.78	1.43	2.21
<b>Outcome expectancy</b>						
Not at all	394	9.3	<.0001	1.39	1.30	1.49
Slightly	790	18.9				
Moderately	1233	26.4				
Very much	2087	40.6				
Extremely	1817	50.7				
<b>Worried smoking will damage health</b>						
Not all worried	774	16.9	<.0001	1.64	1.51	1.78
A little worried	1497	21.9				
Moderately worried	1992	34.1				
Very worried	2058	56.1				

**6.4.1.2 Number of smoking friends at Wave 1 and intentions to quit smoking at Wave 1 (cross-sectional analysis)**

*Multivariate analysis.* Table 19 presents the results of the multivariate regression analysis that tested the relation between number of smoking friends at Wave 1 and intentions to quit smoking at Wave 1. Number of smoking friends at Wave 1 was significantly related to intentions to quit smoking at Wave 1. However, it was only significant for the extreme comparison; smokers who reported having 0 vs. 5 smoking friends at Wave 1 were more likely to have intentions to quit smoking. Table A-1 in Appendix A presents the full multivariate regression table.

**Table 19:** Number of Smoking Friends at Wave 1 and Intentions to Quit Smoking at Wave 1, (N=6,321)<sup>a</sup>

Parameter	n	% Intend to Quit (Wave1)	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	830	38.5	ref	1.00	1.00	1.00
1	840	42.9	0.1455	1.21	0.94	1.55
2	1228	36.8	0.3246	0.89	0.70	1.12
3	1270	38.6	0.6991	0.95	0.75	1.21
4	820	33.5	0.0908	0.80	0.62	1.04
5	1333	31.5	0.0218	0.76	0.59	0.96
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

**6.4.1.3 Base model: Predictors of intentions to quit smoking at Wave 2**

*Multivariate analysis.* Table 20 presents the results the multivariate analysis testing the relation between the demographic and smoking cessation predictor variables included in the base model, and intentions to quit at Wave 2. Overall, smokers who were more likely to have intentions to quit at Wave 2 were more likely to (relative to the comparison group): be from Canada vs. Australia and less likely to be from United Kingdom vs. Australia, be 40 - 54 years old, have attempted to quit in past year, have

reported a longer previous attempt to quit, have had an intention to quit at Wave 1, have a positive outcome expectancy of quitting, and be more worried about the future health damages of smoking.

**Table 20:** Base Model: Predictors of Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Country</b>						
Australia	1602	29.2	ref	1.00	1.00	1.00
Canada	1423	42.2	<.0001	1.66	1.37	2.02
United Kingdom	1557	21.4	0.001	0.70	0.57	0.86
United States	1157	30.6	0.395	1.10	0.89	1.36
<b>Sex</b>						
Female	3211	29.8	ref	1.00	1.00	1.00
Male	2528	31.3	0.458	1.06	0.91	1.23
<b>Age group</b>						
18-24	633	34.6	ref	1.00	1.00	1.00
25-39	1787	32.6	0.245	0.86	0.66	1.11
40-54	2128	28.0	0.047	0.77	0.59	1.00
55-max	1191	28.5	0.424	1.13	0.84	1.51
<b>Education</b>						
Low	3211	27.7	ref	1.00	1.00	1.00
Moderate	1798	33.6	0.267	1.10	0.93	1.30
High	730	36.3	0.077	1.23	0.98	1.56
<b>Household income</b>						
Low	1740	29.3	ref	1.00	1.00	1.00
Moderate	2004	29.7	0.169	0.87	0.72	1.06
High	1615	33.9	0.376	1.10	0.89	1.34
No answer	380	26.4	0.749	1.05	0.76	1.46
<b>Ethnicity</b>						
Non-white, other language	646	32.7	ref	1.00	1.00	1.00
White, English only	5093	30.3	0.936	1.01	0.80	1.28
<b>Employed outside the home</b>						
No	2083	28.9	ref	1.00	1.00	1.00
Yes	3656	31.5	0.817	1.02	0.86	1.21
<b>Smoking status</b>						
Daily	5329	30.1	ref	1.00	1.00	1.00
Weekly/Monthly	410	37.7	0.251	1.20	0.88	1.62

**Table 20 (continued):** Base Model: Predictors of Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking						
0 - low dependence	740	31.1	0.161	0.96	0.91	1.02
1	599	38.3				
2	984	34.6				
3	1672	27.9				
4	1009	29.8				
5	537	27.6				
6 - high dependence	198	22.0				
Attempt to quit past year						
No attempt	3400	23.0	ref	1.00	1.00	1.00
Attempt	2339	40.8	<.0001	1.40	1.18	1.66
Longest attempt to quit						
Never attempted	1099	18.4	ref	1.00	1.00	1.00
<1 week	987	28.6	0.895	0.98	0.74	1.30
>1 week but < 6 months	1787	34.5	0.085	1.24	0.97	1.59
>6 months	1866	35.5	0.009	1.37	1.08	1.73
Quit intentions (Wave 1)						
No intention	3817	17.4	ref	1.00	1.00	1.00
Intention	1922	56.2	<.0001	4.27	3.66	4.98
Outcome expectancy						
Not at all	367	10.0	0.0003	1.15	1.06	1.24
Slightly	721	20.0				
Moderately	1124	23.3				
Very much	1887	34.2				
Extremely	1640	40.1				
Worried smoking will damage health						
Not all worried	728	14.5	<.0001	1.30	1.19	1.41
A little worried	1374	20.3				
Moderately worried	1814	31.9				
Very worried	1823	43.2				

#### 6.4.1.4 Number of smoking friends at Wave 1 and intentions to quit smoking at Wave 2

*Multivariate analysis.* **Table 21** presents the results of the multivariate analysis that tested the relation between number of smoking friends at Wave 1 and intentions to quit smoking at Wave 2 among continuing current smokers. No significant relation was found between number of smoking friends at Wave 1 and intentions to quit smoking at Wave 2. However, there was a slight downward trend in the descriptive data, such that smokers with more smoking friends were less likely to intend to quit. Table A-2 in Appendix A presents the full multivariate regression table.

**Table 21:** Number of Smoking Friends at Wave 1 and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)<sup>a</sup>

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	741	32.9	ref	1.00	1.00	1.00
1	747	34.5	0.668	1.06	0.81	1.39
2	1092	33.7	0.515	1.09	0.84	1.41
3	1159	30.7	0.272	0.86	0.66	1.12
4	757	27.6	0.148	0.81	0.61	1.08
5	1243	27.1	0.250	0.86	0.66	1.12
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

##### 6.4.1.4.1 Interaction: Number of smoking friends at Wave 1 x Heaviness of Smoking Index at Wave 1, and quit intentions at Wave 2

There was a significant number of smoking friends at Wave 1 x Heaviness of Smoking Index interaction, suggesting that the relation between number of smoking friends at Wave 1 and intentions to quit at Wave 2 may depend on smokers' heaviness of smoking/nicotine dependence, ( $p=0.04$ ). Table 22 presents the odds ratios for the relation between number of smoking friends at Wave 1 and intentions to quit at Wave 2 for scores 0 through 6 on the Heaviness of Smoking Index, where higher scores indicate higher nicotine dependence. Further examination of the interaction did not suggest any clear patterns of

significant differences between the odds ratios. Because a large number of a-priori interactions were tested in this dissertation, it may be that this interaction was only significant by chance.

**Table 22:** Number of Smoking Friends at Wave 1x Heaviness of Smoking Index, and Intentions to Quit Smoking at Wave 2: Odds Ratios for the Relation Between Number of Smoking Friends for Levels 0 - 6 on the Heaviness of Smoking Index, (N=5,739)

Number of Smoking Friends at Wave 1	Heaviness of Smoking Index																											
	0				1				2				3				4				5				6			
	OR	LCI	UCI	p	OR	LCI	UCI	p	OR	LCI	UCI	p	OR	LCI	UCI	p	OR	LCI	UCI	p	OR	LCI	UCI	p	OR	LCI	UCI	p
0	ref	1.00	1.00		ref	1.00	1.00		ref	1.00	1.00		ref	1.00	1.00		ref	1.00	1.00		ref	1.00	1.00		ref	1.00	1.00	
1	1.73	1.05	2.87	0.0325	1.43	0.99	2.09	0.0596	1.19	0.89	1.58	0.2412	0.98	0.74	1.30	0.9033	0.813	0.57	1.17	0.2605	0.67	0.41	1.09	0.1096	0.56	0.30	1.04	0.0682
2	1.40	0.87	2.26	0.1637	1.27	0.89	1.81	0.182	1.15	0.88	1.51	0.3021	1.05	0.80	1.36	0.7489	0.947	0.67	1.34	0.7588	0.86	0.54	1.37	0.5246	0.78	0.42	1.43	0.4201
3	1.62	1.00	2.63	0.0504	1.27	0.89	1.82	0.1914	1.00	0.76	1.31	0.9833	0.78	0.60	1.03	0.0773	0.614	0.43	0.87	0.0065	0.48	0.30	0.77	0.0025	0.38	0.20	0.70	0.0018
4	1.16	0.69	1.95	0.5891	1.01	0.68	1.49	0.9756	0.88	0.65	1.19	0.3929	0.76	0.57	1.03	0.0744	0.665	0.46	0.97	0.0341	0.58	0.35	0.96	0.0342	0.51	0.26	0.97	0.0400
5	0.99	0.60	1.62	0.9582	0.93	0.64	1.35	0.6937	0.87	0.66	1.16	0.3467	0.82	0.63	1.07	0.1474	0.771	0.55	1.08	0.1281	0.73	0.46	1.14	0.1601	0.68	0.38	1.22	0.1975

#### **6.4.1.5 Changes in number of smoking friends between Wave 1 and Wave 2 and intentions to quit smoking at Wave 2**

*Multivariate analyses (non-collapsed friend change).* Table 23 presents the results of the model that tested the relation between non-collapsed friend change and intentions to quit smoking at Wave 2. Non-collapsed friend change was significantly related to intentions to quit at Wave 2. Smokers who lost 3 or 4 smoking friends were more likely to intend to quit smoking than smokers who did not experience a change in number of smoking friends. Smokers who gained 2 smoking friends were less likely to intend to quit than those who experienced no change. Number of smoking friends at Wave 1 was also significant in this model, such that smokers with 0 vs. 4 or 5 smoking friends were more likely to intend to quit. Table A-3 in Appendix A presents the full multivariate regression table.

The group means of the individual predicted probabilities of quitting (number of smoking friends at Wave 1 x non-collapsed friend change) are presented in Table 24. The predicted probabilities along with the multivariate model suggest that it is not only the overall loss or gain of smoking friends that was related to intentions to quit, but also the proportion of the loss or gain. Smokers who lost all of their smoking friends between Wave 1 and Wave 2 had the highest probability of reporting an intention to quit at Wave 2.

**Table 23:** Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)<sup>a</sup>

Parameter	n	% Intend to Quit (Wave 2)	Pr > Chi Sq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	741	32.9	ref	1.00	1.00	1.00
1	747	34.5	0.810	1.04	0.78	1.37
2	1092	33.7	0.984	1.00	0.77	1.31
3	1159	30.7	0.081	0.78	0.59	1.03
4	757	27.6	0.015	0.68	0.50	0.93
5	1243	27.1	0.006	0.66	0.50	0.89
Friend change between Wave 1 and Wave 2						
No change	2290	30.2	ref	1.00	1.00	1.00
-5	25	33.5	0.416	1.99	0.38	10.36
-4	59	42.1	0.029	2.22	1.09	4.55
-3	191	39.3	0.010	1.72	1.14	2.59
-2	468	30.5	0.499	1.11	0.83	1.48
-1	1018	31.9	0.408	1.10	0.88	1.36
1	1003	29.6	0.188	0.87	0.70	1.07
2	446	26.8	0.006	0.64	0.47	0.88
3	157	33.2	0.932	1.02	0.64	1.63
4	48	29.7	0.574	0.80	0.37	1.73
5	34	20.7	0.356	0.65	0.26	1.62
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

**Table 24:** Change in Number of Smoking Friends Between Wave 1 and Wave 2 (non-collapsed) and Number of Smoking Friends at Wave 1, and Predicted Probability of Having an Intention to Quit at Wave 2, (N=5,739)

# Smoking Friends at Wave 1	Change in Number of Smoking Friends and Group Means of Predicted Probabilities										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
0						0.352	0.324	0.280	0.318	0.337	0.232
1					0.366	0.355	0.346	0.287	0.392	0.251	
2				0.375	0.363	0.357	0.284	0.244	0.329		
3			0.429	0.341	0.329	0.279	0.292	0.235			
4		0.398	0.392	0.294	0.272	0.274	0.236				
5	0.301	0.404	0.359	0.262	0.263	0.253					

Legend	
	Lowest (10th percentile - less likely to intend to quit)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to intend to quit)

*Multivariate analyses (collapsed friend change).* Table 25 presents the results of the multivariate logistic regression analysis that tested the relation between collapsed friend change and intentions to quit smoking at Wave 2. Collapsed friend change was significantly related to intentions to quit smoking at Wave 2. Smokers who reported gaining smoking friends were less likely to intend to quit than those who reported no change in number of smoking friends. However, smokers who lost smoking friends were no more likely to intend to quit than smokers who experienced no change. Number of smoking friends at Wave 1 was also significant in this model, such that smokers with 0 compared to 4 or 5 smoking friends were more likely to intend to quit. Table A-4 in Appendix A presents the full multivariate regression results.

**Table 25:** Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)<sup>a</sup>

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	741	32.9	ref	1.00	1.00	1.00
1	747	34.5	0.822	1.03	0.78	1.36
2	1092	33.7	0.874	1.02	0.79	1.33
3	1159	30.7	0.075	0.78	0.59	1.03
4	757	27.6	0.027	0.71	0.53	0.96
5	1243	27.1	0.018	0.71	0.53	0.94
Friend change between Wave 1 and Wave 2						
No change	2290	30.2				
Loss	1761	32.6	0.080	1.18	0.98	1.41
Gain	1688	29.0	0.038	0.82	0.68	0.99
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

The group means of the individual predicted probabilities of intentions to quit at Wave 2 (number of smoking friends at Wave 1 x collapsed friend change) are presented in Table 26. The probability of having an intention to quit at Wave 2 was generally highest for smokers with fewer smoking friends, and those who experienced a loss or no change in number of smoking friends between Wave 1 and Wave 2.

**Table 26:** Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2 and Number of Smoking Friends at Wave 1, and Predicted Probability of Having Intentions to Quit at Wave 2, (N=5,739)

Friend Change	# Smoking Friends at Wave 1	Group Means of Predicted Probabilities
No change	0	0.226
	1	0.218
	2	0.217
	3	0.204
	4	0.197
	5	0.195
Gain	0	0.211
	1	0.214
	2	0.198
	3	0.194
	4	0.184
Loss	1	0.221
	2	0.224
	3	0.224
	4	0.214
	5	0.198

Legend	
	Lowest (10th percentile - less likely to intend to quit)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to intend to quit)

**6.4.1.5.1 Interaction: Change in number of smoking friends between Wave 1 and Wave 2 (collapsed) x quit intentions at Wave 1, and intentions to quit at Wave 2**

The relation between collapsed friend change and intentions to quit smoking at Wave 2 depended on smokers' intentions to quit smoking at Wave 1,  $p=0.01$ . Table 27 presents descriptive data on the percentage of smokers that intended to quit at Wave 2 by friend change between Wave 1 and Wave 2, and their intentions to quit at Wave 1. Further details on the interaction are described below Table 27.

**Table 27:** Change in Number of Smoking Friends Between Wave 1 and Wave 2 (collapsed) x Quit Intentions at Wave 1, and Intentions to Quit at Wave 2, (N=5,739)

Friend Change Between Wave 1 and Wave 2	Intentions to Quit at Wave 1	% with Intentions to Quit at Wave 2
No Change	Intention	60.5
	No Intention	15.3
Loss	Intention	56.3
	No Intention	20.0
Gain	Intention	51.4
	No Intention	16.0

*The relation between **losing** smoking friends vs. no change in number of smoking friends, and intentions to quit smoking at Wave 2 by intentions to quit smoking at Wave 1.* For smokers with intentions to quit at Wave 1, those who lost smoking friends were no more or less likely to intend to quit at Wave 2 than smokers who experienced no changes in their number of smoking friends (OR=0.89,  $p=0.38$ ). However, for smokers who had no intention to quit at Wave 1, smokers who lost smoking friends were 1.48 times more likely to intend to quit at Wave 2 than smokers who experienced no change in their number of smoking friends, (95% CI of OR= 1.17-1.89,  $p=0.001$ ). The difference between the ORs for smokers with an intention to quit at Wave 1 (OR=0.89), and with no intention to quit at Wave 1 (OR=1.48) was statistically significant,  $p=0.004$ .

*The relation between **gaining** smoking friends vs. no change in number of smoking friends, and intentions to quit smoking at Wave 2 by intentions to quit smoking at Wave 1.* For smokers with intentions to quit at Wave 1, smokers who gained smoking friends were 0.66 times less likely to intend to quit at Wave 2 than smokers who experienced no changes in their number of smoking friends (95% CI of OR= 0.51-0.87,  $p=0.002$ ). However, for smokers with no intentions to quit smoking at Wave 1, smokers who gained smoking friends were no more or less likely to intend to quit smoking at Wave 2 than smokers who experienced no change in their number of smoking friends (OR=0.99,  $p=0.92$ ). The difference between the ORs for smokers with an intention to quit at Wave 1 (OR=0.66), and with no intention to quit at Wave 1 (OR=0.99) was statistically significant,  $p=0.03$ .

#### **6.4.1.6 Summary of results**

Number of smoking friends at Wave 1 predicted intentions to quit at Wave 1. However, it was only the extreme comparison that was significant (0 vs. 5 smoking friends). Number of smoking friends at Wave 1 did not predict quit intentions at Wave 2.

Change in number of smoking friends between Wave 1 and Wave 2 (collapsed and non-collapsed) was related to intentions to quit at Wave 2. For the non-collapsed friend change variable, smokers who gained smoking friends were less likely to intend to quit at Wave 2 than smokers who experienced no change, and smokers who lost smoking friends were more likely to intend to quit at Wave 2 compared to smokers who experienced no change. For the collapsed friend change variable, smokers who gained smoking friends were less likely to intend to quit than smokers who experienced no change, however smokers who lost smoking friends were no more likely to intend to quit than smokers who experienced no change.

There were two significant interactions. There was a significant friend change (collapsed) x quit intentions at Wave 1 interaction for quit intentions at Wave 2. The relation between changes in number of smoking friends between Wave 1 and Wave 2, and quit intentions at Wave 2 depended on smokers' intentions to quit smoking at Wave 1. There was also a significant number of smoking friends at Wave 1 x Heaviness of Smoking Index interaction for quit intentions at Wave 2. However, examination of the interaction revealed no clear pattern of results.

There were no other significant interactions. The relation between number of smoking friends at Wave 1 and quit intentions at Wave 1 did not differ by country, demographics (age, sex, and education), or smoking behaviour (intentions to quit smoking). The relation between changes in number of smoking friends between Wave 1 and Wave 2 did not differ by country, demographics (age, sex, and education), or smoking behaviour (Heaviness of Smoking).

## 6.4.2 Quit attempts at Wave 2

### 6.4.2.1 Base model: Predictors of quit attempts at Wave 2

*Multivariate analysis.* Table 28 presents the results of the multivariate analysis that tested the relation between the demographic and smoking cessation predictor variables included in the base model, and quit attempts at Wave 2. Overall, smokers who were more likely to have made an attempt to quit (relative to the comparison group) were more likely to be from Canada vs. Australia, be younger, have lower vs. moderate education, be weekly or monthly smokers, be lighter smokers (lower nicotine dependence), have attempted to quit in past year, report a longer previous attempt to quit, have had an intention to quit at Wave 1, have a positive outcome expectancy of quitting, and be more worried about the future health damages of smoking.

**Table 28:** Base Model: Predictors of Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	1748	34.8	ref	1.00	1.00	1.00
Canada	1595	44.5	<.0001	1.46	1.22	1.74
United Kingdom	1714	32.3	0.969	1.00	0.83	1.19
United States	1264	37.1	0.111	1.17	0.96	1.43
Sex						
Female	3549	37.3	ref	1.00	1.00	1.00
Male	2772	36.8	0.889	1.01	0.89	1.15
Age group						
18-24	715	48.4	ref	1.00	1.00	1.00
25-39	2003	38.3	0.001	0.66	0.52	0.82
40-54	2306	32.1	<.0001	0.58	0.46	0.73
55-max	1297	34.1	0.089	0.80	0.62	1.03
Education						
Low	3511	36.3	ref	1.00	1.00	1.00
Moderate	1979	37.1	0.016	0.83	0.71	0.97
High	831	39.9	0.482	0.93	0.75	1.14
Household income						
Low	1894	37.3	ref	1.00	1.00	1.00
Moderate	2200	37.2	0.241	0.90	0.76	1.07
High	1813	37.7	0.262	0.90	0.75	1.08
No answer	414	31.1	0.180	0.82	0.61	1.10
Ethnicity						
Non-white, other language	5608	40.7	ref	1.00	1.00	1.00
White, English only	713	36.5	0.538	0.94	0.76	1.16
Employed outside the home						
No	4065	35.3	ref	1.00	1.00	1.00
Yes	2256	37.8	0.744	1.03	0.88	1.19
Smoking status						
Daily	5792	35.6	ref	1.00	1.00	1.00
Weekly/Monthly	529	53.5	0.001	1.64	1.25	2.14

**Table 28 (continued):** Base Model: Predictors of Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Heaviness of smoking</b>						
0 - low dependence	911	46.9	<.0001	0.90	0.86	0.94
1	680	47.7				
2	1072	40.4				
3	1806	32.1				
4	1084	33.2				
5	562	28.6				
6 - high dependence	206	30.0				
<b>Attempt to quit in past year</b>						
No attempt	3677	27.1	ref	1.00	1.00	1.00
Attempt	2644	49.9	<.0001	1.79	1.54	2.08
<b>Longest attempt to quit</b>						
Never attempted	1180	23.6	ref	1.00	1.00	1.00
<1 week	1021	33.8	0.665	0.95	0.74	1.21
>1 week but < 6 months	1941	41.2	0.081	1.22	0.98	1.52
>6 months	2179	42.5	0.001	1.41	1.15	1.73
<b>Quit intentions (Wave 1)</b>						
No intention	4058	25.1	ref	1.00	1.00	1.00
Intention	2263	57.9	<.0001	2.90	2.52	3.33
<b>Outcome expectancy</b>						
Not at all	394	17.6	0.001	1.11	1.04	1.19
Slightly	790	26.2				
Moderately	1233	31.6				
Very much	2087	39.8				
Extremely	1817	45.7				
<b>Worried smoking will damage health</b>						
Not all worried	774	22.9	<.0001	1.22	1.13	1.31
A little worried	1497	28.5				
Moderately worried	1992	35.7				
Very worried	2058	49.6				

### 6.4.2.2 Number of smoking friends at Wave 1 and quit attempts at Wave 2

*Multivariate analyses.* Table 29 presents the results of the analyses that tested the relation between number of smoking friends at Wave 1 and attempts to quit smoking at Wave 2. No significant relation was found between number of smoking friends at Wave 1 and attempts to quit smoking at Wave 2. Examination of the percentages of smokers who attempted to quit by number of smoking friends at Wave 1 showed no strong pattern, although there did seem to be a slight tendency for smokers with fewer smoking friends to have attempted to quit. Table A-5 in Appendix A presents the full multivariate regression table.

**Table 29:** Number of Smoking Friends at Wave 1 and Quit Attempts at Wave 2, (N=6,321)<sup>a</sup>

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	830	38.7	ref	1.00	1.00	1.00
1	840	37.7	0.530	0.92	0.72	1.18
2	1228	36.4	0.415	0.91	0.72	1.14
3	1270	38.2	0.773	0.97	0.77	1.22
4	820	35.4	0.280	0.87	0.67	1.12
5	1333	36.3	0.826	0.97	0.77	1.23
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

### 6.4.2.3 Changes in number of smoking friends between Wave 1 and Wave 2 and quit attempts at Wave 2

*Multivariate analyses (non-collapsed friend change).* Table 30 presents the results of the analyses that tested the relation between changes in number of smoking friends (non-collapsed) and attempts to quit smoking at Wave 2. There was a significant relation between non-collapsed friend change and attempts to quit smoking at Wave 2. Smokers who experienced any loss in their number of smoking friends (-5, -4, -3, -2, or -1 vs. 0) were more likely to have attempted to quit smoking than smokers who experienced no change in their number of smoking friends. Smokers who gain smoking friends were no more likely to attempt to quit than smokers who experienced no change in their number of smoking

friends. Number of smoking friends at Wave 1 was also significant in this model, such that smokers with 0 vs. 4 or 5 smoking friends were more likely to intend to quit. Table A-6 in Appendix A presents the full multivariate regression table.

**Table 30:** Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Quit Attempts at Wave 2, (N=6,321)<sup>a</sup>

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	830	38.7	ref	1.00	1.00	1.00
1	840	37.7	0.328	0.88	0.69	1.14
2	1228	36.4	0.073	0.80	0.63	1.02
3	1270	38.2	0.131	0.83	0.65	1.06
4	820	35.4	0.012	0.70	0.53	0.93
5	1333	36.3	0.016	0.73	0.56	0.94
Friend change between Wave 1 and Wave 2						
No change	2501	34.5	ref	1.00	1.00	1.00
-5	27	50.0	0.031	2.68	1.10	6.55
-4	70	49.6	0.016	2.07	1.15	3.76
-3	230	51.5	<.0001	2.25	1.57	3.24
-2	529	45.1	<.0001	1.78	1.40	2.26
-1	1148	38.2	0.039	1.23	1.01	1.49
1	1084	33.5	0.348	0.91	0.75	1.11
2	476	36.0	0.726	0.95	0.73	1.25
3	168	39.2	0.241	1.28	0.85	1.94
4	53	38.8	0.802	1.09	0.55	2.18
5	35	26.2	0.455	0.73	0.31	1.68
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

The group means of the individual predicted probabilities of quit attempts (number of smoking friends at Wave 1 x non-collapsed friend change) are presented in Table 31. The probability of making an attempt to quit was consistently highest among smokers who experienced a higher loss in smoking friends. Additionally, smokers who lost all of their smoking friends were the most likely to report an attempt to quit (started with 2 or 3 smoking friends at Wave 1 and reported 0 smoking friends at Wave 2).

**Table 31:** Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2 and Number of Smoking Friends at Wave 1, and Predicted Probability of Quit Attempts at Wave 2, (N=6,321)

# Smoking Friends at Wave 1	Change in Number of Smoking Friends and Group Means of Predicted Probabilities										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
0						0.393	0.381	0.388	0.417	0.434	0.283
1					0.397	0.376	0.363	0.354	0.454	0.335	
2				0.479	0.393	0.350	0.303	0.321	0.379		
3			0.557	0.488	0.393	0.331	0.352	0.340			
4		0.474	0.476	0.454	0.341	0.315	0.292				
5	0.445	0.481	0.486	0.413	0.353	0.314					

Legend	
	Lowest (10th percentile - less likely to attempt to quit)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to attempt to quit)

*Multivariate analyses (collapsed friend change).* Table 32 presents the results of the analyses that tested the relation between changes in number of smoking friends (collapsed) and attempts to quit smoking at Wave 2. There was a significant relation between collapsed friend change and attempts to quit smoking at Wave 2. Smokers who experienced a loss in number of smoking friends were more likely to have attempted to quit than smokers who had no change in their number of smoking friends. Smokers who gained smoking friends were no less likely to have attempted to quit than smokers who experienced no change in their number of smoking friends. Number of smoking friends at Wave 1 was also significant in this model, smokers with 0 vs. 4 or 5 smoking friends were more likely to have attempted to quit. Table A-7 Appendix A presents the full multivariate regression table.

**Table 32:** Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	830	38.7	ref	1.00	1.00	1.00
1	840	37.7	0.203	0.85	0.67	1.09
2	1228	36.4	0.070	0.81	0.64	1.02
3	1270	38.2	0.101	0.82	0.64	1.04
4	820	35.4	0.009	0.70	0.53	0.91
5	1333	36.3	0.050	0.78	0.60	1.00
Friend Change Between Wave 1 and Wave 2						
No change	2501	34.5	ref	1.00	1.00	1.00
Loss	2004	42.1	<.0001	1.50	1.27	1.76
Gain	1816	34.6	0.759	0.97	0.82	1.15
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

The group means of the individual predicted probabilities of quit attempts (number of smoking friends at Wave 1 x collapsed friend change) are presented in Table 33. The predicted probabilities show that the probability of making a quit attempt tended to be highest among smokers who had fewer smoking friends at Wave 1 and experienced a friend loss, and lowest among smokers who had more smoking friends at Wave 1 and experienced no change or a gain in number of smoking friends.

**Table 33:** Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2 and Number of Smoking Friends at Wave 1, and Predicted Probability of Quit Attempts at Wave 2, (N=6,321)

Friend Change	# Smoking Friends at Wave 1	Group Means of Predicted Probabilities
No Change	0	0.392
	1	0.367
	2	0.348
	3	0.326
	4	0.311
	5	0.323
Gain	0	0.382
	1	0.358
	2	0.317
	3	0.350
	4	0.300
Loss	1	0.428
	2	0.434
	3	0.438
	4	0.388
	5	0.399

Legend	
	Lowest (10th percentile - less likely to attempt to quit)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to attempt to quit)

#### **6.4.2.4 Summary of results**

Number of smoking friends at Wave 1 did not predict attempts to quit smoking. Losing smoking friends (collapsed and non-collapsed friend change) was significantly related to quit attempts at Wave 2 compared to no change, with those who lost smoking friends being more likely to have attempted to quit. Gaining smoking friends did not predict quit attempts compared to no change; smokers who gained smoking friends were no more/less likely to attempt to quit than those who experienced no change.

There were no significant interactions. There were no significant differences in the relation between of number of smoking friends at Wave 1 or changes in number of smoking friends between Wave 1 and Wave 2 and attempts to quit smoking at Wave 2 by country, demographics (sex, age, education), or smoking behaviour (intentions to quit, heaviness of smoking).

#### **6.4.3 Abstinence from smoking for at least one month at Wave 2 among everyone**

##### **6.4.3.1 Base model: Predictors of abstinence for at least one month at Wave 2 among everyone**

*Multivariate analysis.* Table 34 presents the results of the multivariate analysis that tested the relation between the demographic and smoking cessation predictor variables included in the base model, and abstinence from smoking for at least one month at Wave 2 among everyone. Overall, smokers who were abstinent from smoking for at least one month at Wave 2 were more likely to (relative to the comparison group): be from Canada or the United States vs. Australia, be 18-24 years old vs. 40-54 years old, be weekly or monthly smokers, be lighter smokers (lower nicotine dependence), have reported a longer previous attempt to quit (greater than six months vs. never) *or* a slightly shorter previous attempt to quit (less than a week vs. never attempted), and have had intentions to quit at Wave 1.

**Table 34:** Base Model: Predictors of Abstinence for at Least One Month at Wave 2 Among Everyone,

(N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	1748	5.4	ref	1.00	1.00	1.00
Canada	1595	8.5	0.003	1.62	1.18	2.21
United Kingdom	1714	6.8	0.056	1.37	0.99	1.89
United States	1264	6.7	0.054	1.44	0.99	2.09
Sex						
Female	3549	7.2	ref	1.00	1.00	1.00
Male	2772	6.5	0.545	0.93	0.73	1.18
Age group						
18-24	715	8.1	ref	1.00	1.00	1.00
25-39	2003	7.5	0.228	0.80	0.56	1.15
40-54	2306	5.5	0.042	0.67	0.45	0.99
55-max	1297	6.9	0.968	1.01	0.66	1.54
Education						
Low	3511	6.4	ref	1.00	1.00	1.00
Moderate	1979	6.6	0.090	0.78	0.59	1.04
High	831	9.3	0.983	1.00	0.71	1.40
Household income						
Low	1894	6.0	ref	1.00	1.00	1.00
Moderate	2200	6.6	0.995	1.00	0.73	1.37
High	1813	7.8	0.582	1.10	0.79	1.54
No answer	414	7.1	0.312	1.29	0.79	2.12
Ethnicity						
Non-white, other language	5608	6.7	ref	1.00	1.00	1.00
White, English only	713	6.8	0.328	1.20	0.83	1.73
Employed outside the home						
No	4065	5.8	ref	1.00	1.00	1.00
Yes	2256	7.3	0.156	1.22	0.93	1.62
Smoking status						
Daily	5792	5.9	ref	1.00	1.00	1.00
Weekly/Monthly	529	17.4	0.001	1.89	1.35	2.64

**Table 34 (continued):** Base Model: Predictors of Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking						
0 - low dependence	911	14.1	<.0001	0.83	0.76	0.91
1	680	10.3				
2	1072	6.6				
3	1806	4.8				
4	1084	4.6				
5	562	3.7				
6 - high dependence	206	4.3				
Attempt to quit in past year						
No attempt	3677	5.8	ref	1.00	1.00	1.00
Attempt	2644	8.1	0.251	1.17	0.89	1.53
Longest attempt to quit						
Never attempted	1180	5.5	ref	1.00	1.00	1.00
<1 week	1021	2.9	0.005	0.47	0.27	0.80
>1 week but < 6 months	1941	5.6	0.321	0.82	0.54	1.22
>6 months	2179	10.8	0.012	1.58	1.11	2.27
Quit intentions (Wave 1)						
No intention	4058	4.2	ref	1.00	1.00	1.00
Intention	2263	11.5	<.0001	2.70	2.07	3.51
Outcome expectancy						
Not at all	394	4.6	0.4297	0.95	0.84	1.08
Slightly	790	6.8				
Moderately	1233	7.3				
Very much	2087	6.5				
Extremely	1817	7.3				
Worried smoking will damage health						
Not all worried	774	5.2	0.9219	1.01	0.87	1.16
A little worried	1497	5.9				
Moderately worried	1992	7.2				
Very worried	2058	7.7				

### 6.4.3.2 Number of smoking friends at Wave 1 and abstinence for at least one month at Wave 2 among everyone

*Multivariate analyses.* Table 35 presents the results of the analyses that tested the relation between number of smoking friends at Wave 1 and abstinence at Wave 2. There was a significant relation between number of smoking friends at Wave 1 and abstinence. However, only one of the subgroup comparisons was significant; smokers with 0 vs. 5 smoking friends were more likely to be abstinent. However, there was no significant relation between number of smoking friends at Wave 1 and abstinence as indicated by the overall omnibus significance test ( $p=0.09$ ). Table A-8 in Appendix A presents the full multivariate regression table.

**Table 35:** Number of Smoking Friends at Wave 1 and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)<sup>a</sup>

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	830	8.2	ref	1.00	1.00	1.00
1	840	8.8	0.691	1.09	0.72	1.65
2	1228	8.0	0.995	1.00	0.67	1.49
3	1270	7.2	0.605	0.90	0.61	1.34
4	820	5.8	0.153	0.71	0.45	1.13
5	1333	4.6	0.040	0.63	0.41	0.98

<sup>a</sup>adjusting for demographics and smoking cessation predictor variables

### 6.4.3.3 Changes in number of smoking friends between Wave 1 and Wave 2 and abstinence for at least one month at Wave 2 among everyone

*Multivariate analyses (non-collapsed).* Table 36 presents the results of the analyses that tested the relation between changes in number of smoking friends between Wave 1 and Wave 2 (non-collapsed) and abstinence at Wave 2. There was a significant relation between non-collapsed friend change and being abstinent for at least one month at Wave 2. Smokers who lost 1, 2, or 3 smoking friends were more likely to be abstinent than smokers who experienced no change in their number of smoking friends. No

significant difference was found between smokers who gained smoking friends and those who experienced no change. Number of smoking friends at Wave 1 was also significant in this model. Smokers who had 5, 4, or 3 vs. 0 smoking friends at Wave 1 were less likely to be abstinent. Table A-9 in Appendix A presents the full multivariate regression table.

**Table 36:** Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)<sup>a</sup>

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	830	8.2				
1	840	8.8	0.801	0.95	0.62	1.45
2	1228	8.0	0.197	0.76	0.50	1.16
3	1270	7.2	0.013	0.57	0.37	0.89
4	820	5.8	0.001	0.41	0.25	0.68
5	1333	4.6	<.0001	0.32	0.19	0.53
Friend change between Wave 1 and Wave 2						
No change	2501	5.9	ref	1.00	1.00	1.00
-5	27	7.7	0.401	2.49	0.30	20.83
-4	70	6.9	0.127	2.13	0.81	5.61
-3	230	14.9	<.0001	4.22	2.51	7.11
-2	529	9.4	0.001	2.15	1.41	3.28
-1	1148	8.2	0.007	1.57	1.14	2.17
1	1084	5.6	0.288	0.82	0.56	1.19
2	476	5.0	0.116	0.65	0.38	1.11
3	168	5.1	0.212	0.59	0.25	1.36
4	53	6.3	0.761	0.82	0.23	2.93
5	35	3.0	0.476	0.46	0.05	3.90

<sup>a</sup>adjusting for demographics and smoking cessation predictor variables

The group means of the individual predicted probabilities of abstinence (number of smoking friends at Wave 1 x non-collapsed friend change) are presented in Table 37. The probability of abstinence was generally highest for smokers that had fewer smoking friends at Wave 1 and reported losing the majority of their smoking friends.

**Table 37:** Change in Number of Smoking Friends between Wave 1 and Wave 2 (non-collapsed) and Number of Smoking Friends at Wave 1, and Predicted Probability of Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

# Smoking Friends at Wave 1	Change in Number of Smoking Friends and Group Means of Predicted Probabilities										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
0						0.096	0.079	0.067	0.073	0.078	0.031
1					0.121	0.099	0.082	0.053	0.068	0.060	
2				0.150	0.116	0.075	0.056	0.052	0.041		
3			0.198	0.120	0.088	0.056	0.046	0.035			
4		0.074	0.153	0.096	0.063	0.039	0.031				
5	0.067	0.059	0.110	0.060	0.045	0.030					

Legend	
	Lowest (10th percentile - less likely to be abstinent)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to be abstinent)

*Multivariate analyses (collapsed).* Table 38 presents the results of the analyses that tested the relation between changes in number of smoking friends between Wave 1 and Wave 2 (collapsed) and abstinence at Wave 2. There was a significant relation between collapsed friend change and being abstinent for at least one month at Wave 2. Smokers who lost smoking friends between Wave 1 and Wave 2 were significantly more likely to be abstinent than smokers who experienced no change in smoking friends. No difference was found between smokers who gained smoking friends and those who experienced no change. Number of smoking friends at Wave 1 was also significantly related to abstinence in this model. Smokers who had 0 vs. 3, 4, or 5 smoking friends were more likely to be abstinent. Table A-10 in Appendix A presents the full multivariate regression table.

**Table 38:** Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)<sup>a</sup>

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	830	8.2	ref	1.00	1.00	1.00
1	840	8.8	0.751	0.93	0.61	1.42
2	1228	8.0	0.198	0.76	0.50	1.15
3	1270	7.2	0.028	0.62	0.40	0.95
4	820	5.8	0.001	0.44	0.27	0.72
5	1333	4.6	<.0001	0.38	0.23	0.61
Friend change between Wave 1 and Wave 2						
No change	2501	5.90	ref	1.00	1.00	1.00
Loss	2004	9.23	<.0001	1.93	1.46	2.54
Gain	1816	5.36	0.096	0.76	0.55	1.05
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

The group means of individual predicted probabilities of being abstinent for at least one month (number of smoking friends at Wave 1 x collapsed friend change) are presented in Table 39. The probability of abstinence was generally highest for smokers that had fewer smoking friends at Wave 1 and lost smoking friends between Wave 1 and Wave 2.

**Table 39:** Change in Number of Smoking Friends Between Wave 1 and Wave 2 (collapsed) and Number of Smoking Friends at Wave 1, and Predicted Probability of Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Friend Change	# Smoking Friends at Wave 1	Group Means of Predicted Probabilities
No Change	0	0.094
	1	0.095
	2	0.072
	3	0.057
	4	0.040
	5	0.033
Gain	0	0.073
	1	0.068
	2	0.052
	3	0.043
	4	0.030
Loss	1	0.136
	2	0.133
	3	0.109
	4	0.080
	5	0.061

Legend	
	Lowest (10th percentile - less likely to be abstinent)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to be abstinent)

#### **6.4.3.4 Summary of results**

Number of smoking friends at Wave 1 did not significantly predict abstinence from smoking for at least one month at Wave 2. There was a significant relation between friend change (non-collapsed and collapsed) and abstinence. Smokers who lost smoking friends were significantly more likely to be abstinent than smokers who experienced no change in their number of smoking friends. No significant difference in abstinence was found between smokers who gained smoking friends and smokers who experienced no change in number of smoking friends.

Interactions were tested, however there were no significant differences in the relation between of number of smoking friends at Wave 1 or changes in number of smoking friends between Wave 1 and Wave 2 and abstinence from smoking at Wave 2 by country, demographics (sex, age, education), or smoking behaviour (intentions to quit, heaviness of smoking).

#### **6.4.4 Abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit**

##### **6.4.4.1 Base model: Predictors of abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit**

*Multivariate analysis.* Table 40 presents the results of the multivariate analysis that tested the relation between the demographic and smoking cessation predictor variables included in the base model, and abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit. Overall, smokers who were abstinent from smoking for at least one month at Wave 2 were more likely (relative to the comparison group) to: have been weekly or monthly smokers, have been lighter smokers (lower nicotine dependence), have reported a slightly shorter previous attempt to quit (less than a week vs. never attempted), and have had an intention to quit at Wave 1.

**Table 40:** Base Model: Predictors of Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	608	15.5	ref	1.00	1.00	1.00
Canada	703	19.2	0.105	1.32	0.94	1.85
United Kingdom	536	21.0	0.064	1.39	0.98	1.97
United States	461	18.0	0.164	1.32	0.89	1.95
Sex						
Female	1316	19.3	ref	1.00	1.00	1.00
Male	992	17.7	0.342	0.88	0.68	1.14
Age group						
18-24	347	16.8	ref	1.00	1.00	1.00
25-39	768	19.6	0.995	1.00	0.68	1.48
40-54	753	17.2	0.821	0.95	0.64	1.43
55-max	440	20.2	0.440	1.20	0.76	1.89
Education						
Low	1240	17.7	ref	1.00	1.00	1.00
Moderate	741	17.8	0.364	0.87	0.65	1.17
High	327	23.2	0.594	1.10	0.77	1.59
Household income						
Low	711	16.0	ref	1.00	1.00	1.00
Moderate	799	17.8	0.773	1.05	0.75	1.48
High	674	20.7	0.459	1.15	0.80	1.65
No answer	124	22.8	0.213	1.43	0.82	2.50
Ethnicity						
Non-white, other language	303	16.4	ref	1.00	1.00	1.00
White, English only	2005	18.8	0.375	1.19	0.81	1.74
Employed outside the home						
No	793	16.5	ref	1.00	1.00	1.00
Yes	1515	19.3	0.134	1.25	0.93	1.67
Smoking status						
Daily	2017	16.7	ref	1.00	1.00	1.00
Weekly/Monthly	291	32.5	0.008	1.63	1.14	2.33

**Table 40(continued):** Base Model: Predictors of Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking						
0 - low dependence	442	30.2	0.020	0.89	0.81	0.98
1	308	21.7				
2	416	16.4				
3	574	14.9				
4	348	13.8				
5	160	13.0				
6 - high dependence	60	14.4				
Attempt to quit in past year						
No attempt	968	21.6	ref	1.00	1.00	1.00
Attempt	1340	16.2	0.336	0.87	0.65	1.16
Longest attempt to quit						
Never attempted	259	23.3	ref	1.00	1.00	1.00
<1 week	336	8.5	0.008	0.45	0.25	0.81
>1 week but < 6 months	771	13.6	0.145	0.72	0.46	1.12
>6 months	942	25.3	0.158	1.34	0.89	2.02
Quit intentions (Wave 1)						
No intention	981	16.6	ref	1.00	1.00	1.00
Intention	1327	19.8	0.017	1.41	1.06	1.87
Outcome expectancy						
Not at all	71	26.1	0.062	0.88	0.77	1.01
Slightly	205	25.9				
Moderately	380	23.2				
Very much	823	16.3				
Extremely	829	16.1				
Worried smoking will damage health						
Not all worried	176	22.7	0.108	0.89	0.77	1.03
A little worried	421	20.6				
Moderately worried	683	20.3				
Very worried	1028	15.6				

#### 6.4.4.2 Number of smoking friends at Wave 1 and abstinence for at least one month at Wave 2 among smokers who attempted to quit

*Multivariate analysis.* Table 41 presents the results of the analysis that tested the relation between number of smoking friends at Wave 1 and abstinence at Wave 2 for at least one month among smokers who attempted to quit. Number of smoking friends at Wave 1 significantly predicted abstinence at Wave 2. Smokers who had 0 smoking friends compared to 5 smoking friends at Wave 1 were more likely to be abstinent at Wave 2. Table A-11 in Appendix A presents the full multivariate regression table.

**Table 41:** Number of Smoking Friends at Wave 1 and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)<sup>a</sup>

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1 <sup>c</sup>						
0	320	21.1	ref	1.00	1.00	1.00
1	316	23.4	0.439	1.20	0.76	1.89
2	445	22.0	0.851	1.04	0.68	1.59
3	466	18.8	0.594	0.89	0.58	1.36
4	291	16.3	0.183	0.71	0.43	1.17
5	470	12.6	0.030	0.60	0.38	0.95
<sup>a</sup> adjusting for demographics and smoking cessation predictor variables						

#### 6.4.4.3 Changes in number of smoking friends at between Wave 1 and Wave 2 and abstinence for at least one month at Wave 2 among smokers who attempted to quit

*Multivariate analysis (non-collapsed).* Table 42 presents the results of the analysis that tested the relation between changes in number of smoking friends between Wave 1 and Wave 2 (non-collapsed) and abstinence at Wave 2 for at least one month among smokers who attempted to quit. There was a significant relation between non-collapsed friend change and being abstinent for at least one month at Wave 2. Smokers who lost 3 or 1 vs. no smoking friends were more likely to be abstinent. Smokers who gained smoking friends were no more or less likely to be abstinent than smokers who experienced no change. Number of smoking friends at Wave 1 was also significant in this model. Smokers who had 0 vs.

3, 4, or 5 smoking friends at Wave 1 were significantly more likely to be abstinent. Table A-12 in Appendix A presents the full multivariate regression table.

**Table 42:** Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)<sup>a</sup>

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	320	21.1	ref	1.00	1.00	1.00
1	316	23.4	0.876	1.04	0.65	1.66
2	445	22.0	0.399	0.82	0.53	1.29
3	466	18.8	0.042	0.62	0.39	0.98
4	291	16.3	0.004	0.44	0.25	0.76
5	470	12.6	<.0001	0.35	0.21	0.59
Friend change between Wave 1 and Wave 2						
No change	860	17.1	ref	1.00	1.00	1.00
-5	10	15.3	0.776	1.34	0.18	10.08
-4	33	14.0	0.386	1.54	0.58	4.12
-3	115	28.9	0.001	2.89	1.65	5.06
-2	226	20.9	0.056	1.56	0.99	2.45
-1	432	21.4	0.034	1.47	1.03	2.09
1	374	16.7	0.376	0.83	0.55	1.25
2	160	13.8	0.086	0.60	0.33	1.08
3	70	13.1	0.118	0.50	0.21	1.19
4	17	16.2	0.943	0.95	0.25	3.64
5	11	11.3	0.742	0.68	0.07	6.62

<sup>a</sup>adjusting for demographics and smoking cessation predictor variables

The group means of the individual predicted probabilities of abstinence (number of smoking friends at Wave 1 x non-collapsed friend change) are presented in Table 43. Smokers who had fewer smoking friends at Wave 1 and who lost the majority of their smoking friends had the highest probability of abstinence.

**Table 43:** Change in Number of Smoking Friends Between Wave 1 and Wave 2 (non-collapsed) and Number of Smoking Friends at Wave 1, and Predicted Probability of Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

# Smoking Friends at Wave 1	Change in Number of Smoking Friends and Group Means of Predicted										
	-5	-4	-3	-2	-1	0	1	2	3	4	5
0						0.246	0.213	0.177	0.172	0.156	0.118
1					0.297	0.265	0.230	0.157	0.149	0.202	
2				0.289	0.299	0.224	0.177	0.149	0.107		
3			0.333	0.244	0.237	0.165	0.144	0.111			
4		0.159	0.326	0.212	0.184	0.119	0.102				
5	0.165	0.126	0.228	0.153	0.129	0.098					

Legend	
	Lowest (10th percentile - less likely to be abstinent)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to be abstinent)

*Multivariate analysis (collapsed).* Table 44 presents the results of the analysis that tested the relation between changes in number of smoking friends between Wave 1 and Wave 2 (collapsed) and abstinence at Wave 2 among smokers who attempted to quit. There was a significant relation between collapsed friend change and being abstinent for at least one month at Wave 2. Smokers who lost smoking friends were significantly more likely to be abstinent than smokers who reported no change in their number of smoking friends. Smokers who gained smoking friends were not significantly more likely to be abstinent than smokers who experienced no change in their number of smoking friends. Number of smoking friends also significantly predicted abstinence in this model. Smokers with 0 vs. 4 or 5 smoking friends at Wave 1 were significantly more likely to be abstinent. Table A-13 in Appendix A presents the full multivariate regression table.

**Table 44:** Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)<sup>a</sup>

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Number of smoking friends at Wave 1						
0	320	21.1	ref	1.00	1.00	1.00
1	316	23.4	0.796	1.06	0.67	1.68
2	445	22.0	0.386	0.82	0.53	1.28
3	466	18.8	0.073	0.66	0.42	1.04
4	291	16.3	0.007	0.48	0.28	0.82
5	470	12.6	0.001	0.39	0.23	0.64
Friend change between Wave 1 and Wave 2						
No change	860	17.1	ref	1.00	1.00	1.00
Loss	632	21.9	0.002	1.62	1.20	2.19
Gain	816	15.5	0.081	0.73	0.52	1.04

The group means of individual predicted probabilities of abstinence (number of smoking friends at Wave 1 x collapsed friend change) are presented in Table 45. The predicted probabilities of abstinence were highest for smokers who had fewer smoking friends at Wave 1 and experienced a loss in smoking friends. Smokers who had 0 or 1 smoking friends at Wave 1 and experienced no change in number of smoking friends also had a high probability of abstinence.

**Table 45:** Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2 and Number of Smoking Friends at Wave 1, and Predicted Probability of Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Friend Change	# Smoking Friends at Wave 1	Group Means of Predicted Probabilities
No Change	0	0.241
	1	0.263
	2	0.217
	3	0.169
	4	0.124
	5	0.102
Gain	0	0.190
	1	0.198
	2	0.155
	3	0.133
	4	0.096
Loss	1	0.313
	2	0.302
	3	0.253
	4	0.211
	5	0.155

Legend	
	Lowest (10th percentile - less likely to be abstinent)
	Midpoint (50th percentile)
	Highest (90th percentile - more likely to be abstinent)

#### 6.4.4.4 Summary of results

Number of smoking friends at Wave 1 predicted abstinence for at least one month at Wave 2 among smokers who attempted to quit, but only for the extreme comparison, 0 vs. 5 smoking friends. Change in number of smoking friends (non-collapsed and collapsed) also predicted abstinence. Smokers who lost smoking friends were more likely to be abstinent from smoking at Wave 2 for at least one month than those who experienced no change in their number of smoking friends. Smokers who gained smoking friends were no more likely to be abstinent than smokers who experienced no change in their number of

smoking friends. Together these results show that smokers who had fewer smoking friends at Wave 1 and who lost smoking friends between Wave 1 and Wave 2 were more likely to succeed to their attempts to quit smoking.

Interactions were tested, however there were no significant differences in the relation between number of smoking friends at Wave 1 or changes in number of smoking friends between Wave 1 and Wave 2 and abstinence from smoking by country, demographics (sex, age, education), or smoking behaviour (intentions to quit, heaviness of smoking).

#### **6.4.5 Comparisons of the base models to models with friends at Wave 1 and changes in number of smoking friends between Wave 1 and Wave 2 added**

Table 46 presents the results of the model comparisons. Overall, the results indicate that adding friend change between Wave 1 and Wave 2 led to model improvements. Adding friends at Wave 1 also improved the base models, but the improvements were smaller, and in one case, non-significant.

**Table 46:** Model Comparison - Chi-Square Difference Test

Models	Likelihood Ratio			Model Comparison	Difference		Significance of Difference (p-value) <sup>a</sup>
	ChiSq	DF	Pr > ChiSq		Chisq	df	
Cross-Sectional Intentions to Quit at Wave 1 (N=6,321)							
Base Model	1254.19	22	<.0001				
Friends at Wave 1	1278.07	27	<.0001	Friends at Wave 1 vs. Base Model	23.88	5	<0.001
Intentions to Quit at Wave 2 (N=5,739)							
Base Model	1189.82	23	<.0001				
Friends at Wave 1	1201.91	28	<.0001	Friends at Wave 1 vs. Base Model	12.08	5	0.03
Friend Change(non-collapsed)	1233.84	38	<.0001	Friend Change(non-collapsed) vs. Friends at Wave 1	44.02	10	<0.001
Friend Change(collapsed)	1217.50	30	<.0001	Friends Change(collapsed) vs. Friends at Wave 1	15.59	2	<0.001
Quit Attempts at Wave 2 (N=6,321)							
Base Model	1097.43	23	<.0001				
Friends at Wave 1	1099.95	28	<.0001	Friends at Wave 1 vs. Base Model	2.52	5	not sig
Friend Change(non-collapsed)	1166.57	38	<.0001	Friend Change(non-collapsed) vs. Friends at Wave 1	69.14	10	<0.001
Friend Change(collapsed)	1140.46	30	<.0001	Friends Change(collapsed) vs. Friends at Wave 1	40.51	2	<0.001
Quit for at least one month at Wave 2(everyone) (N=6,321)							
Base Model	298.08	23	<.0001				
Friends at Wave 1	310.92	28	<.0001	Friends at Wave 1 vs. Base Model	12.84	5	0.025
Friend Change(non-collapsed)	375.62	38	<.0001	Friend Change(non-collapsed) vs. Friends at Wave 1	77.53	10	<0.001
Friend Change(collapsed)	357.34	30	<.0001	Friends Change(collapsed) vs. Friends at Wave 1	46.42	2	<0.001
Quit for at least one month at Wave 2(smokers who attempted to quit) (N=2,308)							
Base Model	141.31	23	<.0001				
Friends at Wave 1	157.38	28	<.0001	Friends at Wave 1 vs. Base Model	16.08	5	0.004
Friend Change(non-collapsed)	194.75	38	<.0001	Friend Change(non-collapsed) vs. Friends at Wave 1	37.37	10	<0.001
Friend Change(collapsed)	184.65	30	<.0001	Friends Change(collapsed) vs. Friends at Wave 1	27.27	2	<0.001
<sup>a</sup> p-values approximated from Chi-square distribution table							

The chi-square difference test demonstrated that (1) adding number of smoking friends at Wave 1 to the base models improved all models predicting smoking cessation outcomes except for the model predicting attempts to quit smoking at Wave 2, and (2) adding change in number of smoking friends between Wave 1 and Wave 2 (non-collapsed and collapsed) significantly improved all base models (base model plus number of smoking friends at Wave 1) for all smoking cessation outcomes. Notable findings include: (1) the higher significance value of the chi-square difference score when number of smoking friends at Wave 1 was added to the model predicting quit intentions at Wave 1 in the cross-sectional analysis compared to when it was added to the models predicting all other smoking cessation outcomes longitudinally, and (2) the higher significance value of the chi-square difference scores when change in number of smoking friends (non-collapsed and collapsed) was added to the models predicting smoking cessation outcomes compared to the significance values when number of smoking friends at Wave 1 was added.

It is also interesting to note that the likelihood ratios for the models where the non-collapsed friend change variable was added were higher compared to the models where the collapsed friend change variable was added.

It should be noted that although the chi-square difference tests indicated that adding number of smoking friends at Wave 1 significantly improved the base models predicting quit intentions at Wave 2 and quitting among everyone at Wave 2, the overall omnibus tests for number of smoking friends at Wave 1 in these models were not significant,  $p=0.11$ , and  $p=0.09$  respectively (see summary of results in Table 47). However, the likelihood test and the overall omnibus test do not always produce the same results. Additionally, the chi-square difference test showing the significance of the difference between the base models and the models with friends at Wave 1 added was low:  $p=0.03$  for adding friends at Wave 1 to the model predicting quit intentions at Wave 2, and  $p=0.025$  for adding friends at Wave 1 to the model predicting abstinence among everyone at Wave 2.

#### **6.4.6 Overall summary of results for smoking cessation outcomes**

Table 47 presents an overall summary of the results from Section 6.4 that tested the relation between number of smoking friends, changes in number of smoking friends, and smoking cessation outcomes.

**Table 47:** Overall Summary of Results for Section 6.4 (p-values are for overall omnibus test)

Smoking Cessation Outcome (dependent variable)	Independent Variable		
	Number of Smoking Friends at Wave 1	Change in Number of Smoking Friends Between Wave 1 and Wave 2 (non-collapsed)	Change in Number of Smoking Friends Between Wave 1 and Wave 2 (collapsed)
<b>Quit Intentions</b>			
Quit Intentions at Wave 1	Smokers with 0 vs. 5 friends were more likely to intend to quit, p=0.0024	N/A	N/A
Quit Intentions at Wave 2	No significant relation, p=0.1052.	Smokers who gained smoking friends were less likely to intend to quit, and smokers who lost smoking friends were more likely to intend to quit compared to those who experienced no change, p=0.0108.	Smokers who gained smoking friends were less likely to intend to quit, and smokers who lost smoking friends were no more likely to intend to quit compared to those who experienced no change, p=0.0038.
<b>Quit Attempts at Wave 2</b>			
Quit Attempts	No significant relation, p=0.8714.	Smokers who lost smoking friends were more likely to have attempted to quit, and smokers who gained smoking friends were no more likely to have attempted to quit compared to smokers who experienced no change, p<0.0001	Smokers who lost smoking friends were more likely to have attempted to quit, and smokers who gained smoking friends were no more likely to have attempted to quit compared to smokers who experienced no change, p<0.0001
<b>Abstinent from Smoking for &gt;30 days at Wave 2</b>			
Abstinent for at least a month among everyone	One sub-group comparison was significant. Smokers with 0 vs. 5 smoking friends were more likely to have attempted to quit. However, overall there was no significant relation, p=0.0909.	Smokers who lost smoking friends were more likely to be abstinent, and smokers who gained smoking friends were no more likely to be abstinent compared to smokers who experienced no change, p<0.0001	Smokers who lost smoking friends were more likely to be abstinent, and smokers who gained smoking friends were no more likely to be abstinent compared to smokers who experienced no change, p<0.0001
Abstinent for at least a month among smokers who attempted to quit (test of quit attempt success)	Smokers with 0 vs. 5 smoking friends were more likely to be abstinent, p=0.0328	Smokers who lost smoking friends were more likely to be abstinent, and smokers who gained smoking friends were no more likely to be abstinent compared to smokers who experienced no change, p=0.0046.	Smokers who lost smoking friends were more likely to be abstinent, and smokers who gained smoking friends were no more likely to be abstinent compared to smokers who experienced no change, p<0.0001

## ***6.5 Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by changes in norms***

This section presents the results of the analyses described in Section 5.5. Results are given for the following research questions:

- 4) *Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by norms***
  - a) Do changes in subjective norms between Wave 1 and Wave 2 mediate the relation between change in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?*
  - b) Do changes in social norms between Wave 1 and Wave 2 mediate the relation between change in number of smoking friends between Wave 1 and Wave 2 and smoking cessation outcomes?*

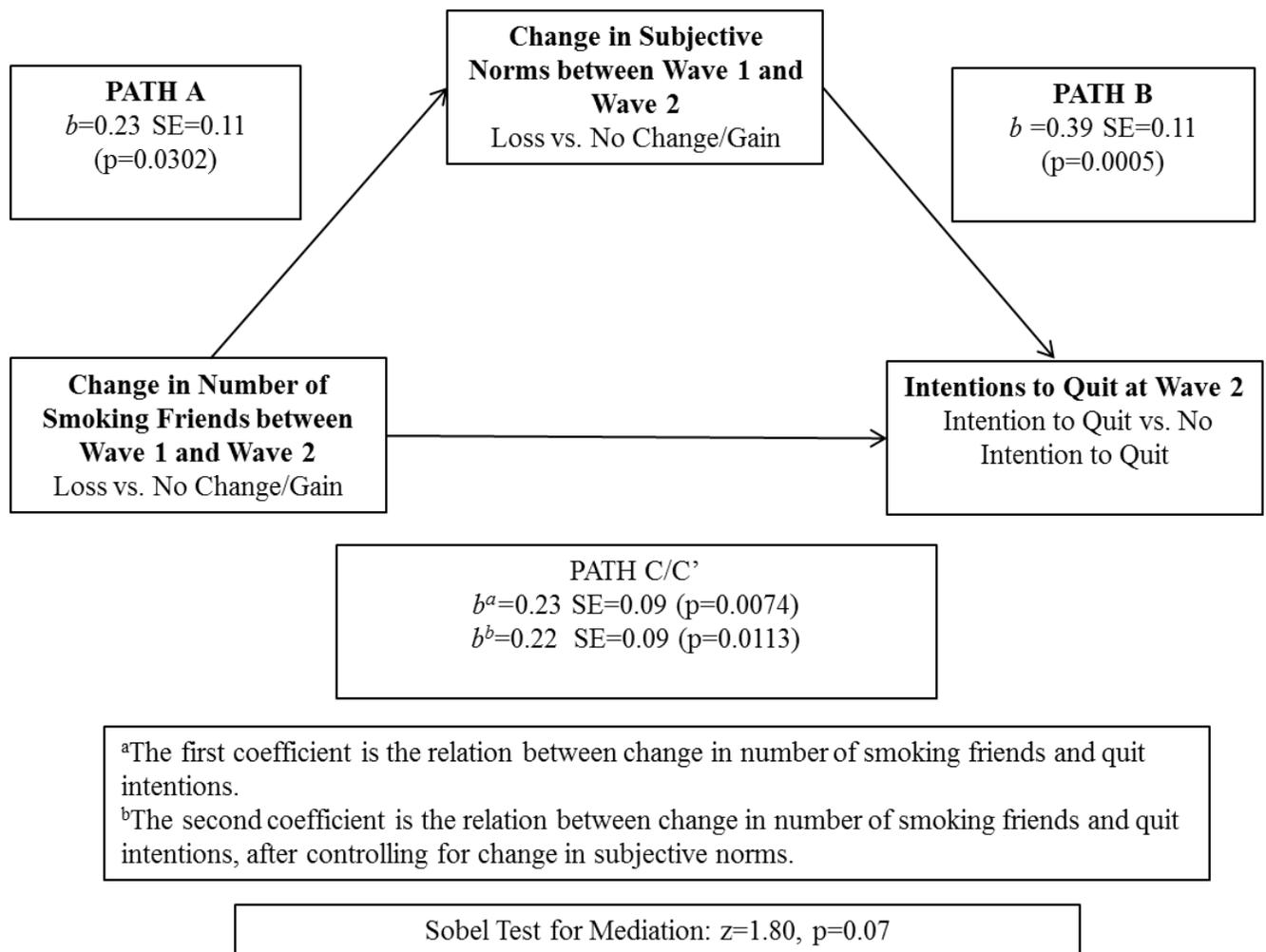
### **6.5.1 Intentions to quit smoking at Wave 2**

#### **6.5.1.1 Subjective Norms**

*Mediational Analysis.* **Figure 3** presents the results of the mediational analysis. Paths A, B, C, and C' were significant. Path A was significant, demonstrating that smokers who lost smoking friends were significantly more likely to show corresponding negative changes in their subjective norms towards smoking, i.e., smokers who lost smoking friends between Wave 1 and Wave 2 became more likely to agree that people who are important to them think they should not smoke between Wave 1 and Wave 2. Path B was also significant, demonstrating that smokers who had negative changes in their subjective norms towards smoking were more likely to intend to quit, i.e. smokers who became more likely to agree that people who are important to them think they should not smoke between Wave 1 and Wave 2 were more likely to intend to quit at Wave 2. Path C was significant, demonstrating that smokers who lost smoking friends between Wave 1 and Wave 2 were more likely to intend to quit at Wave 2. And, path C'

was significant, demonstrating that when controlling for changes in subjective norms, changes in smoking friends continued to be related to quit intentions at Wave 2. Because the regression analysis for path C' did not show that the effect of changes in number of smoking friends on quit intentions disappeared after controlling for changes in subjective norms, there was no evidence for complete mediation of the effect of changes in number of smoking friends between Wave 1 and Wave 2 on quit intentions by changes in subjective norms. However, there was still some evidence for mediation because the other three paths were significant.

*Sobel Test.* The Sobel Test was not significant,  $z=1.80$ ,  $p=0.07$ , indicating that the evidence for mediation was not strong.



**Figure 3:** Mediation of the Relation Between Changes in Number of Smoking Friends and Intentions to Quit Smoking at Wave 2 by Changes in Subjective Norms, (N=5,739)

### 6.5.1.2 Social Norms

*Mediational Analysis.* Path A was not significant,  $b=0.01$ ,  $SE=0.11$ ,  $p=0.92$ . There was no relation between changes in number of smoking friends between Wave 1 and Wave 2 and changes in social norms between Wave 1 and Wave 2. No additional analyses were conducted to test mediation because the first requirement of mediation was not met. There was no evidence for mediation.

*Sobel Test.* The Sobel Test was not conducted because path A was not significant.

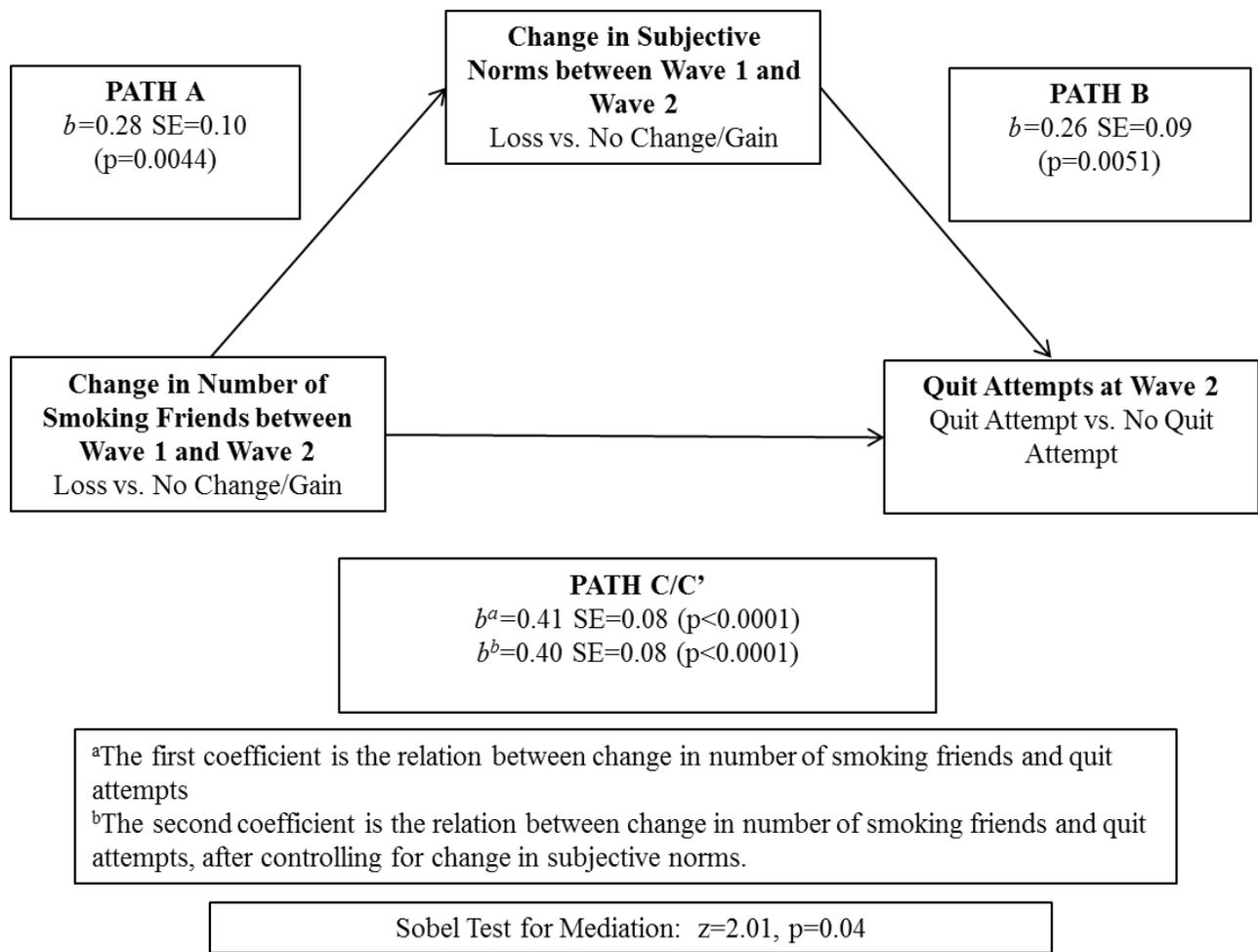
## 6.5.2 Quit attempts at Wave 2

### 6.5.2.1 Subjective Norms

*Mediational Analysis.* **Figure 4** presents the results of the mediational analysis. Path A, B, C, and C' were significant. Path A was significant, demonstrating that smokers who lost smoking friends were significantly more likely to show corresponding negative changes in their subjective norms towards smoking, i.e., smokers who lost smoking friends between Wave 1 and Wave 2 became more likely to agree that people who are important to them think they should not smoke between Wave 1 and Wave 2. Path B was also significant, demonstrating that smokers who had negative changes in their subjective norms towards smoking were more likely to attempt to quit, i.e., smokers who became more likely to agree that people who are important to them think they should not smoke between Wave 1 and Wave 2 were more likely to have attempted to quit between Wave 1 and Wave 2. Path C was significant, demonstrating that smokers who lost smoking friends between Wave 1 and Wave 2 were more likely to have attempted to quit. And, path C' was significant, demonstrating that when controlling for changes in subjective norms, changes in smoking friends continued to be related to quit attempts. Because the regression analysis for path C' did not show that the effect of changes in number of smoking friends on quit intentions disappeared after controlling for changes in subjective norms, there was no strong evidence for complete mediation of the effect of changes in number of smoking friends between Wave 1

and Wave 2 on quit attempts by changes in subjective norms. However, there was still some evidence for mediation because the other three paths were significant.

*Sobel Test.* The Sobel Test was significant,  $z=2.01$ ,  $p=0.04$ , suggesting that changes in subjective norms between Wave 1 and Wave 2 may partially mediate the relation between changes in number of smoking friends between Wave 1 and Wave 2 and quit attempts at Wave 2.



**Figure 4:** Mediation of the Relation Between Changes in Number of Smoking Friends and Attempts to Quit Smoking by Changes in Subjective Norms, (N=6,321)

### **6.5.2.2 Social Norms**

*Mediational Analysis.* Path A was not significant,  $b=0.01$ ,  $SE=0.10$ ,  $p=0.94$ . There was no relation between changes in number of smoking friends and changes in social norms between Wave 1 and Wave 2. No additional analyses were conducted to test mediation because the first requirement of mediation was not met. There was no evidence for mediation.

*Sobel Test.* The Sobel Test was not conducted because path A was not significant.

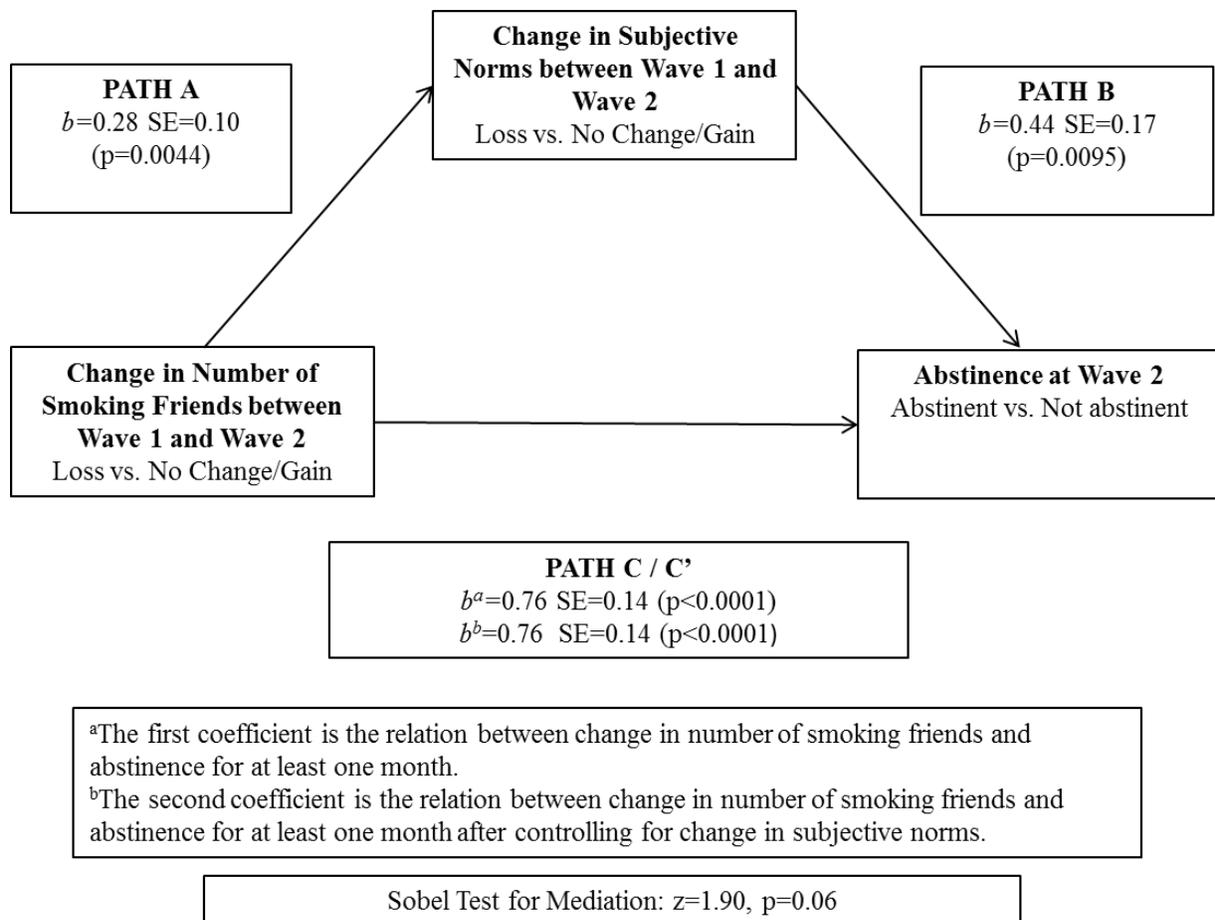
## **6.5.3 Abstinence from smoking for at least one month at Wave 2 among everyone**

### **6.5.3.1 Subjective Norms**

*Mediational Analysis.* Figure 5 shows the results of the mediational analysis. Path A, B, C, and C' were significant. Path A was significant, demonstrating that smokers who lost smoking friends were significantly more likely to show corresponding negative changes in their subjective norms towards smoking, i.e., smokers who lost smoking friends between Wave 1 and Wave 2 became more likely to agree that people who are important to them think they should not smoke between Wave 1 and Wave 2. Path B was also significant, demonstrating that smokers who had negative changes in their subjective norms towards smoking were more likely to be abstinent from smoking at Wave 2, i.e. smokers who became more likely to agree that people who are important to them think they should not smoke between Wave 1 and Wave 2 were more likely to be abstinent from smoking at Wave 2. Path C was significant, demonstrating that smokers who lost smoking friends between Wave 1 and Wave 2 were more likely to be abstinent from smoking at Wave 2. And, path C' was significant, demonstrating that when controlling for changes in subjective norms, changes in smoking friends continued to be related to abstinence from smoking at Wave 2. Because the regression analysis for path C' did not show that the effect of changes in number of smoking friends on abstinence from smoking at Wave 2 disappeared after controlling for changes in subjective norms, there was no strong evidence for complete mediation of the effect of changes in number of smoking friends between Wave 1 and Wave 2 on abstinence from smoking by

changes in subjective norms. However, there was still some evidence for mediation because the other three paths were significant.

*Sobel Test.* The Sobel Test was not significant,  $z=1.90$ ,  $p=0.06$ , indicating weak evidence for partial mediation.



**Figure 5:** Mediation of Relation Between Change in Number of Smoking Friends and Abstinence for at Least One Month Among Everyone by Change in Subjective Norms, (N=6,321)

### **6.5.3.2 Social Norms**

*Mediational Analysis.* Path A was not significant,  $b=0.01$ ,  $SE=0.10$ ,  $p=0.94$ . There was no relation between changes in number of smoking friends and changes in social norms between Wave 1 and Wave 2. No additional analyses were conducted to test mediation because the first requirement of mediation was not met. There was no evidence for mediation.

*Sobel Test.* The Sobel Test was not conducted because path A was not significant.

## **6.5.4 Abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit**

### **6.5.4.1 Subjective Norms**

*Mediational Analysis.* Path A was not significant,  $b=0.19$ ,  $SE=0.16$ ,  $p=0.24$ . There was no relation between changes in smoking friends between Wave 1 and Wave 2 and changes in subjective norms between Wave 1 and Wave 2 among smokers who attempted to quit. There was no evidence for mediation. Although, it would not be normal to test path B in a traditional mediational analyses, path B was nevertheless tested because this dissertation was interested in understanding how the relation between changes in number of smoking friends and different smoking cessation outcomes (intentions, attempts, and abstinence) may or may not be mediated by changes in subjective and social norms. The analysis of path B demonstrated that changes in subjective norms did not predict abstinence among smokers who attempted to quit,  $b=0.25$ ,  $SE=0.18$ ,  $p=0.16$ .

*Sobel Test.* The Sobel Test was not conducted because path A was not significant.

### **6.5.4.2 Social Norms**

*Mediational Analysis.* Path A was not significant,  $b=0.08$ ,  $SE=0.16$ ,  $p=0.64$ . There was no relation between changes in number of smoking friends and changes in social norms between Wave 1 and

Wave 2. No additional analyses were conducted to test mediation because the first requirement of mediation was not met. There was no evidence for mediation.

*Sobel Test.* The Sobel Test was not conducted because path A was not significant.

## **7.0 Discussion**

The discussion section of this dissertation outlines the findings, strengths and limitations, and conclusions and implications for each section separately, and then finishes with an overall summary discussion of the strengths and limitations, and conclusions and implications.

Readers should review the note in Section 2.2.1 on the issue of causality when studying the relation between individual behaviour and the behaviour of people in their social context, i.e., friends. The data in this dissertation does not allow the causal direction of the relation between respondents' number of smoking friends, changes in their number of smoking friends, and smoking cessation outcomes to be established. Still, some of the results will be discussed with an implied direction of causality to lend perspective to the findings.

### ***7.1 Number of smoking friends and smoking prevalence***

The first objective of this dissertation was to examine whether smokers report a greater number of smoking friends than chance would predict.

Because previous research demonstrates that people are more likely to have friends who are similar to themselves, and that smoking behaviour tends to be clustered at greater than chance levels in smokers' social networks, smokers were expected to report a greater number of smoking friends than chance would predict (Christakis & Fowler, 2008; Lazarfield & Merton, 1954; McPherson et al., 2001). As expected, the results showed that across all four countries, and all demographic groups (sex, age, and education), smokers reported a greater number of smoking friends than would have been expected by chance based on current smoking prevalence. The mean number of smoking friends was highest among smokers with higher smoking prevalence (younger smokers, and smokers with lower education). These results suggest that most smokers live in social contexts where smoking behaviour is heavily concentrated, and where smoking may be considered the normative behaviour (Levine & Moreland, 2006). These findings are also consistent with previous research on the stigmatization of smoking and

smokers that suggests friendships among smokers and non-smokers are unlikely because non-smokers stigmatize smokers (Goffman, 1963; Link & Phelan, 2009; Stuber et al., 2008).

### **7.1.1 Strengths and limitations**

To the author's knowledge, this is the first study to examine the relation between smoking prevalence and the mean number of smoking friends reported by adult smokers across demographic groups in nationally representative samples. One minor limitation of this study is that the number of smoking friends that would be expected based on chance for each demographic group was calculated using the smoking prevalence for the population of each demographic group, e.g., the number of smoking friends that would be expected based on chance for smokers with low education in Canada was calculated using the current smoking prevalence for people with low education in Canada. A more detailed analysis may have considered, for example, how many smoking friends a female smoker who is 18-24 years old with low education would be expected to report based on smoking prevalence for 18-24 year old females with low education. Additionally, the method for calculating the number of smoking friends that would be expected by chance in this study assumes that people form friendships with people from their same demographic groups. However, it was quite reasonable for the purposes of these analyses to assume that smokers' friends come from their own demographic groups because people tend to be friends with similar others (Blieszner & Adams, 1992; Byrne et al., 1966; Lazarfield & Merton, 1954; McPherson et al., 2001). Moreover, the number of smoking friends reported by smokers was so much higher than would have been expected by chance that the conclusions would have likely been the same had a different method been used. For example, smokers with low education from Australia reported a mean of 2.75 smoking friends, but based on the prevalence of smoking (21%) were only expected to report 1.05 smoking friends.

### **7.1.2 Conclusion and implications**

These analyses showed that smokers report a greater number of smoking friends than would be expected by chance across all countries, and all demographic groups, suggesting that regardless of demographic group, smoking is more heavily concentrated among smokers' social contacts than it is in the general population. These findings support earlier research and theory that suggest that smokers are more likely to be friends with other smokers. The next section discusses the findings that tested whether the differences in number of smoking friends reported across different demographic groups were statistically significant, and possible implications for disparities in smoking cessation outcomes across demographic groups.

## ***7.2 Number of smoking friends, changes in number of smoking friends over time, and demographic characteristics and smoking cessation predictor variables***

The second objective of this dissertation was to examine whether smokers' number of smoking friends and changes in their number of smoking friends over time were related to demographic characteristics and variables that have been shown to predict smoking cessation outcomes.

### **7.2.1 Number of smoking friends at Wave 1 and demographic characteristics and smoking cessation predictor variables**

In the multivariate analyses controlling for demographics and smoking cessation predictor variables, several variables were related to smokers' number of smoking friends in the cross-sectional analyses at Wave 1. These findings are discussed below.

As predicted, smokers who were younger, had lower education, and lower incomes reported a significantly higher number of smoking friends. This finding was not surprising because smoking prevalence is higher among these groups. Smokers from demographic groups with a higher smoking prevalence likely had more smoking friends because people tend to be friends with others who have

similar demographic characteristics to their own (Byrne et al., 1966; Lazarfield & Merton, 1954; McPherson et al., 2001). Thus, smokers from demographic groups with a higher smoking prevalence would have a higher chance of forming friendships with smokers. It could also be that among some groups with higher smoking prevalence that smoking behaviour is concentrated in contexts where socializing occurs and friendships are formed (Blieszner & Adams, 1992). For example, younger smokers may be more likely to be friends with other smokers because smoking may be an important part of socializing (Fidler & West, 2009). Smokers with low socioeconomic status may also socialize in contexts where the majority of people smoke, and have limited mobility to socialize with people outside of their immediate surroundings (Wiltshire et al., 2003). The present finding that smokers with lower education and lower income reported a higher number of smoking friends agrees with two previous studies. Siahpush, Borland, and Yong, (2007) found that smokers with more smoking friends were more likely to report that they spent money on cigarettes that would be better spent on household essentials (a measure of smoking induced deprivation), and Rose et al., (1996) found that young adult smokers with lower education reported a higher number of smoking friends.

Unexpectedly, male smokers were found to have more smoking friends than female smokers. This was not expected because smoking prevalence, although slightly higher in males, was quite similar for males and females at the time of surveying. However, it is possible that the slightly higher smoking prevalence among males could have led to the small, but significantly greater number of smoking friends reported by males. The overall tendency for men to have more friends than women could have also contributed to this finding (i.e., men tend to have larger groups of friends, whereas women tend to have more intimate relationships with smaller groups of friends) (Blieszner & Adams, 1992).

Also unexpectedly, smokers from Canada, the United Kingdom, and the United States reported a higher number of smoking friends than smokers from Australia. The difference in number of smoking friends between Australia and the United Kingdom was largest, as was the difference in their current smoking prevalence. Additionally, in the bivariate model, the only significant difference in number of

smoking friends across countries was the difference between Australia and the United Kingdom. Current smoking rates are similar across Australia, Canada, and the United States, so it is uncertain why smokers in Australia were found to report a lower number of smoking friends in the multivariate analysis. It could be that despite similar smoking prevalence rates, smokers in the United States and Canada are more likely to live and work in social contexts where smoking is more heavily concentrated, leading them to report more smoking friends.

Tests of interaction showed that there were no differences in the number of smoking friends reported by smokers across countries by age, sex, or education, suggesting that the relation between being male, younger, and having lower education and more smoking friends is universal across the four countries.

In the multivariate analyses controlling for demographics and smoking cessation predictor variables, several smoking cessation predictor variables were related to smokers' number of smoking friends at Wave 1, and, as predicted, they generally corresponded to the characteristics of smokers that have been shown to predict a lower chance of quitting (Hyland et al., 2006; Vangeli et al., 2011). Smokers with more smoking friends were more likely to be daily smokers, heavier smokers, report a shorter time ever off smoking, have no intention to quit, and have a positive outcome expectancy of the benefits of quitting (Hyland et al., 2006).<sup>5</sup> Similar to the finding that heavier smokers reported more smoking friends, a study of adolescents found that heavier smokers preferred to select smokers as friends, whereas smokers who smoked less than one cigarette a week preferred non-smoking friends (Mercken et al., 2010). In the bivariate model, the characteristics that were related to having more smoking friends were similar with some exceptions. In the bivariate analyses, smokers who had attempted to quit in the past year had a significantly higher number of smoking friends. This suggests that smokers with more

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<sup>5</sup> Hyland et al., 2006 found that outcome expectancy of quitting did not predict making a quit attempt, but that a negative outcome expectancy of quitting predicted successful quitting.

smoking friends were more likely to have failed at their previous quit attempt. Additionally, there was no relation between number of smoking friends and outcome expectancy of quitting in the bivariate model.

Smokers who are unlikely to quit may have reported a higher number of smoking friends for a number of reasons. For example, they might be more likely to have smoking friends because they may prefer to be surrounded by people who support their smoking behaviour, i.e., prefer situations where smoking is the normative behaviour. Smokers who are unlikely to quit may also encourage smoking and discourage quitting among their friends (e.g., cuing each other to smoke, socializing/consuming alcohol, and providing each other with cigarettes) (Burton & Tiffany, 1997; Carter & Tiffany, 1999).

### **7.2.2 Changes in number of smoking friends between Wave 1 and Wave 2 and demographic characteristics and smoking cessation predictor variables**

In the multivariate analyses controlling for demographics and smoking cessation predictor variables, several demographic characteristics were related to changes in number of smoking friends over time. However, only one of the smoking cessation predictor variables (worry about the future health damages of smoking) was related to changes in number of smoking friends over time.

As predicted, the demographic characteristics that were related to changes in number of smoking friends were similar to those that were related to having more smoking friends at Wave 1. Smokers from demographic groups with higher smoking prevalence and lower smoking cessation rates were more likely to gain smoking friends and less likely to lose smoking friends over time, with some exceptions.

Unexpectedly, smokers from the United States were more likely to lose smoking friends compared to smokers from Australia. The reason for this difference is uncertain. The percentage of smokers that quit smoking between Wave 1 and Wave 2 in Australia was lower compared to the percentage that quit in the other three countries. Perhaps the smaller number of quitters in Australia resulted in fewer losses in smoking friends. However, this does not explain why this difference only emerged between Australia and the United States.

As predicted, older smokers were more likely to lose and less likely to gain smoking friends over time. This may have been because smoking prevalence is lower among older smokers. Thus, if older smokers' number of friends changed, they may have been more likely to replace a smoking friend with a non-smoking friend. Additionally, because one out of every two smokers are projected to die from a smoking related disease (Doll et al., 2004), it is also possible that older smokers were more likely to lose smoking friends due to smoking related deaths.

Because no differences in changes in males and females number of smoking friends over time were expected, it is uncertain why male smokers were more likely to gain smoking friends than female smokers. Male smokers may have been more likely to gain smoking friends for the same reasons that they may have had more smoking friends at Wave 1, e.g., smoking prevalence was slightly higher among males at the time of surveying, so it is possible that males who lost a smoking friend may have had a higher chance of replacing their friend with another smoker.

As expected, smokers from lower socioeconomic groups were more likely to gain smoking friends over time. Smokers with lower education and lower income may have been more likely to gain smoking friends because smoking prevalence is higher and smoking cessation rates are lower among lower socioeconomic groups (Jarvis & Wardle, 2006). This study did indeed find that a lower percentage of smokers with low education (6.4%) and low income (6.0%) quit smoking between the two waves compared to smokers with high education (9.3%) and high income (7.8%).

Smokers who worked outside the home were more likely to lose smoking friends over time. They may have been more likely to lose smoking friends if employment outside the home was indicative of higher socioeconomic status. Smokers in some jurisdictions may also have been exposed to workplace smoking restrictions that could have led some people in their social context to quit smoking (Chapman et al., 1999).

Smokers who were less worried that smoking would damage their health in the future were more likely to gain smoking friends. This could be because smokers who do not worry about the future health

damages of smoking are less motivated to quit smoking (Borland et al., 2010). Smokers who are not motivated to quit may prefer to avoid non-smokers who challenge their beliefs about the health consequences of smoking, and seek out smokers who support their smoking behaviour.

The lack of relation between the smoking cessation predictor variables and changes in number of smoking friends over time suggests that it is a smoker's demographic characteristics that predict changes in a their number of smoking friends over time as opposed to their smoking behaviour. It also suggests that smokers from demographic groups that are more likely to gain and less likely to lose smoking friends over time may become in a sense 'trapped' in social contexts that support smoking, regardless of their intentions to quit or level of nicotine dependence/heaviness of smoking. Because no relation was found between intentions to quit smoking at Wave 1 and changes in smokers' number of smoking friends over time, this suggests that having an intention to quit (in the next 30 days or next 6 months) does not predict whether smokers will lose, or possibly de-select smoking friends over the next 6.7 months (average time between the Wave 1 and Wave 2 surveys).

In addition to the proposed effects of smoking prevalence and cessation rates on changes in number of smoking friends over time, whether smokers reported a loss, gain, or no change in their number of smoking friends could also depend on other factors. For example, changes in number of smoking friends could be related to how smokers from different demographic groups react to social pressure to quit smoking. For example, smokers could deal with social pressure to quit by: (1) quitting smoking, or (2) seeking out friends who smoke to support their current smoking behaviour. Indeed, a previous study among adolescents found that when smokers with a strong smoking identity attempted to resist pressure to quit smoking, they responded by increasing perceived support for their smoking behaviour from their smoking friends (Falomir & Invernizzi, 1999). Additionally, theories of group composition suggest that when a person senses that their behaviour is incongruent with the behaviour of their social group, they will either leave the group, or quit the behaviour to avoid social conflict (Levine & Moreland, 2006). Thus, because people from lower socioeconomic groups have been shown to have

more smoking friends, and be more deeply construed in their social networks, it is possible that they would be more motivated to keep their smoking behaviour in line with their group, and less likely/less able to leave their group when attempting to quit (Markus & Kitayama, 2010; Stephens et al., 2007). It is also possible that smokers from demographic groups with lower social mobility or less power to make decisions about the social groups that they belong to, such as lower socioeconomic status smokers or those who are otherwise socially isolated/on the periphery of society, were less able to change their friend group/select new friends to match their current or desired smoking status (Blieszner & Adams, 1992).

Tests of interaction showed that there were no differences in changes in number of smoking friends across the four countries by age, sex, or education, indicating that the relation between being younger, male, and having lower education and being more likely to gain and less likely to lose smoking friends over time was universal across the four countries.

### **7.2.3 Strengths and limitations**

This is the first study to examine the demographic characteristics and smoking cessation predictor variables that are related to smokers' number of smoking friends, and changes in their number of smoking friends over time. The main strength of this study was its use of longitudinal data that allowed the prospective predictors of changes in number of smoking friends to be examined in nationally representative samples of smokers.

One major limitation of this study is that it is not possible to determine why smokers experienced a change in their number of smoking friends. For example, changes in smokers' number of smoking friends may have been observed because (1) respondents de-selected existing friends, (2) respondents' friends de-selected them, or (3) respondents friends quit smoking or started to smoke. A limitation of the analysis that examined predictors of smokers' number of smoking friends at Wave 1 is that it cannot be concluded that any of the characteristics led smokers to have more smoking friends, only that smokers'

number of smoking friends and some of the demographic characteristics and smoking cessation predictor variables were related.

#### **7.2.4 Conclusion and implications**

Smokers who were male, younger, had low education, and lower incomes reported a higher number of smoking friends, and were more likely to gain and less likely to lose smoking friends over time. These demographic groups are likely to be most affected by any negative effects of (1) having more smoking friends, (2) being more likely to gain smoking friends, and (3) being less likely to lose smoking friends on smoking cessation outcomes. It was important to conduct these analyses and identify these groups so that smoking cessation interventions could target these groups and any problems they may encounter when trying to quit due to the higher number of smokers in their social context.

The finding that smokers who gained smoking friends over time were less likely to be worried about the future health damages of smoking may have implications for health communication efforts. It could be that smokers who live in social contexts where smoking is highly concentrated are not as receptive to information about the health damages of smoking, or that the information is not reaching them. For example, these smokers may not identify with the current health messages or ‘messengers,’ and health messages may need to be altered to resonate with them.

### ***7.3 Number of smoking friends, changes in number of smoking friends, and smoking cessation outcomes***

The third objective of this dissertation was to determine if there was a relation between number of smoking friends, changes in number of smoking friends over time, and smoking cessation outcomes. The results of these analyses are discussed below.

### 7.3.1 Intentions to quit smoking at Wave 1 and Wave 2

As predicted, smokers who reported fewer smoking friends at Wave 1 were more likely to have intentions to quit at Wave 1. This is consistent with two cross-sectional studies which found that smokers who had a higher number of smokers among their social contacts (as indicated by composite scores) were less likely to intend to quit smoking (Willemsen, De Vries, van Breukelen, & Oldenburg, 1996; van den Putte et al., 2005). van den Putte et al., (2005) also found that smokers with fewer smoking social contacts were more likely to hold negative subjective norms towards smoking (more likely to believe that others think they ought to quit). Other studies have found that smokers who hold negative subjective norms towards smoking are more likely to intend to quit (Hosking et al., 2009; Moan & Rise, 2005) . Thus, one reason that smokers with fewer smoking friends are more likely to intend to quit could be that smokers with fewer smoking friends hold more negative subjective norms towards smoking.

In contrast, smokers' number of smoking friends at Wave 1 was not related to their intentions to quit at Wave 2.<sup>6,7</sup> This shows that the number of smokers in a smoker's social context is related to their current intentions to quit, but not predictive of their future quit intentions. A small clinic/intervention study similarly found that smokers' subjective norms towards smoking (people important to me think I should not smoke) did not predict intentions to quit smoking six months later (Norman, Conner, & Bell, 1999). The non-significant relation between number of smoking friends and future quit intentions might

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<sup>6</sup> Although there was no significant relation between number of smoking friends at Wave 1 and intentions to quit at Wave 2 in the main analysis, there was a significant quit intentions x heaviness of smoking index interaction (see Section 6.4.1.2.1. However, the interaction was weak, and the pattern of the relation in the descriptive data was not clear. Additionally, the model comparisons showed that adding number of smoking friends at Wave 1 to the base model predicting quit intentions at Wave 2 improved by base model.

<sup>7</sup> All longitudinal analysis that examined predictors of quit intentions at Wave 2 controlled for quit intentions at Wave 1.

be explained by previous research that suggests quit intentions are not stable, and can change over short periods of time (e.g., a few days) (Hughes, Keely, Fagerstrom, & Callas, 2005).

As predicted, changes in number of smoking friends between Wave 1 and Wave 2 predicted quit intentions at Wave 2. Smokers who gained smoking friends were less likely to intend quit than smokers who experienced no change in their number of smoking friends, and smokers who lost smoking friends were significantly more likely to intend to quit.<sup>8</sup> This finding is similar to a finding by van den Putte et al., 2005, such that they found that smokers who retrospectively reported that ‘smokers’ who they regularly see had quit in the last three months were more likely to report that they intended to quit.

Interestingly, the relation between changes in number of smoking friends between Wave 1 and Wave 2, and quit intentions at Wave 2 depended on smokers’ intentions to quit smoking at Wave 1. Smokers who had no intention to quit at Wave 1 and who lost smoking friends between Wave 1 and Wave 2 were more likely to intend to quit smoking at Wave 2 compared to smokers who experienced no change in their number of smoking friends. However, if a smoker already intended to quit smoking at Wave 1, and they lost smoking friends, they were no more or less likely to maintain their quit intention than if they experienced no change in their number of smoking friends. Similarly, smokers who had an intention to quit at Wave 1, and who gained smoking friends between Wave 1 and Wave 2, were more likely to have no intention to quit at Wave 2 than smokers who experienced no change in their number of smoking friends. However, again, if a smoker already had no intention to quit and they gained smoking friends, they were no more or less likely to still have no intention to quit at Wave 2 than smokers who experienced no change in their number of smoking friends. Together these results suggest that a change in a person’s social context (i.e., loss of smoking friends) that challenges or is asymmetrical to their

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<sup>8</sup> Smokers who lost smoking friends were only significantly more likely to intend quit at Wave 2 in the analysis that used the non-collapsed friend change variable. Smokers who lost smoking friends were not more likely to intend to quit in the analysis that used the collapsed friend change variable ( $p=0.08$ ).

current cognitions (i.e., no intention to quit smoking) may prompt smokers to align their quit intentions with their new social context (fewer smoking friends), and lead them to develop an intention to quit. However, it is also possible that upon deciding that they intended to quit/or did not intend to quit, that smokers sought out people whose smoking behaviour matched their desired smoking behaviour.

### **7.3.2 Quit attempts at Wave 2**

There was no relation between number of smoking friends at Wave 1 and making an attempt to quit between Wave 1 and Wave 2. In contrast, change in number of smoking friends over time was related to making a quit attempt between Wave 1 and Wave 2.

Although a weak relation was expected between number of smoking friends at Wave 1 and quit attempts at Wave 2, the null finding was not surprising considering that Biener et al., (2010) similarly found that number of smoking friends did not predict attempts to quit smoking. Also consistent with these findings, Zhou et al., (2009) found that smokers' reports that other people often smoked in their presence did not prospectively predict attempts to quit smoking. A small study using a clinical sample also found that the number of smokers in a smoker's social context did not prospectively predict attempts to quit smoking (Kirscht, Janz, & Becker, 1989).

Together these findings suggest that the number of smokers in a person's social context, and any influence that their friends may have on motivation to quit through subjective norms, does not predict quit attempts. Indeed, a theory of behaviour change (PRIME Theory), suggests that perceived duty to quit (subjective norms), must be accompanied by the want or need to quit, and a study testing this theory found no relation between duty to quit and quit attempts (Smit et al., 2011). It is also possible that the number of smokers in a person's social context is a poor predictor of future quit attempts because many quit attempts have been found to be triggered by changes in a smoker's environment (quit attempts are often 'spontaneous'), rather than being planned in advance (Cooper et al., 2010; Larabie, 2005; West & Sohal, 2006). Additionally, previous research has identified other motivational factors that predict quit

attempts, such as the enjoyment of smoking, and worries about the future health damages of smoking (Borland et al., 2010; Fidler & West, 2011).

In contrast, there was a significant relation between change in number of smoking friends between Wave 1 and Wave 2 and attempts to quit smoking at Wave 2. As expected, smokers who lost smoking friends between Wave 1 and Wave 2 were more likely to have attempted to quit between Wave 1 and Wave 2 compared to smokers who experienced no change in their number of smoking friends. Smokers who lost smoking friends may have been more likely to attempt to quit for a number of reasons. For example, if one of their friends quit smoking or the number of smokers in their social context changed for some other reason, this could have caused their subjective norms towards smoking to become more negative, and triggered a quit attempt. It is also possible that smokers' number of smoking friends changed after their quit attempt. For example, upon attempting to quit, smokers may have decided to avoid their smoking friends and seek out new non-smoking friends to support their desired non-smoking status.

Although smokers who lost smoking friends were less likely to attempt to quit compared to smokers who experienced no change in their number of smoking friends, smokers who gained smoking friends were no more or less likely to attempt to quit than smokers who experienced no change. It is uncertain why smokers who gained smoking friends were no less likely to attempt to quit compared to smokers who experienced no change in their number of smoking friends. However, considering the earlier finding for quit intentions, that a change in a smoker's social context (i.e., loss of smoking friends) that challenges their current cognitions (i.e., no intention to quit smoking) predicts intentions to quit, it could be that a gain in smoking friends does not challenge smoking behaviour, and is not as evocative as a loss in smoking friends that challenges smoking behaviour and is related to quit attempts. However, again, it is also possible that smokers attempted to quit, and then sought out new non-smoking friends.

### **7.3.3 Abstinence from smoking for at least one month at Wave 2 among everyone**

Unexpectedly, there was no overall relation between number of smoking friends at Wave 1 and being abstinent from smoking for at least one month at Wave 2 among everyone. Similarly, Biener et al., (2010) and Osler & Prescott, (1998) found that number of smoking friends did not predict quitting (abstinence among everyone).

As predicted, there was a relation between change in number of smoking friends between Wave 1 and Wave 2 and abstinence from smoking at Wave 2. Smokers who lost smoking friends between Wave 1 and Wave 2 were more likely to report being abstinent from smoking at Wave 2 compared to smokers who experienced no change in their number of smoking friends. However, smokers who gained smoking friends were no more or less likely than smokers who reported no change in their number of smoking friends to be abstinent from smoking at Wave 2. The relation between changes in number of smoking friends and abstinence is discussed further in the next section.

### **7.3.4 Abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit**

Among smokers who attempted to quit, there was an overall relation between number of smoking friends at Wave 1 and being abstinent from smoking for at least one month at Wave 2; smokers with 0 vs. 5 smoking friends at Wave 1 were more likely to succeed in their attempt to quit smoking. Although a weak relation was expected, the significant relation was somewhat surprising because there was no relation between number of smoking friends and intentions to quit (at Wave 2), quit attempts, and smoking abstinence among everyone. However, this finding is congruent with other studies that have demonstrated that the factors that predict quit attempts, and successful quitting, often differ (Borland et al., 2010; Fidler & West, 2011). Additionally, one previous study found that having more smoking friends prospectively predicted relapsing from a quit attempt, and another study found that smokers who reported that others often smoked in their presence were more likely to relapse from a quit attempt (Herd et al.,

2009; Zhou et al., 2009). Zhou et al., (2009) suggested that smokers may be less likely to successfully quit if other people smoke in their presence because other smokers may act as a 'nicotine cue' leading to cravings to smoke, and ultimately, relapse to smoking behaviour. Thus, as proposed in the mechanisms section of this dissertation, it could be that smokers with more smoking friends were less likely to succeed in their attempts to quit because they were exposed to more cues to smoke in their social contexts (Carter & Tiffany, 1999; O'Connell et al., 2011; Shiffman et al., 2002).

As predicted, there was a relation between change in number of smoking friends between Wave 1 and Wave 2 and being abstinent from smoking at Wave 2 among smokers who attempted to quit. Smokers who lost smoking friends between Wave 1 and Wave 2 were more likely to succeed in their attempts to quit compared to smokers who experienced no change in their number of smoking friends. Smokers who lost smoking friends may have been more likely to succeed in their attempts to quit for a number of reasons. For example, smokers who successfully quit may have been more likely to avoid other smokers during their quit attempt, and upon quitting, de-selected smoking friends and selected new non-smoking friends to match their new non-smoking status. Indeed, one study of adolescents found that upon quitting, adolescents selected new non-smoking friends to match their new smoking status (McVea, Miller, Creswell, McEntarrfer, & Coleman, 2009). Similarly, Christakis and Fowler, (2008) found that over a 32-year period smokers who quit smoking were less likely to have social contacts who smoked compared to people who continued to smoke. Smokers who lost smoking friends may also have been more likely to quit because losing smoking friends led their subjective norms towards smoking to become more negative, providing them with motivation to attempt to quit, and stay quit. At the same time, smokers who lost smoking friends, may also have been exposed to fewer smokers in their social context (fewer cues to smoke), and may have been less likely to experience urges/cravings to smoke, and less likely to relapse.

Similar to the findings for quit attempts, only smokers who lost smoking friends who were more likely to be abstinent compared to smokers who experienced no change in their number of smoking

friends. It is uncertain why smokers who gained smoking friends were not less likely to be abstinent compared to smokers who experienced no change in their number of smoking friends. However, considering the findings for quit intentions and quit attempts, that a change in a smoker's social context (i.e., loss of smoking friends) that challenges their current cognitions or behaviour (i.e., current smoking) predicts behaviour change, it could be that a gain in smoking friends does not challenge smoking behaviour, and is not as evocative as a loss in smoking friends that challenges smoking behaviour and is related to quitting. However, again, it is also possible that respondents lost smoking friends after they quit.

### **7.3.5 Comparisons of the base models to models with friends at Wave 1 and friend change between Wave 1 and Wave 2**

The base models included variables that have been shown to be important and consistent predictors of smoking cessation outcomes in previous studies (Hyland et al., 2006; Vangeli et al., 2011). In most cases, adding number of smoking friends at Wave 1, and changes in number of smoking friends between Wave 1 and Wave 2 to the base models led to model improvements. However, adding number of smoking friends at Wave 1 to the base models led to fewer and less significant improvements than adding change in number of smoking friends, and in the case of quit attempts, adding number of smoking friends at Wave 1 did not significantly improve the model. Additionally, for the friend change variables, the non-collapsed friend change variable that conceptualized the degree of friend change that occurred (e.g., from a loss of 5 to no change to a gain of 5), led to more significant improvements than the collapsed friend change variable that only tested the difference between no change vs. loss/gain. The more significant improvements found for the non-collapsed variable suggest that when studying smoking cessation outcomes it may be important to consider not only whether a change in the number of smokers in a person's social context occurred, but also the degree of friend change. Indeed, analyses within this dissertation showed that the odd ratios for quit intentions, quit attempt, and abstinence tended to be higher

for smokers who lost more smoking friends. Moreover, the individual predicted probabilities of quitting suggested that smokers who lost a higher proportion of their smoking friends were more likely to experience positive smoking cessation outcomes (e.g., smoking abstinence).

Overall, these findings indicate that it is important to consider how the number of people who smoke and changes in the number of people who smoke in a person's social context may be related to differences in smoking cessation outcomes. Moreover, they suggest that it is important to consider the social context even in the face of other factors (i.e., quit intentions, and heaviness of smoking/nicotine dependence) that consistently predict smoking cessation outcomes.

### **7.3.6 Strengths and limitations**

This is the first study to examine the relation between smokers' number of smoking friends, changes in their number of smoking friends over time, and smoking cessation outcomes in nationally representative samples of adult smokers. The main strength of this study was its use of the longitudinal cohort samples that allowed the relation between number of smoking friends and smoking cessation outcomes to be examined prospectively. The cohort samples also allowed the relation between changes in number of smoking friends over time and smoking cessation outcomes to be examined.

The main limitation of these analyses is the issue of establishing causality when studying the relation between individual and group (friends') behaviour (see Section 2.2.1). Thus, although there was a relation between changes in number of smoking friends and smoking cessation outcomes, it is uncertain whether the change in smoking friends occurred prior to the smoking cessation outcome, after the smoking cessation outcome, or because of a combination of the two. The limitations of the number of smoking friends measure and the change in number of smoking friends measure are further discussed in the overall discussion section (Section 7.5.1).

### **7.3.7 Conclusions and implications**

These findings demonstrate that changes in smokers' number of smoking friends are related to smokers' intentions to quit, making quit attempts, abstinence from smoking, and abstinence among smokers who attempted to quit (successful quitting). In contrast, number of smoking friends at Wave 1 was only related to smokers' intentions to quit at Wave 1, and abstinence from smoking for at least one month at Wave 2 among smokers who attempted to quit (quit attempt success).

One interesting finding was that it was only smokers who lost smoking friends who were more likely to attempt to quit, and be abstinent from smoking at Wave 2 compared to smokers who experienced no change in their number of smoking friends. Smokers who gained smoking friends were no more or less likely to attempt to quit or be abstinent from smoking at Wave 2 compared to smokers who experienced no change in their number of smoking friends. This contrast in findings suggests that changes in a smoker's social context contrary to their current behaviour (i.e., loss in smoking friends) are related to behavioural change, and that changes in the social context in line with current behaviour (i.e., gain in smoking friends) are not related to behavioural change (compared to a situation where the social context did not change, i.e., no change in number of smoking friends).

Together these findings provide strong evidence that the number of smokers in people's social context changes during the smoking cessation process (quit intentions, quit attempts, and abstinence). The findings also suggest that smokers with fewer smoking friends and who lose smoking friends over time are the most likely to successfully quit smoking.

### ***7.4 Mediation of the relation between changes in number of smoking friends over time, and smoking cessation outcomes by norms***

The fourth objective of this dissertation was to examine whether the relation between changes in number of smoking friends between Wave 1 and Wave 2, and smoking cessation outcomes at Wave 2 may be mediated by changes in smokers' norms towards smoking between Wave 1 and Wave 2.

### 7.4.1 Subjective norms

As expected, there was evidence that subjective norms towards smoking may mediate the relation between changes in number of smoking friends and quit attempts. This finding was expected because previous research suggests: (1) motivational factors such as subjective norms predict quit attempts (even though they do not predict the success of quit attempts) (Borland et al., 2010; Fidler & West, 2011), and (2) that many quit attempts are unplanned and may be provoked by changes in a person's social context (Cooper et al., 2010; Larabie, 2005; West & Sohal, 2006).

There was some evidence that changes in subjective norms towards smoking may partially mediate the relation between changes in number of smoking friends and intentions to quit at Wave 2, and abstinence from smoking at Wave 2 among everyone. Although changes in subjective norms were not expected to mediate the relation between changes in number of smoking friends and abstinence from smoking, it is likely that evidence was found because the analysis included everyone (tested abstinence from smoking in general rather than abstinence among smokers who attempted to quit).

As predicted, there was no evidence that changes in subjective norms mediated the relation between change in number of smoking friends and abstinence from smoking among smokers who attempted to quit (successful quitting). This was expected because previous studies have generally shown that motivational variables, such as norms, do not predict the success of quit attempts, and that the most consistent predictor of quit success is nicotine dependence (Borland et al., 2010; Vangeli et al., 2011). As proposed in the introduction section of this dissertation, any effect of losing smoking friends on the success of quit attempts might be explained by a reduction in the number of nicotine cues that smokers are exposed to, rather than changes in their subjective norms towards smoking. In other words, smokers who experienced a loss in their number of smoking friends may have been less likely to relapse from their quit attempt because they were exposed to fewer smokers/smoking related cues (smoking odours, actual cigarettes, alcohol) (Burton & Tiffany, 1997; Carter & Tiffany, 1999).

One of the most important and interesting findings from these mediational analyses was that changes in number of smoking friends were related to changes in subjective norms towards smoking; smokers who lost smoking friends became more likely to agree that people who are important to them think they should not smoke. This finding is important because it provides validation (convergent validity) of the friend change and subjective norm change measure, because one would expect that changes in the number of a person's friends who engage in a given behaviour should be related to changes in their subjective norms towards the behaviour. Furthermore, because there was a relation between changes in number of smoking friends and changes in subjective norms in the analysis that only included continuing smokers (mediation analysis for intentions to quit), it is evident that even among smokers who continue to smoke, that changes in a smoker's number of smoking friends are related to changes in their subjective norms towards smoking.

#### **7.4.2 Social norms**

In contrast, and as predicted, there was no evidence that changes in social norms explained the relation between changes in number of smoking friends and smoking cessation outcomes. The tests of mediation for all smoking cessation outcomes failed because the second test of mediation was not met; changes in respondents' number of smoking friends were not related to changes in their social norms towards smoking (changes in agreement that society disapproves of smoking). The non-significant relation between changes in number of friends who smoke and changes in social norms, and the significant relation between changes in number of smoking friends and changes in subjective norms is congruent with theory on the sources of norms. Social norms are the beliefs that people hold about whether or not they think society approves of a behaviour (Hechter & Opp, 2001). Thus, it is not surprising that the smoking behaviour of people's friends was not related to their social norms towards smoking, but that the smoking behaviour of their friends was related to their subjective norms towards smoking.

### **7.4.3 Strengths and limitations**

This is the first study to examine if the relation between changes in smokers' number of smoking friends and smoking cessation outcomes might be explained by changes in smokers' subjective and social norms towards smoking. Additionally, this is also one of the few studies to consider differences in how subjective and social norms may influence a variety of smoking cessation outcomes. Moreover, to the author's knowledge, this is also the first study to consider how smokers' social and subjective norms change over time with smoking cessation outcomes.

One major limitation of these mediational analyses was that the nature of the data does not allow the direction of causality to be determined. It cannot be determined whether changes in smokers' number of smoking friends caused smokers' subjective norms towards smoking to change, and that changes in smokers' subjective norms then led to smoking cessation outcomes (intentions to quit, quit attempts, and abstinence from smoking).

### **7.4.4 Conclusions and implications**

Together these findings suggest that changes in smokers' subjective norms towards smoking may partially explain the relation between changes in smokers' number of smoking friends and attempts to quit smoking. There is also some evidence that subjective norms may partially explain the relation between changes in number of smoking friends and intentions to quit smoking, and abstinence from smoking among everyone. However, there is no evidence that changes in subjective norms explain the relation between changes in number of smoking friends and abstinence among smokers who attempted to quit (success of quit attempts).

In contrast, there was no evidence that changes in smokers' social norms towards smoking may explain the relation between changes in number of smoking friends and smoking cessation outcomes. This finding was expected because sanctions for smoking from society (sanctions for smoking in an anti-smoking society) would likely be weaker than sanctions from important others (sanctions for smoking

where the subjective norm is anti-smoking) (Cialdini & Trost, 1998). A study comparing the relations between different types of norms and intentions to quit smoking similarly found a strong relation between quit intentions and subjective norms towards smoking, and a relatively weak association with social norms (van den Putte et al., 2005).

As previously eluded to, these findings also provide a good test of validity for the three measures: number of friends who smoke, subjective norms, and social norms. The relation between change in number of smoking friends and change in subjective norms was expected because the source of subjective norms is close others (convergent validity). The non-significant relation between change in number of smoking friends and change in social norms was also expected because the source of social norms is not important others (discriminant validity).

## ***7.5 Overall discussion***

### **7.5.1 Strengths and limitations**

The main strength of this dissertation was its use of data from nationally representative longitudinal cohort surveys of smokers in four countries. The use of these samples allowed the relation between number of smoking friends, changes in number of smoking friends, and smoking cessation outcomes to be examined prospectively, and allows conclusions to be made about the universality of the results across the four countries. However, although longitudinal data was used, it cannot be determined whether smokers experienced changes in their number of smoking friends before or after the smoking cessation outcomes tested occurred (quit intentions, quit attempts, and abstinence). Thus, the temporal order of the effect cannot be established. For example, it is possible that smokers ‘lost’ smoking friends after they attempted to quit rather than before they attempted to quit.

The breadth of smoking cessation outcomes examined in this dissertation (intentions to quit, abstinence from smoking for one month or more at Wave 2, etc.) was an additional strength, particularly

as it is becoming increasingly evident that the predictors of quit attempts, and successful quitting differ (Borland et al., 2010; Fidler & West, 2011; Kotz & West, 2009; Vangeli et al., 2011).

Although this dissertation has several strengths, there are also important limitations. First, the study relied entirely on self-report. However, self-reported smoking behaviour has been shown to be sufficient in most cases, and suitable for the purposes of population health surveys of adult smokers (Patrick et al., 1994). Because the survey was self-report, it is likely that smokers under reported attempts to quit smoking because research suggests that shorter quit attempts or those that occurred more than a few months ago are often forgotten (Berg et al., 2010; Gilpin & Pierce, 1994). There is also the possibility that social desirability had an effect on some of the responses. For example, some respondents may have reported they intended to quit even if they did not in order to appeal to social norms against smoking.

Another important limitation to consider is how number of smoking friends was measured. Respondents were asked: Of the five closest friends or acquaintances that you spend time with on a regular basis, how many of them are smokers (0, 1, 2, 3, 4, or 5)? Because the question asks about close friends and acquaintances, it is possible that respondents could have been thinking about very different people in their lives when they answered the question. Cognitive testing research conducted by Thrasher et al. (2011) on the five closest friend question suggests that a significant portion of respondents considered family members when they answered the question. If respondents did indeed differ in how much they thought about family vs. close friends vs. acquaintances when answering the question, and number of close friends, family, and acquaintances who smoke related differently to smoking cessation outcomes, this could have led to problems with the measure. Additionally, considering the second part of the question, 'that you spend time with on a regular basis,' some respondents may have interpreted a regular basis to mean daily (leading them to think about co-workers and family), whereas other respondents may have interpreted this to mean people whom they spend their leisure time with (friends on evenings/weekends).

Despite the potential problems of this measure, it is difficult to imagine how variability of this kind across individuals would have led to directional **biases** in the relation between this measure and cessation-related outcomes, much less all of the nuanced (but either hypothesized outright or reasonable directional results). To be sure, there may be challenges in the reliability of this measure across individuals, but that unreliability cannot, in and of itself, explain statistically significant results whose direction and magnitude fit within the theoretical framework of this dissertation. In other words, any challenges in the reliability of the five closest friends measure cannot explain the pattern of the findings. In fact, it could be said that statistically significant and meaningful results were obtained **despite** the presence of lower reliability, **not** because of it. The results of this dissertation showed strong and consistent relations between these measures and the smoking cessation outcomes in the expected directions. These strong and consistent relations are consistent with the conclusion that the measure was valid, whatever the challenges to its reliability that may exist.

The measure for changes in number of smoking friends is limited. Because changes in number of smoking friends were calculated as the difference between smokers' number of smoking friends reported at Wave 1 and Wave 2, it is not known why changes in smokers' number of smoking friends occurred. For example, respondents' number of smoking friends could have changed because one of their friends quit smoking, because they de-selected their friends, because their friends de-selected them, etc. Future studies could use social network methods to overcome some of these limitations (ego-centric, or possibly, sociometric methods) (Valente, 2011).

An additional limitation of this dissertation was that the outcome variable for smoking abstinence was abstinence for at least one month at Wave 2, a relatively short minimum period. Thus, this study only considered how smokers' number of smoking friends and changes in their number of smoking friends over time was related to short-term abstinence (Hughes & Keely, 2004). However, most smokers who self-quit relapse within the first week of quitting (Hughes & Keely, 2004), and respondents would no longer meet a common definition of a smoker for adults after not smoking for 30 days (Mills et al., 1994).

If a longer abstinence period was used (i.e., 6 months), it is possible that the results would have been different. For example, if the same sample and dataset was used it is likely that the relation between number of smoking friends and changes in number of smoking friends and abstinence would have been smaller or non-significant because there would have been a smaller sample of quitters. The relation between number of smoking friends at Wave 1 and abstinence at Wave 2 may have also been smaller because one study suggests that having more smoking friends may have the greatest impact on relapse in the first 30 days after quitting (Herd et al., 2009). The relation between changes in number of smoking friends and abstinence may have also been different. It is possible that the relation between losing smoking friends and abstinence could have been stronger if quitters continued to lose smoking friends the longer they remained abstinent. Future research using the ITC Four Country sample could examine how changes in smokers' number of smoking friends over time are related to long-term quitting by combining multiple waves of the ITC Four Country Survey. It would also be interesting to compare quitters who relapse to those who maintain their non-smoking status at Wave 3 to see if their number of smoking friends changes after they relapse back to smoking/maintain their non-smoking status long-term.

### **7.5.2 Conclusions and implications**

This dissertation found evidence that the social context, specifically, smokers' number of smoking friends and changes in their number of smoking friends over time, is related to smoking cessation outcomes. The relation between changes in smoking friends over time and smoking cessation outcomes was more consistent, and stronger than the relation between number of smoking friends at baseline and smoking cessation outcomes, suggesting that it is *changes* in a smoker's social context that are most important when predicting smoking cessation outcomes. Additionally, because it was losses (rather than gains) compared to no change in number of smoking friends that were related to smoking cessation outcomes, this suggests that it is changes in a person's social context contrary to their current behaviour that are related to behavioural change.

The findings from this dissertation also suggest that regardless of demographic group, most smokers live in social contexts where smoking is more heavily concentrated than it is in the general population. However, smokers from certain demographic groups reported a significantly higher number of smoking friends. Smokers who were younger, male, had lower education, and lower incomes were more likely to report having more friends who smoked, and were more likely to gain and less likely to lose smoking friends over time. Thus, it is possible that these groups may be implicated the most by the negative effects of having more smoking friends, and gaining/experiencing no change in their number of smoking friends over time during the smoking cessation process. Additionally, it may be that the higher smoking prevalence and the lower smoking cessation rates among low socioeconomic groups in the four countries studied may be partially explained by the high concentration of smokers in their social context, and the apparent increase in the concentration of smokers in their social context over time observed in this study (Jarvis & Wardle, 2006). Indeed, other researchers have also suggested that this could be the case (Jarvis & Wardle, 2006; Kotz & West, 2009). Because ITC surveys are being conducted in 20 countries, future research could consider how a high concentration of smokers in the social contexts of smokers in other countries might be related to the smoking cessation process. For example, in China where 60% of men smoke, it may be challenging (or nearly impossible) for men to avoid other smokers when attempting to quit (World Health Organization, 2011).

This dissertation may have important implications for smoking cessation research and interventions. Overall, this dissertation illustrates the importance of considering how the social context, and most importantly, how *changes* in the social context may contribute to the smoking cessation process, and suggests that research on predictors of smoking cessation should not be limited to individual characteristics at baseline (i.e., nicotine dependence, intentions to quit). Larabie, (2005) similarly emphasized that need to consider how changes or dynamic factors (health scare, bad weather preventing cigarette purchase) in smokers' environments contribute to smokers' motivation to quit, and the need for models that predict smoking cessation to account for these factors. Methods that may be conducive to this

type of research include Ecological Momentary Assessment (EMA), that allows smoking behaviour, attitudes, etc., to be assessed in real-time at multiple time points (Shiffman, 2005).

Smoking cessation research should consider placing a greater emphasis on understanding how the social context affects smoking cessation outcomes. The most recent review of factors that predict smoking cessation outcomes in population samples did not include any assessment of how the number of smokers in people's social contexts may be related to successful quitting, demonstrating that relatively little is known about this factor and that few studies have considered it (Vangeli et al., 2011). However, this seems to be changing. One recent study acknowledged the lack of research on the role of adult smokers' smoking friends (Biener et al., 2010). Other recent studies have also examined how smokers with a higher number of smokers in their social context may be less likely to quit, more likely to relapse from a quit attempt, and more likely to increase their cigarette consumption over time (Herd et al., 2009; Levy et al., 2009; Zhou et al., 2009).

Additionally, because this study suggests that smokers who lose smoking friends over time are more likely to successfully quit smoking, smoking cessation interventions should consider how they could help smokers avoid other smokers, find non-smoker support, and confront pro-smoking norms when they are attempting to quit. Interventions could consider how to help smokers who are trying to quit avoid other smokers during their quit attempts. Future studies could investigate what makes it more or less difficult for smokers to avoid other smokers when quitting. For example, smokers who live in social contexts where there is a higher prevalence of smoking may have more difficulty avoiding other smokers during their quit attempts, and may find it particularly difficult to avoid other smokers in the long-term.

New social media tools for smoking cessation, such as smartphone applications, could use these findings when designing programs to help smokers quit. Smokers who are interested in quitting and have a high number of smoking friends may benefit from the virtual support of other smokers who are trying to quit, or recent quitters. Future studies could investigate if virtual support for quitting could counter the apparent negative effects of having a higher number of smoking friends on successful quitting.

One study investigated if wearing a high dose nicotine patch helped quitters resist proximal influences (e.g., other smokers) on lapses back to smoking (Ferguson & Shiffman, 2010). However, the study found that although quitters who wore the nicotine patch were able to resist affective influences to smoke, they were not able to resist proximal influences to smoke any more than the control group who wore a placebo patch. This early study suggests that other smokers act as powerful cues to smoke, and that interventions should focus on helping smokers who are attempting to quit completely avoid other smokers.

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## Appendices

*Appendix A: Full multivariate regression tables for Section 6.4*

Table A-1: Number of Smoking Friends at Wave 1 and Intentions to Quit Smoking at Wave 1, (N=6,321)

Parameter	n	% Intend to Quit (Wave1)	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Country</b>						
Australia	1748	35.5	ref	1.00	1.00	1.00
Canada	1595	46.4	<.0001	1.61	1.35	1.92
United Kingdom	1714	29.5	0.0283	0.81	0.67	0.98
United States	1264	34.1	0.2255	0.89	0.73	1.08
<b>Sex</b>						
Female	3549	35.1	ref	1.00	1.00	1.00
Male	2772	37.4	0.0039	1.22	1.07	1.39
<b>Age group</b>						
18-24	715	38.2	ref	1.00	1.00	1.00
25-39	2003	40.0	0.4183	1.10	0.87	1.39
40-54	2306	35.2	0.8704	1.02	0.80	1.29
55-max	1297	30.0	0.1973	1.20	0.91	1.57
<b>Education</b>						
Low	3511	33.7	ref	1.00	1.00	1.00
Moderate	1979	39.5	0.2975	1.09	0.87	1.31
High	831	40.4	0.543	1.07	0.93	1.27
<b>Household income</b>						
Low	1894	32.7	ref	1.00	1.00	1.00
Moderate	2200	39.0	0.1688	1.13	0.87	1.28
High	1813	38.9	0.5784	1.06	0.95	1.35
No answer	414	26.2	0.2508	0.83	0.61	1.14
<b>Ethnicity</b>						
Non-white, other language	5608	36.7	ref	1.00	1.00	1.00
White, English only	713	36.3	0.2955	1.12	0.90	1.39
<b>Employed outside the home</b>						
No	4065	32.3	ref	1.00	1.00	1.00
Yes	2256	38.4	0.2395	1.10	0.94	1.28
<b>Smoking status</b>						
Daily	5792	35.7	ref	1.00	1.00	1.00
Weekly/Monthly	529	44.4	0.0322	1.33	1.02	1.73

Table A-1 (continued): Number of Smoking Friends at Wave 1 and Intentions to Quit Smoking at Wave 1, (N=6,321)

Parameter	n	% Intend to Quit (Wave1)	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			0.0033	0.93	0.89	0.98
0 - low dependence	911	37.2				
1	680	43.7				
2	1072	39.8				
3	1806	36.4				
4	1084	33.4				
5	562	28.6				
6 - high dependence	206	27.6				
Attempt to quit past year						
No attempt	3677	25.4	ref	1.00	1.00	1.00
Attempt	2644	50.7	<.0001	2.40	2.07	2.78
Longest attempt to quit						
Never attempted	1180	18.5	ref	1.00	1.00	1.00
<1 week	1021	35.6	0.2919	1.15	0.88	1.51
>1 week but < 6 months	1941	40.1	0.0281	1.31	1.03	1.65
>6 months	2179	43.7	<.0001	1.76	1.42	2.20
Outcome expectancy			<.0001	1.39	1.30	1.49
Not at all	394	9.3				
Slightly	790	18.9				
Moderately	1233	26.4				
Very much	2087	40.6				
Extremely	1817	50.7				
Worried smoking will damage health			<.0001	1.64	1.50	1.78
Not all worried	774	16.9				
A little worried	1497	21.9				
Moderately worried	1992	34.1				
Very worried	2058	56.1				
Number of smoking friends at wave 1						
0	830	38.5	ref	1.00	1.00	1.00
1	840	42.9	0.1455	1.21	0.94	1.55
2	1228	36.8	0.3246	0.89	0.70	1.12
3	1270	38.6	0.6991	0.95	0.75	1.21
4	820	33.5	0.0908	0.80	0.62	1.04
5	1333	31.5	0.0218	0.76	0.59	0.96

Table A-2: Number of Smoking Friends at Wave 1 and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Country</b>						
Australia	1602	29.2	ref	1.00	1.00	1.00
Canada	1423	42.2	<.0001	1.67	1.37	2.02
United Kingdom	1557	21.4	0.001	0.71	0.57	0.87
United States	1157	30.6	0.395	1.10	0.89	1.36
<b>Sex</b>						
Female	3211	29.8	ref	1.00	1.00	1.00
Male	2528	31.3	0.412	1.06	0.92	1.23
<b>Age group</b>						
18-24	633	34.6	ref	1.00	1.00	1.00
25-39	1787	32.6	0.154	0.83	0.64	1.07
40-54	2128	28.0	0.018	0.73	0.56	0.95
55-max	1191	28.5	0.754	1.05	0.78	1.42
<b>Education</b>						
Low	3211	27.7	ref	1.00	1.00	1.00
Moderate	1798	33.6	0.274	1.10	0.96	1.54
High	730	36.3	0.102	1.22	0.93	1.30
<b>Household income</b>						
Low	1740	29.3	ref	1.00	1.00	1.00
Moderate	2004	29.7	0.163	0.87	0.88	1.33
High	1615	33.9	0.454	1.08	0.72	1.06
No answer	380	26.4	0.758	1.05	0.76	1.46
<b>Ethnicity</b>						
Non-white, other language	646	32.7	ref	1.00	1.00	1.00
White, English only	5093	30.3	0.940	1.01	0.80	1.28
<b>Employed outside the home</b>						
No	2083	28.9	ref	1.00	1.00	1.00
Yes	3656	31.5	0.831	1.02	0.86	1.21
<b>Smoking status</b>						
Daily	5329	30.1	ref	1.00	1.00	1.00
Weekly/Monthly	410	37.7	0.272	1.19	0.88	1.60

Table A-2 (continued): Number of Smoking Friends at Wave 1 and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			0.208	0.97	0.92	1.02
0 - low dependence	740	31.1				
1	599	38.3				
2	984	34.6				
3	1672	27.9				
4	1009	29.8				
5	537	27.6				
6 - high dependence	198	22.0				
Attempt to quit past year						
No attempt	3400	23.0	ref	1.00	1.00	1.00
Attempt	2339	40.8	<.0001	1.41	1.19	1.67
Longest attempt to quit						
Never attempted	1099	18.4	ref	1.00	1.00	1.00
<1 week	987	28.6	0.866	0.98	0.73	1.30
>1 week but < 6 months	1787	34.5	0.091	1.24	0.97	1.58
>6 months	1866	35.5	0.011	1.36	1.07	1.72
Quit intentions (Wave 1)						
No intention	3817	17.4	ref	1.00	1.00	1.00
Intention	1922	56.2	<.0001	4.25	3.64	4.96
Outcome expectancy			0.001	1.14	1.06	1.23
Not at all	367	10.0				
Slightly	721	20.0				
Moderately	1124	23.3				
Very much	1887	34.2				
Extremely	1640	40.1				
Worried smoking will damage health			<.0001	1.30	1.19	1.41
Not all worried	728	14.5				
A little worried	1374	20.3				
Moderately worried	1814	31.9				
Very worried	1823	43.2				
Number of smoking friends at Wave 1						
0	741	32.9	ref	1.00	1.00	1.00
1	747	34.5	0.668	1.06	0.81	1.39
2	1092	33.7	0.515	1.09	0.84	1.41
3	1159	30.7	0.272	0.86	0.66	1.12
4	757	27.6	0.148	0.81	0.61	1.08
5	1243	27.1	0.250	0.86	0.66	1.12

Table A-3: Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > Chi Sq	Exp(Est)	LCI	UCI
Country						
Australia	1602	29.2	ref	1.00	1.00	1.00
Canada	1423	42.2	<.0001	1.67	1.37	2.03
United Kingdom	1557	21.4	0.001	0.71	0.58	0.87
United States	1157	30.6	0.4153	1.09	0.88	1.36
Sex						
Female	3211	29.8	ref	1.00	1.00	1.00
Male	2528	31.3	0.4091	1.07	0.92	1.24
Age group						
18-24	633	34.6	ref	1.00	1.00	1.00
25-39	1787	32.6	0.1098	0.81	0.62	1.05
40-54	2128	28.0	0.0064	0.69	0.53	0.90
55-max	1191	28.5	0.848	0.97	0.72	1.32
Education						
Low	3211	27.7	ref	1.00	1.00	1.00
Moderate	1798	33.6	0.3153	1.09	0.92	1.29
High	730	36.3	0.1574	1.19	0.94	1.50
Household income						
Low	1740	29.3	ref	1.00	1.00	1.00
Moderate	2004	29.7	0.1402	0.86	0.71	1.05
High	1615	33.9	0.5316	1.07	0.87	1.31
No answer	380	26.4	0.7327	1.06	0.76	1.48
Ethnicity						
Non-white, other language	646	32.7	ref	1.00	1.00	1.00
White, English only	5093	30.3	0.9417	1.01	0.80	1.28
Employed outside the home						
No	2083	28.9	ref	1.00	1.00	1.00
Yes	3656	31.5	0.833	1.02	0.86	1.21
Smoking status						
Daily	5329	30.1	ref	1.00	1.00	1.00
Weekly/Monthly	410	37.7	0.186	1.23	0.91	1.67
Heaviness of smoking						
0 - low dependence	740	31.1				
1	599	38.3				
2	984	34.6				
3	1672	27.9				
4	1009	29.8				
5	537	27.6				
6 - high dependence	198	22.0				

Table A-3 (continued): Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > Chi Sq	Exp(Est)	LCI	UCI
Attempt to quit past year						
No attempt	3400	23.0	ref	1.00	1.00	1.00
Attempt	2339	40.8	<.0001	1.40	1.18	1.65
Longest attempt to quit						
Never attempted	1099	18.4	ref	1.00	1.00	1.00
<1 week	987	28.6	0.937	0.99	0.74	1.32
>1 week but < 6 months	1787	34.5	0.081	1.25	0.97	1.60
>6 months	1866	35.5	0.011	1.36	1.07	1.73
Quit intentions (Wave 1)						
No intention	3817	17.4	ref	1.00	1.00	1.00
Intention	1922	56.2	<.0001	4.28	3.66	5.00
Outcome expectancy						
Not at all	367	10.0				
Slightly	721	20.0				
Moderately	1124	23.3				
Very much	1887	34.2				
Extremely	1640	40.1				
Worried smoking will damage health						
Not all worried	728	14.5	<.0001	1.29	1.19	1.41
A little worried	1374	20.3				
Moderately worried	1814	31.9				
Very worried	1823	43.2				
Number of smoking friends at Wave 1						
0	741	32.9	ref	1.00	1.00	1.00
1	747	34.5	0.810	1.04	0.78	1.37
2	1092	33.7	0.984	1.00	0.77	1.31
3	1159	30.7	0.081	0.78	0.59	1.03
4	757	27.6	0.015	0.68	0.50	0.93
5	1243	27.1	0.006	0.66	0.50	0.89
Friend change between Wave 1 and Wave 2						
No change	2290	30.2	ref	1.00	1.00	1.00
-5	25	33.5	0.416	1.99	0.38	10.36
-4	59	42.1	0.029	2.22	1.09	4.55
-3	191	39.3	0.010	1.72	1.14	2.59
-2	468	30.5	0.499	1.11	0.83	1.48
-1	1018	31.9	0.408	1.10	0.88	1.36
1	1003	29.6	0.188	0.87	0.70	1.07
2	446	26.8	0.006	0.64	0.47	0.88
3	157	33.2	0.932	1.02	0.64	1.63
4	48	29.7	0.574	0.80	0.37	1.73
5	34	20.7	0.356	0.65	0.26	1.62

Table A-4: Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	1602	29.2	ref	1.00	1.00	1.00
Canada	1423	42.2	<.0001	1.65	1.36	2.01
United Kingdom	1557	21.4	0.001	0.71	0.57	0.87
United States	1157	30.6	0.450	1.09	0.88	1.34
Sex						
Female	3211	29.8	ref	1.00	1.00	1.00
Male	2528	31.3	0.382	1.07	0.92	1.24
Age group						
18-24	633	34.6	ref	1.00	1.00	1.00
25-39	1787	32.6	0.123	0.82	0.63	1.06
40-54	2128	28.0	0.011	0.71	0.55	0.93
55-max	1191	28.5	0.978	1.00	0.74	1.35
Education						
Low	3211	27.7	ref	1.00	1.00	1.00
Moderate	1798	33.6	0.161	1.18	0.92	1.29
High	730	36.3	0.302	1.09	0.94	1.50
Household income						
Low	1740	29.3	ref	1.00	1.00	1.00
Moderate	2004	29.7	0.129	0.86	0.71	1.05
High	1615	33.9	0.575	1.06	0.86	1.30
No answer	380	26.4	0.778	1.05	0.76	1.46
Ethnicity						
Non-white, other language	646	32.7	ref	1.00	1.00	1.00
White, English only	5093	30.3	0.971	1.00	0.79	1.27
Employed outside the home						
No	2083	28.9	ref	1.00	1.00	1.00
Yes	3656	31.5	0.859	1.02	0.86	1.21
Smoking status						
Daily	5329	30.1	ref	1.00	1.00	1.00
Weekly/Monthly	410	37.7	0.254	1.19	0.88	1.62

Table A-4 (continued): Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Intentions to Quit Smoking at Wave 2 Among Continuing Current Smokers, (N=5,739)

Parameter	n	% Intend to Quit (Wave 2)	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			0.212	0.97	0.92	1.02
0 - low dependence	740	31.1				
1	599	38.3				
2	984	34.6				
3	1672	27.9				
4	1009	29.8				
5	537	27.6				
6 - high dependence	198	22.0				
Attempt to quit past year						
No attempt	3400	23.0	ref	1.00	1.00	1.00
Attempt	2339	40.8	<.0001	1.40	1.19	1.66
Longest attempt to quit						
Never attempted	1099	18.4	ref	1.00	1.00	1.00
<1 week	987	28.6	0.929	0.99	0.74	1.31
>1 week but < 6 months	1787	34.5	0.084	1.24	0.97	1.59
>6 months	1866	35.5	0.012	1.36	1.07	1.72
Quit intentions (Wave 1)						
No intention	3817	17.4	ref	1.00	1.00	1.00
Intention	1922	56.2	<.0001	4.27	3.66	4.99
Outcome expectancy			0.001	1.15	1.06	1.24
Not at all	367	10.0				
Slightly	721	20.0				
Moderately	1124	23.3				
Very much	1887	34.2				
Extremely	1640	40.1				
Worried smoking will damage health			<.0001	1.29	1.19	1.41
Not all worried	728	14.5				
A little worried	1374	20.3				
Moderately worried	1814	31.9				
Very worried	1823	43.2				
Number of smoking friends at Wave 1						
0	741	32.9	ref	1.00	1.00	1.00
1	747	34.5	0.822	1.03	0.78	1.36
2	1092	33.7	0.874	1.02	0.79	1.33
3	1159	30.7	0.075	0.78	0.59	1.03
4	757	27.6	0.027	0.71	0.53	0.96
5	1243	27.1	0.018	0.71	0.53	0.94
Friend change between Wave 1 and Wave 2						
No change	2290	30.2	ref	1.00	1.00	1.00
Loss	1761	32.6	0.080	1.18	0.98	1.41
Gain	1688	29.0	0.038	0.82	0.68	0.99

Table A-5: Number of Smoking Friends at Wave 1 and Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Country</b>						
Australia	1748	34.8	ref	1.00	1.00	1.00
Canada	1595	44.5	<.0001	1.46	1.22	1.74
United Kingdom	1714	32.3	0.983	1.00	0.83	1.20
United States	1264	37.1	0.110	1.17	0.96	1.43
<b>Sex</b>						
Female	3549	37.3	ref	1.00	1.00	1.00
Male	2772	36.8	0.856	1.01	0.89	1.16
<b>Age group</b>						
18-24	715	48.4	ref	1.00	1.00	1.00
25-39	2003	38.3	0.001	0.65	0.52	0.82
40-54	2306	32.1	<.0001	0.57	0.45	0.72
55-max	1297	34.1	0.079	0.79	0.61	1.03
<b>Education</b>						
Low	3511	36.3	ref	1.00	1.00	1.00
Moderate	1979	37.1	0.017	0.83	0.72	0.97
High	831	39.9	0.495	0.93	0.76	1.15
<b>Household income</b>						
Low	1894	37.3	ref	1.00	1.00	1.00
Moderate	2200	37.2	0.237	0.90	0.76	1.07
High	1813	37.7	0.253	0.90	0.75	1.08
No answer	414	31.1	0.175	0.82	0.61	1.10
<b>Ethnicity</b>						
Non-white, other language	5608	40.7	ref	1.00	1.00	1.00
White, English only	713	36.5	0.590	0.94	0.76	1.17
<b>Employed outside the home</b>						
No	4065	35.3	ref	1.00	1.00	1.00
Yes	2256	37.8	0.702	1.03	0.89	1.20
<b>Smoking status</b>						
Daily	5792	35.6	ref	1.00	1.00	1.00
Weekly/Monthly	529	53.5	0.001	1.64	1.25	2.15

Table A-5 (continued): Number of Smoking Friends at Wave 1 and Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			<.0001	0.90	0.85	0.94
0 - low dependence	911	46.9				
1	680	47.7				
2	1072	40.4				
3	1806	32.1				
4	1084	33.2				
5	562	28.6				
6 - high dependence	206	30.0				
Attempt to quit in past year						
No attempt	3677	27.1	ref	1.00	1.00	1.00
Attempt	2644	49.9	<.0001	1.79	1.54	2.08
Longest attempt to quit						
Never attempted	1180	23.6	ref	1.00	1.00	1.00
<1 week	1021	33.8	0.655	0.95	0.74	1.21
>1 week but < 6 months	1941	41.2	0.083	1.22	0.98	1.52
>6 months	2179	42.5	0.001	1.41	1.14	1.73
Quit intentions (Wave 1)						
No intention	4058	25.1	ref	1.00	1.00	1.00
Intention	2263	57.9	<.0001	2.90	2.52	3.33
Outcome expectancy			0.002	1.11	1.04	1.19
Not at all	394	17.6				
Slightly	790	26.2				
Moderately	1233	31.6				
Very much	2087	39.8				
Extremely	1817	45.7				
Worried smoking will damage health			<.0001	1.22	1.13	1.31
Not all worried	774	22.9				
A little worried	1497	28.5				
Moderately worried	1992	35.7				
Very worried	2058	49.6				
Number of smoking friends at Wave 1						
0	830	38.7	ref	1.00	1.00	1.00
1	840	37.7	0.530	0.92	0.72	1.18
2	1228	36.4	0.415	0.91	0.72	1.14
3	1270	38.2	0.773	0.97	0.77	1.22
4	820	35.4	0.280	0.87	0.67	1.12
5	1333	36.3	0.826	0.97	0.77	1.23

Table A-6: Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	1748	34.8	ref	1.00	1.00	1.00
Canada	1595	44.5	<.0001	1.44	1.21	1.72
United Kingdom	1714	32.3	0.999	1.00	0.84	1.20
United States	1264	37.1	0.175	1.15	0.94	1.40
Sex						
Female	3549	37.3	ref	1.00	1.00	1.00
Male	2772	36.8	0.856	1.01	0.89	1.16
Age group						
18-24	715	48.4	ref	1.00	1.00	1.00
25-39	2003	38.3	<.0001	0.63	0.50	0.79
40-54	2306	32.1	<.0001	0.54	0.42	0.68
55-max	1297	34.1	0.013	0.71	0.55	0.93
Education						
Low	3511	36.3	ref	1.00	1.00	1.00
Moderate	1979	37.1	0.019	0.83	0.72	0.97
High	831	39.9	0.399	0.91	0.74	1.13
Household income						
Low	1894	37.3	ref	1.00	1.00	1.00
Moderate	2200	37.2	0.230	0.90	0.76	1.07
High	1813	37.7	0.186	0.88	0.73	1.06
No answer	414	31.1	0.182	0.82	0.61	1.10
Ethnicity						
Non-white, other language	5608	40.7	ref	1.00	1.00	1.00
White, English only	713	36.5	0.632	0.95	0.77	1.18
Employed outside the home						
No	4065	35.3	ref	1.00	1.00	1.00
Yes	2256	37.8	0.744	1.03	0.88	1.20
Smoking status						
Daily	5792	35.6	ref	1.00	1.00	1.00
Weekly/Monthly	529	53.5	0.001	1.67	1.27	2.19
Heaviness of smoking						
0 - low dependence	911	46.9	<.0001	0.90	0.86	0.95
1	680	47.7				
2	1072	40.4				
3	1806	32.1				
4	1084	33.2				
5	562	28.6				
6 - high dependence	206	30.0				

Table A-6 (continued): Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Attempt to quit in past year						
No attempt	3677	27.1	ref	1.00	1.00	1.00
Attempt	2644	49.9	<.0001	1.78	1.53	2.06
Longest attempt to quit						
Never attempted	1180	23.6	ref	1.00	1.00	1.00
<1 week	1021	33.8	0.756	0.96	0.75	1.23
>1 week but < 6 months	1941	41.2	0.062	1.24	0.99	1.55
>6 months	2179	42.5	0.001	1.42	1.15	1.74
Quit intentions (Wave 1)						
No intention	4058	25.1	ref	1.00	1.00	1.00
Intention	2263	57.9	<.0001	2.91	2.52	3.35
Outcome expectancy						
Not at all	394	17.6				
Slightly	790	26.2				
Moderately	1233	31.6				
Very much	2087	39.8				
Extremely	1817	45.7				
Worried smoking will damage health						
Not all worried	774	22.9	<.0001	1.21	1.12	1.31
A little worried	1497	28.5				
Moderately worried	1992	35.7				
Very worried	2058	49.6				
Number of smoking friends at Wave 1						
0	830	38.7	ref	1.00	1.00	1.00
1	840	37.7	0.328	0.88	0.69	1.14
2	1228	36.4	0.073	0.80	0.63	1.02
3	1270	38.2	0.131	0.83	0.65	1.06
4	820	35.4	0.012	0.70	0.53	0.93
5	1333	36.3	0.016	0.73	0.56	0.94
Friend change between Wave 1 and Wave 2						
No change	2501	34.5	ref	1.00	1.00	1.00
-5	27	50.0	0.031	2.68	1.10	6.55
-4	70	49.6	0.016	2.07	1.15	3.76
-3	230	51.5	<.0001	2.25	1.57	3.24
-2	529	45.1	<.0001	1.78	1.40	2.26
-1	1148	38.2	0.039	1.23	1.01	1.49
1	1084	33.5	0.348	0.91	0.75	1.11
2	476	36.0	0.726	0.95	0.73	1.25
3	168	39.2	0.241	1.28	0.85	1.94
4	53	38.8	0.802	1.09	0.55	2.18
5	35	26.2	0.455	0.73	0.31	1.68

Table A-7: Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	1748	34.8	ref	1.00	1.00	1.00
Canada	1595	44.5	<.0001	1.44	1.21	1.72
United Kingdom	1714	32.3	0.986	1.00	0.84	1.20
United States	1264	37.1	0.174	1.15	0.94	1.40
Sex						
Female	3549	37.3	ref	1.00	1.00	1.00
Male	2772	36.8	0.856	1.01	0.89	1.16
Age group						
18-24	715	48.4	ref	1.00	1.00	1.00
25-39	2003	38.3	0.001	0.64	0.51	0.80
40-54	2306	32.1	<.0001	0.55	0.44	0.70
55-max	1297	34.1	0.025	0.74	0.56	0.96
Education						
Low	3511	36.3	ref	1.00	1.00	1.00
Moderate	1979	37.1	0.019	0.83	0.72	0.97
High	831	39.9	0.373	0.91	0.74	1.12
Household income						
Low	1894	37.3	ref	1.00	1.00	1.00
Moderate	2200	37.2	0.200	0.89	0.75	1.06
High	1813	37.7	0.188	0.88	0.73	1.06
No answer	414	31.1	0.165	0.81	0.60	1.09
Ethnicity						
Non-white, other language	5608	40.7	ref	1.00	1.00	1.00
White, English only	713	36.5	0.597	0.94	0.76	1.17
Employed outside the home						
No	4065	35.3	ref	1.00	1.00	1.00
Yes	2256	37.8	0.804	1.02	0.88	1.19
Smoking status						
Daily	5792	35.6	ref	1.00	1.00	1.00
Weekly/Monthly	529	53.5	0.001	1.64	1.25	2.15

Table A-7 (continued): Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Quit Attempts at Wave 2, (N=6,321)

Parameter	n	% Quit Attempts	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			<.0001	0.90	0.86	0.94
0 - low dependence	911	46.9				
1	680	47.7				
2	1072	40.4				
3	1806	32.1				
4	1084	33.2				
5	562	28.6				
6 - high dependence	206	30.0				
Attempt to quit in past year						
No attempt	3677	27.1	ref	1.00	1.00	1.00
Attempt	2644	49.9	<.0001	1.78	1.53	2.07
Longest attempt to quit						
Never attempted	1180	23.6	ref	1.00	1.00	1.00
<1 week	1021	33.8	0.713	0.95	0.74	1.23
>1 week but < 6 months	1941	41.2	0.067	1.23	0.99	1.54
>6 months	2179	42.5	0.001	1.41	1.14	1.73
Quit intentions (Wave 1)						
No intention	4058	25.1	ref	1.00	1.00	1.00
Intention	2263	57.9	<.0001	2.90	2.52	3.35
Outcome expectancy			0.001	1.11	1.04	1.19
Not at all	394	17.6				
Slightly	790	26.2				
Moderately	1233	31.6				
Very much	2087	39.8				
Extremely	1817	45.7				
Worried smoking will damage health			<.0001	1.21	1.12	1.31
Not all worried	774	22.9				
A little worried	1497	28.5				
Moderately worried	1992	35.7				
Very worried	2058	49.6				
Number of smoking friends at Wave 1						
0	830	38.7	ref	1.00	1.00	1.00
1	840	37.7	0.203	0.85	0.67	1.09
2	1228	36.4	0.070	0.81	0.64	1.02
3	1270	38.2	0.101	0.82	0.64	1.04
4	820	35.4	0.009	0.70	0.53	0.91
5	1333	36.3	0.050	0.78	0.60	1.00
Friend change between Wave 1 and Wave 2						
No change	2501	34.5	ref	1.00	1.00	1.00
Loss	2004	42.1	<.0001	1.50	1.27	1.76
Gain	1816	34.6	0.759	0.97	0.82	1.15

Table A-8: Number of Smoking Friends at Wave 1 and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Country</b>						
Australia	1748	5.4	ref	1.00	1.00	1.00
Canada	1595	8.5	0.002	1.64	1.20	2.25
United Kingdom	1714	6.8	0.040	1.40	1.02	1.93
United States	1264	6.7	0.048	1.45	1.00	2.11
<b>Sex</b>						
Female	3549	7.2	ref	1.00	1.00	1.00
Male	2772	6.5	0.549	0.93	0.73	1.18
<b>Age group</b>						
18-24	715	8.1	ref	1.00	1.00	1.00
25-39	2003	7.5	0.109	0.74	0.51	1.07
40-54	2306	5.5	0.010	0.60	0.40	0.88
55-max	1297	6.9	0.518	0.86	0.55	1.35
<b>Education</b>						
Low	3511	6.4	ref	1.00	1.00	1.00
Moderate	1979	6.6	0.070	0.77	0.58	1.02
High	831	9.3	0.785	0.95	0.68	1.35
<b>Household income</b>						
Low	1894	6.0	ref	1.00	1.00	1.00
Moderate	2200	6.6	0.070	0.77	0.72	1.36
High	1813	7.8	0.728	1.06	0.76	1.49
No answer	414	7.1	0.296	1.30	0.79	2.14
<b>Ethnicity</b>						
Non-white, other language	5608	6.7	ref	1.00	1.00	1.00
White, English only	713	6.8	0.324	1.20	0.83	1.73
<b>Employed outside the home</b>						
No	4065	5.8	ref	1.00	1.00	1.00
Yes	2256	7.3	0.161	1.22	0.92	1.61
<b>Smoking status</b>						
Daily	5792	5.9	ref	1.00	1.00	1.00
Weekly/Monthly	529	17.4	0.001	1.84	1.32	2.58

Table A-8 (continued): Number of Smoking Friends at Wave 1 and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			0.001	0.84	0.77	0.92
0 - low dependence	911	14.1				
1	680	10.3				
2	1072	6.6				
3	1806	4.8				
4	1084	4.6				
5	562	3.7				
6 - high dependence	206	4.3				
Attempt to quit in past year						
No attempt	3677	5.8	ref	1.00	1.00	1.00
Attempt	2644	8.1	0.224	1.18	0.90	1.55
Longest attempt to quit						
Never attempted	1180	5.5	ref	1.00	1.00	1.00
<1 week	1021	2.9	0.006	0.47	0.27	0.80
>1 week but < 6 months	1941	5.6	0.313	0.81	0.54	1.22
>6 months	2179	10.8	0.013	1.58	1.10	2.26
Quit intentions (Wave 1)						
No intention	4058	4.2	ref	1.00	1.00	1.00
Intention	2263	11.5	<.0001	2.64	2.03	3.44
Outcome expectancy			0.381	0.95	0.84	1.07
Not at all	394	4.6				
Slightly	790	6.8				
Moderately	1233	7.3				
Very much	2087	6.5				
Extremely	1817	7.3				
Worried smoking will damage health			0.931	1.01	0.87	1.17
Not all worried	774	5.2				
A little worried	1497	5.9				
Moderately worried	1992	7.2				
Very worried	2058	7.7				
Number of smoking friends at Wave 1						
0	830	8.2	ref	1.00	1.00	1.00
1	840	8.8	0.691	1.09	0.72	1.65
2	1228	8.0	0.995	1.00	0.67	1.49
3	1270	7.2	0.605	0.90	0.61	1.34
4	820	5.8	0.153	0.71	0.45	1.13
5	1333	4.6	0.040	0.63	0.41	0.98

Table A-9: Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	1748	5.4	ref	1.00	1.00	1.00
Canada	1595	8.5	0.005	1.58	1.15	2.17
United Kingdom	1714	6.8	0.036	1.41	1.02	1.95
United States	1264	6.7	0.111	1.36	0.93	1.97
Sex						
Female	3549	7.2	ref	1.00	1.00	1.00
Male	2772	6.5	0.458	0.91	0.72	1.16
Age group						
18-24	715	8.1	ref	1.00	1.00	1.00
25-39	2003	7.5	0.046	0.68	0.47	0.99
40-54	2306	5.5	0.002	0.52	0.35	0.78
55-max	1297	6.9	0.134	0.71	0.45	1.11
Education						
Low	3511	6.4	ref	1.00	1.00	1.00
Moderate	1979	6.6	0.102	0.79	0.59	1.05
High	831	9.3	0.682	0.93	0.66	1.32
Household income						
Low	1894	6.0	ref	1.00	1.00	1.00
Moderate	2200	6.6	0.878	0.98	0.71	1.35
High	1813	7.8	0.927	1.02	0.72	1.43
No answer	414	7.1	0.318	1.30	0.78	2.16
Ethnicity						
Non-white, other language	5608	6.7	ref	1.00	1.00	1.00
White, English only	713	6.8	0.343	1.20	0.83	1.73
Employed outside the home						
No	4065	5.8	ref	1.00	1.00	1.00
Yes	2256	7.3	0.186	1.21	0.91	1.61
Smoking status						
Daily	5792	5.9	ref	1.00	1.00	1.00
Weekly/Monthly	529	17.4	0.001	1.92	1.36	2.70
Heaviness of smoking						
0 - low dependence	911	14.1	0.001	0.85	0.77	0.93
1	680	10.3				
2	1072	6.6				
3	1806	4.8				
4	1084	4.6				
5	562	3.7				
6 - high dependence	206	4.3				

Table A-9 (continued): Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Attempt to quit in past year						
No attempt	3677	5.8	ref	1.00	1.00	1.00
Attempt	2644	8.1	0.393	1.13	0.86	1.48
Longest attempt to quit						
Never attempted	1180	5.5	ref	1.00	1.00	1.00
<1 week	1021	2.9	0.010	0.49	0.29	0.85
>1 week but < 6 months	1941	5.6	0.367	0.83	0.55	1.25
>6 months	2179	10.8	0.011	1.60	1.12	2.29
Quit intentions (Wave 1)						
No intention	4058	4.2	ref	1.00	1.00	1.00
Intention	2263	11.5	<.0001	2.60	1.99	3.40
Outcome expectancy						
Not at all	394	4.6	0.388	0.95	0.84	1.07
Slightly	790	6.8				
Moderately	1233	7.3				
Very much	2087	6.5				
Extremely	1817	7.3				
Worried smoking will damage health						
Not all worried	774	5.2	0.957	1.00	0.87	1.16
A little worried	1497	5.9				
Moderately worried	1992	7.2				
Very worried	2058	7.7				
Number of smoking friends at Wave 1						
0	830	8.2	ref	1.00	1.00	1.00
1	840	8.8	0.801	0.95	0.62	1.45
2	1228	8.0	0.197	0.76	0.50	1.16
3	1270	7.2	0.013	0.57	0.37	0.89
4	820	5.8	0.001	0.41	0.25	0.68
5	1333	4.6	<.0001	0.32	0.19	0.53
Friend change between Wave 1 and Wave 2						
No change	2501	5.9	ref	1.00	1.00	1.00
-5	27	7.7	0.401	2.49	0.30	20.83
-4	70	6.9	0.127	2.13	0.81	5.61
-3	230	14.9	<.0001	4.22	2.51	7.11
-2	529	9.4	0.001	2.15	1.41	3.28
-1	1148	8.2	0.007	1.57	1.14	2.17
1	1084	5.6	0.288	0.82	0.56	1.19
2	476	5.0	0.116	0.65	0.38	1.11
3	168	5.1	0.212	0.59	0.25	1.36
4	53	6.3	0.761	0.82	0.23	2.93
5	35	3.0	0.476	0.46	0.05	3.90

Table A-10: Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	1748	5.4	ref	1.00	1.00	1.00
Canada	1595	8.5	0.005	1.57	1.14	2.16
United Kingdom	1714	6.8	0.036	1.41	1.02	1.94
United States	1264	6.7	0.100	1.37	0.94	1.99
Sex						
Female	3549	7.2	ref	1.00	1.00	1.00
Male	2772	6.5	0.504	0.92	0.72	1.17
Age group						
18-24	715	8.1	ref	1.00	1.00	1.00
25-39	2003	7.5	0.055	0.69	0.48	1.01
40-54	2306	5.5	0.002	0.54	0.37	0.81
55-max	1297	6.9	0.197	0.74	0.47	1.17
Education						
Low	3511	6.4	ref	1.00	1.00	1.00
Moderate	1979	6.6	0.089	0.78	0.59	1.04
High	831	9.3	0.606	0.91	0.64	1.29
Household income						
Low	1894	6.0	ref	1.00	1.00	1.00
Moderate	2200	6.6	0.884	0.98	0.71	1.35
High	1813	7.8	0.854	1.03	0.73	1.45
No answer	414	7.1	0.308	1.30	0.79	2.15
Ethnicity						
Non-white, other language	5608	6.7	ref	1.00	1.00	1.00
White, English only	713	6.8	0.351	1.19	0.83	1.72
Employed outside the home						
No	4065	5.8	ref	1.00	1.00	1.00
Yes	2256	7.3	0.200	1.20	0.91	1.59
Smoking status						
Daily	5792	5.9	ref	1.00	1.00	1.00
Weekly/Monthly	529	17.4	0.001	1.87	1.33	2.63

Table A-10 (continued): Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Everyone, (N=6,321)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking						
0 - low dependence	911	14.1	0.001	0.84	0.77	0.92
1	680	10.3				
2	1072	6.6				
3	1806	4.8				
4	1084	4.6				
5	562	3.7				
6 - high dependence	206	4.3				
Attempt to quit in past year						
No attempt	3677	5.8	ref	1.00	1.00	1.00
Attempt	2644	8.1	0.322	1.15	0.88	1.50
Longest attempt to quit						
Never attempted	1180	5.5	ref	1.00	1.00	1.00
<1 week	1021	2.9	0.008	0.48	0.28	0.83
>1 week but < 6 months	1941	5.6	0.393	0.84	0.56	1.26
>6 months	2179	10.8	0.014	1.57	1.10	2.26
Quit intentions (Wave 1)						
No intention	4058	4.2	ref	1.00	1.00	1.00
Intention	2263	11.5	<.0001	2.64	2.02	3.45
Outcome expectancy						
Not at all	394	4.6				
Slightly	790	6.8				
Moderately	1233	7.3				
Very much	2087	6.5				
Extremely	1817	7.3				
Worried smoking will damage health						
Not all worried	774	5.2	0.970	1.00	0.87	1.16
A little worried	1497	5.9				
Moderately worried	1992	7.2				
Very worried	2058	7.7				
Number of smoking friends at Wave 1						
0	830	8.2	ref	1.00	1.00	1.00
1	840	8.8	0.751	0.93	0.61	1.42
2	1228	8.0	0.198	0.76	0.50	1.15
3	1270	7.2	0.028	0.62	0.40	0.95
4	820	5.8	0.001	0.44	0.27	0.72
5	1333	4.6	<.0001	0.38	0.23	0.61
Friend Change Between Wave 1 and Wave 2						
No change	2501	5.9	ref	1.00	1.00	1.00
Loss	2004	9.2	<.0001	1.93	1.46	2.54
Gain	1816	5.4	0.096	0.76	0.55	1.05

Table A-11: Number of Smoking Friends at Wave 1 and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
<b>Country</b>						
Australia	608	15.5	ref	1.00	1.00	1.00
Canada	703	19.2	0.091	1.34	0.96	1.87
United Kingdom	536	21.0	0.041	1.44	1.02	2.03
United States	461	18.0	0.162	1.32	0.89	1.95
<b>Sex</b>						
Female	1316	19.3	ref	1.00	1.00	1.00
Male	992	17.7	0.324	0.88	0.68	1.14
<b>Age group</b>						
18-24	347	16.8	ref	1.00	1.00	1.00
25-39	768	19.6	0.652	0.91	0.62	1.35
40-54	753	17.2	0.400	0.84	0.56	1.26
55-max	440	20.2	0.964	1.01	0.63	1.63
<b>Education</b>						
Low	1240	17.7	ref	1.00	1.00	1.00
Moderate	741	17.8	0.312	0.86	0.63	1.16
High	327	23.2	0.837	1.04	0.72	1.51
<b>Household income</b>						
Low	711	16.0	ref	1.00	1.00	1.00
Moderate	799	17.8	0.852	1.03	0.73	1.46
High	674	20.7	0.605	1.10	0.77	1.59
No answer	124	22.8	0.157	1.50	0.86	2.62
<b>Ethnicity</b>						
Non-white, other language	303	16.4	ref	1.00	1.00	1.00
White, English only	2005	18.8	0.329	1.21	0.83	1.77
<b>Employed outside the home</b>						
No	793	16.5	ref	1.00	1.00	1.00
Yes	1515	19.3	0.121	1.26	0.94	1.68
<b>Smoking status</b>						
Daily	2017	16.7	ref	1.00	1.00	1.00
Weekly/Monthly	291	32.5	0.020	1.54	1.07	2.22

Table A-11(continued): Number of Smoking Friends at Wave 1 and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			0.027	0.90	0.81	0.99
0 - low dependence	442	30.2				
1	308	21.7				
2	416	16.4				
3	574	14.9				
4	348	13.8				
5	160	13.0				
6 - high dependence	60	14.4				
Attempt to quit in past year						
No attempt	968	21.6	ref	1.00	1.00	1.00
Attempt	1340	16.2	0.365	0.88	0.66	1.17
Longest attempt to quit						
Never attempted	259	23.3	ref	1.00	1.00	1.00
<1 week	336	8.5	0.011	0.46	0.25	0.84
>1 week but < 6 months	771	13.6	0.146	0.72	0.46	1.12
>6 months	942	25.3	0.145	1.36	0.90	2.04
Quit intentions (Wave 1)						
No intention	981	16.6	ref	1.00	1.00	1.00
Intention	1327	19.8	0.027	1.38	1.04	1.83
Outcome expectancy			0.068	0.88	0.77	1.01
Not at all	71	26.1				
Slightly	205	25.9				
Moderately	380	23.2				
Very much	823	16.3				
Extremely	829	16.1				
Worried smoking will damage health			0.081	0.88	0.75	1.02
Not all worried	176	22.7				
A little worried	421	20.6				
Moderately worried	683	20.3				
Very worried	1028	15.6				
Number of smoking friends at Wave 1						
0	320	21.1	ref	1.00	1.00	1.00
1	316	23.4	0.439	1.20	0.76	1.89
2	445	22.0	0.851	1.04	0.68	1.59
3	466	18.8	0.594	0.89	0.58	1.36
4	291	16.3	0.183	0.71	0.43	1.17
5	470	12.6	0.030	0.60	0.38	0.95

Table A-12: Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	608	15.5	ref	1.00	1.00	1.00
Canada	703	19.2	0.117	1.32	0.93	1.85
United Kingdom	536	21.0	0.029	1.48	1.04	2.11
United States	461	18.0	0.236	1.27	0.86	1.89
Sex						
Female	1316	19.3	ref	1.00	1.00	1.00
Male	992	17.7	0.318	0.87	0.67	1.14
Age group						
18-24	347	16.8	ref	1.00	1.00	1.00
25-39	768	19.6	0.403	0.84	0.57	1.26
40-54	753	17.2	0.173	0.75	0.49	1.14
55-max	440	20.2	0.533	0.86	0.53	1.39
Education						
Low	1240	17.7	ref	1.00	1.00	1.00
Moderate	741	17.8	0.409	0.88	0.65	1.19
High	327	23.2	0.927	1.02	0.70	1.48
Household income						
Low	711	16.0	ref	1.00	1.00	1.00
Moderate	799	17.8	0.955	0.99	0.70	1.41
High	674	20.7	0.947	1.01	0.70	1.46
No answer	124	22.8	0.168	1.49	0.85	2.64
Ethnicity						
Non-white, other language	303	16.4	ref	1.00	1.00	1.00
White, English only	2005	18.8	0.344	1.20	0.82	1.77
Employed outside the home						
No	793	16.5	ref	1.00	1.00	1.00
Yes	1515	19.3	0.160	1.24	0.92	1.66
Smoking status						
Daily	2017	16.7	ref	1.00	1.00	1.00
Weekly/Monthly	291	32.5	0.013	1.60	1.10	2.31
Heaviness of smoking						
0 - low dependence	442	30.2	0.028	0.90	0.81	0.99
1	308	21.7				
2	416	16.4				
3	574	14.9				
4	348	13.8				
5	160	13.0				
6 - high dependence	60	14.4				

Table A-12 (continued): Change in Number of Smoking Friends (non-collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Attempt to quit in past year						
No attempt	968	21.6	ref	1.00	1.00	1.00
Attempt	1340	16.2	0.269	0.85	0.63	1.14
Longest attempt to quit						
Never attempted	259	23.3	ref	1.00	1.00	1.00
<1 week	336	8.5	0.018	0.48	0.26	0.88
>1 week but < 6 months	771	13.6	0.218	0.75	0.48	1.18
>6 months	942	25.3	0.117	1.40	0.92	2.12
Quit intentions (Wave 1)						
No intention	981	16.6	ref	1.00	1.00	1.00
Intention	1327	19.8	0.024	1.39	1.05	1.85
Outcome expectancy						
Not at all	71	26.1	0.078	0.88	0.77	1.01
Slightly	205	25.9				
Moderately	380	23.2				
Very much	823	16.3				
Extremely	829	16.1				
Worried smoking will damage health						
Not all worried	176	22.7	0.079	0.87	0.75	1.02
A little worried	421	20.6				
Moderately worried	683	20.3				
Very worried	1028	15.6				
Number of smoking friends at Wave 1						
0	320	21.1	ref	1.00	1.00	1.00
1	316	23.4	0.876	1.04	0.65	1.66
2	445	22.0	0.399	0.82	0.53	1.29
3	466	18.8	0.042	0.62	0.39	0.98
4	291	16.3	0.004	0.44	0.25	0.76
5	470	12.6	<.0001	0.35	0.21	0.59
Friend change between Wave 1 and Wave 2						
No change	860	17.1	ref	1.00	1.00	1.00
-5	10	15.3	0.776	1.34	0.18	10.08
-4	33	14.0	0.386	1.54	0.58	4.12
-3	115	28.9	0.001	2.89	1.65	5.06
-2	226	20.9	0.056	1.56	0.99	2.45
-1	432	21.4	0.034	1.47	1.03	2.09
1	374	16.7	0.376	0.83	0.55	1.25
2	160	13.8	0.086	0.60	0.33	1.08
3	70	13.1	0.118	0.50	0.21	1.19
4	17	16.2	0.943	0.95	0.25	3.64
5	11	11.3	0.742	0.68	0.07	6.62

Table A-13: Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Country						
Australia	608	15.5	ref	1.00	1.00	1.00
Canada	703	19.2	0.113	1.32	0.94	1.85
United Kingdom	536	21.0	0.029	1.48	1.04	2.11
United States	461	18.0	0.214	1.29	0.87	1.91
Sex						
Female	1316	19.3	ref	1.00	1.00	1.00
Male	992	17.7	0.321	0.88	0.67	1.14
Age group						
18-24	347	16.8	ref	1.00	1.00	1.00
25-39	768	19.6	0.448	0.86	0.58	1.28
40-54	753	17.2	0.208	0.77	0.51	1.16
55-max	440	20.2	0.665	0.90	0.56	1.46
Education						
Low	1240	17.7				
Moderate	741	17.8	0.386	0.87	0.65	1.19
High	327	23.2	0.958	1.01	0.69	1.47
Household income						
Low	711	16.0	ref	1.00	1.00	1.00
Moderate	799	17.8	0.964	0.99	0.70	1.41
High	674	20.7	0.894	1.03	0.71	1.48
No answer	124	22.8	0.136	1.53	0.88	2.67
Ethnicity						
Non-white, other language	303	16.4	ref	1.00	1.00	1.00
White, English only	2005	18.8	0.322	1.21	0.83	1.77
Employed outside the home						
No	793	16.5	ref	1.00	1.00	1.00
Yes	1515	19.3	0.172	1.23	0.92	1.64
Smoking status						
Daily	2017	16.7	ref	1.00	1.00	1.00
Weekly/Monthly	291	32.5	0.016	1.58	1.09	2.29

Table A-13 (continued): Change in Number of Smoking Friends (collapsed) Between Wave 1 and Wave 2, and Abstinence for at Least One Month at Wave 2 Among Smokers who Attempted to Quit, (N=2,308)

Parameter	n	% Abstinent	Pr > ChiSq	Exp(Est)	LCI	UCI
Heaviness of smoking			0.023	0.89	0.81	0.99
0 - low dependence	442	30.2				
1	308	21.7				
2	416	16.4				
3	574	14.9				
4	348	13.8				
5	160	13.0				
6 - high dependence	60	14.4				
Attempt to quit in past year						
No attempt	968	21.6	ref	1.00	1.00	1.00
Attempt	1340	16.2	0.319	0.86	0.65	1.15
Longest attempt to quit						
Never attempted	259	23.3	ref	1.00	1.00	1.00
<1 week	336	8.5	0.013	0.47	0.26	0.85
>1 week but < 6 months	771	13.6	0.220	0.75	0.48	1.19
>6 months	942	25.3	0.141	1.37	0.90	2.08
Quit intentions (Wave 1)						
No intention	981	16.6	ref	1.00	1.00	1.00
Intention	1327	19.8	0.019	1.41	1.06	1.87
Outcome expectancy			0.076	0.88	0.77	1.01
Not at all	71	26.1				
Slightly	205	25.9				
Moderately	380	23.2				
Very much	823	16.3				
Extremely	829	16.1				
Worried smoking will damage health			0.069	0.87	0.75	1.01
Not all worried	176	22.7				
A little worried	421	20.6				
Moderately worried	683	20.3				
Very worried	1028	15.6				
Number of smoking friends at Wave 1						
0	320	21.1	ref	1.00	1.00	1.00
1	316	23.4	0.796	1.06	0.67	1.68
2	445	22.0	0.386	0.82	0.53	1.28
3	466	18.8	0.073	0.66	0.42	1.04
4	291	16.3	0.007	0.48	0.28	0.82
5	470	12.6	0.001	0.39	0.23	0.64
Friend change between Wave 1 and Wave 2						
No change	860	17.1	ref	1.00	1.00	1.00
Loss	632	21.9	0.002	1.62	1.20	2.19
Gain	816	15.5	0.081	0.73	0.52	1.04