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**Associations between social and environmental factors
and smoking incidence**

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Associations between social and environmental factors and smoking incidence

Abstract

The study investigates the association between social cues (other smokers in the vicinity), environmental factors (sight of cigarettes for sale) and the incidence of smoking. The results show that after controlling for individual level variables (age, quit status and socio-economic status), individuals are more likely to smoke if there are others smoking in the vicinity (with additive effects for friends and/or family and other smokers), and/or if there are cigarettes for sale in the vicinity, with the effect of retail display particularly strong for attempting quitters. The results suggest implications for policy to help attempting quitters avoid triggers to smoke.

Keywords: smoking, social influences, diary study, public health policy

Track: Consumer Behaviour

1. Introduction

Cigarette smoking is an established threat to health, which persists despite a variety of public health initiatives to decrease the prevalence, and amount, of smoking. Smoking behaviour is known to be influenced by social factors, with regular tobacco use by family and peers well established to be an important influence on the smoking behaviour of adolescents and young adults, especially at vulnerable stages of change such as initiation and/or planning to quit (Flay, Hu, & Richardson, 1998; Jones, Schroeder, & Moolchan, 2004; Pokorny, Jason, & Schoeny, 2003; Prochaska & DiClemente, 1983; Schofield, 2001). In a study of smokers aged 14 years and older, Siahpush, Borland, and Scollo (2003) found that the odds of successfully quitting were significantly greater for participants who lived in households where smoking was banned, and for those who reported that few or none of their friends smoked (compared to those who said most or all of their friends smoked).

This body of literature has tended to conceptualise peer and family tobacco use as exerting a long-term influence on smoking behaviour, through the creation of pro-smoking norms. There has been much less attention to the short-term impact of nearby smokers on the daily smoking behaviour of adults, but the few studies that have been undertaken in this area are suggestive of an effect. For example Shiffman and various co-authors found that the presence of others smoking was an important antecedent of situational smoking for smokers (Shiffman et al., 2002) and for both lapsing and relapsing quitters (Shiffman et al., 1996a; Shiffman, Paty, Gnys, Kassel, & Hickcox, 1996b). Similarly, Trotter, Wakefield and Borland (2002) found that 70% of smokers who regularly attended bars, nightclubs and gaming venues reported that they smoked more in these settings. Very little previous research has sought to differentiate between the effect of peers and unknown others smoking, however. The difference is important for understanding the cues which drive smoking: for example, if smoking is triggered by the sight and/or smell of smoke, then peers or strangers smoking in the vicinity would be expected to have an equivalent effect on smoking. If, in contrast, smoking is driven more by normative effects, then any effect of peers smoking would be expected to be greater than unknown others smoking. If smoking is driven by *both* normative effects and physical triggers, then peers and others smoking in the vicinity could have separate and additive effects on smoking rates. Understanding the potential triggers for smoking has important implications

for advice to attempting quitters, in helping them to anticipate and avoid situations where they are most likely to be tempted to smoke. There are also implications for health policy: if smoking is influenced by the sight and smell of smoke, even if those smoking are not friends and family, there would be increased evidence to support further restrictions of smoking in public places.

Another factor which has received limited research attention is the influence of ease of retail access to cigarettes on smoking activity or on attempts to quit. For adolescents, there is some evidence that restriction of tobacco supply is associated with lower rates of experimental and regular smoking: studies have found drops in underage smoking ranging from 15.8% to 46% after restrictions to access, community education and enforcement of laws banning sales to minors (Altman, Rasenick-Douss, Foster, & Tye, 1991; Bellew & Wayne, 1991; Bishai, Mercer, & Tapales, 2005; DiFranza, Carlson, & Caisse, 1992; Jason, Ji, Ames, & Birkhead, 1991). Pokorny et al. (2003) found higher retail tobacco availability was associated with increased odds that a youth initiated smoking, and another study found that young people (aged 11-23 years) living in areas with relatively high retail tobacco density were more likely to smoke than those living in areas with much lower tobacco outlet density (Novak, Reardon, Raudenbush, & Buka, 2006). Other studies, however, have found that youths often substitute non-retail sources when retail supply is restricted (e.g. Levy, Chaloupka, & Gitchell, 2004). Moreover, to date there has been only limited investigation of the extent to which ease of retail access to tobacco contributes to the rate of adult smoking (Chuang, Cubbin, Ahn, & Winkleby, 2005), or to the failure of attempts to quit.

The lack of attention in the literature to the influence of retail access to cigarettes on smoking activity is surprising in light of market theory which holds that the number of distribution outlets is strongly associated with the level of sales (Farris, Oliver, & de Kluyver, 1989). If a product is visible in more places, customers will be exposed to it more often and will be more likely to buy it, and vice versa (Farris et al., 1989; Reibstein & Farris, 1995). An association between distribution, sales and product consumption is supported by strong evidence from a range of product categories including fast food, psychoactive drugs, and alcohol (Ashe, Jernigan, Klinc, & Gataz, 2003; Goldstein & Kalant, 1990; Jekanowski, Binkley, & Eales, 2001). These studies have not been able to demonstrate a causal relationship between distribution and consumption, however, with a bi-directional relationship thought to be more likely (Dubelaar, 2002; Reibstein & Farris, 1995).

While there are thus good grounds to suspect that retail availability of tobacco has an effect on the smoking behaviour of all smokers, it is probable that any effect is greater for some smokers (i.e. under-age, experimental and intermittent smokers, and those attempting to quit). For example, Wakefield, Germain, and Henriksen (2008) found that around one-third of recent quitters reported an urge to make an impulse purchase of cigarettes as a result of seeing retail cigarette displays. That study, however, used retrospective recall and reporting, and such studies have been shown to be vulnerable to error in subject reporting (Bernard, Killworth, Kronenfeld, & Sailer, 1984). As a result, this study uses a diary method to analyse the factors associated with smoking among a population based sample of Australian smokers.

2. Methodology

Data were collected through a mail survey sent to a sample of 20,000 people representative of the population by age and gender. Respondents were excluded from data analysis if they: 1)

did not report being a smoker, and did not smoke during the four day study period, or 2) reported being a smoker who had quit more than 12 months before, and did not smoke during the period covered by the survey. Recipients were asked to record a number of measures for each four-hour interval that they were awake over a four day period: their physical location (home, work, restaurant etc); the presence of others smoking (no/yes); purchase (or supply by others) of cigarettes (no/yes); and the number of cigarettes smoked, if any. Demographic and behavioural characteristics were also collected, e.g. age, gender, socio-economic status, smoker status (number smoked per day, how soon after waking was first cigarette consumed) and quit status (whether currently attempting to quit, planning to quit in future, etc.). In order to collect data for all seven days of the week, the starting day for data collection was randomly varied, asking participants to commence recording on the next (randomly assigned) day of the week. A reminder with a duplicate survey was sent to all non-respondents approximately four weeks after the initial mailout.

3. Results

3,735 responses were obtained, for a response rate of 19.4%. 2,613 surveys were excluded as representing non-smokers, resulting in a sample of 1,122 smokers. As approximately 20% of the Australian population smokes, this represents a response rate from the smoking population of approximately 29.1%. Females were somewhat over-represented in the sample, at 61.2% of respondents. Since there is evidence that younger smokers may have different smoking patterns, and may show greater susceptibility to social influence (Gardner & Steinberg, 2005), the age of respondents was grouped into those aged 30 or over (81.5%) and those under 30 (18.5%), following Wakefield et al. (2008). The sample composition on age was broadly representative of the state population (which has 21.7% of people under 30 years old).

3.1 Smoking frequency and quit status

A large majority of respondents (87.9%) smoked at some stage during the four day period. The incidence of smoking was further analysed by self-reported quit status: those who reported that they had quit smoking within the last month (2.7% of responses); those who had quit between one month and one year ago (7.3%) and those who reported smoking daily or occasionally (90.0%). Not surprisingly, there were significant differences between these groups in the probability of smoking and the total number of cigarettes smoked over the four day period ($p < 0.001$ for both analyses), with current smokers and recent quitters being more likely to smoke, and likely to smoke more cigarettes than less recent quitters (those of more than one month duration). A report of having 'quit' however did not mean that subjects did not smoke: 53.3% of subjects who reported having quit within the past month smoked at some stage during the four day period, and 13.6% of respondents who reported having quit more than one month ago smoked. In order to model the association between the independent variables (presence of peer and other smokers, and access to cigarettes for sale), the probability of smoking (no/yes) was modelled for each four hour period. The following analyses are thus based on 26,688 four-hour intervals (or cases) from the 1,121 surveys received prior to the cut-off date for data entry and analysis.

3.2 Presence of other smokers and smoking

Chisquare analysis was used to separately estimate the associations between the presence of (a) smoking friends and/or family and (b) other smokers, and the incidence of smoking during

each four-hour period. Respondents were significantly more likely to smoke during a four-hour period if their friends and/or family were present and smoking ($p < 0.001$). This apparent effect of other smokers was not restricted to friends and family; if there were other smokers (i.e. not friends and family) subjects were also significantly more likely to smoke ($p < 0.001$), providing evidence that the sight or smell of smoking, even by unknown others, is associated with higher rates of smoking.

3.4 Retail availability and smoking

Subjects' ease of retail access to cigarettes was assessed by asking subjects to report if they saw cigarettes available for sale during each four hour period. Even if they did not buy cigarettes during the four hour interval, subjects were significantly more likely to smoke if cigarettes were seen to be available for sale in that period ($p < 0.001$). The increase in the frequency of smoking if cigarettes were available for sale was particularly marked for self-reported quitters: as shown in Table 1, those who reported having quit more than a month ago were three times more likely to smoke in any four hour period where they reported having seen cigarettes available for sale, and those who reported having quit within the past month were more than twice as likely to smoke.

Table 1: Association between quitter/smoker status, cigarettes for sale and smoking

Quitter/Smoker status	% smoking when cigarettes not available for sale	% smoking when cigarettes available for sale	Binomial test of proportions
Quit more than one month ago	3.0	9.0	$Z = 3.7, p < 0.001$
Quit within last month	17.3	44.1	$Z = 6.1, p < 0.001$
Smoke daily or occasionally	65.3	83.4	$Z = 27.1, p < 0.001$

3.5 Additive effects

In order to determine if smoking by family/friends, or by others, and the presence of cigarettes for sale had additive or correlated effects on the incidence of smoking, a binary logistic regression, simultaneously including all variables, was also conducted. The dependent variable was smoking (no/yes). Since the univariate analysis showed a difference in the probability of smoking by quit status, the respondent's quit status was included as a control variable. Since there is evidence that lower socio-economic groups are more likely to smoke, socio-economic status (SEIFA) was also included as a control variable. In order to test for the effect on smoking for different age groups, a binary age variable (less than/more than 30 years) was also included. Since social effects might be more prominent on weekends, a dummy variable (weekend, no/yes) was included in a preliminary analysis. This variable was not significant ($p > 0.1$) so was excluded from the final model, shown in Table 2. The results show that, after allowing for the control variables (age, socio-economic status, and quit status), the presence of friends or family smoking (FF smoking) and others smoking (Other smokers) had separate and significant effects ($p < 0.001$ for both) on the probability of smoking. The presence of cigarettes for sale (Cigs for sale) also had a significant effect ($p < 0.001$) on the frequency of smoking. Smoking occurred in 63.15% of cases, with 76% of cases correctly explained, 20.2% of cases incorrectly explained, and 3.7% of cases ties.

Table 2: Logistic regression: Prediction of smoking

Variable	Coefficient	SE Coef.	Z	P
Constant	-3.06	0.13	22.7	<0.001

FF smoking	0.96	0.04	20.7	<0.001
Other smokers	0.84	0.05	17.1	<0.001
Cigs for sale	0.51	0.05	11.0	<0.001
Age (<30yrs, 30+)	0.70	0.04	17.7	<0.001
SEIFA	-0.05	0.01	3.95	<0.001
Quit status*				
More than one month	-2.1	0.16	13.4	<0.001
Smoke daily or occasionally	2.1	0.10	21.0	<0.001

*Relative to quitters of less than one month

4. Discussion

The high rate of smoking, particularly by self-reported quitters, provides evidence of the difficulty of stopping smoking: over 50% of respondents who reported having quit smoking within the past month smoked at some stage during the four day period. The results also suggest some of the factors which appear to contribute to this high rate of relapse by attempting quitters, and to the incidence of smoking by current smokers. The largest unique factor in predicting smoking was if friends and family were present and smoking, providing support for the influence of social cues described by other authors (Siahpush et al., 2003). The additional significant effect of others (not friends and family) smoking, however, has not been separately examined in previous studies. This study suggests that the presence of unknown smokers (even if friends and family are smoking) further contributes to smoking, possibly by normalising smoking, and/or by creating an enhanced physical stimulus. Despite other research which has shown that younger individuals are more likely to be influenced by peers (e.g. Gardner & Steinberg, 2005), the association between others smoking and higher rates of smoking was not restricted to younger smokers, with an additive effect of peer smoking found for both younger and older smokers.

The results also show strong evidence of an association between retail availability and rates of smoking. While there have been reports of an effect of retail distribution on smoking by intending quitters, (Burton, Clark, & Bollerup, 2008) this study provides the first evidence that the presence of cigarettes for sale is significantly associated with higher rates of smoking in the general population of smokers. Distribution was particularly important in increasing rates of smoking by attempting quitters, but smoking rates also increased amongst daily or occasional smokers when cigarettes were seen to be available for sale. This result provides evidence to support the increased restrictions on retail display of cigarettes which have been introduced in some countries (Hall & Sherborne, 2008; Weeks, 2008).

5. Conclusion

This study is the first to separately assess and quantify the association between the presence of other smokers (both friends/family and others) and seeing cigarettes for sale on the incidence of smoking by adult smokers. The results are consistent with a causative chain, where the urge to smoke is initiated by friends or family smoking, and further reinforced by the presence of other smokers and by the sight of cigarettes for sale. The results provide evidence to support policy initiatives to restrict the retail display of tobacco, and also suggest that there may be value in providing more specific advice to attempting quitters, to assist them in anticipating and responding to potential triggers for relapse.

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