THE PATTERN, CORRELATES, AND PREDICTORS OF CIGARETTE SMOKING IN ADOLESCENCE

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DECLARATION

I, Jennifer Anne Fidler, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, or contributions have been made by other researchers, I confirm that this has been indicated in the thesis.

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ABSTRACT

The health effects of smoking are well known and, despite efforts to reduce smoking in adolescence, prevalence of smoking during the teenage years in the UK has remained stable over recent years. This thesis examines smoking uptake during adolescence and identifies the social, psychological and physical factors associated with this process using data from the longitudinal Health And Behaviour In Teenagers study (HABITS). Between 1999 and 2003 over 5000 students from South London were assessed annually from age 11 to age 16. Self-report questionnaires identified smoking status as well as a range of demographic, social and psychological variables. Objective height, waist and weight data were taken and saliva samples provided for cotinine assay. First, analyses examining smoking prevalence and the sociodemographic factors associated with smoking behaviour were conducted. Gender and ethnicity differences were observed, although the association between smoking and deprivation was less clear. The development of smoking behaviour among an understudied group, 'one time triers' of cigarettes, was tracked, revealing that even brief experimentation with cigarettes leads to a lasting vulnerability for later smoking. Second, social factors associated with smoking were examined and the association between smoking by friends, parents and step-parents and adolescent smoking documented. An independent relationship between early dating and later smoking was also revealed. Third, psychological factors associated with adolescent smoking were identified, and the lack of a prospective relationship between attitudes towards smoking and smoking behaviour was confirmed. Fourth, significantly smaller increases over time in BMI and waist, but not height, were observed among smokers compared with non-smokers. Finally, a population level model of the vulnerability and trigger factors associated with smoking, based on an individual level theory of motivation, was constructed. The findings presented extend current literature on adolescent smoking and have implications for effective prevention strategies.

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Chapter 1: Introduction

1.1 Smoking and health

Smoking is one of the most important preventable causes of death and illness in the UK and there were around 81,900 deaths from smoking related diseases in England in 2005 (The Information Centre, 2007). The majority of these deaths are a result of lung cancer, chronic obstructive pulmonary disease (COPD), and coronary heart disease (The Information Centre, 2007; Doll, Peto, Boreham, & Sutherland, 2004). As many as 90% of all lung cancer cases in the UK are caused by smoking (Twigg, Moon, & Walker, 2004), with greater smoking duration and intensity increasing risk (Doll et al., 2004). Chronic bronchitis and emphysema, which come under the umbrella term COPD are largely caused by smoking, as are circulatory diseases in younger age groups (age 35-54) (Twigg et al., 2004). In addition a large number of other causes of death, illness, and disability are also linked to smoking (see Table 1.1). Overall, around half of all regular smokers will eventually be killed because of their smoking (Doll et al., 2004; Twigg et al., 2004), and on average people who continue to smoke will die approximately 10 years younger than non-smokers (Doll et al., 2004). The earlier smoking cessation occurs the more this risk of mortality and morbidity is reduced (Doll et al., 2004).

Smoking is not only a cause of death and disease in adulthood but also has health implications during the teenage years; young smokers have a greater number of days off sick from school (Charlton & Blair, 1989) and are more susceptible to respiratory infections than non-smokers (Royal College of Physicians, 1992). Furthermore, the risk of lung cancer in later life becomes greater with decreasing age of initiation (Doll & Peto, 1981), and permanent lung damage can be caused, even if a teenage smoker quits smoking (Wiencke, Thurston, Kelsey, Varkonyi, Wain et al., 1999).

Table 1.1 Causes of death, illness and disability linked to smoking

Disorders for which tobacco use is a known or probable cause or exacerbating factor*	
Cancer of the lung	Peripheral vascular disease
Cancer of the larynx	Vascular dementia
Cancers of the oral cavity	Macular degeneration
Cancer of the nasopharynx	Cataract
Cancer of the oropharynx and hypopharynx	Hearing loss
Cancer of the oesophagus	Infertility
Cancer of the liver	Spontaneous abortion
Cancer of the cervix	Stillbirth
Cancer of the stomach	Low birth weight
Cancer of the urinary tract, kidney, ureter and bladder	Conduct disorder in offspring of women who smoke during pregnancy
Leukaemia	Sudden infant death syndrome
Chronic obstructive pulmonary disease	Low back pain
Pneumonia	Osteoporosis
Asthma attacks	Tuberculosis
Coronary heart disease	Type II diabetes
Aortic aneurism	Peptic ulcer disease
Cerebrovascular disease	Surgical complications

*taken from West (2006c)

1.2 Smoking Prevalence

1.2.1 Adults

According to recent figures from the General Household Survey 24% of UK adults, about 1 in every 4, smoke cigarettes (Goddard, 2006). However, smoking rates differ by age and gender, with the percentage of smokers greatest in the 20 to 24 age bracket and lowest in those over 60, and men more likely to be smokers than women (see Figure 1.1 and Figure 1.2) (Goddard, 2006). Rates of adult smoking have fallen slightly in the last few years, following a relatively stable period in the 1990s. However, although smoking prevalence has declined from 28% in 1998 to 24% in 2005, smoking cessation has largely occurred in the older age groups, and in younger age categories more people are starting to smoke than are quitting (Goddard, 2006).

Figure 1.1 Prevalence of adult smoking by age: 1974 to 2005 – Men (Goddard, 2006)

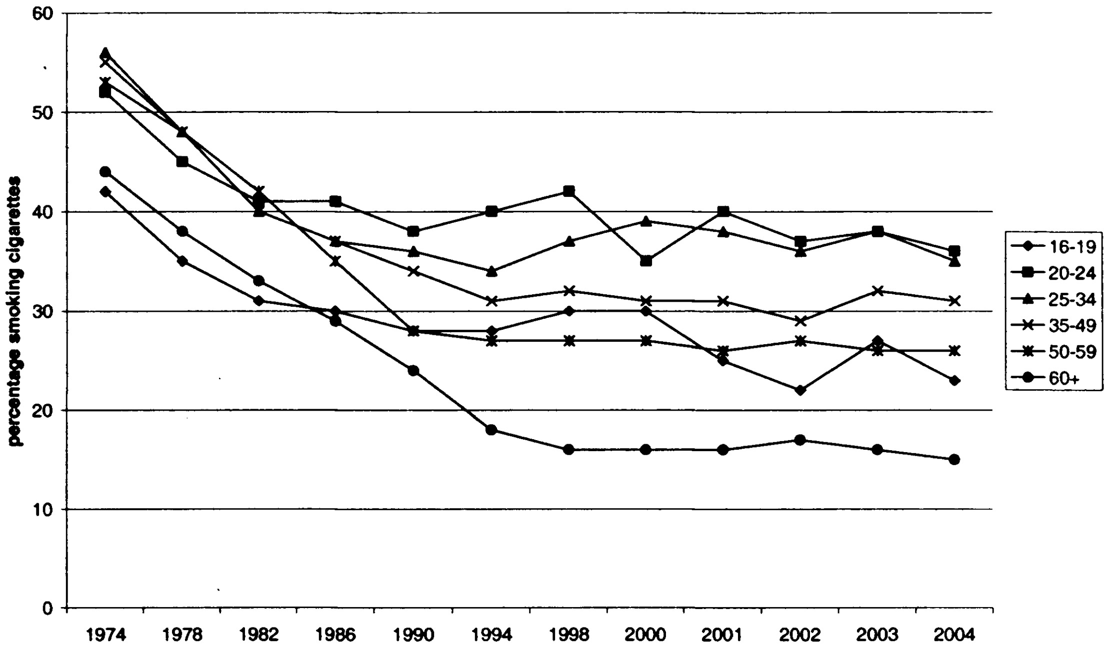
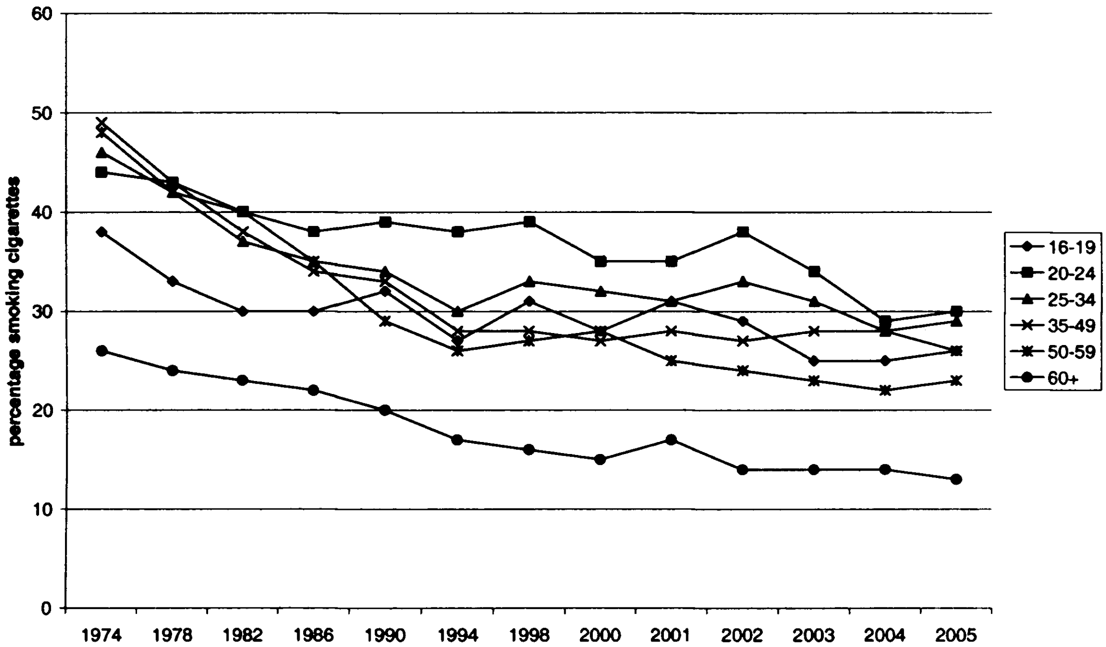


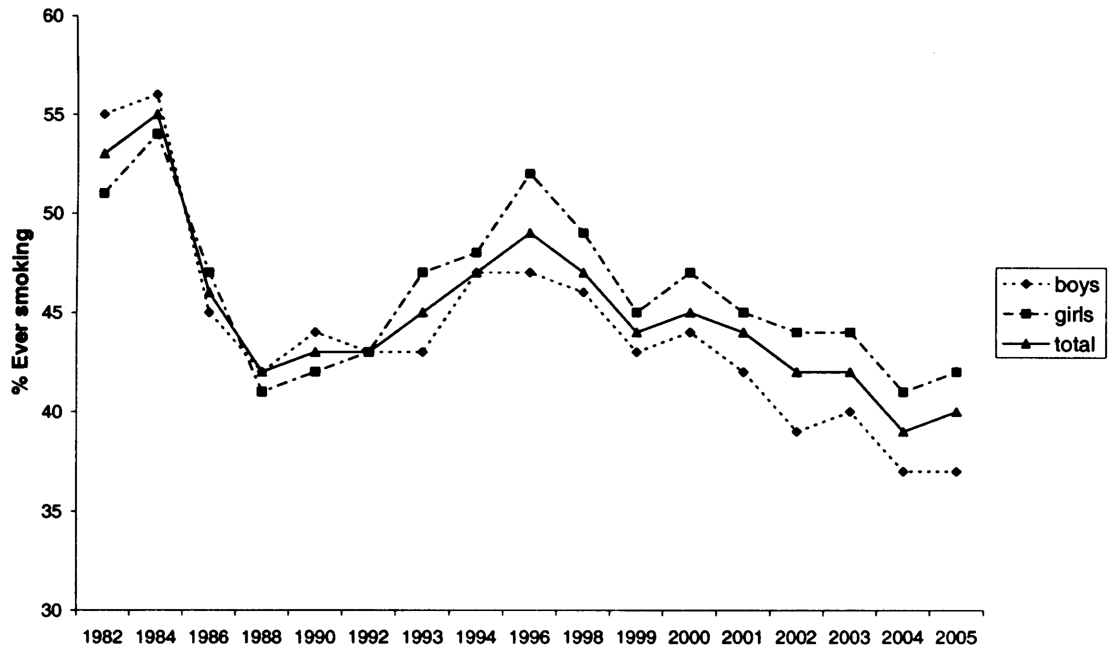
Figure 1.2 Prevalence of adult smoking by age: 1974 to 2005 – Women (Goddard, 2006)



1.2.2 Adolescents

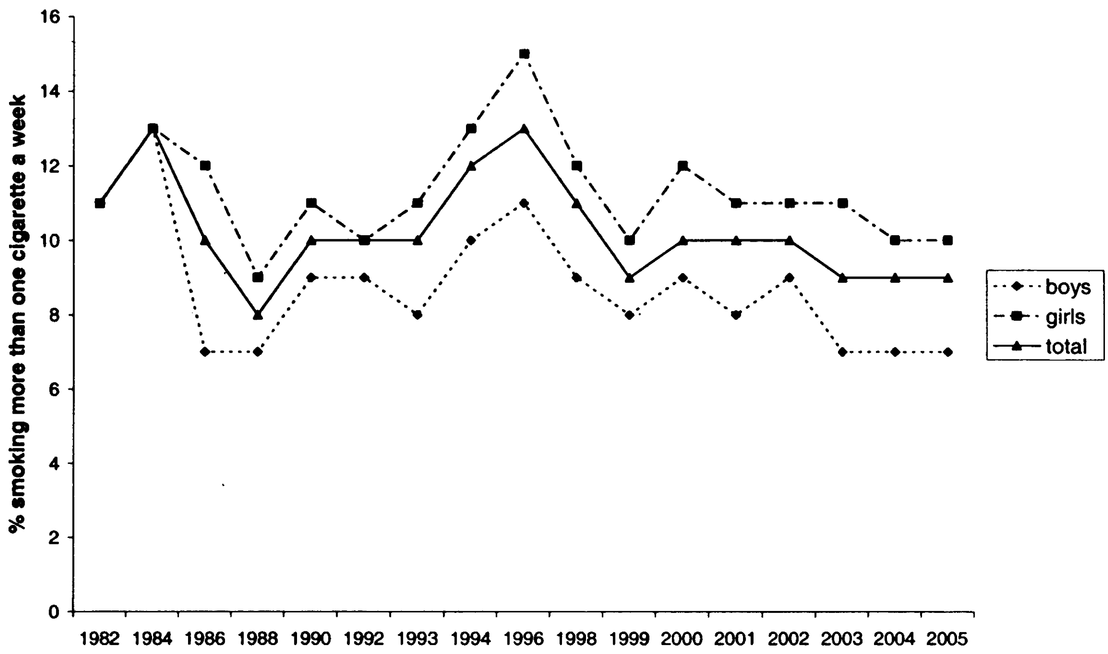
The majority of adult smokers first started smoking when they were teenagers, with two thirds of smokers starting before the age of 18 and two fifths starting before the age of 16 (Goddard, 2006). Two sources of adolescent smoking prevalence information are the Health Surveys for England (HSE) and the Smoking, Drinking and Drug use (SDD) surveys. SDD data is used here for three methodological reasons: First, SDD surveys are completed in the classroom, while HSE data is collected in the family home - resulting in a slight under-estimation of prevalence (Sprogston & Primatesta, 2003); second SDD surveys are carried out on an annual basis, whereas the last HSE survey with a boosted child and young person sample was in 2002 (Sprogston & Primatesta, 2003); and third they are similar in methodology to the HABITS study reported in this thesis. Figure 1.3 shows that the prevalence of 'ever' smoking (defined as any experience with cigarettes) among 11 to 15 year olds in these national surveys has declined from 55% in 1984 to 40% in 2005 (Fuller, 2006), with headline figures for 2006 showing a further decline to 39% (National Centre for Social Research, 2007). However, regular smoking (defined as smoking at least one cigarette a week) has remained stable since 1999 at around 9-10% (see Figure 1.4) (Fuller, 2006).

Figure 1.3 Prevalence of ever† smoking among 11-15 year olds between 1982 and 2005 (Fuller 2006)



†any experience with cigarettes

Figure 1.4 Prevalence of regular smoking† among 11 to 15 year olds between 1982 and 2005 (Fuller 2006)



†at least one cigarette a week

1.2.3 Age of uptake

Although children may begin experimenting with cigarettes as young as age 8, the largest increase in smoking behaviour occurs once children enter secondary school. SDD data show that in 2005 13% of 11 year olds reported smoking and by the age of 15 this had risen to 64% (Figure 1.5). Similarly a very small number of adolescents report regular smoking at age 11 (1%), but by age 15 20% report smoking more than one cigarette a week (Figure 1.6) (Fuller, 2006).

1.2.4 Gender differences

In the UK (though not necessarily other countries (Currie, Roberts, Morgan, Smith, Samdal et al., 2004)), a stark gender difference has become apparent since the early 1990s, with boys tending to experiment earlier than girls but girls more likely to smoke than boys from the age of 12. Figure 1.5 displays 2005 SDD data; at age 11, 15% of boys reported ever smoking compared to 11% of girls but by age 16 figures for boys and girls rose to 59% and 69% respectively. Rates of regular smoking at age 11 among boys and girls were broadly similar, but again the rate of smoking among girls increased at a faster rate than boys with 16% of boys and 25% of girls reporting regular smoking at age 15 (See Figure 1.6) (Fuller, 2006).

Figure 1.5 Prevalence of ever smoking from age 11 to age 15 in 2005 (Fuller 2006)

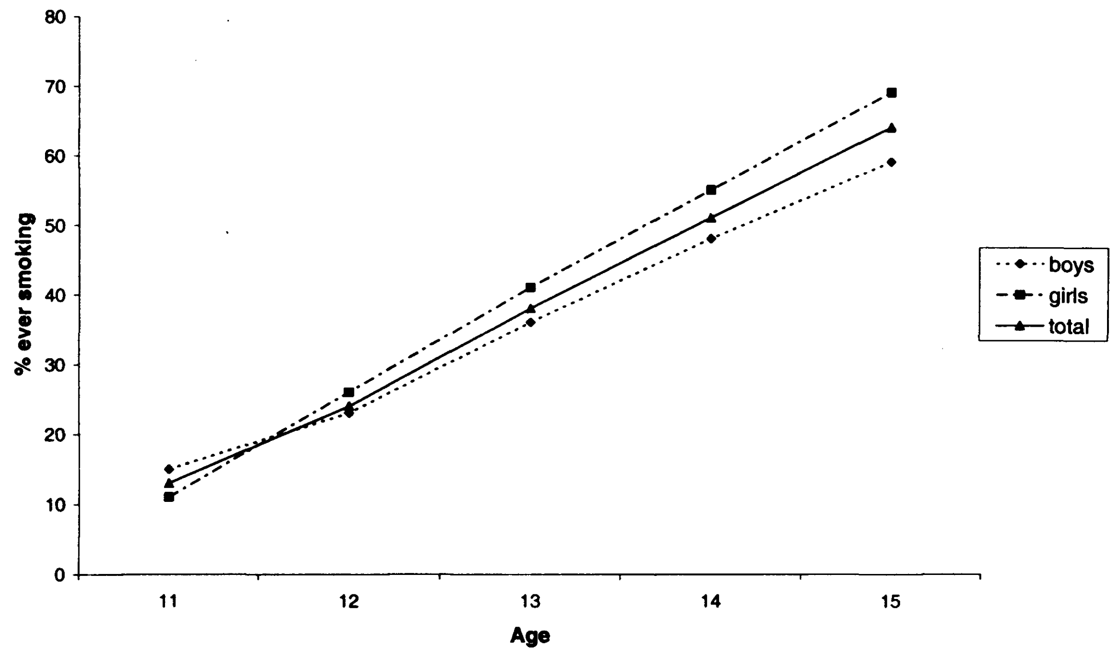
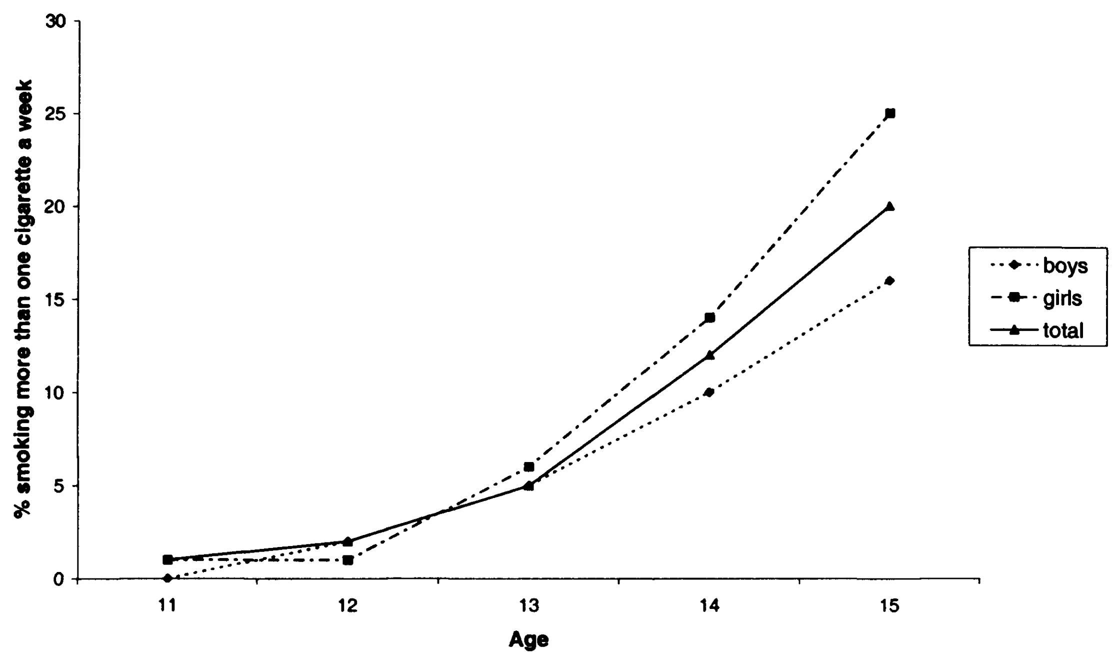


Figure 1.6 Prevalence of regular smoking from age 11 to age 15 in 2005 (Fuller 2006)



1.3 Smoking and addiction

Smoking is an extremely addictive behaviour. Cigarettes contain nicotine, a highly addictive drug, which acts on cholinergic and doperminergic systems in the brain to influence mood and cognition and is the primary reason why smokers continue smoking (Jarvis, 2004; Le Houezec, 2003). The effect smoking has on the body is complex as smoking both positively reinforces behaviour (providing a positive reward) and negatively reinforces behaviour (through the relief of withdrawal symptoms and cravings). Other aspects of smoking, such as sensory cues are also important and become associated with the rewarding effect of nicotine further reinforcing the positive chemical effect (Gifford & Humphreys, 2007; Le Houezec, 2003). Cigarette smoking is the fastest method of delivering nicotine into the body, with nicotine reaching the brain in 10 to 20 seconds. However, the half life of nicotine is very short (2 hours) and repeated doses are required to maintain nicotine levels in the body (Jarvis, 2004).

Many adults would like to stop smoking, with 68% reporting a desire to quit in the General Household Survey, and 55% expecting to find cessation difficult (Goddard, 2006). Indeed, of the total number of smokers who make an attempt to quit each year, using all available methods of cessation, less than 3% are successful (West, 2006a). The strength of addiction to nicotine is well illustrated by reports of patients continuing to smoke after diagnosis with cancer, COPD, or after suffering a myocardial infarction, despite evidence that cessation would significantly improve their recovery or chance of survival (Scholte op Reimer, de Swart, De Bacquer, Pyorala, Keil et al., 2006; Jolly, Bradley, Sharp, Smith, Thompson et al., 1999; Ostroff, Jacobsen, Moadel, Spiro, Shah et al., 1995; Research Committee of the British Thoracic Society, 1990).

Of course, although nicotine addiction explains why people continue to smoke it is not directly responsible for smoking initiation, rather smoking is perceived as an attractive behaviour by young smokers who may see positive outcomes outweighing the negative health impact (Gruer, 2006; Siegel, Alvaro, & Burgoon, 2003). Many adolescent smokers believe that they can stop when they want and do not necessarily see themselves going on to smoke into adulthood (Schoenbaum, 2005). However, research suggests the path towards addiction is started within the first few cigarettes (DiFranza, Savageau, Rigotti, Fletcher, Ockene et al., 2002; Russell, 1990) and even young smokers have been found to experience withdrawal symptoms on quitting (McNeill, 1991).

1.4 The Development of smoking in adolescence

Once smoking has been initiated it can take several years before regular smoking behaviour in adolescence is maintained (Robinson, Berlin, & Moolchan, 2004; Stallings, Hewitt, Beresford, Heath, & Eaves, 1999; Leventhal & Cleary, 1980). Flay proposed a stage model describing how adolescents move from never smoking (the 'preparatory stage') through a 'trial phase' and an 'experimental phase' before entering the phase of 'regular smoking' and finally ‘nicotine dependence or addiction’ (Flay, 1993). Further work has extended these stages to include 'non-smoking deciding' and 'quitting' (Kremers, Mudde, & de Vries, 2001) and 'daily smoking' (Mayhew, Flay, & Mott, 2000) and a large number of studies have examined variables that predict stage membership (Mayhew et al., 2000). However, the rate and intensity of this development varies from individual to individual, with a number of patterns of smoking development identified (Abroms, Simons-Morton, Haynie, & Chen, 2005; Audrain-McGovern, Rodriguez, Tercyak, Cuevas, Rodgers et al., 2004; Orlando, Tucker, Ellickson, & Klein, 2004; Soldz & Cui, 2002; White, Pandina, & Chen, 2002; Chassin, Presson, Pitts, &

Sherman, 2000; Wills, Vaccaro, McNamara, & Hirky, 1996). Furthermore, although it is probable that young smokers move through these stages at some point, adolescent smoking has been described as one which is characterised by change (Petraitis, Flay, & Miller, 1995) and movement in and out of these described stages is likely (Goddard, 1990).

1.5 Smoking prevention

The addictive nature of smoking and the low rates of cessation in adults, coupled with evidence that smoking at even a young age can have detrimental effects on health, points to the value of working to prevent smoking behaviour at an early age. The 1998 White Paper 'Smoking Kills' highlighted reducing smoking among young people as a key objective and proposed a number of practical changes designed to prevent smoking uptake and encourage cessation in children and young people (Department of Health, 1998). However, recent reviews and meta-analyses (including several Cochrane reviews) summarising evidence on school, family and community based strategies, mass media, and retail interventions, conclude that attempts to prevent smoking in children and young people have so far had little success (Thomas, Baker, & Lorenzetti, 2007; Thomas & Perera, 2006; Wiehe, Garrison, Christakis, Ebel, & Rivara, 2005; Stead & Lancaster, 2005; Sowden, Arblaster, & Stead, 2003; Skara & Sussman, 2003; Sowden & Arblaster, 2000; Tobler, Roona, Ochshorn, Marshall, Streke et al., 2000) . These reviews are either unable to draw firm conclusions regarding the effectiveness of, or state there is little strong evidence to support, such smoking prevention programmes (with the exception of Skara and Sussman et al. (2003) who conclude in their review that a number of prevention programmes have shown positive results). There has been less focus on the success of smoking cessation programmes in adolescent age groups. A Cochrane review concluded that limited evidence prevented firm conclusions; some studies showed successful cessation rates but other cessation programmes targeted at adolescents had no effect (Grimshaw & Stanton, 2006). Meanwhile tobacco companies are working to maintain customer levels by focusing on young people (Hastings & MacFadyen, 2000), with tobacco marketing practices especially influential on smoking uptake at young ages (Slater, Chaloupka, Wakefield, Johnston, & O'Malley, 2007).

1.6 Conclusion

Adolescence is a time of great importance as individuals become more autonomous (Eiser, 1997), and unhealthy and risk taking behaviour, such as smoking, first emerge. It is therefore a 'pivotal period' in terms of current and future health and illness (Williams, Holmbeck, & Greenley, 2002). Reducing smoking among young people will benefit health both in adolescence and later adulthood if smoking continues. However, with rates of adolescent smoking showing little sign of decline, and evaluated attempts to prevent uptake and increase cessation having little effect, there is much still to understand. The following chapter summarises research on the factors which are known to be associated with adolescent smoking behaviour.

Chapter 2: Factors associated with adolescent smoking

Understanding which adolescents smoke, why they smoke, and what factors predict smoking uptake and smoking progression can provide vital information regarding how best to prevent adolescents from trying smoking or continuing to smoke, and encourage successful quitting at this young age. This chapter outlines factors associated with adolescent smoking, including and building upon the past reviews in this area of Conrad, Flay and Hill (1992) and Tyas and Pederson (1998).

2.1 Sociodemographic factors

2.1.1 Gender

Gender has been described, along with ethnicity, as one of the most important predictors of adolescent smoking (Mermelstein, 1999). As discussed in Chapter 1 there are consistent gender differences in adolescent smoking behaviour, with boys typically beginning to smoke at an earlier age than girls, but more girls beginning to smoke than boys from around age 13/14. The largest excess of females over males smoking in the adolescent years has been observed in the UK (Amos & Bostock, 2007; Rugkasa, Stewart-Knox, Sittlington, Abaunza, & Treacy, 2003), although it is important to highlight that gender differences in smoking vary by ethnic group (see section 2.1.2). The tendency for adolescent girls to smoke more than boys may be particularly concerning as some research has suggested that girls may be more vulnerable to the damaging effects of cigarette smoke on lung function and lung growth (Holmen, Barrett-Connor, Clausen, Langhammer, Holmen et al., 2002; Gold, Wang, Wypij, Speizer, Ware et al., 1996).

The factors that predict adolescent smoking frequently differ by gender, although research is often inconsistent as to which factors are important for boys and girls (Amos & Bostock, 2007). However, there is some tendency for girls to be influenced by social pressure to smoke (Hoving, Reubsaet, & de Vries, 2007; Mermelstein, 1999) and to report smoking in relation to weight control and dieting to a greater extent than boys (Potter, Pederson, Chan, Aubut, & Koval, 2004; Mermelstein, 1999), whereas boys reportedly worry more about the effect of smoking on impaired fitness (Amos & Bostock, 2007).

2.1.2 Ethnicity

Research on smoking behaviour is often drawn from the U.S. However, the difference in distribution of ethnic groups compared to the UK, and the lack of information on Asian subgroups especially, means research on ethnic differences from the U.S. cannot be generalised. Although research on ethnic differences in this country has been limited by low numbers, several different reports of smoking behaviour in the UK describe adolescents from some ethnic backgrounds as more likely to smoke than others. Typically White adolescents are most likely to smoke, followed by Black Caribbean adolescents, with Asian groups smoking less and, on some occasions, Black African adolescents also showing low rates of smoking (Fuller, 2006; Viner, Haines, Head, Bhui, Taylor et al., 2006; Sprogston & Mindell, 2006; Rodham, Hawton, Evans, & Weatherall, 2005; Markham, Aveyard, Thomas, Charlton, Lopez et al., 2004; Currie, Fairgrieve, Akhtar, & Currie, 2003; Best, Rawaf, Rowley, Floyd, Manning et al., 2001; Nazroo, Becher, Kelly, & McMunn, 1999). Earlier and less focused studies have been limited to broad categories of ethnic group such as White, Black and Asian, although there has been an increasing recognition that differences within these broad sub-groups exist, for example the comparatively lower numbers smoking among Black African adolescents compared to those with a Black Caribbean background (Viner et al., 2006). Smoking uptake among Bangladeshi, Pakistani and Indian adolescents, commonly grouped into a South Asian category, is also reported to differ (Sprogston & Mindell, 2006). However, these studies especially suffer from low numbers within particular groups.

Furthermore different ethnic groups vary in the intensity of smoking behaviour reported, with rates of ever smoking relatively high in Black adolescents, but more regular smoking much lower than other groups (Ellickson, Orlando, Tucker, & Klein, 2004; Best et al., 2001). There are also gender differences reported within ethnic groups. As discussed above there is a now a clear overall trend for girls to smoke more than boys, but although this pattern is apparent among White and Black Caribbean populations, other groups show the reverse, with South Asian girls smoking much less than their male counterparts (Markham et al., 2004). This can be explained by cultural taboos surrounding South Asian women smoking (Bush, White, Kai, Rankin, & Bhopal, 2003). Again research in the area is limited by low numbers of survey respondents in minority groups reduced further when split by gender, and comparisons are often made with bases well below 100. However, there has been increasing concern in recent years that smoking among South Asian girls is increasing, with stop smoking service providers noting a raised level of smoking in Pakistani girls especially (ASH Scotland, 2005; Bush et al., 2003).

2.1.3 Deprivation

Research on adult smokers shows a clear socioeconomic status (SES) gradient, with those in high deprivation groups smoking more than those in less deprived groups (Stimpson, Ju, Raji, & Eschbach, 2007; Siahpush, McNeill, Borland, & Fong, 2006;

Siahpush, Heller, & Singh, 2005; Gilman, Abrams, & Buka, 2003; Jefferis, Graham, Manor, & Power, 2003; Shohaimi, Luben, Wareham, Day, Bingham et al., 2003; Jarvis & Wardle, 1999). This relationship is especially apparent regarding persistent smoking, dependence and difficulty in quitting (Siahpush et al., 2006; Siahpush et al., 2005; Jarvis & Wardle, 1999). There is also evidence that low childhood SES is associated with later smoking in adulthood (Fagan, Brook, Rubenstone, & Zhang, 2005; Gilman et al., 2003; Jefferis et al., 2003). However, the relationship between SES and smoking during adolescence is much less clear. Although several review papers have concluded that studies overall tend to support an association between low SES and smoking behaviour in adolescence (Chen, Matthews, & Boyce, 2002; Tyas & Pederson, 1998; Conrad, Flay, & Hill, 1992), this association has been described as weak (Derzon & Lipsey, 1999) and a number of studies fail to find any effect (Tuinstra, Groothoff, Van Den Heuvel, & Post, 1998; Glendinning, Shucksmith, & Hendry, 1997; McNeill, Jarvis, Stapleton, Russell, Eiser et al., 1988).

It has been suggested that SES differentials may not be present at this young age (Siahpush & Singh, 2000; West, Macintyre, Annandale, & Hunt, 1990). However, studies vary considerably in terms of both the definition of SES (Gilman et al., 2003; Scarinci, Robinson, Alfano, Zbikowski, & Klesges, 2002) and the definition of smoking status (Chen et al., 2002; Sweeting & West, 2001) used. Sweeting and West (2001) examined this issue and found that although no effect of deprivation on 'current' smoking behaviour was observed, when current smokers were split into 'occasional' and 'regular' smokers, 'occasional' smoking showed a negative association with level of deprivation while 'regular' smoking was positively associated with deprivation. The opposite direction of these associations consequently combines to result in a lack of association between deprivation and current smoking as a whole. Sweeting and West therefore propose that the use of current smoking as a variable is best avoided in the assessment of the relation between smoking and SES in adolescence (Sweeting & West, 2001). It is also likely that the effect of SES is mediated by other variables, and educational achievement, conduct problems, family and peer smoking and attitudes towards smoking have all been identified as mediators in the smoking/SES relationhip (Fergusson, Horwood, Boden, & Jenkin, 2007; Droomers, Schrijvers, Casswell, & Mackenbach, 2005; Wilkinson & Abraham, 2004; Soteriades & DiFranza, 2003). Finally, personal income in adolescence has been identified as important with a high level of spending money often associated with increased cigarette use, although this is not necessarily correlated with other measures of SES (Unger, Sun, & Johnson, 2007; Ausems, Mesters, van Breukelen, & de Vries, 2003; Soteriades & DiFranza, 2003).

2.2 Social and environmental factors

2.2.1 Parents

The association between parental smoking and offspring smoking uptake is well documented; adolescents with one or more parents who smoke are more likely to smoke themselves than those with no smoking parents (Exter Blokland, Engels, Hale, Meeus, & Willemsen, 2004; Vink, Willemsen, & Boomsma, 2003a; Jackson, Henriksen, Dickinson, Messer, & Robertson, 1998). A recent large nine year study found that no parental smoking was associated with the lowest level of adolescent smoking, followed by one parent smoking, and adolescents with both parents smoking having the highest odds of smoking themselves (Peterson, Jr., Leroux, Bricker, Kealey, Marek et al., 2006). Parental smoking cessation has also been associated with increased cessation attempts by adolescents, but only if the parent quits early in the child's life (Bricker, Rajan, Andersen, & Peterson, Jr., 2005). However, the strength of the association between parental and adolescent smoking is often less strong than might be expected and frequently disappears when other variables are added (Avenevoli & Merikangas, 2003; Conrad et al., 1992), perhaps because parental influence is mediated and moderated by other variables (Avenevoli & Merikangas, 2003).

A variety of mechanisms by which parents might be influencing adolescent smoking, both directly and indirectly, have been proposed (Darling & Cumsille, 2003). Observational learning is an obvious path, along with increased accessibility of cigarettes in the home setting, perhaps leading to sanctioned experimentation. Other mechanisms proposed include; genetic predisposition to becoming and/or staying a smoker (Haberstick, Timberlake, Ehringer, Lessem, Hopfer et al., 2007; Vink, Willemsen, & Boomsma, 2005; Li, Cheng, Ma, & Swan, 2003; Vink et al., 2003a; Sullivan & Kendler, 1999); the transmission of norms and attitudes (Kalesan, Stine, & Alberg, 2006; Komro, McCarty, Forster, Blaine, & Chen, 2003); parenting styles and relationships (Huver, Engels, & de, 2006; Jackson & Dickinson, 2006; Chassin, Presson, Rose, Sherman, Davis et al., 2005); and parental monitoring and warmth (Foster, Jones, Olson, Forehand, Gaffney et al., 2007; Hill, Hawkins, Catalano, Abbott, & Guo, 2005). In addition parents have been recognised as gatekeepers to other sources of influence such as peers (Avenevoli & Merikangas, 2003; White, Hopper, Wearing, & Hill, 2003; Steinberg, 2001).

2.2.2 Siblings

Having siblings who smoke is also a consistently observed risk factor for smoking uptake (Slomkowski, Rende, Novak, Lloyd-Richardson, & Niaura, 2005; Komro et al., 2003; Rajan, Leroux, Peterson, Jr., Bricker, Andersen et al., 2003; Avenevoli & Merikangas, 2003), and is known to have a stronger association with adolescent smoking than parental smoking behaviour (Vink et al., 2003a), although there is less research on sibling smoking than there is on parent or friend smoking behaviour. As with parents, a number of factors are at play in the relationship between sibling and adolescent smoking, including social influence, as well as sibling connectedness and quality of relationship (Slomkowski et al., 2005). A genetic link is also plausible, with siblings sharing the same degree of genetic material as parents. However, several studies have now suggested that the mechanism of sibling influence is most likely environmental (Slomkowski et al., 2005; Rende, Slomkowski, Lloyd-Richardson, & Niaura, 2005). As found in research on parental influence, some degree of sex-specific influence is apparent, with same sex siblings having a greater impact than opposite sex siblings (Nofziger & Lee, 2006; Vink et al., 2003a; Tyas & Pederson, 1998).

2.2.3 Friends

Peer influence is one of the major correlates of adolescent smoking (Kobus, 2003; Avenevoli & Merikangas, 2003; Tyas & Pederson, 1998; Conrad et al., 1992), and typically has a stronger association with adolescent smoking behaviour than parental or sibling smoking (Nofziger & Lee, 2006; Vitaro, Wanner, Brendgen, Gosselin, & Gendreau, 2004; Avenevoli & Merikangas, 2003; de Vries, Engels, Kremers, Wetzels, & Mudde, 2003; Bauman, Carver, & Gleiter, 2001; West, Sweeting, & Ecob, 1999; Conrad et al., 1992). However, when examined closely the situation would appear to be complex. Hoffman et al. in their theoretical review of the literature posit a 'hydraulic model' (Hoffman, Sussman, Unger, & Valente, 2006) where parental influence on adolescents decreases with age and is replaced by an increased influence by peers. Previous research had supported this position (Vitaro et al., 2004; Bauman et al., 2001; West et al., 1999). However, more recent research concludes differently, with some studies finding the influence of both peers and parents consistently strong over time (Bricker, Peterson, Jr., Sarason, Andersen, & Rajan, 2007; de Vries et al., 2003;

Bauman et al., 2001) and others showing an increase in the role of parental influence with age and a greater influence on smoking continuation once initiation has occurred (Bricker, Peterson, Jr., Andersen, Rajan, Leroux et al., 2006; Evans, Powers, Hersey, & Renaud, 2006).

Exactly how friends influence smoking behaviour is still disputed as research has not unravelled whether it is peer influence (more probably internal pressure to conform to group norms than direct coercion (Stewart-Knox, Sittlington, Rugkasa, Harrisson, Treacy et al., 2005; Kobus, 2003; Simons-Morton, Haynie, Crump, Eitel, & Saylor, 2001)), peer selection (smokers choosing smoking friends), or both, that results in the well documented association between friends who smoke and smoking uptake (Kobus, 2003). Although peer influence was previously considered most important, the role of peer influence in adolescent smoking has probably been overestimated (Arnett, 2007; Kobus, 2003); fewer studies have examined the role that selection plays (Hoffman, Monge, Chou, & Valente, 2007) and the methodological complexities involved in examining the relationship between peer and adolescent smoking correctly make the relationship very difficult to assess (Arnett, 2007; Reid, Manske, & Leatherdale, 2007; Lundborg, 2006; Kobus, 2003). It is likely however that this is a dialectic process and there is a reciprocal, interactive relationship between peer influence and peer selection. The debate as to the independent importance of each process is therefore of little value, with more recent studies concluding that both selection and influence are involved (Hall & Valente, 2007; Hoffman et al., 2007; de Vries, Candel, Engels, & Mercken, 2006; Simons-Morton & Chen, 2006).

2.2.4 School environment

It is not only an adolescent's immediate friends and family that can influence smoking behaviour. Wilcox (2003) describes a multi-level model of smoking that includes community and institutional characteristics and processes as well as inter-individual differences. One of the most obvious community level factors adolescents are exposed to is their school environment. Several reviews have reported that schools differ in terms of smoking prevalence (Sellstrom & Bremberg, 2006; Aveyard, Markham, & Cheng, 2004; Evans-Whipp, Beyers, Lloyd, Lafazia, Toumbourou et al., 2004), with school level determinants explaining between 4% and 40% of these differences (Sellstrom & Bremberg, 2006). Aveyard et al. (2004) conclude that methodological difficulties make it difficult to unravel the specific determinants involved. It does appear however that school policies regarding smoking have a particular role, and although some studies find no effect of school policy on smoking (Murnaghan, Sihvonen, Leatherdale, & Kekki, 2007; Darling, Reeder, Williams, & McGee, 2006), when policies are regarded as effectively implemented and enforced results are encouraging (Kumar, O'Malley, & Johnston, 2005; Evans-Whipp et al., 2004; Hamilton, Cross, Lower, Resnicow, & Williams, 2003; Griesbach, Inchley, & Currie, 2002). School climate, school culture and levels of smoking by older students are other proposed inter-school differences found to be associated with smoking (Sellstrom & Bremberg, 2006; Leatherdale, Brown, Cameron, & McDonald, 2005; Leatherdale, McDonald, Cameron, & Brown, 2005; Aveyard, Markham, Lancashire, Bullock, Macarthur et al., 2004).

2.2.5 Other social and environmental factors

Other social factors associated with smoking include; image formation, whereby smoking among adolescents is often a social act used to influence social status and popularity (Valente, Unger, & Johnson, 2005; Rugkasa, Knox, Sittlington, Kennedy, Treacy et al., 2001; Michell & Amos, 1997), as well as attracting members of the opposite sex (Lloyd, Lucas, Holland, McGrellis, & Arnold, 1998); and family environment and structure, two parent families have been shown to be protective against smoking uptake, while children from step-families and children whose parents have separated show higher levels of smoking, even when controlling for other variables (Otten, Engels, van de Ven, & Bricker, 2007; Griesbach, Amos, & Currie, 2003; Bjarnason, Davidaviciene, Miller, Nociar, Pavlakis et al., 2003; Anda, Croft, Felitti, Nordenberg, Giles et al., 1999; Tyas & Pederson, 1998; Michaud, bos-Piot, & Narring, 1998). The accessibility of cigarettes is another important factor. Although most occasional smokers report obtaining cigarettes from friends (Leatherdale & Strath, 2007; Croghan, Aveyard, Griffin, & Cheng, 2003), the majority of regular smokers buy their own cigarettes, and are more likely to do so if there are a greater number of cigarette retailers near the school area and less likely to buy their own cigarettes if their parents are smokers (Leatherdale & Strath, 2007).

2.3 Personal and behavioural factors

A large number of personal and behavioural factors have been associated with smoking in adolescents, for example stress has been linked to smoking initiation (Booker, Gallaher, Unger, Ritt-Olson, & Johnson, 2004; Byrne & Mazanov, 2003; Siqueira, Diab, Bodian, & Rolnitzky, 2000; Koval, Pederson, Mills, McGrady, & Carvajal, 2000), as has depression (Pirkle & Richter, 2006; Poulin, Hand, Boudreau, & Santor, 2005; Nezami, Unger, Tan, Mahaffey, Ritt-Olson et al., 2005), although in both cases it is unclear whether smoking is used to self-medicate stress and depression or whether smoking itself is associated with the onset of depression and increased perceived stress

(Steuber & Danner, 2006; Wills, Sandy, & Yaeger, 2002; Goodman & Capitman, 2000; Parrott, 1999; McMahon, 1999).

Several personality characteristics have been associated with smoking in adolescence including rebellious and risk taking tendencies (Koval, Pederson, & Chan, 2004; Burt, Dinh, Peterson, & Sarason, 2000; Tyas & Pederson, 1998), high extraversion (Harakeh, Scholte, de Vries, & Engels, 2006; Wilkinson & Abraham, 2004; White, Hill, & Hopper, 1996) and novelty seeking (Audrain-McGovern et al., 2004), while self-esteem and anxiety are other psychological factors which have been linked to smoking behaviour (Harakeh et al., 2006; Croghan, Bronars, Patten, Schroeder, Nirelli et al., 2006; Dudas, Hans, & Barabas, 2005; Wilkinson & Abraham, 2004; Glendinning, 2002; Carvajal, Wiatrek, Evans, Knee, & Nash, 2000). In terms of cognition, it might be expected that students who hold pro-smoking attitudes will go on to initiate smoking behaviour (Piko, 2001; Andrews & Duncan, 1998), however research has not found a consistent effect of attitudes towards smoking on adolescent behaviour prospectively (Piko, 2001; McNeill et al., 1988).

Other personal and behavioural factors related to smoking include body and weight issues; teenage girls especially are more likely to smoke if they have concerns about body image and a desire to stay slim (Stice & Shaw, 2003; Field, Austin, Frazier, Gillman, Camargo et al., 2002; Austin & Gortmaker, 2001; Tomeo, Field, Berkey, Colditz, & Frazier, 1999; French, Story, Downes, Resnick, & Blum, 1995; French, Perry, Leon, & Fulkerson, 1994). Pubertal status has also been associated with increased smoking uptake (Harrell, Bangdiwala, Deng, Webb, & Bradley, 1998; Patton, Johnson-Sabine, Wood, Mann, & Wakeling, 1990), although recent findings suggest it is early maturation relative to peers which is important, with higher rates of smoking persisting in those who start puberty early, rather than reaching puberty per se (van Jaarsveld, Fidler, Simon, & Wardle, 2007; Lanza & Collins, 2002; Dick, Rose, Viken, & Kaprio, 2000).

Poor academic achievement has consistently been associated with adolescent smoking, with poor grades, low academic aspirations, perception of academic failure and other academic problems linked to smoking uptake and progression (Bergen, Martin, Roeger, & Allison, 2005; Audrain-McGovern et al., 2004; Dierker, Avenevoli, Goldberg, & Glantz, 2004; Tucker, Ellickson, & Klein, 2003; Ellickson, Tucker, & Klein, 2001; Bryant, Schulenberg, Bachman, O'Malley, & Johnston, 2000). Anti-social behaviour and truanting are also behavioural factors associated with smoking in adolescence (Leatherdale & Strath, 2007; Dierker et al., 2004; Croghan et al., 2003; Adalbjarnardottir & Rafnsson, 2002; Bryant et al., 2000; Michaud et al., 1998; Jessor, 1991) and other 'risky' and health related behaviours such as drinking, drug use, and sexual behaviour have been shown to cluster together with smoking (Wiefferink, Peters, Hoekstra, Dam, Buijs et al., 2006; Dierker et al., 2004; Ellickson et al., 2001).

2.4 Conclusion

There exists a wide and varied range of sociodemographic, social, environmental, psychological, personal, and behavioural factors which have been associated with smoking behaviour in adolescence. However, there is still much to learn and understand in order to determine how best to aid smoking prevention. Many findings are tentative because they are based on cross-sectional studies or studies in other populations. More longitudinal, UK-based, research is required to establish how adolescent smoking develops and how associated factors are involved in the uptake and progression of smoking and in which groups of adolescents different factors are most important. The next chapter progresses from the description of individual factors associated with adolescent smoking to present theories of adolescent smoking that bring together many of these variables in order to understand and study adolescent smoking more comprehensibly.

Chapter 3: Theories of Adolescent Smoking Behaviour

Chapter 2 presented a wide and varied range of factors which have been shown to be associated with adolescent smoking. A number of theories of adolescent smoking organise these factors into coherent structures and attempt to provide predictive models of smoking behaviour based on proposed theoretical concepts. As Petraitis et al. point out in their comprehensive review of this literature, these theories are as diverse as the different factors that they combine, with each focusing on a different key central theme and developed by theorists from a range of disciplines, including sociology, social psychology, and individual psychology (Petraitis et al., 1995).

Petraitis et al. (1995) grouped 14 different theories of adolescent smoking into 5 types:

1. Cognitive-affective theories, which focus on the cognitive process of decision making, based on costs and benefits of performing a behaviour, with key roles for cognitions, perceptions, evaluations and attitudes. Other factors, such as social influence are also important, but are processed through these cognitive channels. Cognitive-affective theories include the Theory of Reasoned Action (Ajzen & Fishbein, 1980) and the Theory of Planned Behaviour (Ajzen, 1991; Ajzen, 1988).
2. Social learning theories, which highlight the function of role models in determining behaviour. Cognitions are not unimportant in these theories but they are formed from observing others. Theories in this category include Social Learning Theory (Akers, 1977) and Social Cognitive Theory (Bandura, 1986).
3. Conventional commitment and social attachment theories, which focus on emotional attachments to peers and the conventional bonds adolescents want to conform or rebel against. Theories such as Social Control Theory (Elliot,

Huizinga, & Menard, 1989; Elliot, Huizinga, & Ageton, 1985) and the Social Development Model (Hawkins & Weis, 1985) fall in this category.

4. Theories in which intrapersonal characteristics play key roles, such as self-esteem, coping, and personality traits. Self-derogation theory (Kaplan, Martin, & Robbins, 1984; Kaplan, Martin, & Robbins, 1982; Kaplan, 1975) and the Social Ecology Model (Kumpfer & Turner, 1990) are examples here.
5. Theories that integrate cognitive-affective, learning, commitment and intrapersonal constructs. The main multivariate theory which has tried to encompass the whole range of types of predictors of adolescent smoking behaviour is Problem Behaviour Theory (Jessor, Donovan, & Costa, 1991; Jessor & Jessor, 1977), although others include Peer Cluster Theory (Oetting & Beauvais, 1987), Sher's Model of Vulnerability (Sher, 1991) and the Domain model (Huba & Bentler, 1982).

This chapter describes the key constructs in 4 theories which are most frequently utilised and relevant to health psychology; the Theory of Planned Behaviour (TPB), Social Cognitive Theory (SCT), Problem Behaviour Theory (PBT), and the Triadic Theory of Influence (TTI) (Flay & Petraitis, 1994). Other health psychology theories, such as the Health Belief Model have been used in this field, but can be subsumed by the TPB (Petraitis et al., 1995), likewise the Attitudes-Social influences-Efficacy (ASE) model is also similar to the TPB (Harakeh, Scholte, Vermulst, de Vries, & Engels, 2004). The Transtheoretical Model has been used to look at smoking initiation, but applicability to this area appears limited (Kremers, de Vries, Mudde, & Candel, 2004; Aveyard, Lancashire, Almond, & Cheng, 2002; Aveyard, Sherratt, Almond, Lawrence, Lancashire et al., 2001). Finally, a new theory of motivation (West, 2006b) is described and applied to adolescent smoking behaviour.

3.1 The Theory of Planned Behaviour

The Theory of Planned Behaviour (Ajzen, 1991; Ajzen, 1988) views smoking behaviour as determined by cognitive processes and evaluations. According to the TPB, intentions to perform a behaviour determine whether that behaviour is performed or not. In turn intentions are driven by 3 constructs: 1) attitudes towards smoking, based on evaluated costs and benefits of the consequences of smoking and the extent to which individuals value these costs or benefits; 2) Beliefs regarding social norms, i.e. the degree to which it is perceived other people want you to smoke or not smoke, and the extent to which an individual wants to comply with these views; and 3) Perceived Behavioural Control (PBC), which was added to create the new TPB from its forerunner, the Theory of Reasoned Action (Ajzen & Fishbein, 1980). Ajzen recognised that an intention to perform a behaviour does not always translate to behaviour if there are personal or situational barriers that prevent the behaviour occurring as intended. PBC is similar to self-efficacy and allows a perception of how easy or difficult performing a behaviour is likely to be, and can either directly predict behaviour or work indirectly through intention.

TPB-based questionnaires have been shown to predict intention and behaviour, including smoking onset among young people, to some degree (Armitage & Conner, 2001). However, a large number of other variables not included in the original TPB structure are found to improve prediction, e.g. Socioeconomic status, extraversion, self-esteem, parent relationships and behaviour, and anticipated regret (Conner, Sandberg, McMillan, & Higgins, 2006; Wilkinson & Abraham, 2004; Harakeh et al., 2004; Conner & Armitage, 1998). A further criticism of theories such as the TPB is that they only really tackle the proximal causes of behaviour, with distal causes such as environment playing less of a role (Petraitis et al., 1995). It has been argued that distal causes influence behaviour through the factors outlined in the TPB, but research suggests that this is not always the case (Harakeh et al., 2004; Petraitis et al., 1995).

3.2 Social Cognitive Theory

Social Cognitive Theory (Bandura, 1986), which builds upon Social Learning Theory, claims that smoking behaviour is driven by both the observation of smoking and smoking related discussion by role models, such as friends and family, as well as the observed costs and rewards of smoking. The smoking behaviour of these role models is imitated and may then be socially reinforced, resulting in expectations about the positive social and eventually physiological consequences of smoking. These are evaluated (as in the cognitive theories) and if the perceived benefits outweigh the costs, smoking is a likely outcome. Social Cognitive Theory also adds a central role for self-efficacy in that the observation of role models can provide knowledge and skills required to perform the behaviour.

Social Cognitive Theory has been applied in a number of studies of adolescent smoking (Kinzie, 2005). However, the association between adolescent smoking and peer smoking is not straightforward; adolescents not only learn from and imitate their smoking peers, but adolescents who smoke are more likely to associate with other adolescents who smoke. A criticism of Social Cognitive Theory is that it is unable to account for why adolescents associate with peers who smoke in the first place (Petraitis et al., 1995).

3.3 Problem Behaviour Theory

Problem Behaviour Theory (Jessor et al., 1991; Jessor & Jessor, 1977) is a more comprehensive description of the variety of factors that influence adolescent smoking. A key premise of PBT is that adolescents prone to one problem behaviour, e.g. smoking, are prone to other problem behaviours and that problem behaviours such as smoking, drug use, and sexual activity are attractive to youth because they are accepted in adulthood and therefore associated with maturity. According to the theory susceptibility to problem behaviour is a result of both the person and the environment. Aspects of the person are divided into distal, intermediate and proximal factors. Distal factors are grouped into the 'personal belief structure' whereby adolescents are at risk of problem behaviour if they are socially critical and culturally alienated, have low self-esteem (hence feel have little to risk through deviant behaviours), and have an external locus of control. Intermediate factors are grouped into the 'motivational instigation structure' and adolescents are at risk if they value association with peers, desire independence from parents, and place little value on academic achievement. Proximal factors, or the 'personal control structure', include attitudes towards behaviour and analyses of the costs and benefits of deviant behaviours. The environment is also divided into distal and proximal factors. Distal factors include the degree of attachment to, and influence by, peers over the family. Proximal factors include social modelling of the behaviours of parents and peers, with problem behaviour more likely if friends perform the behaviour and parents and friends have positive attitudes towards the behaviour.

Problem Behaviour Theory was one of the first multivariate theories of experimental substance use and is still influential. However, it gives little weight to cognitive-affective influences, with specific beliefs seen as less important than the behaviour of role models and their opinions (Petraitis et al., 1995). Also, PBT doesn't provide a description of the mechanisms of indirect effects and some of the distal variables do not explain much unique variance (Petraitis et al., 1995). Furthermore, PBT is probably best at explaining initiation of smoking at early ages when it might most be considered a deviant behaviour (Hoffman et al., 2006).

3.4 The Theory of Triadic Influence

The Theory of Triadic Influence (Flay & Petraitis, 1994) was developed in conjunction with Petraitis, Flay and Miller's (1995) review of the theories of adolescent smoking. They took each of the concepts from these theories and structured them into a 3 by 3 (plus 1) matrix which consists of 3 types of influence (social, attitudinal and intrapersonal) and 3 levels of influence (ultimate, distal and proximal), plus immediate predictors of behaviour such as intention and trial behaviour. This incorporated each aspect of the 14 theories reviewed and recognised both the distal and proximal influences on behaviour (Flay, Petraitis, & Hu, 1999). The resulting theory formalised this structure into three streams of influence (cultural/attitudinal, social/normative and intrapersonal) that exist on several levels: ultimate (e.g. the cultural environment, the social situation and biology/personality); distal (e.g. opportunities, religion, others behaviour and attitudes, social bonding, social competence and a sense of self, as well as knowledge/expectacies, values/evaluations, perceived norms, motivation to comply, social skills and self-determination); and proximal (e.g. attitudes, social normative beliefs, self-efficacy/PBC, decisions/intentions, and experience of the behaviour). These streams cross over and interact with other streams through mediating variables and processes with no one path adequately explaining smoking behaviour, although some paths have received stronger support than others (e.g. social control and learning) (Flay et al., 1999). The TTI also states the importance of past behaviour and how this feeds back to influence the original causes of behaviour in a dynamic feedback loop, with past tobacco use being the best predictor of future use.

The TTI suggests that research needs to address smoking behaviour on a much wider scale, taking account of mediating variables and interactions as well as moderating variables, including more distal and ultimate influences and the impact of past behaviour as a feedback mechanism (Flay et al., 1999). The construction of the TTI provides a useful framework for modelling determinants of health behaviour (Wiefferink et al., 2006), but is not exhaustive and Schofield et al. found, in their investigation of the theoretical predictors of adolescent smoking, that adding constructs from self-categorization theory to the TTI improved model fit (Schofield, Pattison, Hill, & Borland, 2003).

3.5 Summary - theories of adolescent smoking

On the basis of Petraitis et al's (1995) theoretical overview of theories of adolescent smoking, Collins and Erickson empirically tested the difference between four well-used theories, including three of the four discussed above: the Theory of Planned Behaviour; Social Learning Theory; Social Attachment Theory; and Problem Behaviour Theory (Collins & Ellickson, 2004). They found that not every aspect of every theory was important, although the key construct was always maintained. In addition they suggested that different theories might be more useful for different aspects of smoking in adolescence and that the theories they reviewed showed a better fit for frequent smoking as opposed to smoking initiation, which they claim may be more of a 'random' process.

Theories of adolescent smoking behaviour have made a useful contribution to the prediction of adolescent smoking, to the development of interventions and to the further understanding and progression of the field of adolescent smoking. However, as the Theory of Triadic Influence suggests, and Collins and Erickson (2004) support, many of the theories of adolescent smoking overlap and, despite unique defining features, have often been used interchangeably. Another way to make sense of the development of adolescent smoking behaviour is to use a more general theory of motivation. West (2006b) has proposed such a theory and attempted to apply it to understanding addictive behaviours such as smoking.

3.6 A synthetic theory of motivation: PRIME Theory

The PRIME theory of motivation states that human motivation can be understood in terms of five interacting levels: Plans, Responses, Impulses/inhibitory forces, Motives and Evaluations (West, 2006b). Responses (i.e. the behaviour in question, in this context smoking a cigarette) result from the balance of impulses and inhibitions at any one moment. That balance is shifted on a moment to moment basis by even the smallest change in internal or external stimuli, which interact with dispositions. Dispositions develop as a dialectic process, beginning with inheritance and then following a path down a 'dispositional landscape' as experience influences future dispositions through three learning processes; habituation and sensitisation, associative learning, and memory. Dispositions to form impulses directly from stimuli can involve either habit (an impulse to act which results from learning and repetition) or instinct (unlearned reactions).

Impulses and inhibitions can also be indirectly influenced by motives. These are 'wants' (anticipation of pleasure and satisfaction) and 'needs' (anticipation of relief). Motives arise directly from reminders (activation of mental representations formed from prior learning), and indirectly from evaluations (beliefs). Identity (for example the view of oneself as a non-smoker or a risk taker) is an important source of evaluations, wants, and needs. Finally, responses can result from the effect of plans to act on wants or needs in the future. Plans are constructed although the want or need could be acted on immediately because: there is a belief that a goal is more likely to be achieved if they are acted upon in the future; the response is only relevant to the future; or there are higher priorities at the present time. An adolescent's disposition to smoke a cigarette at any one point, or to accept an offer of a cigarette, or buy cigarettes to smoke when none are available is therefore considered to arise as a function of a constantly changing balance in forces that promote smoking behaviour and those that inhibit it, coupled with learning and repetition of the behaviour once it has occurred for the first time.

The key elements of the theory are: 1) the importance of momentary impulses and inhibitions, 2) the importance of wants and needs as the conduit through which beliefs and plans translate into impulses and inhibitions, 3) the importance of identity as a source of wants and needs, and 4) the 'chaotic' nature of dispositional change, so that the way we respond in terms of beliefs, motives, impulses and inhibitions can change abruptly, often with minor triggers.

3.7 Conclusion

A number of authors conclude that future work in the area of adolescent smoking needs to be theory driven (Tyas & Pederson, 1998; Petraitis et al., 1995; Conrad et al., 1992). However, although the importance of the above theories to the field of adolescent smoking is recognised, a specific theoretical background has not been used in the construction of this thesis. When designed the HABITS study was not guided by any one particular theory and although theoretically based questions could be addressed, or attempts made to test the validity of a particular theoretical model, this work would be limited by addressing post-hoc issues which were not integrated into the initial design. Tests of the Theory of Planned Behaviour, for example, require specific items which were not factored into the HABITS questionnaire. The TTI suggests a large number of factors on several levels should be addressed to fully understand adolescent smoking behaviour, which have not been included in the design of the HABITS study. This is obviously a limitation of the HABITS study as the value of using theory to guide and develop studies is clear.

This thesis is not, therefore, based on any of the formulaic theories described above (although their value is recognised) but focuses on a broader thematic structure of the factors associated with adolescent smoking to try and further understanding of how and why these aspects of an adolescent's life can place them at risk of smoking behaviour. While doing this the theories described are kept in mind and referred to where appropriate. However, West's theory of motivation (West, 2006b), the basics of which make much sense in understanding smoking initiation as well as addiction, informs the final chapter on the development of a parsimonious model of vulnerability and trigger factors associated with smoking in adolescence.

Chapter 4: Aims and Methods

4.1 Background to the HABITS Study

A small number of early UK-based prospective studies have examined the association between smoking in adolescence and a range of social and psychological factors (Goddard, 1990; McNeill et al., 1988; Banks, Bewley, Bland, Dean, & Pollard, 1978). More up-to-date prospective studies include: work on a Sussex based cohort of 3500 school children which focused on the construction of identities in relation to smoking (Lloyd et al., 1998); the West of Scotland Teenage Health study (Sweeting & West, 2000) which has explored smoking and other health behaviours among 2309 pupils at age 11, 13, and 15 (although in a non-ethnically diverse sample); and a Leeds based study (Conner, 2004) which was recently extended to assess the development of smoking behaviour longitudinally. This last study looked at the ability of variables taken from the theory of planned behaviour (TPB) to predict smoking behaviour (e.g. attitudes, subjective norms and perceived behavioural control) and assessed students between 11-12 and 12-13 and then two years later at age 15-16.

The HABITS study was designed to extend the understanding of the development of adolescent health behaviours in the UK, how smoking, diet and exercise behaviours change over the period of adolescence, and the factors which predict and are associated with these behaviours. The study, led by Professor Jane Wardle and Professor Martin Jarvis and run by a team of researchers at the Health Behaviour Unit, University College London, was funded by Cancer Research UK and the Department of Health. The HABITS study addresses some of the limitations of the above studies by: assessing a range of ethnic and socioeconomic groups; following-up adolescents annually across the five years of secondary schooling; and including a wide range of behaviours and potential predictors of those behaviours, as well as a number of objective measures - salivary cotinine, height, weight, and waist circumference.

5863 students from 36 schools in South London took part in the study. They were visited annually from age 11 to age 16 during the period 1999 to 2003. Three behaviours were of particular focus; diet, exercise, and smoking. Demographic, social, developmental, anthropometric and psychological variables were included to help understand the mechanisms behind the intra- and inter-person variation in these behaviours. This large study consequently provides an important resource from which a greater understanding of the process of adolescent smoking can be gained. Data from the HABITS study are therefore used in this thesis to address questions arising from the literature review in the opening chapters in order to understand in more depth and clarity the process of becoming a young smoker.

4.2 Aims

The aims of the research described in this thesis are:

1. To characterise the patterns of smoking development across time from age 11 to age 16
2. To identify factors that place adolescents at greater risk for smoking uptake focusing on:
    a. Sociodemographic factors (e.g. deprivation, ethnicity)
    b. Social and familial factors (e.g. smoking by family and friends)
    c. Psychological factors (e.g. stress, personality, attitudes to smoking)
    d. Anthropometric factors (e.g. BMI)
3. To develop a population level model of smoking behaviour among adolescents based on an individual level theory of motivation

Achievement of these aims will provide a greater understanding of the process by which adolescents take up smoking and how this behaviour develops and is influenced over time. This knowledge can be used to inform the development of targeted intervention studies, aid those working in smoking cessation to deliver effective programmes and advice, and provide further questions for research.

4.3 Methods

4.3.1 School Sampling frame

The HABITS sample was drawn from a sampling frame designed to give a socioeconomically diverse sample with an overrepresentation of ethnic minority students. Schools were sampled by school type and location (independent (private) schools, outer London state (public) schools and inner London state (public) schools) and gender (boys' schools, girls' schools, mixed schools), creating a three by three sampling frame with nine cells. The catchment areas for inner London state schools include areas of high deprivation, whereas more affluent suburbs typify the outer London area. In addition to ensuring a wide range of socio-economic groups this sampling factor also resulted in a high representation of Black and Minority Ethnic groups; in the 1991 census, inner London boroughs reported 38% of children (aged 5-15) as not white, whereas in outer London boroughs only 14% of children were not white (Wardle, Jarvis, Steggles, Sutton, Williamson et al., 2003).

To select participating schools a list was compiled of all secondary schools in South London boroughs taking students from the age of 11-16. Four schools were then drawn at random from each of the nine cells. Each school was approached and if a school declined to take part a substitute was drawn randomly from the remainder of the list until all cells were complete. Due to pressures on staff time or recent staff turn-over 25 schools declined to take part; 5 independent schools, 2 inner London schools and 18 outer London schools. Of these 13 were girls' schools, 4 were boys' schools and and 8 were mixed gender schools.

4.3.2 Procedure

Researchers liaised with the 36 schools, arranging appropriate times for the research team to visit each class in Year 7 (age 11-12, the first year of secondary school), a process repeated each subsequent year through to Year 11 (age 15-16, the final year of secondary school). Schools were visited in two waves, 18 schools in each wave, but due to the timing of the start of the study the first wave was collected in the spring term of 1999 (January) and the second wave in the Autumn term of 1999 (September). This meant that the pupils in the second wave of schools (academic year September 1999 to summer 2000) were slightly younger than, and technically one academic year below, those in the first wave (academic year September 1998 to summer 1999). Prior to the visits parental consent letters were sent home via the school, informing parents of the study and giving them the option to exclude their child from the project (see Appendix I).

Questionnaire packs were compiled before school visits and contained:

1. A gender specific questionnaire booklet with a unique identifier
2. A separate cover sheet to be completed with name, address, school and consent to participate, with same unique identifier
3. A test tube containing a cotton wool roll to collect saliva for cotinine assay, also labelled with same unique identifier

4. A quiz sheet for quick finishers/those not participating, which included help-line numbers in the later years of the study

Each pack was then sealed in an A4 envelope and marked appropriately as 'Girl' or 'Boy'.

Students were first assessed in Year 7, the start of secondary schooling (age 11-12), and then yearly assessments were carried out until participants were in Year 11, their final year of secondary school (age 15-16). I was involved in the final two years of this data collection. School visits took place during lesson time and were carried out with whole classes of students. Lesson lengths varied from school to school but were approximately an hour in duration, and double lessons were taken where lessons were considered to be too short to enable completion of the questionnaire by students. All students in the classroom at each data wave were eligible to take part, therefore the total sample size increased as new students entered the schools. In each class, a researcher explained the purpose and procedures of the study, as well as informing students of their right to not participate and to withdraw from the study once it had started. Pupils were asked to complete the separate cover sheet, with a unique identifier number, detailing their name, address, postcode and school, and confirming their consent to participate (See Appendix II). This sheet was stored separately, and used to track students throughout the study. Students then completed the questionnaire, with the researchers present to provide assistance where required (e.g. explaining questions, helping those with low reading ability, ensuring quality of responses). Simultaneously students had their height, weight, waist and height measured by trained researchers out of sight of the class using Tanita Scales and Leicester Stadiometers. Waist measurements were taken using a non-elastic tape. Students took their questionnaires with them to be weighed and measured and their unique identifying number was recorded against their measurements. Students were asked to insert the cotton wool roll provided between their teeth and cheek for a period of 10 minutes and were informed that this was to provide a saliva sample for cotinine assay, which would give an indication of the level of nicotine present in their body. Students placed the cotton wool rolls back into the ID labeled test tubes which were then collected by the researchers. After all aspects of the study had been completed, students were asked to seal their questionnaires and cover sheets in their envelope and return them to the researchers.

After the classroom visit, each student's data from their cover sheets and questionnaires were entered into SPSS alongside their unique identifier (10% were double-checked). Names and addresses were used to match student data with previous years data and a 'master' ID number allocated to each student (their unique identifier number the first year they took part in the study). After matching, the data were merged into one large file and all names and addresses removed and stored on a separate CD. Using syringes, saliva from the cotton wool rolls was squeezed back into the identifier labeled test tubes to be sent for analysis by gas chromatography (Feyerabend & Russell, 1990). Once cotinine values for each unique identifier were produced by the lab these were also merged into the data set, which was then extensively cleaned.

4.3.3 Ethics

The study was granted ethical approval by the University College London/University College London Hospital Medical Ethics Committee.

4.3.4 Participants

Because of pupil movement into and out of the study schools during the study period, a total of 5863 students participated in the study at some point. Of the 5120 students registered at the schools at baseline 4319 students (84%) participated in Year 7. In Year 8, 4400 took part, 4247 in Year 9, 4167 in Year 10 and 3748 in Year 11 when, due to increased absence due to exam and out-of-school commitments and the loss of two schools to data collection, the response rate was slightly reduced. As with any longitudinal study there was a degree of attrition; 36% of students (n = 2134) were present at every wave of data collection, 58% (n = 3397) were present for 4 or more years, 73% (n = 4303) for 3 or more years and 88% (5184) for 2 or more years. Reasons for non-participation were absence from class and refusal to partake on the part of either the student or parent. Where possible, schools were revisited when extremely low attendance occurred.

4.3.5 Questionnaire Design

Questions included validated measures from a number of sources, adapted where required. A number of questions were also designed specifically for the study. Core variables were measured at each year, and additional questions were asked at one or more years of the study. A copy of the questionnaire at Year 11 is included in Appendix III, although there were slight variations in content at each study year.

Questions fell into the following areas: demographic variables, smoking, food choice, physical activity, dieting, body image, psychological variables and physical development (puberty). Questions on smoking and their sources are listed in Table 4.1. Further description of these and other variables used will be given in later chapters.

Table 4.1 Sources of smoking questions used in the HABITS study

Question	Source
All participants	
Close friends who smoke Mother and step-mother smoking Father and step-father smoking Parental reaction to smoking Sibling smoking	Smoking among secondary school children in 1996, Office of National Statistics (Jarvis, 1996)
Friends smoking	Created for study
Smoking intention	Youth Risk Behaviour Surveillance System Questionnaire (YRBSSQ), (Kann, Kolbe, & Collins, 1993)
Smoking attitudes	Smoking among secondary school children in 1996, Office of National Statistics (Jarvis, 1996)
Smoking status	From UK National Smoking Surveys: Smoking, Drinking and Drug Use among Young Teenagers in 1998 (Goddard & Higgins, 1999)
Smokers only	
Age first smoked	(created for study)
How much liked first cigarette	(created for study)
Effects of first cigarette Was first cigarette inhaled	Adapted from list in (Hirschman, Leventhal, & Glynn, 1984)
Desire to try another cigarette	(created for study)
How much of first cigarette smoked	(created for study)
How long before tried another cigarette	(created for study)
Current smokers only	
Cigarettes smoked in life When last smoked a cigarette	Smoking among secondary school children in 1996, Office of National Statistics (Jarvis, 1996)
Time after waking smoke first cigarette	(Bridgwood, Lilly, Thomas, Bacon, Sykes et al., 2000)
Effects of smoking Presence of cravings Giving up Brand smoked	From UK National Smoking Surveys: Smoking, Drinking and Drug Use among Young Teenagers in 1998 (Goddard & Higgins, 1999)

4.3.6 Data Analysis

Each of the following chapters uses slightly different statistical methodology to address the particular questions concerned. However there are two points worth noting here regarding the analysis of data using the HABITS dataset; the issue of missing data and the multi-level structure of the data set.

4.3.6.1 Missing data

As with all longitudinal studies there is a certain degree of attrition at each study year. This is a potential problem on two counts. First, in order to make valid longitudinal comparisons of data from one year to the next, only students with complete data at the study years in question can be included. This obviously greatly reduces the available numbers of students. The second issue is that the students missing at one or more years may not be typical of the sample as a whole as students absent from class on days of assessment are most likely to be: truanting, rather than absent for any other reason; and different from those present in class in terms of a number of characteristics, including smoking (Bovet, Viswanathan, Faeh, & Warren, 2006; Michaud et al., 1998; Conrad et al., 1992). This introduces a level of bias into analyses as results will not necessarily generalise to all students, especially those of particular interest in this thesis, young smokers (who may be more likely to be absent from class). One option to avoid problems of missing data is to impute values. This is a technique often employed when using continuous measures such as scores and BMI. However, the issue is more complicated for a variable such as smoking which is both discrete and fluctuating, especially during adolescence (Goddard, 1990), and predicting missing data values is consequently problematic. It was decided therefore to refrain from imputing missing values. Rather, where analyses required that the same people at each year be included the reduced data-set resulting from this restriction was used, and an indication of how results would differ if a more complete data-set were employed has been presented. However, as stated, this will remove from analyses a disproportionate number of smokers, the participants of particular interest. Therefore, the maximum number of students that could be included were entered into analyses where analyses allowed. Another option is to 'weight' missing data so it approximates a pre-defined sample, for example adjusting the proportion of individuals from a particular ethnic group in line with what might be expected from that population. However, this strategy is not without limitation and correcting for potential bias is necessarily associated with a loss of precision (Korn & Graubard, 1999). It was decided therefore that, given the sample is not intended to be representative of the population, precision would be valued over bias and weighting was not performed.

4.3.6.2 Data structure

All multi-site studies where participants are drawn, in this case, from a number of different schools, suffer from potential problems due to the clustered nature of the data. Pupils from one school are more likely to be similar to each other than they are to pupils from a different school, due to the type of pupil that particular school attracts, the area a particular school is in, or the particular effects that a school has on pupils' behaviour (Merlo, Chaix, Yang, Lynch, & Rastam, 2005a). Differences observed between pupils may therefore be due to a contextual, as opposed to an individual, level effect. This, as well as providing interesting empirical questions in itself (Merlo, Yang, Chaix, Lynch, & Rastam, 2005b; Duncan, Jones, & Moon, 1996), is of concern as clustering results in underestimated standard errors which, if ignored, may result in an increased risk of finding differences and relationships where none in fact exist (a type I error) (Paterson & Goldstein, 1991). To avoid this, multi-level modelling procedures which allow for variation at both the individual and school level can be used to ensure correct, unbiased standard errors (Merlo et al., 2005b; Paterson & Goldstein, 1991).

Multi-level analyses have therefore been used for all analyses run using HABITS data. Programs such as MLwiN, MPlus, STATA, and more recently SPSS, can take account of school clustering. MLwiN is one of the most comprehensive packages and this program was used in early analyses in Chapter 8. However, final analyses used mixed model procedures in SPSS which also take account of clustering and produced similar results to those found using MLwiN. For dichotomous outcomes complex samples logistic regression in SPSS has been used, which when checked provided identical results to complex survey procedures in STATA. However, the school clustering effect in HABITS is actually quite small, with Intra-Class Correlations between school and current smoking ranging from 0.0004 to 0.049, and with a mean of 0.022 (intraclass correlations of 0.15, 0.10, and 0.05 have been described as 'large', 'medium, and 'small' respectively (Zyzanski, Flocke, & Dickinson, 2004)). This implies that the smoking behaviour of students within schools is not as homogeneous as might be expected and therefore the use of multi-level analysis is less critical (Merlo et al., 2005a). The general trend throughout this thesis has therefore been to present traditional methods of analysis, although multi-level analyses have also been run and their similarity to main findings noted.

Chapter 5: Smoking levels and sociodemographic factors

5.1 Introduction

As described in Chapter 1, though smoking rates have declined slightly in the adult population, young people are still starting to smoke and most smokers first try smoking before the age of 18 (Goddard, 2006). The National Statistics Smoking Drinking and Drug use (SDD) reports provide an annual update on smoking prevalence among adolescents in England, and show a slight decline in prevalence of ever smoking in recent years, although levels of regular smoking have stayed fairly stable. The HABITS study is similar in methodology to these surveys, it is carried out in a classroom setting and uses the same standard UK smoking question. At the equivalent years the HABITS study schools were visited SDD data show that 20% of 11 year olds had ever smoked (20% of boys and 19% of girls) and 1% of 11 year olds were smoking regularly (1 or more cigarettes a week) (Boreham & Shaw, 2001). By age 15, 64% of students had ever smoked, 59% of boys and 70% of girls, with 22% of students smoking regularly, 18% of boys and 26% of girls (Boreham & Blenkinsop, 2004).

This chapter describes the smoking prevalence of adolescents at each year of the HABITS study. Although this is important data to present in order to understand the smoking behaviour of the HABITS population, prior to examining the factors associated with this smoking, the HABITS sample is not representative of the population as a whole. This data is therefore not intended to provide valid rates of adolescent smoking prevalence as the SDD surveys are able to provide this data on a much larger scale. Rather, being a cohort study, the development of behaviour from age 11/12 to age 15/16 is of particular interest, whereas the SDD surveys collect cross-sectional data only.

The HABITS study is also ideally placed to examine the smoking behaviour of particular sub-groups of students. As discussed in Chapter 2, a number of sociodemographic factors are associated with adolescent smoking, notably gender, deprivation and ethnicity. Gender differences are particularly stark in the UK (Amos & Bostock, 2007) and the data from the SDD surveys confirm that although boys tend to start smoking at an earlier age than girls, girls quickly overtake boys and show higher rates of smoking than boys from age 13/14 upwards.

UK studies of ethnic differences in smoking behaviour have been limited by small numbers, although White adolescents consistently show higher levels of smoking than most other Black and Ethnic Minority groups (Fuller, 2006; Viner et al., 2006; Sprogston & Mindell, 2006; Rodham et al., 2005; Markham et al., 2004; Currie et al., 2003; Best et al., 2001; Nazroo et al., 1999). Intensity of smoking behaviour has also been shown to differ by ethnic group, for example ever smoking is typically high among Black adolescents, but more regular smoking is less prevalent than in other groups (Ellickson et al., 2004; Best et al., 2001). There are also important gender differences between ethnic groups and although overall girls tend to smoke more than boys, this is not always the case, particularly among South Asian girls (Markham et al., 2004; Bush et al., 2003). However, it is worth noting that there has been recent concern that smoking among South Asian girls is increasing (ASH Scotland, 2005; Bush et al., 2003).

The relationship between SES and smoking in adolescence is less clear than it is in adults with some studies finding an association between low SES (high deprivation) and increased smoking (Chen et al., 2002; Tyas & Pederson, 1998; Conrad et al., 1992), and others finding no clear relationship (Tuinstra et al., 1998; Glendinning et al., 1997;

McNeill et al., 1988). This may be due to the definition of smoking used, as Sweeting and West (2001) found a negative association between level of deprivation and occasional smoking, while a positive association was observed between deprivation and more regular smoking behaviour.

It is important to understand who smokes and how much in order that smoking prevention efforts can be appropriately directed and suitably targeted towards those people most at risk. The HABITS study was designed to be socioeconomically and ethnically diverse to allow such questions about deprivation and ethnicity to be addressed. This chapter presents basic prevalence data overall, and by gender, ethnicity and deprivation status, outlining differences in these groups and setting the scene for the rest of this thesis.

The specific questions addressed are:

1. What is the level of smoking observed in the HABITS data set?
    a. How many students reported smoking at different intensities at each year?
    b. How does self reported smoking compare with cotinine values?
2. How does smoking vary by the sociodemographic factors:
    a. Gender?
    b. Ethnicity?
    c. Deprivation?

5.1 Methods

5.1.1 Population

This chapter describes smoking behaviour and the cross-sectional association of sociodemographic factors with smoking at each study year. A total of 4273 students provided smoking data in Year 7, 4292 in Year 8, 4142 in Year 9, 4136 in Year 10 and 3712 in Year 11.

5.1.2 Measures

5.1.2.1 Smoking status

At each study year participants were asked which of the following statements best described them: 'I have never smoked'; 'I have only ever tried smoking once'; 'I used to smoke sometimes but I never smoke cigarettes now'; 'I sometimes smoke cigarettes now but I don't smoke as many as one a week'; 'I usually smoke between one and six cigarettes a week' or; 'I usually smoke more than six cigarettes a week'. A second 'check' question asked 'Just to check, please tick the box next to the statement which best describes you again: I have never tried smoking a cigarette, not even a puff or two; I did once have a puff or two of a cigarette, but I never smoke now or; I do sometimes smoke cigarettes'. After adjusting responses in relation to the check question, students were classified as never smokers, one time triers, ex-smokers, sometimes smokers, those smoking one to six cigarettes a week, and those smoking more than six cigarettes a week.

Additionally, for the purpose of some analyses, the dichotomous variables 'ever smoking', 'current smoking', 'regular smoking' and 'daily smoking' were also created. The variable 'ever smoking' splits participants at each year between those who reported never smoking ('never smokers') and those reporting experience with cigarettes, at any level ('ever smokers'). 'Current smoking' splits participants at each year into two groups: those who had never tried smoking, had tried only once, or reported being an ex-smoker ('non-current smokers'); and those who were smoking currently, i.e. sometimes, one to six cigarettes a week or more than six cigarettes a week ('current smokers'). 'Regular' smoking splits participants between those who report smoking one or more cigarettes a week ('regular smokers'); and those who smoke less than this, or not at all ('non-regular smokers'). Finally, 'Daily smoking' splits participants at each year into: those who reported smoking more than six cigarettes a week ('daily smokers'); and those who smoked less than this, or not at all ('non-daily smokers').

5.1.2.2 Cotinine

Each year pupils provided a saliva sample (a cotton wool swab rotated round the mouth for a number of minutes) to be sent for cotinine assay. Cotinine is a derivative of nicotine produced by the body when nicotine is present; it can detect the presence of both passive and personal smoking for a period of approximately two days prior to assessment (SRNT Subcommittee on Biochemical Verification, 2002). Saliva samples were analysed from all students in Years 7, 8 and 11 and just for those who self-reported current smoking in Years 9 and 10. Therefore, for three out of five years self-reported never smoking could be biologically validated. Where responses of never smoking were inconsistent with cotinine values suggesting recent smoking (with a value of cotinine of 15ng/ml indicative of recent smoking behaviour, (McNeill, Jarvis, West, Russell, & Bryant, 1987)) responses were altered to show ever smoking. Similarly where non-current smoking was self-reported and cotinine values suggested recent smoking behaviour, values were also adjusted. Regular and daily smoking were not cotinine adjusted, as this may have resulted in participants with a high cotinine level who only smoke sometimes being wrongly categorised as regular or daily smokers.

5.1.2.3 Sociodemographic factors

Gender

At each year participants were given gender appropriate questionnaires and were also asked to confirm whether they were male or female. The total sample consisted of 59% Boys (3459) and 41% Girls (2403), with one participant not reporting their gender.

Deprivation

Level of Deprivation was acquired by matching student reports of postcodes with enumeration district census data from 1991 to derive Townsend scores. Townsend scores give an indication of area level deprivation based on car ownership, housing tenure, unemployment and overcrowded living conditions (Townsend, Phillimore, & Beattie, 1998) found to accurately reflect material disadvantage (Morris & Carstairs, 1991). Scores are based around a national average of zero with negative values representing below-average levels of deprivation, and positive values representing higher than average deprivation. Scores in the HABITS sample ranged from -5.58 to 11.08 with a mean of 1.77 and standard deviation of 3.38, indicating a higher level of deprivation than observed in the UK as a whole. To ensure these scores were representative of the South London population that the data were sampled from, the scores were standardised according to the distribution of Townsend scores across the South London area (no attempt was made to ensure the data were nationally representative as the aim was to ensure a socioeconomically and ethnically diverse sample). To achieve this Townsend scores from each enumeration district across South London were collated and split into five quintiles of deprivation, from least deprived to most deprived. These cut-points were then mapped onto the HABITS Townsend scores so that each student was placed into one of these five levels (by a former HABITS postdoctoral researcher prior to the commencement of this PhD). Table 5.1 shows the percentage of students in each of these 5 quintiles in this sample and the comparatively high number of students in the most deprived quintile indicates that the HABITS sample was disproportionately more deprived than the South London sample as a whole.

Table 5.1 Mean Townsend Scores of the HABITS sample by quintile groups standardised to the South London Area

	n	Mean Townsend Score	Standard Deviation
Least Deprived	1167	-3.20	0.82
Quintile 2	985	-0.92	0.59
Quintile 3	978	1.21	0.62
Quintile 4	1025	3.39	0.67
Most deprived	1481	6.74	1.33

It should be noted that Townsend scores were used to define deprivation rather than other available methods, such as student report of housing tenure and possession of items such as a dishwasher, microwave or computer, as these latter questions were found to be subject to unreliable student report. Although both methods were shown to correlate overall, the more reliable postcode method has been preferred.

Ethnicity

Ethnicity was assessed initially with the question 'would you say you are. . .White, Black, Asian, mixed, or other', simplified from categories used in the 1991 census. In the penultimate year of the study a more comprehensive set of responses taken from the 2001 census allowed students to classify themselves into more distinct ethnic groups. This was used to adjust earlier responses where necessary and create a definitive ethnicity variable. Table 5.2 shows the complete set of ethnicity groups reported in Year 10 when the 2001 census question was included. For the majority of analyses these groups were amalgamated with previous responses and categorised into 'White' (56.7%, 3324) 'Black/mixed Black' (25.3%, 1482) 'Asian/mixed Asian' (10.7%, 627) and 'other' ethnicities (4.6%, 271). The 'other' category includes individuals who cannot be placed in one of the first three categories, for example, those stating their ethnicity as Mediterranean, Hispanic or South American and those reporting a variety of mixed ethnic backgrounds and for this reason have been excluded from analyses except where ethnicity has been used as a control factor.

Table 5.2 Ethnic distribution of the HABITS sample as defined by the 2001 census categories

	%	n
Black Caribbean	10.5	432
Black African	10.3	422
Black Other	1.8	73
White British	49.5	2034
White European	4.9	203
White Other	3.2	131
Asian Indian	3.1	128
Asian Pakistani	1.1	44
Asian Bangladeshi	1.4	56
Asian Other	2.7	109
Mixed White and Black Caribbean	3.4	140
Mixed White and Black African	1.6	64
Mixed White and Asian	0.9	36
Mixed Other	2.8	115
Chinese	1.3	55
Other	1.6	64

5.2 Results

The full smoking status data of the whole sample at each study year, and also split by gender, is shown in Table 5.3. At the beginning of the study smoking levels were low, with less than 1% of participants smoking one to six cigarettes, or more than six cigarettes a week. Rates rose with each year, although smoking more than six cigarettes a week did not increase dramatically until Year 9 or 10. The number of ex-smokers also increased and, by the end of the study, as many students reported that they used to smoke as were daily smokers. The percentage of students reporting having tried smoking only once remained fairly constant across the five years, although movement in and out of this category will have occurred. By age 16 only 37% of students, 40% of boys and 34% of girls, had no experience with cigarettes. This is comparable with data from the 2002 SDD Survey (Boreham & McManus, 2003) where 37% percent of 15 year old students, 42% of boys and 32% of girls, reported never smoking. It is slightly lower than the young person boosted Health Survey for England data in the same year where 53% of boys and 44% of girls aged 15 reported never smoking (Sprogston & Primatesta, 2003). The greater proportion of never smokers in the Health Survey for England than both SDD data and that seen in the HABITS study is to be expected given the data were collected in a home environment.

Table 5.3 Smoking status in the total sample and split by gender at each study year, percentage (n)

	Never smoked	Tried once	Used to smoke	Smoke sometimes	Smoke 1-6 a week	Smoke > 6 a week
Year 7						
Boys	74.9 (1905)	18.6 (474)	4.2 (108)	1.7 (43)	0.4 (9)	0.2 (4)
Girls	80.7 (1396)	14.5 (250)	2.4 (41)	1.6 (28)	0.5 (8)	0.4 (7)
Total	77.3 (3301)	16.9 (724)	3.5 (149)	1.7 (71)	0.4 (17)	0.3 (11)
Year 8						
Boys	64.0 (1602)	22.7 (569)	6.1 (153)	4.4 (109)	1.9 (47)	0.9 (22)
Girls	63.1 (1130)	21.2 (380)	6.2 (111)	5.9 (105)	2.2 (40)	1.3 (24)
Total	63.7 (2732)	22.1 (949)	6.2 (264)	5.0 (214)	2.0 (87)	1.1 (46)
Year 9						
Boys	54.2 (1306)	23.5 (565)	8.8 (211)	7.5 (180)	3.1 (75)	3.0 (72)
Girls	50.6 (877)	20.8 (361)	10.5 (182)	10.0 (174)	4.4 (77)	3.6 (62)
Total	52.7 (2183)	22.4 (926)	9.5 (393)	8.5 (354)	3.7 (152)	3.2 (134)
Year 10						
Boys	44.9 (1065)	22.3 (528)	11.3 (267)	12.4 (295)	3.6 (85)	5.6 (133)
Girls	40.8 (720)	21.0 (371)	10.3 (182)	14.6 (257)	5.0 (88)	8.2 (145)
Total	43.2 (1785)	21.7 (899)	10.9 (449)	13.3 (552)	4.2 (173)	6.7 (278)
Year 11						
Boys	39.7 (844)	21.4 (456)	10.0 (212)	13.4 (286)	5.2 (111)	10.3 (219)
Girls	34.3 (543)	22.0 (349)	10.8 (171)	15.7 (248)	5.9 (93)	11.4 (180)
Total	37.4 (1387)	21.7 (805)	10.3 (383)	14.4 (534)	5.5 (204)	10.7 (399)

5.2.1 Ever, current, regular, and daily smoking

Grouping the full smoking status variables above into the dichotomous variables ever, current, regular, and daily smoking shows that at Year 7 22.7% of participants had ever tried smoking, although only a small number reported current smoking; 2.3% (n=99) reporting smoking currently, 0.7% (n = 28) smoking regularly and even less reporting smoking daily, 0.3% (n = 11), (see Table 5.4). Smoking levels increased at each year and by Year 11 (age 15/16) 62.6% of students had ever tried a cigarette, 30.6% reporting current smoking, 16.2% (603) smoking regularly and 10.7% (n=399) smoking daily.

Ever smoking is obviously cumulative across the five years and provides an indication of experimentation with smoking at any level, whereas current, regular and daily smoking are specific to each time-point. As levels of current smoking were very low at Year 7, ever smoking has been used in relation to this year group at some points during this thesis, otherwise current and regular smoking have largely been used as the variables of interest. The pattern of daily smoking has been described in this chapter but, as will be apparent, the numbers of these heavier smokers were small. Therefore this dichotomous daily smoking variable has not been used in the following chapters, although daily smoking will be used in reference to the full six category variable in some analyses.

Table 5.4 Ever, Current, Regular, and Daily smoking reported at each study year

	Ever smoking		Current smoking		Regular smoking		Daily smoking	
	%	n	%	n	%	n	%	n
Year 7	22.7	972	2.3	99	0.7	28	0.3	11
Year 8	36.3	1560	8.1	347	3.1	133	1.1	46
Year 9	47.3	1959	15.5	640	6.9	286	3.2	134
Year 10	56.8	2351	24.3	1003	10.9	451	6.7	278
Year 11	62.6	2325	30.6	1137	16.2	603	10.7	399

5.2.2 Cotinine validated smoking status

Cotinine validated and non-validated levels of ever and current smoking in Years 7, 8 and 11, when cotinine data were available, are shown in Table 5.5. It is apparent that at each of these years only a small number of self-reported never smokers have been re-categorised as ever smokers as a result of high cotinine values. These figures reassure that self-report of never smoking is very accurate (at least when students are told saliva samples will be tested). Self reported smoking status in ever smokers was less consistent with the cotinine validated variable, with 12, 14 and 22 participants who reported never smoking, smoking just once or being an ex-smoker reclassified as current smokers at Years 7, 8 and 11 respectively. It is possible that some of these students may have registered a high cotinine value due to a recent first experimentation with cigarettes. Therefore before the final cotinine validated current smoking variables were created those who reported having tried smoking only once, but whose cotinine value was above 15 ng/ml (n = 18) were examined. Where these students either reported first trying smoking at a younger age than the cotinine sample was taken, or responded that after their first try they had tried again after a certain period of time, a high cotinine score was taken as indicative of current smoking behaviour and responses were recoded. Two cases were consistent with having only tried smoking once, these cases were not recoded and were kept as non-current smokers.

Cotinine samples from all students were sent for analysis in Years 7, 8 and 11, and from those reporting current smoking only in Years 9 and 10. However, 500 Year 9 samples and 515 Year 10 samples from non-current smokers in these years were erroneously sent for assay by HABITS researchers. Of these, four samples in Year 9 and 17 samples in Year 10 were returned with a cotinine value over 15 ng/ml. As this information was available, these students were also reclassified as current smokers. Cotinine validated current smoking variables at each study year will therefore be used throughout the thesis.

Table 5.5 Cotinine validated (≥ 15 ng/ml) smoking status

	Ever smoking		Current smoking	
	Self-reported % (n)	Cotinine validated % (n)	Self-reported % (n)	Cotinine validated % (n)
Year 7	22.7 (972)	22.8 (976)	2.3 (99)	2.6 (111)
Year 8	36.3 (1560)	36.4 (1564)	8.1 (347)	8.4 (361)
Year 11	62.6 (2325)	62.8 (2330)	30.6 (1137)	31.2 (1159)

5.2.3 Smoking status by gender

Table 5.6 shows smoking rates at each study year split by gender. At Year 7 more boys reported having ever smoked than girls (25.2% compared with 19.4%), although a similar proportion of boys and girls reported current, regular and daily smoking (though numbers were very small). The gender gap in ever smoking closed by Year 8 when 36.1% of boys and 36.9% of girls had ever smoked, and girls were now more likely to be current smokers (9.6% compared with 7.6%). By Year 9, girls were more likely to have ever smoked than boys (49.4% compared to 45.8%). This difference, in both ever and current smoking, remained statistically significant to the end of the study, when 60.6% of boys had ever smoked compared to 65.7% of girls and 29.9% of boys and 33.0% of girls smoked currently. Although rates of regular and daily smoking appear higher among girls throughout most of the study, these differences were only significant at Years 9 and 10.

Table 5.6 Ever, Current, Regular and Daily smoking by gender at each study year

	Boys %(n)	Girls %(n)	χ^2 significance test
Ever smoking			
Year 7	25.2 (641)	19.4 (335)	$\chi^2(1) = 19.94$, $p<0.001$
Year 8	36.1 (903)	36.9 (661)	$\chi^2(1) = 0.32$, $p=0.575$
Year 9	45.8 (1103)	49.4 (856)	$\chi^2(1) = 5.26$, $p=0.022$
Year 10	55.2 (1310)	59.2 (1043)	$\chi^2(1) = 6.46$, $p=0.011$
Year 11	60.6 (1289)	65.7 (1041)	$\chi^2(1) = 10.29$, $p=0.001$
Current smoking			
Year 7	2.5 (63)	2.8 (48)	$\chi^2(1) = 0.36$, $p=0.549$
Year 8	7.6 (189)	9.6 (172)	$\chi^2(1) = 5.72$, $p=0.017$
Year 9	13.6 (328)	18.1 (314)	$\chi^2(1) = 15.61$, $p<0.001$
Year 10	22.3 (528)	27.9 (492)	$\chi^2(1) = 17.42$, $p<0.001$
Year 11	29.9 (636)	33.0 (523)	$\chi^2(1) = 4.14$, $p=0.042$
Regular smoking			
Year 7	0.5 (13)	0.9 (15)	$\chi^2(1) = 2.00$, $p=0.157$
Year 8	2.8 (69)	3.6 (64)	$\chi^2(1) = 2.32$, $p = 0.127$
Year 9	6.1 (147)	8.0 (139)	$\chi^2(1) = 5.77$, $p=0.016$
Year 10	9.2 (218)	13.2 (233)	$\chi^2(1) = 16.91$, $p<0.001$
Year 11	15.5 (330)	17.2 (273)	$\chi^2(1) = 1.99$, $p = 0.158$
Daily smoking			
Year 7	0.2 (4)	0.4 (7)	$\chi^2(1) = 2.45$, $p=0.117$
Year 8	0.9 (22)	1.3 (24)	$\chi^2(1) = 2.10$, $p = 0.148$
Year 9	3.0 (72)	3.6 (62)	$\chi^2(1) = 1.12$, $p=0.291$
Year 10	5.6 (133)	8.2 (145)	$\chi^2(1) = 11.07$, $p=0.001$
Year 11	10.3 (219)	11.4 (180)	$\chi^2(1) = 1.09$, $p = 0.297$

5.2.4 Smoking status by ethnicity

At each year of the study White participants were most likely to have ever tried smoking, followed by Black/mixed Black participants while Asian/mixed Asian participants were least likely to have ever smoked (see Table 5.7). Among White participants levels of both current, regular, and daily smoking increased rapidly from Year 8 onwards (Table 5.8, Table 5.9, Table 5.10). However, although Black/mixed Black participants showed similar smoking levels of ever smoking to White participants in the early years of the study, by Year 10 levels of ever smoking among Black/mixed Black participants did not increase at a similar rate to that of White participants. Furthermore, current, regular and daily smoking levels in the Black/mixed Black group were comparatively lower and by Year 11 levels were lower than among the Asian/mixed Asian group (see Tables 5.8-5.10).

When these results were also split by gender (see Table 5.7, Table 5.8, Table 5.9 and Table 5.10), White and Black/mixed Black groups showed a similar pattern with boys smoking more than, or to a similar extent to, girls in the early years of the study, but with girls overtaking boys in later years. Asian girls were less likely to have ever smoked than Asian boys throughout the study, but current smoking in this ethnic group was split fairly equally between boys and girls, and in Years 8, 9 and 10 was more common in girls (see Table 5.8). Numbers were low when looking at regular smoking, and even more so in terms of daily smoking, especially in the early years, but in general findings were the same as above. White boys and girls smoked regularly and daily to a greater extent than other ethnic groups, and more girls smoked regularly and daily than boys across ethnic groups.

Table 5.7 Ever smoking status by ethnicity and gender at each study year

	White	Black/mixed Black	Asian/mixed Asian	χ^2 significance test
Year 7				
Boys	26.6 (423)	25.0 (142)	14.7 (37)	$\chi^2(2) = 16.27$, $p<0.001$
Girls	19.9 (201)	19.6 (88)	6.9 (12)	$\chi^2(2) = 17.30$, $p<0.001$
Total	24.0 (624)	22.6 (230)	11.5 (49)	$\chi^2(2) = 32.88$, $p<0.001$
Year 8				
Boys	38.2 (595)	32.9 (189)	27.0 (71)	$\chi^2(2) = 14.90$, $p=0.001$
Girls	37.0 (370)	40.1 (208)	24.1 (46)	$\chi^2(2) = 15.67$, $p<0.001$
Total	37.7 (965)	36.3 (397)	25.8 (117)	$\chi^2(2) = 23.90$, $p<0.001$
Year 9				
Boys	48.1 (723)	43.3 (231)	33.9 (94)	$\chi^2(2) = 20.14$, $p<0.001$
Girls	52.4 (497)	49.9 (256)	30.3 (59)	$\chi^2(2) = 32.03$, $p<0.001$
Total	49.8 (1220)	46.6 (487)	32.4 (153)	$\chi^2(2) = 48.07$, $p<0.001$
Year 10				
Boys	58.9 (866)	51.1 (282)	41.3 (118)	$\chi^2(2) = 34.09$, $p<0.001$
Girls	64.7 (604)	58.1 (325)	35.1 (74)	$\chi^2(2) = 62.44$, $p<0.001$
Total	61.1 (1470)	54.6 (607)	38.6 (192)	$\chi^2(2) = 87.06$, $p<0.001$
Year 11				
Boys	64.8 (891)	51.8 (204)	49.4 (129)	$\chi^2(2) = 36.24$, $p<0.001$
Girls	72.2 (596)	62.3 (302)	44.0 (77)	$\chi^2(2) = 54.30$, $p<0.001$
Total	67.5 (1487)	57.6 (506)	47.2 (206)	$\chi^2(2) = 76.19$, $p<0.001$

Table 5.8 Current smoking status by ethnicity and gender at each study year

	White	Black/mixed Black	Asian/mixed Asian	χ^2 significance test
Year 7				
Boys	3.0 (47)	1.8 (10)	1.2 (3)	$\chi^2(2) = 4.38$, p=0.112
Girls	3.4 (34)	1.6 (7)	1.1 (2)	$\chi^2(2) = 5.68$, p=0.058
Total	3.1 (81)	1.7 (17)	1.2 (5)	$\chi^2(2) = 9.76$, p=0.008
Year 8				
Boys	8.9 (138)	4.9 (28)	4.6 (12)	$\chi^2(2) = 13.24$, p=0.001
Girls	9.8 (98)	8.7 (45)	7.3 (14)	$\chi^2(2) = 1.39$, p=0.500
Total	9.2 (236)	6.7 (73)	5.7 (26)	$\chi^2(2) = 10.67$, p=0.005
Year 9				
Boys	16.4 (246)	9.0 (48)	5.4 (15)	$\chi^2(2) = 35.65$, p<0.001
Girls	21.9 (208)	13.1 (67)	9.2 (18)	$\chi^2(2) = 28.90$, p<0.001
Total	18.5 (454)	11.0 (115)	7.0 (33)	$\chi^2(2) = 60.20$, p<0.001
Year 10				
Boys	28.6 (421)	12.0 (66)	9.1 (26)	$\chi^2(2) = 97.04$, p<0.001
Girls	35.1 (328)	20.6 (115)	13.3 (28)	$\chi^2(2) = 61.86$, p<0.001
Total	31.1 (749)	16.3 (181)	10.9 (54)	$\chi^2(2) = 147.72$, p<0.001
Year 11				
Boys	35.9 (494)	15.7 (62)	20.3 (53)	$\chi^2(2) = 72.69$, p<0.001
Girls	41.6 (344)	22.3 (108)	20.0 (35)	$\chi^2(2) = 66.77$, p<0.001
Total	38.1 (838)	19.3 (170)	20.2 (88)	$\chi^2(2) = 130.55$, p<0.001

Table 5.9 Regular smoking status by ethnicity and gender at each study year

	White	Black/mixed Black	Asian/mixed Asian	χ^2 significance test
Year 7				
Boys	0.6 (10)	0.4 (2)	0.4 (1)	$\chi^2(2) = 0.698$, p= 0.705
Girls	1.1 (11)	0.4 (2)	0.6 (1)	$\chi^2(2) = 1.714$, p=0.424
Total	0.8 (21)	0.4 (4)	0.5 (2)	$\chi^2(2) = 2.18$, p=0.337
Year 8				
Boys	3.3 (51)	1.9 (11)	1.5 (4)	$\chi^2(2) = 4.580$, p=0.101
Girls	3.6 (36)	2.7 (14)	3.7 (7)	$\chi^2(2) = 0.932$, p=0.628
Total	3.4 (87)	2.3 (25)	2.4 (11)	$\chi^2(2) = 3.85$, p=0.146
Year 9				
Boys	7.5 (113)	3.6 (19)	2.5 (7)	$\chi^2(2) = 17.674$, p<0.001
Girls	9.8 (93)	5.1 (26)	5.1 (10)	$\chi^2(2) = 12.600$, p=0.002
Total	8.4 (206)	4.3 (45)	3.6 (17)	$\chi^2(2) = 28.08$, p<0.001
Year 10				
Boys	12.3 (181)	3.4 (19)	3.5 (10)	$\chi^2(2) = 50.506$, p<0.001
Girls	18.3 (171)	6.6 (37)	6.2 (13)	$\chi^2(2) = 52.224$, p<0.001
Total	14.6 (352)	5.0 (56)	4.6 (23)	$\chi^2(2) = 95.10$, p<0.001
Year 11				
Boys	19.5 (269)	5.3 (21)	9.2 (24)	$\chi^2(2) = 56.377$, p<0.001
Girls	23.0 (190)	10.3 (50)	8.6 (15)	$\chi^2(2) = 44.927$, p<0.001
Total	20.8 (459)	8.1 (71)	8.9 (39)	$\chi^2(2) = 94.72$, p<0.001

Table 5.10 Daily smoking status by ethnicity and gender at each study year

	White	Black/mixed Black	Asian/mixed Asian	χ^2 significance test
Year 7				
Boys	0.2 (3)	0.2 (1)	0.0 (0)	$\chi^2(2) = 0.47$, p=0.791
Girls	0.5 (5)	0.2 (1)	0.6 (1)	$\chi^2(2) = 0.643$, p=0.725
Total	0.3 (8)	0.2 (2)	0.2 (1)	$\chi^2(2) = 0.36$, p=0.836
Year 8				
Boys	1.0 (15)	0.7 (4)	0.4 (1)	$\chi^2(2) = 1.10$, p=0.577
Girls	1.7 (17)	0.0 (0)	1.0 (2)	$\chi^2(2) = 8.99$, p=0.011
Total	1.3 (32)	0.4 (4)	0.7 (3)	$\chi^2(2) = 6.83$, p=0.033
Year 9				
Boys	3.9 (59)	0.9 (5)	1.1 (3)	$\chi^2(2) = 16.18$, p<0.001
Girls	4.5 (43)	1.8 (9)	2.6 (5)	$\chi^2(2) = 8.26$, p=0.016
Total	4.2 (102)	1.3 (14)	1.7 (8)	$\chi^2(2) = 22.94$, p<0.001
Year 10				
Boys	7.5 (111)	1.8 (10)	2.1 (6)	$\chi^2(2) =32.66$, p<0.001
Girls	11.1 (104)	4.8 (27)	2.8 (6)	$\chi^2(2) = 27.60$, p<0.001
Total	8.9 (215)	3.3 (37)	2.4 (12)	$\chi^2(2) = 54.91$, p<0.001
Year 11				
Boys	12.9 (178)	3.6 (14)	5.0 (13)	$\chi^2(2) = 38.34$, p<0.001
Girls	16.0 (132)	5.6 (27)	4.6 (8)	$\chi^2(2) = 42.06$, p<0.001
Total	14.1 (310)	4.7 (41)	4.8 (21)	$\chi^2(2) = 76.32$, p<0.001

The comparatively high percentage of Asian girls smoking compared to Asian boys is interesting. Typically Asian men are much more likely to be smokers than Asian women (Bush et al., 2003). However, the ethnic groups as categorised above do not take into account separate sub-groups within each category, an important consideration as different Asian sub-groups vary in terms of smoking prevalence by gender (Sprogston & Mindell, 2006). Table 5.11 displays smoking prevalence by gender for each of the ethnic subgroups as specified by the 2001 census categories in Table 5.2 above (which were recorded at Year 10 only). Current smoking at any year throughout the study was used as numbers in each year were low, however, numbers are perhaps still too low to draw any meaningful conclusion regarding gender differences. Indian and Pakistani girls were more likely to be smokers than boys from these ethnic groups, but Bangladeshi boys were more likely to report current smoking than girls, however these gender differences were not significant. Another interesting gender difference observed when these more detailed ethnic groupings are tabulated is that the higher levels of smoking among Black/mixed Black girls compared to boys was only apparent in the Black Caribbean subgroup ($p < 0.0001$), with the level of smoking among boys and girls fairly similar among Black African students (though again the sample size here is low).

Table 5.11 Current smoking at any point throughout the study by ethnic subgroups as specified in the 2001 census and gender

Current smoking any time point	Boys %(n)	Girls %(n)	χ^2 significance test	Bases – Boys	Bases - Girls
Black Caribbean	15.9 (36)	37.9 (78)	$\chi^2(1) = 26.69$, $p<0.001$	226	206
Black African	16.4 (29)	13.9 (34)	$\chi^2(1) = 0.51$, $p=0.48$	177	245
Black Other	32.5 (13)	33.3 (11)	$\chi^2(1) = 0.01$, $p=0.94$	40	33
White British	41.6 (524)	49.5 (384)	$\chi^2(1) = 12.20$, $p<0.001$	1259	775
White European	32.2 (38)	42.4 (36)	$\chi^2(1) = 2.20$, $p=0.14$	118	85
White Other	32.9 (24)	41.4 (24)	$\chi^2(1) = 1.01$, $p=0.32$	73	58
Asian Indian	15.2 (15)	19.5 (8)	$\chi^2(1) = 0.40$, $p=.53$	99	41
Asian Pakistani	18.6 (8)	28.6 (6)	$\chi^2(1) = 0.82$, $p=0.37$	43	21
Asian Bangladeshi	27.3 (6)	14.3 (2)	$\chi^2(1) = 0.84$, $p=0.36$	22	14
Asian Other	36.2 (21)	10.5 (6)	$\chi^2(1) = 10.55$, $p=0.001$	58	57
Mixed White and Black Caribbean	27.6 (21)	59.6 (31)	$\chi^2(1) = 13.09$, $p<0.001$	76	52
Mixed White and Black African	34.8 (8)	52.4 (11)	$\chi^2(1) = 1.39$, $p=0.24$	23	21
Mixed White and Asian	25.8 (8)	48.0 (12)	$\chi^2(1) = 2.97$, $p=0.09$	31	25
Mixed Other	35.4 (17)	44.3 (27)	$\chi^2(1) = 0.87$, $p=0.35$	48	61
Chinese	7.1 (2)	11.1 (3)	$\chi^2(1) = 0.26$, $p=0.61$	28	27
Other	25.0 (7)	27.8 (10)	$\chi^2(1) = 0.06$, $p=0.80$	28	36

5.2.5 Smoking status by deprivation

From Year 7 to Year 9, participants in the least deprived quintile (quintile 1) were least likely to have ever smoked and those in the more deprived quintiles 4 and 5 were most likely to have reported ever smoking (see Table 5.12). However, by Year 10 differences in smoking by deprivation group were non-significant. In terms of current smoking, differences by deprivation only emerged at Year 9 where those in the comparatively deprived quintile 4 were more likely than all other groups to be currently smoking, and those in quintile 5, the most deprived group, showed the lowest levels of current smoking behaviour (Table 5.13). By Year 11 quintiles 1 to 4 showed similar levels of current smoking (31.8% to 34.0%) and quintile 5 was much less likely to report current smoking (24.9%). Differences in regular and daily smoking only really appeared in the later years of the study, but again, quintile 4 showed high levels of smoking compared to the much lower levels in the most deprived quintile 5 (see Table 5.14 and Table 5.15).

When these deprivation analyses were split by gender the differences in smoking by deprivation group were still apparent among girls, again with quintile 4 showing higher levels of ever smoking than other groups, but disappeared in boys from Year 8 onwards (Table 5.12). There remained a deprivation effect in both genders for current smoking in the later years of the study, with quintile 5 displaying comparatively low levels of current smoking and quintile 4 comparatively high levels (Table 5.13). However, this effect was only consistent in girls when looking at current smoking and daily smoking, and only in the later years of the study (Table 5.14 and Table 5.15).

Deprivation also only seemed to show a consistent association with ever and current smoking among White participants, with differences in smoking rates between deprivation groups among Black/mixed Black participants and Asian/mixed Asian participants occurring in only one or two years (see Table 5.16 and Table 5.17). Numbers were too small to consider meaningfully for regular and daily smoking, although again the pattern emerging is that of increased smoking in quintile 4 and low levels of smoking in quintile 5 among White participants, and to some extent Black/mixed Black participants (Table 5.18 and Table 5.19).

Table 5.12 Ever smoking status by deprivation and gender at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
Boys	18.1 (97)	25.8 (123)	24.6 (119)	28.5 (139)	28.8 (153)	$\chi^2(4) = 21.10$, $p<0.001$
Girls	12.2 (45)	13.4 (38)	18.4 (49)	25.4 (69)	24.3 (127)	$\chi^2(4) = 33.47$, $p<0.001$
Total	15.7 (142)	21.2 (161)	22.4 (168)	27.4 (208)	26.5 (280)	$\chi^2(4) = 44.92$, $p<0.001$
Year 8						
Boys	34.1 (187)	35.5 (167)	32.3 (150)	39.8 (183)	37.3 (193)	$\chi^2(4) = 6.93$, $p =0.140$
Girls	27.3 (100)	29.8 (88)	34.1 (89)	47.0 (134)	42.4 (236)	$\chi^2(4) = 41.38$, $p<0.001$
Total	31.4 (287)	33.3 (255)	32.9 (239)	42.6 (317)	39.9 (429)	$\chi^2(4) = 34.76$, $p<0.001$
Year 9						
Boys	41.1 (233)	44.6 (210)	46.4 (216)	49.9 (216)	47.8 (228)	$\chi^2(4) = 8.91$, $p =0.063$
Girls	45.3 (154)	43.6 (120)	43.0 (110)	59.9 (170)	52.4 (295)	$\chi^2(4) = 24.64$, $p<0.001$
Total	42.7 (377)	44.2 (330)	45.2 (326)	53.8 (386)	50.3 (523)	$\chi^2(4) = 27.67$, $p<0.001$
Year 10						
Boys	54.6 (290)	55.4 (250)	58.1 (264)	53.8 (231)	53.9 (261)	$\chi^2(4) = 2.32$, $p =0.678$
Girls	57.0 (188)	54.7 (152)	54.6 (147)	67.0 (199)	60.5 (346)	$\chi^2(4) = 13.21$, $p =0.010$
Total	55.5 (478)	55.1 (402)	56.8 (411)	59.2 (430)	57.5 (607)	$\chi^2(4) = 3.34$, $p =0.503$
Year 11						
Boys	59.9 (311)	61.4 (263)	60.5 (244)	59.9 (223)	61.5 (224)	$\chi^2(4) = 0.429$, $p =0.980$
Girls	65.5 (201)	65.4 (161)	60.1 (140)	74.0 (188)	65.4 (318)	$\chi^2(4) = 11.05$, $p =0.026$
Total	62.0 (512)	62.9 (424)	60.4 (384)	65.7 (411)	63.8 (542)	$\chi^2(4) = 4.34$, $p =0.362$

Table 5.13 Current smoking status by deprivation and gender at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
Boys	2.0 (11)	3.8 (18)	2.1 (10)	3.1 (15)	1.7 (9)	$\chi^2(4) = 6.07$, $p = 0.194$
Girls	0.8 (3)	1.4 (4)	4.1 (11)	4.4 (12)	3.3 (17)	$\chi^2(4) = 12.30$, $p = 0.015$
Total	1.5 (14)	2.9 (22)	2.8 (21)	3.6 (27)	2.5 (26)	$\chi^2(4) = 7.16$, $p = 0.128$
Year 8						
Boys	8.4 (46)	6.4 (30)	6.7 (31)	9.6 (44)	5.8 (30)	$\chi^2(4) = 6.97$, $p = 0.138$
Girls	6.8 (25)	8.1 (24)	11.1 (29)	11.9 (34)	9.9 (55)	$\chi^2(4) = 6.53$, $p = 0.163$
Total	7.8 (71)	7.1 (54)	8.3 (60)	10.5 (78)	7.9 (85)	$\chi^2(4) = 6.73$, $p = 0.151$
Year 9						
Boys	13.1 (71)	13.8 (65)	15.0 (70)	16.6 (72)	9.4 (45)	$\chi^2(4) = 11.42$, $p = 0.022$
Girls	15.3 (52)	21.8 (60)	18.0 (46)	24.3 (69)	15.1 (85)	$\chi^2(4) = 15.11$, $p = 0.004$
Total	13.9 (123)	16.8 (125)	16.1 (116)	19.7 (141)	12.5 (130)	$\chi^2(4) = 19.42$, $p = 0.001$
Year 10						
Boys	24.3 (129)	25.7 (116)	21.8 (99)	25.6 (110)	14.3 (69)	$\chi^2(4) = 25.19$, $p<0.001$
Girls	29.4 (97)	31.3 (87)	29.0 (78)	34.3 (102)	21.7 (124)	$\chi^2(4) = 19.23$, $p = 0.001$
Total	26.2 (226)	27.8 (203)	24.5 (177)	29.2 (212)	18.3 (193)	$\chi^2(4) = 36.36$, $p<0.001$
Year 11						
Boys	33.7 (175)	31.5 (135)	29.5 (119)	29.0 (108)	23.4 (85)	$\chi^2(4) = 11.78$, $p = 0.019$
Girls	32.6 (100)	38.2 (94)	35.6 (83)	40.2 (102)	26.1 (127)	$\chi^2(4) = 19.96$, $p = 0.001$
Total	33.3 (275)	34.0 (229)	31.8 (202)	33.5 (210)	24.9 (212)	$\chi^2=21.30$, $p<0.001$

Table 5.14 Regular smoking status by deprivation and gender at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
Boys	0.4 (2)	1.3 (6)	0.2 (1)	0.4 (2)	0.4 (2)	$\chi^2(4) = 6.532$, $p = 0.163$
Girls	0.0 (0)	0.4 (1)	1.1 (3)	1.1 (3)	1.3 (7)	$\chi^2(4) = 6.141$, $p = 0.189$
Total	0.2 (2)	0.9 (7)	0.5 (4)	0.7 (5)	0.9 (9)	$\chi^2(4) = 4.346$, $p = 0.361$
Year 8						
Boys	3.3 (18)	3.6 (17)	2.2 (10)	2.6 (12)	1.7 (9)	$\chi^2(4) = 4.603$, $p = 0.331$
Girls	2.2 (8)	1.7 (5)	5.0 (13)	5.3 (15)	3.8 (21)	$\chi^2(4) = 9.118$, $p = 0.058$
Total	2.8 (26)	2.9 (22)	3.2 (23)	3.6 (27)	2.8 (30)	$\chi^2(4) = 1.316$, $p = 0.859$
Year 9						
Boys	6.3 (34)	6.4 (30)	6.0 (28)	7.2 (31)	4.8 (23)	$\chi^2(4) = 2.297$, $p = 0.681$
Girls	5.6 (19)	8.0 (22)	7.0 (18)	12.3 (35)	7.8 (44)	$\chi^2(4) = 10.213$, $p = 0.037$
Total	6.0 (53)	7.0 (52)	6.4 (46)	9.2 (66)	6.4 (67)	$\chi^2(4) = 7.682$, $p = 0.104$
Year 10						
Boys	10.0 (53)	11.3 (51)	7.9 (36)	12.4 (53)	4.8 (23)	$\chi^2(4) = 20.246$, $p<0.001$
Girls	11.2 (37)	12.2 (34)	16.0 (43)	18.5 (55)	10.7 (61)	$\chi^2(4) = 13.753$, $p = 0.008$
Total	10.5 (90)	11.7 (85)	10.9 (79)	14.9 (108)	8.0 (84)	$\chi^2(4) = 21.877$, $p<0.001$
Year 11						
Boys	16.0 (83)	17.8 (76)	15.6 (63)	15.3 (57)	11.5 (42)	$\chi^2(4) = 6.153$, $p = 0.188$
Girls	13.7 (42)	21.1 (52)	16.3 (38)	25.6 (65)	14.6 (71)	$\chi^2(4) = 19.856$, $p = 0.001$
Total	15.1 (125)	19.0 (128)	15.9 (101)	19.5 (122)	13.3 (113)	$\chi^2=14.774$, $p=0.005$

Table 5.15 Daily smoking status by deprivation and gender at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
Boys	0.0 (0)	0.2 (1)	0.0 (0)	0.4 (2)	0.2 (1)	$\chi^2(4) = 3.67$, $p = 0.453$
Girls	0.0 (0)	0.0 (0)	0.4 (1)	0.7 (2)	0.8 (4)	$\chi^2(4) = 5.04$, $p = 0.284$
Total	0.0 (0)	0.1 (1)	0.1 (1)	0.5 (4)	0.5 (5)	$\chi^2(4) = 7.25$, $p = 0.123$
Year 8						
Boys	0.2 (1)	1.7 (8)	0.4 (2)	1.3 (6)	0.6 (3)	$\chi^2(4) = 9.88$, $p = 0.043$
Girls	0.8 (3)	0.7 (2)	0.8 (2)	2.1 (6)	1.6 (9)	$\chi^2(4) = 4.13$, $p = 0.389$
Total	0.4 (4)	1.3 (10)	0.6 (4)	1.6 (12)	1.1 (12)	$\chi^2(4) = 8.13$, $p = 0.087$
Year 9						
Boys	3.3 (18)	2.8 (13)	3.6 (17)	3.9 (17)	1.5 (7)	$\chi^2(4) = 6.05$, $p = 0.195$
Girls	2.1 (7)	2.5 (7)	4.3 (11)	5.3 (15)	3.7 (21)	$\chi^2(4) = 5.98$, $p = 0.201$
Total	2.8 (25)	2.7 (20)	3.9 (28)	4.5 (32)	2.7 (28)	$\chi^2(4) = 6.57$, $p = 0.160$
Year 10						
Boys	6.4 (34)	6.7 (30)	4.4 (20)	8.2 (35)	2.7 (13)	$\chi^2(4) = 15.85$, $p = 0.003$
Girls	4.8 (16)	8.3 (23)	10.4 (28)	12.8 (38)	6.5 (37)	$\chi^2(4) = 17.40$, $p = 0.002$
Total	5.8 (50)	7.3 (53)	6.6 (48)	10.1 (73)	4.7 (50)	$\chi^2(4) = 21.10$, $p<0.001$
Year 11						
Boys	11.0 (57)	9.8 (42)	11.2 (45)	10.5 (39)	7.7 (28)	$\chi^2(4) = 3.37$, $p = 0.498$
Girls	10.1 (31)	14.2 (35)	10.7 (25)	16.9 (43)	8.8 (43)	$\chi^2(4) = 13.13$, $p = 0.011$
Total	10.7 (88)	11.4 (77)	11.0 (70)	13.1 (82)	8.4 (71)	$\chi^2(4) = 9.07$, $p = 0.059$

Table 5.16 Ever smoking status by deprivation and ethnicity at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
White	17.1 (133)	21.1 (126)	24.9 (115)	30.8 (123)	34.8 (120)	$\chi^2(4) = 55.77$, $p<0.001$
Black	18.8 (6)	29.6 (21)	19.6 (29)	26.7 (60)	20.6 (109)	$\chi^2(4) = 6.31$, $p=0.177$
Asian	0.0 (0)	13.3 (10)	8.8 (8)	12.0 (10)	20.2 (21)	$\chi^2(4) = 17.80$, $p= 0.001$
Year 8						
White	32.2 (253)	33.4 (200)	34.2 (152)	47.3 (177)	50.3 (164)	$\chi^2(4) = 54.07$, $p<0.001$
Black	32.4 (11)	38.0 (27)	37.5 (57)	41.1 (97)	33.2 (191)	$\chi^2(4) = 5.15$, $p=2.72$
Asian	21.1 (15)	21.1 (16)	20.6 (20)	27.2 (25)	35.7 (41)	$\chi^2(4) = 8.95$, $p=0.062$
Year 9						
White	43.9 (330)	45.9 (267)	49.5 (215)	60.9 (220)	58.6 (181)	$\chi^2(4) = 41.35$, $p<0.001$
Black	43.8 (14)	44.9 (31)	46.1 (70)	51.3 (115)	45.0 (250)	$\chi^2(4) = 2.76$, $p=0.599$
Asian	31.0 (26)	28.2 (22)	22.8 (23)	33.0 (30)	44.0 (51)	$\chi^2(4) = 12.09$, $p=0.017$
Year 10						
White	57.2 (419)	58.5 (331)	61.4 (267)	65.7 (238)	69.8 (208)	$\chi^2(4) = 19.02$, $p=0.001$
Black	51.4 (18)	51.4 (38)	55.6 (85)	59.7 (141)	52.9 (315)	$\chi^2(4) = 3.77$, $p=0.438$
Asian	37.7 (29)	32.1 (25)	38.1 (43)	37.0 (37)	45.1 (55)	$\chi^2(4) = 3.73$, $p=0.444$
Year 11						
White	64.0 (455)	66.1 (353)	68.6 (269)	71.7 (230)	74.2 (175)	$\chi^2(4) = 11.97$, $p =0.018$
Black	44.4 (12)	45.6 (26)	53.5 (68)	66.0 (126)	57.7 (271)	$\chi^2(4) = 11.60$, $p=0.021$
Asian	47.9 (35)	48.6 (34)	34.4 (33)	42.7 (35)	59.6 (65)	$\chi^2(4) = 13.84$, $p=0.008$

Table 5.17 Current smoking status by deprivation and ethnicity at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
White	1.7 (13)	3.5 (21)	2.8 (13)	5.3 (21)	3.5 (12)	$\chi^2(4) = 12.17$, $p = 0.016$
Black	3.1 (1)	1.4 (1)	2.7 (4)	1.3 (3)	1.5 (8)	$\chi^2(4) = 1.61$, $p = 0.807$
Asian	0.0 (0)	0.0 (0)	2.2 (2)	2.4 (2)	1.0 (1)	$\chi^2(4) = 3.67$, $p = 0.452$
Year 8						
White	8.0 (63)	6.7 (40)	9.0 (40)	12.6 (47)	11.7 (38)	$\chi^2(4) = 13.47$, $p = 0.009$
Black	2.9 (1)	7.0 (5)	9.9 (15)	7.6 (18)	5.2 (30)	$\chi^2(4) = 5.69$, $p = 0.224$
Asian	5.6 (4)	5.3 (4)	3.1 (3)	9.8 (9)	5.2 (6)	$\chi^2(4) = 4.11$, $p = 0.391$
Year 9						
White	14.8 (111)	18.2 (106)	18.7 (81)	24.9 (90)	20.4 (63)	$\chi^2(4) = 17.56$, $p = 0.002$
Black	6.3 (2)	11.6 (8)	13.8 (21)	15.2 (34)	8.3 (46)	$\chi^2(4) = 10.30$, $p = 0.036$
Asian	10.7 (9)	6.4 (5)	5.0 (5)	9.9 (9)	4.3 (5)	$\chi^2(4) = 4.92$, $p = 0.296$
Year 10						
White	27.9 (204)	31.1 (176)	28.7 (125)	39.8 (144)	32.9 (98)	$\chi^2(4) = 17.82$, $p =0.001$
Black	17.1 (6)	18.9 (14)	18.3 (28)	21.6 (51)	12.8 (76)	$\chi^2(4) = 11.31$, $p = 0.023$
Asian	13.0 (10)	11.5 (9)	13.3 (15)	13.0 (13)	5.7 (7)	$\chi^2(4) = 4.78$, $p = 0.310$
Year 11						
White	35.3 (251)	37.6 (201)	38.8 (152)	43.3 (139)	39.0 (92)	$\chi^2(4) = 6.25$, $p = 0.182$
Black	18.5 (5)	21.1 (12)	22.0 (28)	24.6 (47)	16.2 (76)	$\chi^2(4) = 7.16$, $p = 0.128$
Asian	19.2 (14)	17.1 (12)	17.7 (17)	19.5 (16)	25.7 (28)	$\chi^2(4) = 2.88$, $p = 0.578$

Table 5.18 Regular smoking status by deprivation and ethnicity at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
White	0.3 (2)	1.2 (7)	0.4 (2)	0.5 (2)	2.0 (7)	$\chi^2(4) = 12.101$, $p = 0.017$
Black	0.0 (0)	0.0 (0)	0.7 (1)	0.4 (1)	04 (2)	$\chi^2(4) = 0.716$, $p = 0.949$
Asian	0.0 (0)	0.0 (0)	1.1 (1)	1.2 (1)	0.0 (0)	$\chi^2(4) = 2.898$, $p = 0.575$
Year 8						
White	2.9 (23)	2.3 (14)	3.2 (14)	4.5 (17)	4.6 (15)	$\chi^2(4) = 5.689$, $p =0.224$
Black	0.0 (0)	2.8 (2)	3.9 (6)	3.4 (8)	1.4 (8)	$\chi^2(4) = 6.227$, $p = 0.183$
Asian	1.4 (1)	3.9 (3)	1.0 (1)	2.2 (2)	3.5 (4)	$\chi^2(4) = 2.401$, $p = 0.662$
Year 9						
White	6.4 (48)	7.4 (43)	8.1 (35)	11.1 (40)	12.6 (39)	$\chi^2(4) = 15.282$, $p = 0.004$
Black	6.3 (2)	7.2 (5)	5.3 (8)	6.7 (15)	2.5 (14)	$\chi^2(4) = 9.555$, $p = 0.049$
Asian	3.6 (3)	3.8 (3)	2.0 (2)	6.6 (6)	2.6 (3)	$\chi^2(4) = 3.45$, $p = 0.485$
Year 10						
White	11.1 (81)	13.1 (74)	13.6 (59)	22.9 (83)	17.8 (53)	$\chi^2(4) = 31.280$, $p < 0.001$
Black	5.7 (2)	6.8 (5)	7.2 (11)	7.2 (17)	3.2 (19)	$\chi^2(4) = 8.691$, $p = 0.069$
Asian	6.5 (5)	5.1 (4)	5.3 (6)	6.0 (6)	1.6 (2)	$\chi^2(4) = 3.612$, $p = 0.461$
Year 11						
White	16.5 (117)	21.5 (115)	20.4 (80)	27.1 (87)	24.6 (58)	$\chi^2(4) = 18.121$, $p = 0.001$
Black	7.4 (2)	10.5 (6)	8.7 (11)	12.0 (23)	6.2 (29)	$\chi^2(4) = 6.826$, $p = 0.145$
Asian	5.5 (4)	7.1 (5)	7.3 (7)	9.8 (8)	13.8 (15)	$\chi^2(4) = 4.780$, $p = 0.311$

Table 5.19 Daily smoking status by deprivation and ethnicity at each study year, percentage (n)

	Least deprived	Quintile 2	Quintile 3	Quintile 4	Most deprived	χ^2 test
Year 7						
White	0.0 (0)	0.2 (1)	0.2 (1)	0.5 (2)	1.2 (4)	$\chi^2(4) = 11.48$, $p = 0.022$
Black	0.0 (0)	0.0 (0)	0.0 (0)	0.4 (1)	0.2 (1)	$\chi^2(4) = 1.18$, $p = 0.881$
Asian	0.0 (0)	0.0 (0)	0.0 (0)	1.2 (1)	0.0 (0)	$\chi^2(4) = 4.12$, $p = 0.390$
Year 8						
White	0.4 (3)	1.2 (7)	0.7 (3)	2.7 (10)	1.8 (6)	$\chi^2(4) = 14.01$, $p = 0.007$
Black	0.0 (0)	0.0 (0)	0.7 (1)	0.4 (1)	0.2 (1)	$\chi^2(4) = 1.48$, $p = 0.831$
Asian	0.0 (0)	0.0 (0)	0.0 (0)	1.1 (1)	1.7 (2)	$\chi^2(4) = 3.89$, $p = 0.421$
Year 9						
White	3.1 (23)	2.9 (17)	4.6 (20)	6.1 (22)	6.5 (20)	$\chi^2(4) = 12.19$, $p = 0.016$
Black	3.1 (1)	1.4 (1)	4.6 (7)	1.8 (4)	0.0 (0)	$\chi^2(4) = 22.17$, $p < 0.001$
Asian	1.2 (1)	1.3 (1)	1.0 (1)	3.3 (3)	1.7 (2)	$\chi^2(4) = 1.90$, $p = 0.754$
Year 10						
White	6.1 (45)	8.3 (47)	7.8 (34)	15.7 (57)	10.1 (30)	$\chi^2(4) = 29.14$, $p < 0.001$
Black	5.7 (2)	4.1 (3)	4.6 (7)	5.5 (13)	1.8 (11)	$\chi^2(4) = 9.13$, $p = 0.058$
Asian	2.6 (2)	2.6 (2)	4.4 (5)	2.0 (2)	0.8 (1)	$\chi^2(4) = 3.30$, $p = 0.509$
Year 11						
White	11.4 (81)	12.7 (68)	14.0 (55)	19.3 (62)	18.2 (43)	$\chi^2(4) = 15.66$, $p = 0.004$
Black	7.4 (2)	8.8 (5)	6.3 (8)	7.3 (14)	2.6 (12)	$\chi^2(4) = 11.06$, $p = 0.026$
Asian	4.1 (3)	2.9 (2)	4.2 (4)	3.7 (3)	8.3 (9)	$\chi^2(4) = 3.75$, $p = 0.440$

5.2.6 The independent effect of gender, ethnicity and deprivation

Having described the basic pattern of smoking across the five years of the study and compared smoking rates of boys, girls, those of different ethnicities and those of different levels of area deprivation, the extent to which these variables were independently associated with smoking behaviour was examined.

Logistic regression analyses were run predicting current smoking (Table 5.20) and regular smoking (Table 5.21) at each study year. Ever smoking was not used as a predictor here due to the cumulative nature of this variable. Daily smoking was also not examined because numbers of daily smokers, especially by ethnic group, were very low.

In relation to current smoking unadjusted results reinforce the findings above, with no gender difference in current smoking at Year 7, followed by girls smoking to a greater extent than boys, with a slight narrowing of this gap at Year 11. Black and Asian students were less likely to smoke than their white counterparts throughout the study. These findings were largely unchanged when all three sociodemographic variables were entered into the model (although the effect of gender remained strong in Year 11) suggesting that both gender and ethnicity have an independent effect on smoking behaviour during adolescence. The relationship between smoking and deprivation was more complex, unadjusted results indicated that the most deprived students were less likely to smoke than the least deprived students in the later years of the study, a finding that disappeared when gender and ethnicity were included. In contrast adjusted analyses showed adolescents in the comparatively deprived quintile 4 smoked significantly more than the least deprived students. However, there were no overall interactions between deprivation and gender or ethnicity. When analyses were re-run using complex samples logistic regression to take account of school clustering there were slight reductions in significance levels for deprivation and for gender in Year 8 and Year 9, with the gender effect disappearing in Year 8. However, conclusions remain the same.

Due to low numbers of regular smokers in the early years of the study, results in Table 5.21 are only worth examining from Year 9 onwards. Unadjusted analyses again support the above discussion, with regular smoking significantly more common in girls in year

9 and Year 10, but not Year 11, and a strong effect of ethnicity, with Black/mixed Black and Asian/mixed Asian students significantly less likely to smoke than White students. These findings again remained when other variables were also included in the model. The only consistent significant finding in terms of deprivation was a greater likelihood of regular smoking in the relatively deprived quintile 4 in comparison with least deprived quintile 1, which became stronger and more significant when other demographic variables were included. Examination of interaction terms showed a significant deprivation by gender interaction ($p = 0.042$) with girls in the more deprived quintiles being more likely to smoke than boys in these groups. When analyses were re-run using complex samples logistic regression to take account of clustering, significance levels were reduced for both gender and deprivation and the effect of gender in Year 9 became non-significant, as did all unadjusted deprivation results findings, although the adjusted effect of deprivation remained.

Table 5.20 Unadjusted and adjusted logistic regression analyses showing independent associations between sociodemographic factors and current smoking at each study year

	Year 7		Year 8		Year 9		Year 10		Year 11	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Gender										
Boys	1	1	1	1	1	1	1	1	1	1
Girls	1.12	1.13	1.30*	1.36**	1.40***	1.53***	1.35***	1.51***	1.16*	1.32***
	(0.77-1.64)	(0.77-1.66)	(1.05-1.62)	(1.09-1.70)	(1.19-1.66)	(1.28-1.82)	(1.17-1.56)	(1.30-1.75)	(1.01-1.33)	(1.14-1.53)
Ethnicity										
White	1	1	1	1	1	1	1	1	1	1
Black	0.53*	0.43**	0.70*	0.60**	0.54***	0.48***	0.43***	0.40***	0.39***	0.35***
	(0.31-0.90)	(0.25-0.76)	(0.54-0.92)	(0.44-0.81)	(0.44-0.68)	(0.38-0.62)	(0.36-0.52)	(0.33-0.49)	(0.32-0.47)	(0.29-0.44)
Asian	0.37*	0.34*	0.60*	0.57*	0.33***	0.31***	0.27***	0.26***	0.41***	0.40***
	(0.15-0.92)	(0.13-0.83)	(0.39-0.91)	(0.37-0.87)	(0.23-0.48)	(0.22-0.45)	(0.20-0.36)	(0.19-0.35)	(0.32-0.53)	(0.31-0.51)
Other	1.4	1.23	1.41	1.35	1.28	1.22	0.95	0.87	0.80	0.74
	(0.67-2.98)	(0.58-2.63)	(0.88-2.24)	(0.84-2.18)	(0.88-1.85)	(0.83-1.79)	(0.63-1.44)	(0.57-1.32)	(0.54-1.20)	(0.50-1.12)
Deprivation										
Least deprived	1	1	1	1	1	1	1	1	1	1
2nd quintile	1.90	2.02*	0.90	0.92	1.24	1.32	1.08	1.17	1.03	1.10
	(0.96-3.73)	(1.02-3.97)	(0.62-1.30)	(0.64-1.34)	(0.95-1.63)	(1.00-1.73)	(0.87-1.35)	(0.94-1.47)	(0.83-1.28)	(0.88-1.37)
3rd quintile	1.84	2.16*	1.07	1.20	1.18	1.39*	0.91	1.13	0.93	1.16
	(0.93-3.64)	(1.08-4.29)	(0.75-1.53)	(0.84-1.73)	(0.90-1.56)	(1.05-1.85)	(0.73-1.14)	(0.90-1.43)	(0.75-1.16)	(0.92-1.45)
4th quintile	2.35*	2.94**	1.39	1.59**	1.51**	1.86***	1.16	1.57***	1.01	1.36**
	(1.22-4.51)	(1.51-5.70)	(0.99-1.95)	(1.12-2.26)	(1.16-1.97)	(1.41-2.45)	(0.93-1.45)	(1.24-1.98)	(0.81-1.26)	(1.08-1.72)
Most deprived	1.61	2.29*	1.02	1.25	0.88	1.16	0.63***	0.96	0.67***	1.09
	(0.84-3.10)	(1.15-4.57)	(0.74-1.42)	(0.87-1.79)	(0.68-1.15)	(0.87-1.55)	(0.51-0.78)	(0.75-1.23)	(0.54-0.82)	(0.86-1.39)

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

Table 5.21 Unadjusted and adjusted logistic regression analyses showing independent associations between sociodemographic factors and regular smoking at each study year

	Year 7		Year 8		Year 9		Year 10		Year 11	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Gender										
Boys	1	1	1	1	1	1	1	1	1	1
Girls	1.70	1.58	1.31	1.36	1.34*	1.40**	1.51***	1.67***	1.14	1.32**
	(0.81-3.59)	(0.74-3.39)	(0.93-1.85)	(0.95-1.95)	(1.06-1.71)	(1.10-1.80)	(1.24-1.83)	(1.36-2.04)	(0.95-1.35)	(1.10-1.58)
Ethnicity										
White	1	1	1	1	1	1	1	1	1	1
Black	0.49	0.34	0.66	0.61	0.49***	0.39***	0.31***	0.25***	0.33***	0.27**
	(0.17-1.42)	(0.12-1.06)	(0.42-1.04)	(0.37-1.02)	(0.35-0.68)	(0.27-0.57)	(0.23-0.41)	(0.18-0.35)	(0.26-0.43)	(0.21-0.37)
Asian	0.58	0.51	0.71	0.70	0.41***	0.37***	0.28***	0.26***	0.37***	0.35***
	(0.14-2.48)	(0.12-2.22)	(0.37-1.33)	(0.37-1.33)	(0.25-0.67)	(0.23-0.62)	(0.18-0.44)	(0.17-0.40)	(0.26-0.53)	(0.25-0.49)
Other	0.67	0.55	1.35	1.35	1.19	1.05	1.18	0.96	0.88	0.76
	(0.09-5.01)	(0.07-4.16)	(0.65-2.84)	(0.64-2.88)	(0.71-2.00)	(0.62-1.78)	(0.71-1.96)	(0.57-1.62)	(0.54-1.42)	(0.46-1.24)
Deprivation										
Least deprived	1	1	1	1	1	1	1	1	1	1
2nd quintile	4.20	4.52	1.01	1.00	1.17	1.24	1.13	1.25	1.32*	1.41*
	(0.87-20.26)	(0.93-21.78)	(0.57-1.80)	(0.56-1.80)	(0.79-1.74)	(0.83-1.84)	(0.83-1.55)	(0.91-1.71)	(1.00-1.72)	(1.07-1.85)
3rd quintile	2.42	2.99	1.12	1.24	1.07	1.27	1.05	1.37	1.06	1.33
	(0.44-13.27)	(0.54-16.45)	(0.63-1.98)	(0.70-2.20)	(0.71-1.60)	(0.84-1.92)	(0.76-1.45)	(0.99-1.90)	(0.80-1.41)	(1.00-1.78)
4th quintile	2.99	3.99	1.28	1.47	1.59*	2.01***	1.50**	2.17***	1.36*	1.89***
	(0.58-15.47)	(0.76-20.81)	(0.74-2.22)	(0.84-2.58)	(1.09-2.31)	(1.37-2.96)	(1.11-2.02)	(1.59-2.96)	(1.03-1.79)	(1.42-2.51)
Most deprived	3.89	6.02*	0.98	1.15	1.08	1.54*	0.74	1.33	0.86	1.54**
	(0.84-18.05)	(1.24-29.16)	(0.58-1.67)	(0.64-2.06)	(0.74-1.56)	(1.03-2.31)	(0.54-1.01)	(0.94-1.86)	(0.65-1.13)	(1.14-2.08)

*p < 0.05 **p < 0.01 ***p < 0.001

5.3 Discussion

This chapter has presented smoking prevalence data from the HABITS study. Levels of smoking in this sample were broadly consistent with what might be expected from national, representative surveys of adolescent smoking in England, with almost identical percentages of students ever smoking and regularly smoking at age 11-12 to the 2000 SDD survey (Boreham & Shaw, 2001). Ever smoking at age 15-16 was also comparable to the 2003 SDD survey, although the levels of regular smoking observed at this age was somewhat lower, probably because of the higher proportion of non-white students in the HABITS sample (Boreham & Blenkinsop, 2004). It is important to note that these data are not intended to be nationally representative and so, while the comparison with the SDD surveys is interesting, the presentation of this data is of most relevance to the understanding of the extent of smoking behaviour in the HABITS sample.

A benefit of the HABITS study is the over-representation of students from a variety of Black and Ethnic Minority backgrounds and of students from lower socioeconomic groups. Conclusions regarding the smoking behaviour of different socio-demographic groups are therefore of particular interest. As expected, there was a clear effect of gender, with girls more likely to be smokers than boys towards the later years of the study supporting previous findings from both the SDD surveys and other studies (Amos & Bostock, 2007; Rugkasa et al., 2003). There were also ethnic differences with White participants more likely to be ever, current, regular and daily smokers than other ethnic groups, again in support of previous findings (Fuller, 2006; Viner et al., 2006; Sprogston & Mindell, 2006; Rodham et al., 2005; Markham et al., 2004; Currie et al., 2003; Best et al., 2001; Nazroo et al., 1999).

Further examination of ethnic differences in smoking revealed some interesting observations, with Black/mixed Black participants showing relatively high levels of 'ever' smoking, but comparatively low levels of more regular smoking, replicating the previous findings of Best et al. (2001) and Ellickson et al. (2004). This suggests a high level of experimentation with smoking which does not progress to a more regular smoking habit. It is possible that this is a function of a higher level of deprivation in this sub-group; however, no interactions between ethnicity and deprivation were observed. Also of particular interest is the observed high level of smoking among Asian girls. Cigarette smoking among South Asian women is comparatively rare (Markham et al., 2004; Bush et al., 2003). It is therefore surprising that current smoking was more common among girls than boys in this ethnic group, and Indian and Pakistani girls in particular, supporting recent concerns that smoking behaviour in these previously less 'at risk' sub-groups is rising (ASH Scotland, 2005; Bush et al., 2003).

The conclusion regarding the extent of smoking behaviour in different socio-economic groups is less clear cut, as might be expected from the past literature review of this area, and it may be wise to only focus on more regular smoking to avoid the problem of diverging relationships with different smoking intensities, as suggested by Sweeting and West (2001). Individuals in Quintile 4 were most likely to smoke regularly. There was a trend towards the most deprived individuals being least likely to smoke regularly. This may be a consequence of a lower personal income among these students (although recent research by West et al. (2007) from Scotland suggests personal income may correlate less to smoking behaviour in lower socio-economic groups than previously thought), or a higher proportion of Black/mixed Black individuals in this category, who show lower levels of regular smoking behaviour. Analyses using more regular smoking were however limited by a small sample size, so conclusions are only tentative.

Similarly, although there appeared a greater effect of deprivation among girls and among White participants the sample size is very small.

Indeed, the major limitation throughout this chapter has been the small sample size of certain groups preventing more detailed analysis or firm conclusions regarding patterns of smoking. This is despite the study being especially designed to sample these smaller sections of society. However, the HABITS study remains one of the best samples for this purpose, and can add to the literature on ethnic minority groups especially.

In conclusion this chapter has set the scene for the analyses that follow in the remainder of this thesis. Levels of smoking were similar to those observed in a more representative population and differences in gender, ethnicity and deprivation have been highlighted. Examination of other factors associated with smoking may consequently vary by these sociodemographic variables and all analyses to follow have therefore included gender ethnicity and deprivation as important confounding factors. Some i

Chapter 6: Development of smoking in 'one time triers'[1]

6.1 Introduction

Understanding how smoking behaviour develops across adolescence is important to inform the development of effective intervention programmes. By identifying patterns of smoking uptake, projections of the extent to which young people who start smoking will continue to smoke and the amount that they will go on to smoke can be made.

Previous cross-sectional and retrospective studies have suggested that the progression from early trying to regular smoking can take several years (Robinson et al., 2004; Stallings et al., 1999; Leventhal & Cleary, 1980). Similarly, a number of longitudinal studies have tracked adolescent smoking behaviour over time and shown that the development of smoking behaviour can occur at different rates and intensities (Abroms et al., 2005; Audrain-McGovern et al., 2004; Orlando et al., 2004; Soldz & Cui, 2002; White et al., 2002; Chassin et al., 2000; Wills et al., 1996). For example Audrain-McGovern et al. (2004) distinguished early/fast adopters, late/slow adopters, experimenters and never smokers, while Chassin et al. (2000) differentiated between early stable smokers, late stable smokers, experimenters and quitters. These subgroups of smokers can often, although not always (Abroms et al., 2005), be distinguished in terms of risk factors for smoking such as attitudes to smoking (Soldz & Cui, 2002), parental and friend smoking (Chassin et al., 2000), reported grades (Audrain-McGovern et al., 2004; White et al., 2002) and coping style (Wills et al., 1996). This heterogeneity suggests that smoking prevention programmes need to be tailored and varied in order to reach all groups of potential smokers.

[1] A version of this chapter was published in Tobacco Control, 15, 205-209, 2006 (see Appendix IV)

There are now a large number of similar studies to those discussed above. However, the value of these studies, beyond understanding that the process to regular smoking among adolescents can take many and varied forms, is limited. It was decided therefore not to replicate these studies further by presenting findings suggesting that a certain number of different trajectories exist in this dataset, and that these may or may not map onto one or more of those discovered in the studies presented above. Rather, focus has been placed on understanding the development of smoking behaviour across time among one particular group of smokers that have not received so much attention, those students who have only tried smoking once ('one-time triers').

There is good reason to believe that experimentation with cigarettes is a risk factor for later smoking as it is known that early smoking experience is strongly linked to later behaviour, after even very limited exposure (Jackson & Dickinson, 2004; Choi, Gilpin, Farkas, & Pierce, 2001; Patton, Carlin, Coffey, Wolfe, Hibbert et al., 1998b; Russell, 1990). For example, Patton et al. found that occasional smoking was associated with an eight-fold increase in the probability of being a daily smoker three years later (Patton et al., 1998b), while Jackson and Dickinson showed even minimal childhood use of cigarettes to be predictive of smoking at age 17 (Jackson & Dickinson, 2004). However, these studies all have limited follow-up waves, with large gaps of several years between assessments. This limits the extent to which conclusions can be made regarding the progression of smoking uptake, from first experimentation to current smoking, in a continuous fashion.

The aim of this Chapter is to use the HABITS data to track the development of smoking behaviour among those who have tried just one cigarette at age 11 and to establish the probability of, and time taken to progress to, later current smoking at each of the following four years in this sub-sample.

6.2 Methods

6.2.1 Population

This chapter tracks the development of smoking from Year 7 onwards. The analyses are therefore prospective and only data from students who were present at each study year are included (n = 2041, 34% of the total sample).

6.2.2 Measures

Smoking

For these analyses the full six category variable at Year 7 was used to isolate never smokers and those who reported they had only ever tried smoking once at baseline. Cotinine values were checked and one never smoker with a cotinine value over 15 ng/ml was removed from this group. The dichotomous current smoking variable (smoking sometimes or more often), adjusted for cotinine, was used to assess smoking behaviour at each of the later years of the study.

Potential confounding variables

Gender, ethnicity (White, Black/mixed Black, Asian/mixed Asian and other) and deprivation (Townsend scores) were included as potential confounding variables and measured as described in Chapter 5. Parental smoking and conduct problems at Year 7 were also included as confounding factors that may influence vulnerability to smoking uptake. Participants were asked ‘Does your mother smoke?’ and ‘Does your father smoke?’ and could answer ‘yes’ or ‘no’. Responses to these two questions were then combined to make a four category variable; neither parent smokes, father smokes, mother smokes or, both parents smoke. The conduct problems scale from the Strengths and Difficulties Questionnaire was used to assess conduct problems (Goodman, Meltzer, & Bailey, 1998). This scale measures the extent to which individuals lie, steal, cheat, fight, and have temper tantrums.

6.2.3 Statistical analysis

At each year the probability of *becoming* a new current smoker (smoking cigarettes sometimes or more frequently among previous never smokers) was calculated for those who had never tried cigarettes at Year 7 (age 11-12) and who had tried cigarettes just once at Year 7 (Year 7 'one time triers'). New current cigarette use was calculated at each year as the percentage of previously non-current smokers who became current cigarette smokers for the first time that year, as opposed to remaining a non-current smoker. In order to establish when students first reported current smoking, only data from participants who provided smoking status data at each year were included in the analyses. This obviously limits the sample available and may introduce bias, but is necessary to ensure results are not confounded by prior smoking.

To establish the magnitude of the association between being a 'one time trier' and onset of current smoking, a series of logistic regressions were performed with smoking status at Year 7 as the independent variable and new uptake of current smoking at each study year as the dependent variables. By looking at new uptake of current smoking, participants were excluded from analyses if they had already progressed to current smoking. This methodology therefore describes the longitudinal development of current smoking across the five years of the study. Gender, deprivation, ethnicity, parental smoking and conduct problems were then added to the model as co-variates in order to examine the persistence of any effect once common variables known to influence vulnerability to smoking uptake were included. Finally complex samples logistic regression analyses were run to take account of school clustering.

6.3 Results

Of those with full smoking data at each year (n = 2041, 34% of the whole sample), 56.4% (1151) were boys and 43.6% (890) were girls. 64.1% (1309) were White, 22.6% (461) Black/mixed black, 11.1% (227) Asian/mixed Asian, and 2.2% (44) of other ethnic origin. Current smoking prevalence at each study year in this reduced sample is shown in Table 6.1, along with the percentage of all participants who reported current smoking for the first time at each year. At Year 7 84.2% (1719) of participants were never smokers and 12.7% (260) of this sample reported having tried smoking just once.

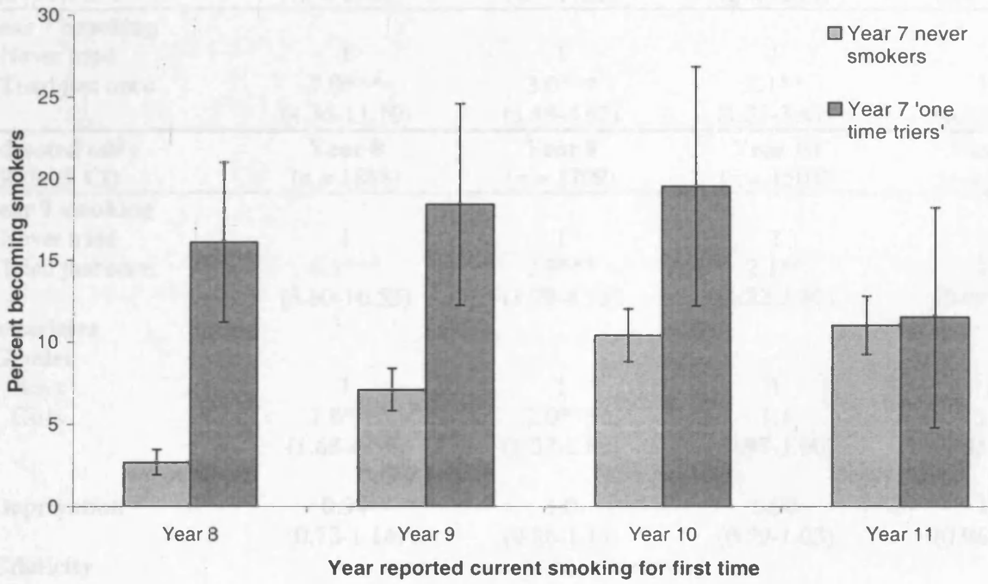
Table 6.1 Percentage (n) of current smoking and new current smoking at each study year

	Year 7	Year 8	Year 9	Year 10	Year 11
Cotinine-adjusted current smoking	1.3 (26)	5.1 (105)	12.5 (255)	23.0 (469)	29.3 (597)
Cotinine-adjusted new current smoking	-	3.9 (80)	6.8 (139)	8.2 (168)	6.9 (141)

Figure 6.1 shows that 16% (35) of Year 7 'one time triers' became current smokers for the first time in Year 8 (age 12-13) compared with only 3% (45) of Year 7 never smokers. Similarly 18% (28) of Year 7 'one time triers' became current smokers for the first time in Year 9 (age 13-14) compared with only 7% (111) of Year 7 never smokers, and 20% (22) became current smokers in Year 10 (age 14-15) compared with 10% (146) of Year 7 never smokers. In these respondents, no further smoking, beyond the initial cigarette, had been reported in the intervening years and therefore current cigarette use was not reported until several years after the first cigarette. It was only in Year 11 that new current cigarette use finally equalised across the Year 7 'one time triers', 12% (10) and never smokers, 11% (131). By Year 11 49.6% (n = 129) of Year 7

one time triers were current smokers compared to only 24.7% (n = 425) of Year 7 never smokers.

Figure 6.1 Percentage (95% Confidence Intervals) of students becoming current smokers for the first time at each year by Year 7 smoking status (never smokers vs 'one time triers')



The results of logistic regression analyses are shown in Table 6.2. Being a Year 7 'one time trier' placed students at an increased risk, compared with those who had never smoked at this age, of reporting current smoking in the future. The relationship was strongest one year later (OR=6.3) and, although the odds ratios decrease at each subsequent year, being a 'one time trier' at Year 7 was still predictive of starting to smoke for the first time up to Year 10 (OR=2.1), several years after the first cigarette was smoked. The adjusted results show that the addition of gender, ethnicity, deprivation score, parental smoking and conduct problems to the model did not alter these results and that being a Year 7 'one time trier' was a stronger predictor of new current smoking than these covariates. All analyses were re-run using complex samples logistic regression procedures to take account of school clustering, however findings were unchanged.

Table 6.2 Unadjusted and adjusted odds of starting current smoking for the first time at Year 8, Year 9, Year 10 and Year 11 as a function of being a Year 7 'one time trier' in relation to never smoking

Unadjusted odds OR (94% CI)	**Year 8** (n = 1900)	**Year 9** (n = 1721)	**Year 10** (n = 1514)	**Year 11** (n = 1283)
Year 7 Smoking				
Never tried	1	1	1	1
Tried just once	7.0*** (4.36-11.10)	3.0*** (1.89-4.67)	2.1** (1.27-3.41)	1.1 (0.53-2.09)
Adjusted odds OR (94% CI)	**Year 8** (n = 1888)	**Year 9** (n = 1709)	**Year 10** (n = 1503)	**Year 11** (n = 1273)
Year 7 smoking				
Never tried	1	1	1	1
Tried just once	6.3*** (3.80-10.53)	2.9*** (1.79-4.73)	2.1** (1.22-3.51)	1.0 (0.49-2.02)
Covariates				
Gender				
Boys	1	1	1	1
Girls	2.8*** (1.68-4.59)	2.0*** (1.37-2.85)	1.4 (0.97-1.90)	1.2 (0.83-1.71)
Deprivation	0.94 (0.78-1.14)	1.0 (0.86-1.15)	0.90 (0.79-1.03)	1.1 (0.96-1.28)
Ethnicity				
White	1	1	1	1
Black	1.0 (0.54-1.87)	0.41** (0.24-0.73)	0.45** (0.26-0.77)	0.40*** (0.21-0.65)
Asian	0.91 (0.37-2.23)	0.41* (0.20-0.83)	0.62 (0.35-1.09)	0.60 (0.32-1.03)
Other	0.96 (0.20-4.52)	0.46 (0.11-2.00)	0.40 (0.09-1.72)	0.65 (0.19-2.23)
Parental smoking				
Neither Smoke	1	1	1	1
Father smokes	0.96 (0.48-1.90)	1.3 (0.81-2.06)	1.4 (0.95-2.21)	1.3 (0.83-2.07)
Mother smokes	2.1 (1.00-4.22)	1.8* (1.00-3.18)	1.5 (0.81-2.72)	1.3 (0.69-2.63)
Both smoke	2.9** (1.52-5.42)	1.2 (0.61-2.17)	1.8* (1.06-3.19)	0.73 (0.35-1.54)
Conduct problems score	1.1 (0.94-1.22)	1.1 (0.98-1.21)	1.1* (1.00-1.22)	1.1** (1.04-1.27)

*p<0.05 **p<0.01, ***p<0.001

In order to identify the year current smoking was first reported, only participants who provided complete smoking data at every year were included in the above analyses (n = 2041, 34% of the whole sample). Table 6.3 shows how those with complete smoking data differ from those who were absent at one or more years. Most notably those with complete data were less likely to be smokers. However, when analyses were re-run using all available data for the required years (i.e. Years 7 and 8 when predicting new Year 8 current smoking and Years 7, 8 and 9 when predicting new Year 9 current smoking), findings remained the same; being a 'one time trier' at Year 7 was associated with a higher risk of new uptake of current smoking compared to Year 7 never smokers, even after three years of non-current smoking (Year 8 (n = 3229); OR = 8.7, 95% CI 6.47-11.68, Year 9 (n = 2320); OR = 3.1, 95% CI 2.17-4.41, Year 10 (n = 1731); OR = 2.3, 95% CI 1.45-3.50, Year 11 (n = 1283); OR = 1.1, 95% CI 0.53-2.09).

Table 6.3 Sociodemographic and smoking differences between those providing full smoking data and those absent for one or more years, percentage/mean (n)

	Full Data	Incomplete Data	Significance
Gender			
Boys	56.4 (1151)	60.4 (2308)	$p = 0.003$
Girls	43.6 (890)	39.6 (1513)	
Deprivation (mean score)	2.9 (2037)	3.2 (3599)	$p < 0.001$
Ethnicity			
White	64.1 (1309)	55.0 (2015)	$p < 0.001$
Black	22.6 (461)	27.9 (1021)	
Asian	11.1 (227)	10.9 (400)	
Other	2.2 (44)	6.2 (227)	
Conduct problems (mean score)	2.6 (2034)	3.0 (2252)	$p < 0.001$
Parental smoking			
Neither smoke	62.5 (1274)	46.6 (1049)	$p < 0.001$
Father smokes	18.5 (378)	21.0 (472)	
Mother smokes	8.6 (176)	12.4 (279)	
Both smoke	10.3 (210)	20.0 (450)	
Smoking			
Year 7 one time trier	12.7 (260)	20.7 (462)	$p < 0.001$
Year 8 current smoker	5.1 (105)	11.4 (256)	$p < 0.001$
Year 9 current smoker	12.5 (255)	18.4 (387)	$p < 0.001$
Year 10 current smoker	23.0 (469)	26.3 (551)	$p = 0.013$
Year 11 current smoker	29.3 (597)	33.6 (562)	$p = 0.004$

6.4 Discussion

In line with past research suggesting that progression to current smoking uptake can take several years (Robinson et al., 2004; Stallings et al., 1999; Leventhal & Cleary, 1980), these results show that progression from experimenting with one cigarette (being a 'one time trier') to current smoking can take up to three years. However, these results also show that between trying an early cigarette and regular smoking uptake there may be a protracted period of dormancy when no reported smoking occurs; what may be termed a 'sleeper effect', or a personal propensity or vulnerability to smoke that may not become manifest until additional factors trigger further smoking behaviour.

There are several potential explanations for the mechanism of this 'sleeper effect'. From a neurobiological viewpoint, neural reward pathways might be changed as a consequence of a single exposure to nicotine (Fagen, Mansvelder, Keath, & McGehee, 2003), thus potentially increasing vulnerability to later smoking uptake. Although the length of time involved between the initial trial and later smoking uptake is substantial this argument is still plausible, in vivo observation suggests a first exposure to nicotine can last for an extended period of time (Mansvelder & McGehee, 2000) and scientists in animal research have referred to the published version of this chapter to provide more epidemiological support for their laboratory based studies on the effect of nicotine on the adolescent brain (McQuown, Belluzzi, & Leslie, 2007; James-Walke, Williams, Taylor, & McMillen, 2007). There are other explanations however. Changes in the environment are likely to trigger a repeated experience with cigarettes among those vulnerable, for example through changing protective and risk factors such as peer smoking, stress, depression, and school environment (Schepis & Rao, 2005; Tyas & Pederson, 1998). Alternatively, from a social cognition perspective (Bandura, 1986), an early experience with cigarettes might break down barriers that would otherwise prevent or delay smoking, such as fear of adverse reactions to smoking or insecurities regarding how to smoke. If these potential concerns have been overcome in the past, the likelihood of accepting a cigarette at a later time point may be raised in relation to those who have not had this experience, resulting in the expression of a behaviour which has been dormant. Finally, from a constitutional vulnerability viewpoint, past research suggests that individuals with a particular social and psychological profile are more likely to become smokers (Schepis & Rao, 2005; Burt et al., 2000; Tyas & Pederson, 1998). The personal traits that lead to early experience of smoking could contribute an underlying increase in risk of smoking that is not triggered until environmental conditions are right.

In PRIME Theory the 'sleeper' effect is construed in terms of a stochastic process in which the momentary balance between impulses and inhibitions to smoke when the opportunity arises hovers around a level close to, but below, the point of positive balance and at some point 'chance' factors tip the balance in favour of the impulse to smoke (a kind of 'action threshold').

Whatever the explanation, there are important practical and policy implications of this finding. The results show that young adolescents enter secondary school with a smoking history which represents a lasting predisposition to be at risk of becoming a later current smoker. It may be that preventing children from trying even one cigarette is an important goal, and prevention efforts could usefully be focused at the earliest ages. Secondly, these results suggest that previous experimentation is a strong predictor of later smoking uptake and the finding of a 'sleeper effect' indicates that health care providers and those designing targeted interventions should pay particular attention to adolescents who report having tried cigarettes just once in the past.

An obvious limitation of these analyses is the reduction in numbers as a result of using data from only those providing smoking responses at each study year. As shown, this sub-sample of students are significantly different from the entire sample, but attempts to replicate analyses using a more complete sample do not change results. The lack of effect in Year 11 may be due to reduced numbers at Year 11, or alternatively low numbers of new smokers at this age reflecting a ceiling effect in smoking uptake. Either way, caution should be taken in concluding that the non-significant result in Year 11 signifies that the 'sleeper effect' does not extend for more than three years. The extent of smoking experimentation by age 11 (Year 7) in this sample suggests that the story actually starts at a much earlier time point and although the development of smoking behaviour is largely captured in examination of those aged 11 to 16, extension of research to both younger children and older teenagers and young adults would enable a fuller understanding of this progression.

In summary, this Chapter has shown that students who have experimented only briefly with cigarettes at an early age are more likely than those who have not tried smoking at all at this point to go on to become current smokers. This supports previous work illustrating that past behaviour is a strong predictor of future smoking, but also adds to the literature by revealing that this susceptibility can remain dormant for up to three years.

Chapter 7: Social and familial factors associated with smoking

7.1 Introduction

Smoking is often conceptualised as a social behaviour, but especially in adolescence when smoking behaviour is less a function of the physical effects of nicotine on the body and much more a social act which impacts on social status and is influenced by important others (Rugkasa et al., 2001). A large proportion of research on adolescent smoking has focused on the social influence that family and friends exert and social influence plays a fundamental role in a number of theories of health behaviour in general, and adolescent smoking specifically.

Parental smoking is an obvious important potential influence on adolescent smoking behaviour. Social Learning Theories would certainly predict that parent role models are important, with adolescents exposed to the modelling of smoking behaviour from a young age becoming equipped with the necessary skills and knowledge to perform that behaviour themselves in the future. However, despite a plethora of research, the picture of the degree to which parents play a role in influencing adolescents to take up smoking in the population is far from clear. Although a number of studies have shown a positive relationship between smoking by one or more parents and adolescent smoking behaviour (Exter Blokland et al., 2004; Vink et al., 2003a; Jackson et al., 1998), and some studies suggesting a 'dose-response' relationship between the number of parents smoking and higher odds of adolescent smoking uptake (Peterson 2006), reviews of the area have concluded that the strength of these relationships is often relatively modest with odds ratios typically less than 2, and effects frequently disappearing when other variables are added (Avenevoli & Merikangas, 2003; Conrad et al., 1992).

Families are complicated systems, however, and it is likely that whatever influence parents have on smoking behaviour it is not a simple relationship (Darling & Cumsille, 2003). Although the transmission of behaviour through observational learning is the most obvious pathway, along with increased accessibility of cigarettes in the home setting, perhaps leading to sanctioned experimentation (Leatherdale & Strath, 2007), a number of other mechanisms have been proposed. These include a genetic predisposition to becoming and staying a smoker and the transmission of norms and attitudes about smoking (Kalesan et al., 2006; Komro et al., 2003). The role of parenting styles and relationships with adolescents (Huver et al., 2006; Jackson & Dickinson, 2006; Chassin et al., 2005), as well as parental monitoring and warmth of relationship (Foster et al., 2007; Hill et al., 2005), have also been addressed in terms of their impact on adolescent smoking behaviour.

It has been proposed that the weak relationship often observed between parental smoking and adolescent smoking behaviour might be a function of a more indirect influence of parents on adolescent smoking. For example, parents may act as mediators in the relationship between other factors and smoking, strengthening the role that susceptibility to peer pressure and health beliefs, for example, have on smoking (Avenevoli & Merikangas, 2003). Parents may also moderate a number of other well known predictors of smoking behaviour, for example a number of studies have shown that parents can play a strong role in determining which social networks adolescents are exposed to and are encouraged or prevented from associating with (Avenevoli & Merikangas, 2003; White et al., 2003; Steinberg, 2001). However, as most research tends to examine the direct relationship between parent and child smoking, the role of parental influence is often obscured. Other proposed reasons for the weak association between parent and adolescent smoking are more methodological; adolescents are typically asked about their parents' smoking behaviour rather than direct self-reports from parents themselves, resulting in a degree of reporting error (Avenevoli & Merikangas, 2003). Many studies also simply look at smoking uptake. However, the relationship between parental and adolescent smoking is often stronger if more regular smoking or dependence are examined (Hill et al., 2005; Avenevoli & Merikangas, 2003). Recent work also suggests that the role of parental influence becomes more apparent as the age of the adolescent sample examined increases (Bricker et al., 2007).

Having siblings who smoke is also a risk factor for smoking uptake (Komro et al., 2003; Rajan et al., 2003), with the majority of studies in this area suggesting that the impact of peers on adolescent smoking is probably slightly greater and more consistent than that of parents (Slomkowski et al., 2005; Avenevoli & Merikangas, 2003; Vink et al., 2003a); Vink et al. (2003a) note that whereas parents who smoke typically increase the odds of adolescent smoking two-fold, sibling smoking is often associated with an increased risk of smoking by 2 to 4 times. As with parents, a number of factors are potentially involved in the relationship between sibling and adolescent smoking, including social influence, as well as sibling connectedness and quality of sibling relationship (Slomkowski et al., 2005). A genetic link is also likely, with siblings sharing the same degree of genes on average as parents. However, several studies have now suggested that the mechanism of the association between adolescent and sibling smoking is most likely environmental (Slomkowski et al., 2005; Rende et al., 2005). Rende et al. (2005), having found a clear genetic link between Mono-Zygotic twin siblings, noted that non-identical twin siblings and non-twin siblings had a different level of impact, despite the same genetic link. They concluded that closeness in age was the greatest predictor of sibling influence, with siblings closer in age having more contact and sharing more environmental characteristics than siblings with a larger age gap.

It has long been recognised that peer smoking is one of the main predictors of adolescent smoking (Kobus, 2003; Avenevoli & Merikangas, 2003; Tyas & Pederson, 1998; Conrad et al., 1992), and that friends smoking is more closely associated with adolescent smoking in the population than parental smoking (Nofziger & Lee, 2006; Vitaro et al., 2004; Avenevoli & Merikangas, 2003; de Vries et al., 2003; Bauman et al., 2001; West et al., 1999; Conrad et al., 1992). However, when examined closely the situation would appear to be complex. Hoffman et al. in their theoretical review of the literature describe a 'hydraulic model' (Hoffman et al., 2006) where parental influence on adolescents decreases with age and is replaced by an increased influence by peers. Previous research had supported this position, with the smoking behaviour of friends predicting adolescent smoking behaviour more so than that of parents, but with parents having more influence on the early stages of adolescent smoking behaviour (Vitaro et al., 2004; Bauman et al., 2001; West et al., 1999). However, more recent research concludes differently, with some studies finding the influence of both peers and parents consistently strong over time (Bricker et al., 2007; de Vries et al., 2003; Bauman et al., 2001) and others showing an increase in the role of parents with age (Bricker et al., 2006; Evans et al., 2006). It would appear, for example, that the association between adolescent smoking and having friends who smoke is stronger than the association between adolescent and parental smoking in terms of initiation and experimentation, but the association between adolescent and parental smoking is stronger for more regular smoking (Bricker et al., 2006).

Exactly how friends influence smoking behaviour is still disputed as research has not unravelled whether it is peer influence, peer selection or both that causes the well documented association between friends who smoke and smoking uptake (Kobus, 2003). Peer influence was previously considered most important, although 'peer pressure' or direct coercion to smoke is also probably much less common than thought, with peer influence most likely characterised by an internal pressure to conform to the norms of a group (Stewart-Knox et al., 2005; Simons-Morton et al., 2001). Even so, the role of peer influence in adolescent smoking has probably been overestimated (Arnett, 2007; Kobus, 2003). Firstly, fewer studies have examined the role of selection, or smokers choosing smoking friends (Hoffman et al., 2007) and, secondly, the methodological complexities involved in examining the relationship between peer and adolescent smoking correctly make the relationship very difficult to assess (Arnett, 2007; Reid et al., 2007; Lundborg, 2006; Kobus, 2003). Even longitudinal studies cannot accurately portray the situation without both examining a wide range of other potential predictors of smoking, which may explain why adolescents both smoke and associate with peers who smoke (Arnett, 2007; Urberg, Luo, Pilgrim, & Degirmencioglu, 2003). In addition, friend smoking is best assessed directly (as adolescents are more likely to project their own behaviour onto their friends, with smokers reporting a greater number of their peers as smokers than is actually the case, what is termed a 'false consensus effect' (Arnett, 2007; Kobus, 2003)). This had led to the use of social network analysis to directly examine the smoking characteristics of the peer groups adolescents are connected to and how these characteristics and connections change over time (Simons-Morton & Chen, 2006; Kobus, 2003). This also has difficulties, however, as networks of friends outside of the school setting are often not accounted for (Simons-Morton & Chen, 2006) and Bricker et al. (2006) argue that the only way to definitively assess the peer selection/influence direction is by a randomised controlled trial, which is, of course, impossible. It is likely that both processes occur and there is a reciprocal relationship between the two (Hall & Valente, 2007; Hoffman et al., 2007; de Vries et al., 2006; Simons-Morton & Chen, 2006).

An issue of interest in relation to all social influences on smoking is the extent to which same, or opposite, sex role models differentially influence the smoking behaviour among boys and girls. Research has also focused on differences in the way that boys and girls respond to social influence. Again there are contradictory findings, with some studies finding no difference in the strength of parental influence by the gender of parents, or that of adolescents, but other studies have shown clear gender-specific effects (Peterson, Jr. et al., 2006; Avenevoli & Merikangas, 2003; Wang, Fitzhugh, Green, Turner, Eddy et al., 1999). In a recent study Nofziger and Lee (2006) found that mothers influenced daughters more than sons, and that fathers influenced sons, not daughters. Similarly in terms of siblings, boys were influenced by their older brothers, and to a lesser extent their older sisters. Girls were only influenced by their older sisters. There is some evidence that mothers who smoke have a greater influence on adolescent smoking behaviour (Vink, Willemsen, Engels, & Boomsma, 2003b) and a number of studies have found girls to be more influenced by both parents and peers, however, again these findings are inconsistent (Avenevoli & Merikangas, 2003).

The first section in this chapter will establish the extent to which smoking by parents, siblings and friends is associated with adolescent smoking behaviour. Methodological difficulties with the assessment of these factors, such as self-reported number of friends who smoke and a very basic sibling smoking question means that little novel can be gained from analysis of these variables over more recent research using social network analysis. However, the importance of these variables in the literature means they should not be left out of any examination of the factors associated with adolescent smoking. Therefore simple cross-sectional analyses will be presented in order to compare the similarity of the relationship between adolescent smoking and smoking by parents, siblings and friends in the HABITS study to past findings. The extent to which these variables are independently associated with smoking will also be investigated.

Having presented these basic data the rest of this chapter will focus on two novel areas of research, the first being the association between step-parent smoking and adolescent smoking behaviour. As discussed above, one potential mechanism to explain the relationship between parent and adolescent smoking is that adolescents inherit from their parents a genetic predisposition to smoke. However, despite a strong base of evidence suggesting that likelihood of smoking in adulthood is determined, at least in part, by genetic factors (Li et al., 2003; Sullivan & Kendler, 1999), research in the adolescent age range is much less clear (Avenevoli & Merikangas, 2003). White et al. (2003) found that although genetic factors explained young adult smoking to some extent, environmental factors played the highest role in adolescence, perhaps with genes playing an indirect role via peer choice. Vink et al. studied Mono-Zygotic (MZ) and Di-Zygotic (DZ) twins, concluding that MZ twins' smoking profiles were more similar than DZ twins, suggesting a genetic susceptibility to smoking (Vink et al., 2003a). However, genes seemed more important in older than younger cohorts and Vink et al. suggest that at younger ages social influence is especially important and genes play a more 'back-seat' role at this time-point.

An interesting question in relation to the role of parental smoking in adolescent smoking behaviour is the extent to which smoking by non-parent figures in the home influences adolescent behaviour. Bjarnason et al. (2003) found that smoking by adults other than parents in the home did influence adolescent smoking behaviour, but were unable to distinguish the genetic relationship of these role models to participants. Examining the role that non-biological parent figures play in predicting adolescent smoking may help unravel the mechanisms through which adolescent smoking behaviour develops and is an important public health issue in itself (Avenevoli & Merikangas, 2003).

A large number of studies report that children from step-families are more likely to go on to show problem behaviour, including smoking (Griesbach et al., 2003; Bjarnason et al., 2003; Tyas & Pederson, 1998), with proposed explanations including reduced income, more limited parent-child interactions, higher stress and increased residential mobility (Hoffmann, 2006). However, no study has as yet examined the extent to which the actual smoking behaviour of step-parents predicts adolescent smoking. The second part of this chapter uses biological- and step-parent smoking behaviour data to examine the influence of step-parent smoking on adolescent smoking behaviour.

The final section of this chapter addresses an aspect of adolescents' social lives which has had little attention (Kobus, 2003), but nonetheless has produced some intriguing results in the past; that of the association between smoking and romantic relationships. Three early studies have reported a cross-sectional association between smoking and 'dating' (Tucker, 1985; Murray, Kiryluk, & Swan, 1984; Bynner, 1969) and a prospective study in 1988 demonstrated that dating predicted smoking uptake two and a half years later (McNeill et al., 1988). Indeed there is good reason to expect that there would be a relationship between smoking and dating as a number of factors are associated with both behaviours.

As discussed in Chapter 1, unlike adult smokers, who largely smoke because of the effects of nicotine on the brain, smoking among adolescents is principally a social act used to influence social status (Rugkasa et al., 2001). Examination of the composition of peer groups shows that the most popular students, or those who are 'leaders' of social groups, are more likely to be smokers (Valente et al., 2005; Michell & Amos, 1997). High status and popularity are also associated with the ability to attract the opposite sex and maintain romantic relationships (Michell & Amos, 1997). In fact attracting the opposite sex has been reported as an explicit motivation for smoking among teenage girls (Lloyd et al., 1998).

Another factor common to both smoking and dating is the transition from childhood to adulthood (Rugkasa et al., 2001; Magnusson, Stattin, & Allen, 1986). Puberty has been associated with both the development of smoking (Simon, Wardle, Jarvis, Steggles, & Cartwright, 2003; Dick et al., 2000) and the occurrence of dating (Smolak, Levine, & Gralen, 1993). Lloyd and Lucas et al. (1998) note an interesting relationship between pubertal development and smoking among girls, with smoking being more common among girls who enter puberty early as well as among late maturing girls. They explain this phenomenon in terms of portraying an adult-identity, with girls either smoking in accordance with their pubertally advanced status or smoking as a 'badge of maturity' (p168) in order to bolster their otherwise less mature image.

Experimentation with both smoking and dating at an early stage of adolescence may also be linked to an aspiration to be more 'mature' or 'adult-like'(Rugkasa et al., 2001). An early study of the development of smoking among teenage boys measured anticipation of adulthood as a function of taking part in a number of 'adult-like' behaviours, such as staying out late and going out drinking with friends, and found an association between high scores on this scale and both smoking and 'going out' with girls (Bynner, 1969). The concept of smoking as an aspiration to maturity has also been addressed by Chassin et al. (1992) who followed young smokers into early adulthood. Smokers were more likely to be married at follow-up than non-smokers (independent of socioeconomic position), although among married individuals, those who had been young smokers were also more likely to be divorced than those who had not been young smokers. Chassin et al. suggested that this supports a 'pseudomaturity' viewpoint whereby smoking signals an aspiration to maturity ahead of time, but the lack of developmental maturity means that adult roles are not well maintained.

The final section of this chapter about social influences on smoking behaviour examines the association between dating and smoking prospectively using the HABITS dataset. This takes previous research further by looking at the association between the two variables in a contemporary sample over a period of five years. In addition, the direction of the relationship between the two behaviours can be investigated, facilitating conclusions about the validity of this finding for smoking prevention.

In summary, the specific questions addressed in this chapter are:

1) To what extent is parent, sibling and peer smoking associated with adolescent smoking behaviour?
    a. Which of these social influences appears most important?
    b. Does this differ by the gender of parents and of adolescents?
    c. Does any parental relationship disappear when friends smoking is considered?
2) What role do step-parents play in influencing adolescent smoking behaviour?
    a. Are adolescents with step-parents more likely to smoke?

   b. Are parents of adolescents with step-parents more likely to smoke?
   c. Do step-parents who smoke independently influence adolescents smoking behaviour?
      i. If so how does this influence compare to that of biological parents?

3) Does having a boyfriend or girlfriend make adolescents more susceptible to taking up smoking?
   a. What is the direction of this relationship?

7.2 The association between smoking by parents, siblings, and friends and adolescent smoking behaviour

7.2.1 Methods

7.2.1.1 Population

The first section of this chapter presents simple cross-sectional data on the relationship between smoking by adolescents and smoking by their parents, siblings and friends at each study year. A total of 4273 students provided smoking data in Year 7, 4292 in Year 8, 4142 in Year 9, 4136 in Year 10 and 3712 in Year 11.

7.2.1.2 Measures

At each study year participants were asked 'Does your mother smoke?' and 'Does your father smoke?' and could answer 'yes' or 'no'. These variables were then combined to create a four category variable indicating whether a participant has no parent who smokes, that just their father smokes, that just their mother smokes or that both their parents smoke. Sibling smoking was ascertained by asking whether participants had any brothers or sisters who smoke, again with the response categories 'yes' or 'no', and data on smoking by peers was gathered with the question 'How many of your close friends smoke? All, Most, Some, A few, None'. All the above questions were taken from the 1996 ONS survey (Jarvis, 1996).

Current smoking, adjusted for cotinine, and regular smoking variables were used in the following analyses. Ethnicity (White, Black/mixed Black, Asian/mixed Asian, and other), deprivation (Townsend score) and gender were included as important confounding factors.

7.2.1.3 Statistical analysis

The percentage of mothers, fathers, siblings and close friends who smoke were calculated for each study year. The association between smoking by these significant others and adolescent current smoking was then assessed using crosstab analyses with chi-square tests of significance. Logistic regression analyses were then performed to control for demographic factors ethnicity and deprivation. Further logistic regression analyses were then run to establish the independent association of parent, sibling and friend smoking on adolescent smoking behaviour. As discussed above, past literature suggests that there may be a gender difference in the relationship between parental smoking and adolescent smoking behaviour, and that the role parents play in influencing adolescent smoking behaviour is gender specific, with mothers influencing daughters to a greater extent than sons, and fathers having a greater impact on sons. These results have therefore been run separately for boys and girls. Literature also suggests that associations between social factors and smoking may differ with the level of smoking behaviour reported. Analyses were therefore repeated using regular smoking (smoking one or more cigarettes a week) as the dependent variable. Daily smoking was not used as numbers were small when split by the social factors examined. All logistic regression analyses were then re-run using complex samples logistic regression procedures to account for school clustering.

7.2.2 Results

7.2.2.1 Smoking by parents, siblings, and close friends

Table 7.1 shows the percentage of students who report that their parents, siblings, and friends smoke at each study year. A greater percentage of fathers compared to mothers smoke and at each year a lower percentage of parents were reported as smokers, probably due to a combination of the actual decline in adult smoking prevalence and the selective drop-out of participants whose parents are more likely to be smokers. The percentage of participants who report siblings who smoke increases at each year. Unfortunately there are no data to suggest the age of these siblings, but it is likely the sample consists of young people who are also developing new smoking habits. The number of friends who smoke also increases, predictably, with each study year, although very few participants reported that all their close friends smoked. The categories 'All' and 'Most' were therefore combined.

Table 7.1 Percentage (n) of students reporting that their parents, siblings and friends smoke at each study year

	Year 7	Year 8	Year 9	Year 10	Year 11
Parent smoking					
No parent smokes	54.2 (2323)	55.5 (2430)	56.7 (2391)	57.3 (2369)	63.4 (2342)
Father smokes	19.8 (850)	18.8 (824)	18.9 (798)	19.2 (794)	17.1 (630)
Mother smokes	10.6 (455)	10.4 (455)	10.1 (426)	10.2 (423)	9.1 (338)
Both parents smoke	15.4 (660)	15.3 (669)	14.3 (601)	13.3 (549)	10.4 (385)
Sibling smoking					
Sibling smokes	17.5 (741)	22.0 (948)	25.7 (1078)	28.3 (1168)	28.8 (1063)
No. friends who smoke					
All	0.5 (20)	1.0 (44)	1.8 (77)	3.0 (126)	3.8 (140)
Most	2.7 (114)	7.4 (321)	11.7 (491)	17.3 (716)	22.1 (818)
Some	5.5 (233)	13.6 (593)	19.5 (819)	23.4 (965)	27.7 (1026)
A few	20.6 (878)	31.2 (1357)	33.4 (1405)	30.1 (1245)	29.1 (1079)
None	70.8 (3020)	46.8 (2038)	33.7 (1418)	26.1 (1080)	17.4 (646)

7.2.2.2 The relationship between parental smoking and adolescent smoking behaviour

Table 7.2 and Table 7.3 show that both boys and girls who have parents who smoke were more likely to have reported both current smoking and regular smoking at each year of the study. As might be expected, reporting that both parents smoke was associated with the greatest percentage of smoking among boys and girls. However, there was no obvious gender difference in the role of mothers and fathers who smoked on smoking behaviour, with both boys and girls who report that just their mother smokes appearing more likely to be smokers than those who report that just their father smokes.

Logistic regression analyses, controlling for the sociodemographic variables ethnicity and deprivation, also show that having parents who smoke was a significant risk factor for both current and regular smoking (see Table 7.4 and Table 7.5). Smoking by both parents, and by mothers only, had a strong, highly significant, association with adolescent smoking at each study year among both boys and girls, although odds ratios were slightly higher for girls. Smoking by fathers only shows a weaker association which was largely non-significant among boys. This pattern was repeated for regular smoking (see Table 7.5), although the association between fathers smoking and girls smoking, though still comparatively small, was stronger than for current smoking.

Table 7.2 Current smoking by parental smoking at each study year, percentage (n)

	Parents don't smoke	Father smokes	Mother smokes	Both Parents smoke	Chi-square test
Boys					
Year 7	1.6 (22)	2.8 (14)	4.5 (12)	4.0 (15)	$\chi^2 = 12.949$, df = 3, $p = 0.005$
Year 8	5.5 (76)	5.5 (26)	12.3 (32)	14.7 (54)	$\chi^2 = 46.691$, df = 3, $p < 0.001$
Year 9	10.3 (144)	13.4 (58)	19.0 (44)	24.3 (79)	$\chi^2 = 45.808$, df = 3, $p < 0.001$
Year 10	18.2 (251)	22.2 (97)	31.6 (75)	32.6 (102)	$\chi^2 = 44.351$, df = 3, $p < 0.001$
Year 11	24.8 (337)	33.5 (118)	40.7 (77)	46.4 (98)	$\chi^2 = 57.151$, df = 3, $p < 0.001$
Girls					
Year 7	1.5 (14)	3.2 (11)	4.3 (8)	5.4 (15)	$\chi^2 = 14.196$, df = 3, $p = 0.003$
Year 8	5.1 (51)	10.9 (37)	16.8 (31)	19.3 (53)	$\chi^2 = 64.531$, df = 3, $p < 0.001$
Year 9	11.8 (111)	17.1 (59)	30.4 (56)	34.3 (87)	$\chi^2 = 89.064$, df = 3, $p < 0.001$
Year 10	20.8 (204)	27.0 (96)	43.5 (80)	46.6 (109)	$\chi^2 = 87.784$, df = 3, $p < 0.001$
Year 11	26.3 (256)	35.9 (99)	46.3 (69)	54.3 (94)	$\chi^2 = 68.303$, df = 3, $p < 0.001$

Table 7.3 Regular smoking by parental smoking at each study year, percentage (n)

	Parents don't smoke	Father smokes	Mother smokes	Both Parents smoke	Chi-square test
Boys					
Year 7	0.4 (5)	0.0 (0)	0.7 (2)	1.6 (6)	n/a†
Year 8	1.6 (22)	2.3 (11)	6.1 (16)	5.4 (20)	$\chi^2 = 28.338$, df = 3, $p < 0.001$
Year 9	4.0 (55)	5.8 (25)	8.6 (20)	13.6 (46)	$\chi^2 = 45.808$, df = 3, $p < 0.001$
Year 10	6.2 (86)	7.8 (34)	16.0 (38)	18.5 (58)	$\chi^2 = 68.992$, df = 3, $p < 0.001$
Year 11	11.6 (157)	15.9 (56)	23.8 (45)	31.8 (67)	$\chi^2 = 57.151$, df = 3, $p < 0.001$
Girls					
Year 7	0.3 (3)	1.2 (4)	1.1 (2)	2.2 (6)	n/a†
Year 8	1.9 (19)	3.5 (12)	5.4 (10)	8.4 (23)	$\chi^2 = 28.257$, df = 3, $p < 0.001$
Year 9	3.6 (34)	10.1 (35)	14.1 (26)	17.3 (44)	$\chi^2 = 65.762$, df = 3, $p < 0.001$
Year 10	7.2 (71)	13.8 (49)	24.5 (45)	28.6 (67)	$\chi^2 = 99.522$, df = 3, $p < 0.001$
Year 11	10.9 (106)	21.0 (58)	30.2 (45)	35.8 (62)	$\chi^2 = 89.660$, df = 3, $p < 0.001$

†chi-square tests not reported as cells have expected counts less than 5

Table 7.4 Cross sectional association between parental smoking and adolescent current smoking at each study year

	Boys				Girls			
	Parents don't smoke	**Father smokes**	**Mother smokes**	**Both Parents smoke**	**Parents don't smoke**	**Father smokes**	**Mother smokes**	**Both Parents smoke**
Year 7								
Unadjusted odds	1	1.79	2.93**	2.61**	1	2.13	2.90*	3.68**
(2532,1726)[†]		(0.91-3.52)	(1.43-5.99)	(1.34-5.08)		(0.96-4.75)	(1.20-7.02)	(1.76-7.73)
Adjusted odds[1]	1	1.89	2.86**	2.71**	1	1.84	1.93	2.37*
(2476,1701)		(0.95-3.75)	(1.38-5.93)	(1.36-5.40)		(0.82-4.15)	(0.75-4.95)	(1.08-5.19)
Year 8								
Unadjusted odds	1	1.01	2.42***	2.98***	1	2.26***	3.74***	4.43***
(2494,1790)		(0.64-1.59)	(1.56-3.74)	(2.06-4.31)		(1.45-3.52)	(2.32-6.04)	(2.94-6.68)
Adjusted odds	1	1.03	2.23**	2.84***	1	2.24***	3.72***	4.34***
(2447,1763)		(0.65-1.66)	(1.41-3.51)	(1.91-4.23)		(1.42-3.52)	(2.27-6.10)	(2.78-6.77)
Year 9								
Unadjusted odds	1	1.34	2.03***	2.64***	1	1.54*	3.28***	3.90***
(2395,1726)		(0.97-1.86)	(1.40-2.94)	(1.95-3.59)		(1.09-2.17)	(2.26-4.75)	(2.82-5.40)
Adjusted odds	1	1.34	1.91**	2.48***	1	1.53*	3.00***	3.66***
(2375,1712)		(0.96-1.87)	(1.31-2.78)	(1.80-3.43)		(1.08-2.17)	(2.05-4.40)	(2.59-5.18)
Year 10								
Unadjusted odds	1	1.28	2.08***	2.17***	1	1.41*	2.94***	3.33***
(2363,1755)		(0.99-1.67)	(1.53-2.82)	(1.65-2.85)		(1.07-1.87)	(2.11-4.08)	(2.47-4.49)
Adjusted odds	1	1.33*	1.94***	2.18***	1	1.49**	2.65***	3.07***
(2333,1738)		(1.01-1.75)	(1.41-2.66)	(1.63-2.91)		(1.12-1.99)	(1.89-3.71)	(2.24-4.22)
Year 11								
Unadjusted odds	1	1.53**	2.08***	2.63***	1	1.57**	2.42***	3.33***
(2110,1571)		(1.19-1.97)	(1.52-2.86)	(1.95-3.54)		(1.18-2.08)	(1.70-3.44)	(2.39-4.64)
Adjusted odds	1	1.51**	1.82***	2.57***	1	1.68**	2.20***	2.94***
(2664,1513)		(1.16-1.97)	(1.31-2.52)	(1.89-3.51)		(1.25-2.27)	(1.53-3.17)	(2.06-4.18)

* $p<0.05$, **$p<0.01$, ***$p<0.001$
[†] (n for boys, n for girls)
[1]Adjusted for ethnicity and deprivation

Table 7.5 Cross sectional association between parental smoking and adolescent regular smoking at each study year

	Boys				Girls			
	Parents don't smoke	**Father smokes**	**Mother smokes**	**Both Parents smoke**	**Parents don't smoke**	**Father smokes**	**Mother smokes**	**Both Parents smoke**
Year 8#								
Unadjusted odds	1	1.48	4.07***	3.58***	1	1.88	2.95**	4.70***
(2494,1790)†		(0.71-3.08)	(2.11-7.85)	(1.93-6.63)		(0.90-3.92)	(1.35-6.44)	(2.52-8.76)
Adjusted odds[1]	1	1.59	4.48***	3.97***	1	1.71	2.79*	4.75***
(2447,1763)		(0.74-3.43)	(2.28-8.81)	(2.04-7.70)		(0.79-3.67)	(1.22-6.41)	(2.41-9.37)
Year 9								
Unadjusted odds	1	1.49	2.29**	3.83***	1	3.01***	4.40***	5.60***
(2395,1726)		(0.92-2.42)	(1.35-3.90)	(2.54-5.78)		(1.84-4.90)	(2.57-7.53)	(3.49-8.97)
Adjusted odds[1]	1	1.42	2.19**	3.84***	1	2.85***	3.76***	4.78***
(2375,1712)		(0.86-2.35)	(1.28-3.76)	(2.50-5.90)		(1.74-4.67)	(2.17-6.52)	(2.91-7.87)
Year 10								
Unadjusted odds	1	1.27	2.87***	3.41***	1	2.06***	4.15***	5.15***
(2363,1755)		(0.84-1.92)	(1.90-4.32)	(2.38-4.89)		(1.40-3.02)	(2.75-3.02)	(3.55-7.47)
Adjusted odds[1]	1	1.34	2.80***	3.71***	1	2.06***	3.50***	4.25***
(2333,1738)		(0.88-2.05)	(1.83-4.27)	(2.53-5.44)		(1.39-3.07)	(2.28-5.36)	(2.86-6.31)
Year 11								
Unadjusted odds	1	1.45*	2.39***	3.56***	1	2.18***	3.54***	4.57***
(2110,1571)		(1.04-2.01)	(1.65-3.47)	(2.55-4.97)		(1.53-3.10)	(2.36-5.30)	(3.15-6.62)
Adjusted odds[1]	1	1.37	2.05***	3.41***	1	2.29***	3.17***	3.74***
(2064,1513)		(0.97-1.94)	(1.39-3.02)	(2.40-4.85)		(1.59-3.29)	(2.09-4.81)	(2.52-5.56)

* p<0.05, **p<0.01, ***p<0.001

#Analyses were not run for year 7 as numbers were too low – as shown in Table 7.3

† (n for boys, n for girls)

[1]Adjusted for ethnicity and deprivation

7.2.2.3 The relationship between sibling smoking and adolescent smoking behaviour

Table 7.6 and Table 7.7 show there was a strong association between having siblings who smoke and adolescent smoking behaviour. This appeared strongest among girls, with over half of girls who have siblings who smoke reporting current smoking by Year 11, but only a quarter of girls without siblings who smoke reporting smoking by the end of the study. Logistic regressions controlling for ethnicity and deprivation support this, with strong, significant associations between sibling smoking and adolescent smoking behaviour at every year, for both current and regular smoking. Odds ratios were slightly higher among girls for current smoking (see Table 7.8), however, the association between sibling smoking and regular smoking appears stronger for boys (see Table 7.9).

Table 7.6 Current smoking by sibling smoking at each study year, percentage (n)

	Siblings smoke	No siblings smoke	Chi-square test
Boys			
Year 7	6.0 (26)	1.7 (35)	$\chi^2 = 28.023$, df = 1, $p < 0.001$
Year 8	16.1 (85)	5.0 (97)	$\chi^2 = 73.654$, df = 1, $p < 0.001$
Year 9	27.3 (159)	9.0 (161)	$\chi^2 = 127.164$, df = 1, $p < 0.001$
Year 10	36.9 (238)	16.6 (286)	$\chi^2 = 111.447$, df = 1, $p < 0.001$
Year 11	43.6 (257)	24.3 (368)	$\chi^2 = 75.204$, df = 1, $p < 0.001$
Girls			
Year 7	6.9 (21)	1.9 (27)	$\chi^2 = 22.574$, df = 1, $p < 0.001$
Year 8	23.8 (91)	5.6 (78)	$\chi^2 = 114.050$, df = 1, $p < 0.001$
Year 9	34.3 (157)	12.4 (157)	$\chi^2 = 107.399$, df = 1, $p < 0.001$
Year 10	45.2 (235)	20.7 (253)	$\chi^2 = 108.475$, df = 1, $p < 0.001$
Year 11	51.2 (240)	25.5 (283)	$\chi^2 = 98.131$, df = 1, $p < 0.001$

Table 7.7 Regular smoking by sibling smoking at each study year, percentage (n)

	Siblings smoke	No siblings smoke	Chi-square test
Boys			
Year 7	2.1 (9)	0.1 (3)	n/a†
Year 8	7.9 (42)	1.2 (24)	$\chi^2 = 71.122$, df = 1, $p < 0.001$
Year 9	14.4 (84)	3.3 (59)	$\chi^2 = 96.653$, df = 1, $p < 0.001$
Year 10	18.9 (122)	5.5 (95)	$\chi^2 = 100.739$, df = 1, $p < 0.001$
Year 11	27.3 (161)	10.6 (161)	$\chi^2 = 90.716$, df = 1, $p < 0.001$
Girls			
Year 7	2.6 (8)	0.5 (7)	n/a†
Year 8	8.4 (32)	2.2 (31)	$\chi^2 = 32.668$, df = 1, $p < 0.001$
Year 9	16.6 (76)	5.0 (63)	$\chi^2 = 60.892$, df = 1, $p < 0.001$
Year 10	24.2 (126)	8.5 (104)	$\chi^2 = 78.660$, df = 1, $p < 0.001$
Year 11	32.2 (151)	11.0 (122)	$\chi^2 = 103.671$, df = 1, $p < 0.001$

†chi-square tests not reported as cells have expected counts less than 5

Table 7.8 Cross-sectional association between sibling smoking and adolescent current smoking at each study year

	Boys		Girls	
	No Siblings smoke	**Siblings smoke**	**No Siblings smoke**	**Siblings smoke**
Year 7				
Unadjusted odds (2497,1708)†	1	3.71*** (2.21-6.24)	1	3.77*** (2.10-6.76)
Adjusted odds[1] (2442,1683)	1	3.93*** (2.33-6.65)	1	3.03*** (1.65-5.55)
Year 8				
Unadjusted odds (2456,1768)	1	3.61*** (2.65-4.92)	1	5.22*** (3.76-7.25)
Adjusted odds (2410,1742)	1	3.61*** (2.61-4.98)	1	4.96*** (3.54-6.96)
Year 9				
Unadjusted odds (2378,1720)	1	3.82*** (2.99-4.87)	1	3.67*** (2.84-4.74)
Adjusted odds (2358,1706)	1	3.56*** (2.77-4.57)	1	3.63*** (2.79-4.72)
Year 10				
Unadjusted odds (2363,1742)	1	2.93*** (2.39-3.59)	1	3.16*** (2.53-3.94)
Adjusted odds (2333,1725)	1	2.93*** (2.37-3.63)	1	3.19*** (2.54-4.02)
Year 11				
Unadjusted odds (2103,1579)	1	2.40*** (1.97-2.94)	1	3.06*** (2.44-3.84)
Adjusted odds (2057,1521)	1	2.46*** (2.00-3.04)	1	3.15*** (2.48-4.00)

* p<0.05, **p<0.01, ***p<0.001

† (n for boys, n for girls)

[1]Adjusted for ethnicity and deprivation

Table 7.9 Cross-sectional association between sibling smoking and adolescent regular smoking at each study year

	Boys		Girls	
	No Siblings smoke	**Siblings smoke**	**No Siblings smoke**	**Siblings smoke**
Year 8#				
Unadjusted odds (2456,1768)†	1	6.84*** (4.10-11.40)	1	3.98*** (2.40-6.62)
Adjusted odds[1] (2410,1742)	1	6.77*** (3.98-11.52)	1	3.68*** (2.17-6.25)
Year 9				
Unadjusted odds (2378,1720)	1	4.97*** (3.51-7.03)	1	3.79*** (2.66-5.39)
Adjusted odds (2358,1706)	1	4.67*** (3.28-6.64)	1	3.51*** (2.44-5.04)
Year 10				
Unadjusted odds (2363,1742)	1	3.99*** (3.00-5.30)	1	3.44*** (2.59-4.57)
Adjusted odds (2333,1725)	1	3.88*** (2.89-5.20)	1	3.43*** (2.56-4.61)
Year 11				
Unadjusted odds (2103,1579)	1	3.15*** (2.47-4.02)	1	3.85*** (2.94-5.04)
Adjusted odds (2057,1521)	1	3.19*** (2.48-4.12)	1	3.82*** (2.88-5.06)

* p<0.05, **p<0.01, ***p<0.001
#Analyses were not run for year 7 as numbers were too low – as shown in Table 7.7
† (n for boys, n for girls)
[1]Adjusted for ethnicity and deprivation

7.2.2.4 The relationship between friends who smoke and adolescent smoking behaviour

Table 7.10 and Table 7.11 display the percentage of students who smoke by the proportion of friends that students report smoke. It is clear from these tables that very few students with no friends who smoke report current smoking and virtually none report regular smoking. As the proportion of friends who smoke increases, the percentage of boys and girls who report both current and regular smoking also increases. Logistic regressions controlling for ethnicity and deprivation confirm that the association between friend and adolescent smoking is exceptionally strong, with unusually high odds ratios (Table 7.12 and Table 7.13). There were some interesting gender differences with higher odds ratios observed for current smoking among girls in the earlier years of the study, but odds ratios for boys higher than those for girls in Year 11 for current smoking (see Table 7.12) and for all analyses with regular smoking (see Table 7.13).

Table 7.10 Current smoking by number of friends who smoke at each study year, percentage (n)

	Friend smoking				
	All/most	**Some**	**A few**	**None**	**Chi-square test**
Boys					
Year 7	19.5 (16)	8.5 (13)	4.0 (21)	0.7 (12)	$\chi^2 = 150.830$, df = 3, $p < 0.001$
Year 8	35.9 (60)	18.6 (65)	7.1 (57)	0.5 (6)	$\chi^2 = 334.913$, df = 3, $p < 0.001$
Year 9	55.2 (170)	22.6 (95)	6.3 (51)	0.9 (8)	$\chi^2 = 635.782$, df = 3, $p < 0.001$
Year 10	58.0 (254)	31.9 (374)	11.5 (85)	1.7 (11)	$\chi^2 = 556.497$, df = 3, $p < 0.001$
Year 11	60.6 (345)	32.0 (191)	14.3 (90)	1.9 (6)	$\chi^2 = 450.220$, df = 3, $p < 0.001$
Girls					
Year 7	26.5 (13)	18.2 (14)	4.1 (14)	0.5 (6)	$\chi^2 = 198.846$, df = 3, $p < 0.001$
Year 8	51.7 (91)	18.5 (43)	6.1 (32)	0.5 (4)	$\chi^2 = 470.453$, df = 3, $p < 0.001$
Year 9	62.7 (151)	30.3 (113)	7.9 (45)	0.9 (5)	$\chi^2 = 506.934$, df = 3, $p < 0.001$
Year 10	64.3 (257)	35.4 (146)	15.8 (79)	2.0 (9)	$\chi^2 = 456.615$, df = 3, $p < 0.001$
Year 11	69.0 (265)	35.2 (151)	20.7 (92)	4.6 (15)	$\chi^2 = 374.518$, df = 3, $p < 0.001$

Table 7.11 Regular smoking by number of friends who smoke at each study year, percentage (n)

	Friend smoking				
	All/most	**Some**	**A few**	**None**	**Chi-square test**
Boys					
Year 7	9.8	2.0	0.2	0.1	n/a†
	(8)	(3)	(1)	(1)	
Year 8	18.0	7.4	1.5	0.1	n/a†
	(30)	(26)	(12)	(1)	
Year 9	32.1	8.3	1.2	0.1	$\chi^2 = 456.536$, df = 3,
	(99)	(35)	(10)	(1)	$p < 0.001$
Year 10	35.6	7.3	2.4	0.3	$\chi^2 = 470.860$, df = 3,
	(156)	(40)	(18)	(2)	$p < 0.001$
Year 11	42.5	10.2	3.7	0.3	$\chi^2 = 454.444$, df = 3,
	(242)	(61)	(23)	(1)	$p < 0.001$
Girls					
Year 7	18.4	3.9	0.9	0.0	n/a†
	(9)	(3)	(3)	(0)	
Year 8	23.9	5.2	1.1	0.4	$\chi^2 = 248.081$, df = 3,
	(42)	(12)	(6)	(3)	$p < 0.001$
Year 9	38.2	8.8	2.1	0.4	$\chi^2 = 366.616$, df = 3,
	(92)	(33)	(12)	(2)	$p < 0.001$
Year 10	41.8	11.6	3.0	0.5	$\chi^2 = 393.053$, df = 3,
	(167)	(48)	(15)	(2)	$p < 0.001$
Year 11	50.8	12.8	4.7	0.6	$\chi^2 = 419.993$, df = 3,
	(195)	(55)	(21)	(2)	$p < 0.001$

†chi-square tests not reported as cells have expected counts less than 5

Table 7.12 Cross-sectional association between friend smoking and adolescent current smoking at each study year

	Boys				Girls			
	No friends smoke	A few friends smoke	Some friends smoke	All/Most friends smoke	No friends smoke	A few friends smoke	Some friends smoke	All/Most friends smoke
Year 7								
Unadjusted odds	1	5.99***	13.50***	35.25***	1	8.94***	45.96***	74.69***
(2523,1711)[†]		(2.93-12.25)	(6.05-30.150)	(16.04-77.50)		(3.41-23.44)	(17.09-123.61)	(26.87-207.65)
Adjusted odds[1]	1	6.06***	13.84***	39.07***	1	8.26***	41.70***	69.68***
(2467,1687)		(2.96-12.42)	(6.16-31.09)	(17.47-87.38)		(3.12-21.88)	(15.22-114.23)	(23.59-205.845)
Year 8								
Unadjusted odds	1	14.63***	43.94***	107.66***	1	13.66***	47.78***	224.82***
(2479,1776)		(6.28-34.10)	(18.85-102.43)	(45.46-255.00)		(4.80-38.85)	(16.94-134.72)	(80.60-627.130)
Adjusted odds	1	21.13***	60.55***	150.93***	1	18.24***	65.87***	283.51***
(2433,1749)		(7.63-58.55)	(21.82-168.00)	(53.63-424.78)		(5.54-60.09)	(20.18-215.03)	(87.41-919.512)
Year 9								
Unadjusted odds	1	7.09***	30.67***	129.66***	1	9.21***	46.77***	180.53***
(2387,1728)		(3.34-15.04)	(14.74-63.82)	(62.39-269.47)		(3.63-23.37)	(18.86-115.93)	(72.06-452.30)
Adjusted odds	1	6.64***	27.84***	120.313***	1	9.31***	47.63***	188.77***
(2367,1714)		(3.12-14.11)	(13.35-58.04)	(57.77-250.58)		(3.66-23.70)	(19.17-118.33)	(74.86-476.02)
Year 10								
Unadjusted odds	1	7.36***	26.50***	78.18***	1	8.99***	26.25***	86.27***
(2360,1755)		(3.89-13.93)	(14.22-49.39)	(41.82-146.15)		(4.45-18.14)	(13.16-52.34)	(43.22-172.17)
Adjusted odds	1	7.03***	24.96***	73.00***	1	9.32***	25.89***	85.56***
(2330,1738)		(3.71-13.34)	(13.35-46.66)	(38.89-137.03)		(4.60-18.86)	(12.95-51.77)	(42.68-171.53)
Year 11								
Unadjusted odds	1	8.76***	24.62***	80.60***	1	5.40***	11.23***	46.02***
(2114,1582)		(3.79-20.24)	(10.78-56.23)	(35.32-183.94)		(3.07-9.52)	(6.45-19.55)	(26.25-80.69)
Adjusted odds	1	9.01***	23.93***	77.63***	1	5.24***	10.69***	43.75***
(2068,1524)		(3.89-20.88)	(10.46-54.79)	(33.91-177.74)		(2.91-9.42)	(6.01-19.00)	(24.39-78.46)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$
[†] (n for boys, n for girls)
[1] Adjusted for ethnicity and deprivation

Table 7.13 Cross-sectional association between friend smoking and adolescent regular smoking at each study year

	Boys				Girls			
	No friends smoke	**A few friends smoke**	**Some friends smoke**	**All/Most friends smoke**	**No friends smoke**	**A few friends smoke**	**Some friends smoke**	**All/Most friends smoke**
Year 9#								
Unadjusted odds (2387,1728)†	1	10.64* (1.36-83.30)	76.98*** (10.51-563.96)	402.16*** (55.77-2900.06)	1	5.81* (1.29-26.07)	26.25*** (6.26-110.12)	167.02*** (40.67-685.87)
Adjusted odds[1] (2367,1714)	1	10.46* (1.34-81.88)	70.52*** (9.61-517.54)	379.36*** (52.53-2739.65)	1	5.41* (1.92-24.55)	25.59*** (6.09-107.44)	161.93*** (39.26-667.85)
Year 10								
Unadjusted odds (2360,1755)	1	7.89** (1.82-34.13)	24.83*** (5.97-103.24)	174.81*** (43.03-710.16)	1	6.78* (1.54-29.79)	28.87*** (6.97-119.57)	157.32*** (38.67-640.03)
Adjusted odds (2330,1738)	1	7.51** (1.74-35.54)	22.75*** (5.46-94.69)	156.10*** (38.33-635.67)	1	6.93* (1.57-30.51)	28.79*** (6.93-119.57)	153.46*** (37.59-626.57)
Year 11								
Unadjusted odds (2114,1582)	1	12.13* (1.63-90.21)	36.30*** (5.01-263.16)	236.08*** (32.92-1692.95)	1	8.02** (1.87-34.44)	23.75*** (5.75-98.13)	166.63*** (40.91-678.76)
Adjusted odds (2068,1524)	1	12.43* (1.67-92.54)	33.06** (4.55-240.07)	221.03*** (30.77-1587.56)	1	6.95** (1.61-29.98)	21.02*** (5.08-87.01)	144.522*** (35.38-590.29)

* p<0.05, **p<0.01, ***p<0.001
#Analyses were not run for Years 7 and 8 as numbers were too low – as shown in Table 7.11
† (n for boys, n for girls)
[1]Adjusted for ethnicity and deprivation

7.2.2.5 The independent association between smoking behaviour of parents, siblings and friends and adolescent smoking behaviour

In order to examine the independent association between the smoking behaviour of parents, siblings, and friends and adolescent smoking in the HABITS sample, each of these variables were entered simultaneously into logistic regression procedures. Table 7.14 shows that the association between parental smoking and adolescent current smoking practically disappears in boys, and was much reduced in girls, when friends and siblings were also included in the model. Sibling smoking remained significantly associated with current smoking, although odds ratios were slightly reduced. Smoking by friends was by far the strongest predictor of adolescent smoking, but even here odds ratios were slightly lower than in univariate analyses suggesting some confounding may be occurring. In terms of regular smoking the same basic pattern was observed, although there was a slightly stronger role for parental smoking, in both boys and girls (see Table 7.15). There was also a clearer gender difference, and though having friends who smoke still had the strongest association with adolescent regular smoking, the role of friends appeared greatest among boys and the role of parents most obvious in girls. Sibling smoking retained a small but significant association with regular smoking in both boys and girls.

To further understand the association between the smoking behaviour of parents and friends and adolescent smoking, and the extent to which the association between parental and adolescent smoking may be explained by the number of friends who smoke, a series of partition analyses were performed. Restricting the sample to first those with no friends who smoke, and then to those who had any friends who smoke ('all/most', 'some' and 'a few'), the univariate association between parent and adolescent smoking was examined using logistic regression (see Table 7.16). These analyses were limited somewhat because of the very low number of students with no friends who smoke who also smoke themselves, however, tentative conclusions might be made that unless students have friends who smoke they are unlikely to be influenced by the smoking behaviour of their parents.

Finally, all analyses were repeated using complex samples logistic regression procedures to account for school clustering. Only very minor differences to confidence intervals were observed as a result of this re-analysis and only a couple of borderline significant findings became non-significant, all in relation to parental smoking.

Table 7.14 Cross-sectional association between parental, sibling, and friend smoking and adolescent current smoking at each study year

	Boys					Girls				
	Year 7 (n = 2420)	**Year 8** (n = 2387)	**Year 9** (n = 2334)	**Year 10** (n = 2320)	**Year 11** (n = 2040)	**Year 7** (n = 1666)	**Year 8** (n = 1729)	**Year 9** (n = 1697)	**Year 10** (n = 1717)	**Year 11** (n = 1507)
Parent smoking										
None	1	1	1	1	1	1	1	1	1	1
Father smokes	1.30	0.68	1.06	1.03	1.23	1.04	1.59	1.10	0.99	1.12
	(0.63-2.70)	(0.41-1.14)	(0.72-1.57)	(0.75-1.41)	(0.91-1.67)	(0.46-2.56)	(0.93-2.72)	(0.73-1.67)	(0.71-1.39)	(0.79-1.58)
Mother smokes	1.98	1.42	0.98	1.27	1.55*	1.49	3.14***	1.88**	1.89**	1.34
	(0.92-4.27)	(0.85-2.38)	(0.63-1.54)	(0.88-1.84)	(1.07-2.25)	(0.53-4.15)	(1.71-5.79)	(1.18-2.99)	(1.26-2.82)	(0.89-2.03)
Both Smoke	1.19	1.41	1.21	1.39	1.90***	1.08	2.46**	2.04**	1.87**	1.53*
	(0.55-2.56)	(0.91-2.19)	(0.82-1.78)	(0.99-1.94)	(1.33-2.72)	(0.46-2.56)	(1.44-4.19)	(1.34-3.10)	(1.28-2.72)	(1.02-2.31)
Sibling smoking										
No	1	1	1	1	1	1	1	1	1	1
Yes	2.68**	2.12***	1.89***	1.70***	1.82***	1.67	2.85***	2.30***	2.21***	2.26***
	(1.53-4.69)	(1.49-3.02)	(1.41-2.54)	(1.33-2.17)	(1.43-2.32)	(0.86-3.25)	(1.91-4.27)	(1.68-3.16)	(1.71-2.94)	(1.72-2.98)
Friend smoking										
None	1	1	1	1	1	1	1	1	1	1
A few	5.38***	23.37***	6.07***	6.63***	8.24***	7.32***	14.37***	8.38***	9.97***	5.03***
	(2.60-11.12)	(7.25-75.33)	(2.85-12.94)	(3.49-12.58)	(3.55-19.14)	(2.72-19.70)	(4.33-47.68)	(3.28-21.40)	(4.73-21.05)	(2.78-9.11)
Some	11.76***	67.83***	23.26***	22.30***	22.69***	37.68***	49.72***	41.34***	26.90***	10.23***
	(5.16-26.79)	(20.99-219.16)	(11.09-48.75)	(11.91-41.77)	(9.89-52.06)	(13.41-105.89)	(15.09-163.79)	(16.58-103.07)	(12.89-56.12)	(5.74-18.34)
All/Most	25.87***	148.34***	94.54***	59.45***	64.42***	70.50***	200.46***	140.78***	80.80***	35.41***
	(10.94-61.17)	(45.21-486.69)	(45.02-198.52)	(31.52-112.15)	(28.05-147.95)	(22.94-216.68)	(61.18-656.82)	(55.54-356.83)	(38.56-169.31)	(19.59-64.01)

* p<0.05, **p<0.01, ***p<0.001

Table 7.15 Cross-sectional association between parental, sibling, and friend smoking and adolescent regular smoking at each study year

	Boys			Girls		
	Year 9† (n = 2334)	**Year 10** (n = 2320)	**Year 11** (n = 2040)	**Year 9†** (n = 1697)	**Year 10** (n = 1717)	**Year 11** (n = 1507)
Parent smoking						
None	1	1	1	1	1	1
Father smokes	1.09	0.96	1.01	2.24**	1.56	1.36
	(0.62-1.90)	(0.60-1.55)	(0.68-1.50)	(1.28-3.91)	(1.00-2.44)	(0.88-2.12)
Mother smokes	1.10	1.73*	1.69*	2.23*	2.69***	2.02***
	(0.60-2.00)	(1.07-2.80)	(1.07-2.67)	(1.19-4.15)	(1.63-4.43)	(1.24-3.31)
Both Smoke	1.70*	2.54***	2.54**	2.50**	2.85***	1.74*
	(1.03-2.81)	(1.64-3.94)	(1.67-3.86)	(1.43-4.38)	(1.79-4.52)	(1.09-2.77)
Sibling smoking						
No	1	1	1	1	1	1
Yes	2.22***	1.95***	2.14***	1.89**	2.18***	2.43***
	(1.50-3.30)	(1.40-2.72)	(1.59-2.86)	(1.25-2.85)	(1.55-3.08)	(1.73-3.39)
Friend smoking						
None	1	1	1	1	1	1
A few	9.08*	6.72*	10.96*	4.86*	6.12*	6.48*
	(1.16-71.24)	(1.55-29.16)	(1.47-81.77)	(1.07-22.12)	(1.38-27.07)	(1.49-28.08)
Some	56.08***	18.73***	30.07**	21.32***	24.34***	18.96***
	(7.61-413.44)	(4.49-78.24)	(4.13-218.83)	(5.05-89.94)	(5.83-101.59)	(4.56-78.83)
All/Most	260.30***	114.58***	174.98***	117.03***	118.94***	110.03***
	(35.81-1892.16)	(27.99-469.00)	(24.30-1260.01)	(28.19-485.92)	(28.97-488.27)	(26.81-451.62)

* p<0.05, **p<0.01, ***p<0.001
†Analyses were not run for years 7 and 8 as numbers were too low – as shown in Table 7.3, Table 7.7, and Table 7.11

Table 7.16 Cross-sectional association between parental smoking and adolescent current smoking by number of friends who smoke at each study year

	Boys				Girls			
	Parents don't smoke	Father smokes	Mother smokes	Both Parents smoke	Parents don't smoke	Father smokes	Mother smokes	Both Parents smoke
No friends who smoke								
Year 7 (1721,1233)†	1	1.40 (0.26-7.38)	3.91 (0.89-17.22)	2.15 (0.39-12.03)	1	6.48 (0.57-73.46)	4.04 (0.24-67.81)	6.07 (0.48-76.15)
Year 8 (1141,836)	1	1.05 (0.10-10.52)	-#	-	1	-	14.83* (1.12-196.00)	-
Year 9 (840,538)	1	7.28* (1.16-45.65)	-	19.41** (3.00-125.64)	1	-	4.35 (0.39-48.90)	5.99 (0.47-77.15)
Year 10 (624,435)	1	1.25 (0.26-6.03)	1.58 (0.19-13.25)	-	1	-	1.50 (0.16-13.85)	2.69 (0.23-32.03)
Year 11 (309,305)	1	1.56 (0.17-14.56)	2.43 (0.25-24.12)	-	1	1.52 (0.38-6.12)	1.54 (0.17-14.19)	0.88 (0.09-8.43)
Any friends who smoke								
Year 7 (740,454)†	1	1.36 (0.62-2.99)	1.85 (0.78-4.35)	1.67 (0.77-3.59)	1	0.98 (0.38-2.50)	1.23 (0.43-3.52)	1.18 (0.50-2.78)
Year 8 (1286,913)	1	0.74 (0.45-1.22)	1.80* (1.12-2.90)	1.97** (1.30-2.99)	1	2.04** (1.26-3.30)	3.09*** (1.80-5.31)	3.24*** (2.02-5.19)
Year 9 (1522,1171)	1	1.10 (0.77-1.57	1.46 (0.98-2.16)	1.80** (1.28-2.52)	1	1.50* (1.04-2.17)	2.76*** (1.83-4.17)	3.02*** (2.10-4.35)
Year 10 (1703,1299)	1	1.20 (0.89-1.60)	1.67** (1.19-2.35)	1.84*** (1.36-2.51)	1	1.31 (0.97-1.78)	2.30*** (1.59-3.32)	2.45*** (1.75-3.43)
Year 11 (1747,1206)	1	1.38* (1.05-1.82)	1.68** (1.19-2.36)	2.37*** (1.72-3.28)	1	1.568** (1.14-2.16)	1.86** (1.27-2.73)	2.79*** (1.91-4.07)

* $p<0.05$, ** $p<0.01$, *** $p<0.001$
† (n for boys, n for girls)
# Cell sizes were too small to calculate odds ratios

7.2.3 Discussion

The first section of this chapter has outlined associations between the most studied social factors linked to adolescent smoking; the smoking behaviour of parents, siblings and friends. As expected, each of these variables showed a significant association with adolescent smoking in univariate analyses. Consistent with past literature (Nofziger & Lee, 2006; Vitaro et al., 2004; Avenevoli & Merikangas, 2003; Vink et al., 2003a; Bauman et al., 2001; West et al., 1999; Conrad et al., 1992), having a high proportion of friends who smoke was the strongest factor associated with adolescent smoking, among both boys and girls, followed by sibling smoking, with parental smoking showing a less stable relationship, particularly among boys.

The strength of the relationship between smoking by friends and adolescent smoking is somewhat surprising, though examination of the data shows clearly that a very small number of students with no friends who smoke actually smoked themselves. Although these data are unable to unravel the relative contribution of peer influence and peer selection, what can be concluded is that if an adolescent reports no friends who are smokers, be that because they have not been exposed to smoking friends or have rather chosen to not associate with smokers, they are extremely unlikely to be a smoker. The partition analyses go some way to suggesting that in the absence of smoking friends other sources of influence, such as parental smoking, are also unlikely to be associated with adolescent smoking. These analyses are, however, unsurprisingly limited by the small number of adolescents who smoke who do not have friends who smoke.

The gender differences observed in the association with parental smoking are interesting. Research has been relatively inconclusive in the extent to which smoking by mothers and fathers influence the smoking behaviour of girls and boys, however the data presented here suggests that mothers have an important role to play regardless of the gender of the adolescent. Fathers, despite being more likely to smoke than mothers, seem to have a smaller influence. This supports the work of Vink (2003b) and Nofziger and Lee (2006).

There were clear associations between smoking by siblings and by friends and smoking among both boys and girls. These associations appeared stronger for girls in terms of current smoking, but when more regular smoking was examined this was reversed, with a stronger relationship between sibling and friend smoking observed for boys. This suggests there may be a different mechanism of social influence for boys and girls and despite current smoking being clearly associated with the smoking behaviour of others among girls, persistent smoking may be driven by more personal factors.

There are obvious limitations with these analyses and they have been deliberately restricted to basic cross-sectional presentations of data due to the inability of this data-set to examine cause and effect in the relationship between adolescent smoking and social factors (although it is highly unlikely that an adolescent's smoking behaviour would determine their parents smoking). Social network analysis is much better placed to examine the question of the role that friends have on smoking behaviour (Kobus, 2003). As expected a significant association was observed between sibling smoking and adolescent smoking behaviour. However, it would have been interesting to know the impact that sibling age and gender had on this relationship. Finally, the analyses have been restricted by a small sample size, especially in relation to more regular smoking. This is interesting in itself as it is a result of the low number of smokers among those with no smoking role models that results in this limitation.

Nonetheless, these analyses provide reassurance that the HABITS sample shows a similar pattern of the role of parents, friends and siblings to other published research and have provided some interesting findings that may contribute to the present literature. For example, the special role of smoking by mothers, the greater association between social factors and regular smoking among boys, and the virtually non-existent presence of smokers who do not have any friends who smoke. The final two sections of this chapter will go on to examine further additions to the present literature on social factors and smoking as described in the introduction: the role of step-parents; and early dating behaviour on adolescent smoking.

7.3 The role of step-parents in smoking behaviour[2]

7.3.1 Method

7.3.1.1 Population

The analyses in this section of Chapter 7 are based on only those students who reported living with a step-parent (n = 650). Current smoking at any time-point across the study has been used as the outcome variable because the number of students who reported that their step-parent smoked, and who reported that they themselves smoked, were small. Consequently data from all five years of the study have been collapsed together.

7.3.1.2 Measures

In addition to the parental smoking questions outlined above, participants were also asked whether they lived with a step-mother or step-father, and if so whether that step-parent smoked or not. From these measures a composite variable was constructed categorising those who reported living with a step-parent as having no parent figures who smoke, just a step-parent who smokes, just a biological parent who smokes or

[2] A version of section 7.3 is in press in the journal Addiction (see Appendix V)

having both a biological parent and a step-parent who smoke. This meant that only those students who reported living with a step-parent were included in analyses to avoid confounding of any observed effects of step-parent smoking with having a step-parent per se.

As the number of participants living in step-families was comparatively small, the smoking responses across the five years of the study were collapsed together to increase power. Current smoking (adjusted for cotinine) at any time-point across the study was then used to identify smokers. Although it is appreciated that this measure will include both students who are consistent regular smokers and those who report current smoking just on one occasion, it highlights students who are at increased risk of smoking uptake while allowing the inclusion of students who were not present at every year of the study. Gender, ethnicity (White, Black/mixed Black, Asian/mixed Asian, other) and deprivation (Townsend score) were also included in analyses.

7.3.1.3 Statistical Analysis

Crosstabulations were first used to describe the pattern of smoking behaviour in each of the parent/step-parent smoking categories. Logistic regression analyses were used to test the impact of step-parent and biological parent smoking; comparing the odds of being a current smoker if neither a parent nor a step-parent smokes to other family smoking categories (Model 1), then reversed so that other groups are compared in reference to just having a step-parent who smokes (Model 2). Univariate analyses were performed first, then the associations were tested controlling for gender and the demographic factors deprivation and ethnicity, which may explain both adolescent smoking and parent/step-parent smoking. Regression analyses were then repeated using complex samples logistic regression procedures which take account of school clustering.

When a step-parent is present it is reasonable to suppose that the family home is split into two, with one parent living with the child and potentially another parent living elsewhere, although varying degrees of contact and visiting may occur. Although numbers were small, further analyses were run to establish the extent to which having parents who smoke in the home and absent from the home predicts smoking compared with having step-parents who smoke. To assess this an eight category variable of the smoking behaviour of biological parents at home, step-parents, and absent parents was constructed (see Table 7.19 for categories). If participants reported living with a step-father it has been assumed here that they lived also with their mother, and that their father (if applicable) was absent from the family home. Conversely, if they reported living with a step-mother, it was assumed they did not also live with their biological mother. 248 participants reported living with both a step-mother and a step-father. Therefore, in order to determine which biological parent students were residing with, data were restricted to those reporting living with one step-parent only (n = 402). However, as families are complex, and numbers were low, if just one of these step-parents were recorded as smoking they were included as living with a smoking step-parent in the main analyses described above. Basic crosstabulations and logistic regressions were then run as before on this extended eight category variable.

7.3.2 Results

At baseline 15% (650) of students reported living with a step-parent, 64.2% of whom were boys and 57.2% were White. Further demographic characteristics of this sample are shown in Table 7.17. The majority of step-parents reported were step-fathers (566) rather than step-mothers (332) and a greater percentage of step-fathers were smokers than step-mothers (34.1% vs 13.6%). 48.5% of biological parents in this sub-sample of students living in step-families smoked, which was no higher than the percentage of parents who smoked in non-step-families (48.5 vs 45.4%, $\chi^2 = 2.14$, df = 1, p = 0.143). Current smoking at any time point was observed in 35.8% (n = 232) of participants in this reduced sub-sample of the HABITS study, compared to 32.1% (n = 1169) of participants who do not have step-parents ($\chi^2 = 3.35$, df = 1, p = 0.067).

Table 7.17 Demographic characteristics of the sub-sample of students living in step-families

	%	n
Gender		
Boys	64.2	417
Girls	35.8	233
Ethnicity		
White	57.3	366
Black/mixed Black	29.1	186
Asian/mixed Asian	7.7	49
Other	5.9	38
Deprivation		
Least deprived	16.2	103
2^{nd} Quintile	16.2	103
3^{rd} Quintile	17.0	108
4^{th} Quintile	21.7	138
Most deprived	29.0	185

A total of 294 participants (45.2%) of this sample of students with a step-parent had neither a biological parent, nor a step-parent, who smoked; 41 (6.3%) reported a step-parent who smoked but no smoking by biological parents, 136 (20.9%) had a biological parent who smoked, but their step-parent did not smoke and 179 (27.5%) reported both a biological parent and a step-parent who smoked. Current smoking at any point throughout the study was less prevalent if neither a biological parent nor a step-parent smoked (26.9%, n = 79) than if just a step-parent smoked (51.2%, n = 21), just a biological parent smoked (36.3%, n = 49) or both a biological parent and a step-parent smoked (46.6%, n = 83), $\chi^2 = 23.54$, df = 3, $p < 0.0001$).

Table 7.18 shows the results of logistic regression analyses. Students living in homes where just their step-parent smoked were significantly more likely to smoke than those who reported having neither parents nor a step-parent who smoked (OR 2.72, $p < 0.01$, 95% CI = 1.36-5.47), as were those who lived with both a parent and a step-parent who were smokers (OR 2.23, $p < 0.001$, 95% CI = 1.46-3.41). Having just a biological parent who smoked was associated with current smoking in unadjusted analyses, although once demographic variables were included this association was not significant in this sub-sample. However, as shown earlier in this chapter, having a biological parent who smokes was significantly associated with adolescent smoking in the total sample of students, i.e. those both with and without step-parents, (OR 1.74, $p < 0.001$, 95% CI = 1.53-1.98), with a similar effect size as that observed in the reduced sample of only those adolescents with step-parents.

Model 2, with having just a step-parent who smokes now as the reference category, clarifies that those students who live in a home where only their step-parent smokes are at a greater risk of current smoking than those who have neither a biological parent nor a step-parent who smoke, but are no more or less likely to be smokers than those with just a biological parent who smokes or both a biological parent and a step-parent who smokes (although there was a trend towards having just a biological parent who smokes being less important than having just a step-parent who smokes, OR = 0.51, 95% CI = 0.24-1.06). The above analyses were repeated using complex logistic regression procedures to take account of school clustering and results were unchanged.

Table 7.18 Year 7 parent/step-parent smoking predicting current smoking at any study year among students living in step-families (n = 650), unadjusted and adjusted odds ratios

	Neither smoke	Just step- parent smokes	Just parent smokes	Both smoke
Unadjusted OR (95% CI)				
N	294	41	135	178
Model 1	1	2.86** (1.47-5.55)	1.55* (1.00-2.40)	2.38*** (1.61-3.52)
Model 2	.35** (0.18-0.68)	1	.54 (0.27-1.10)	.83 (0.42-1.64)
Adjusted# OR (95% CI)				
N	284	39	131	174
Model 1	1	2.72** (1.36-5.47)	1.39 (0.88-2.19)	2.23*** (1.46-3.41)
Model 2	.37** (0.18-0.74)	1	.51 (0.24-1.06)	.82 (0.40-1.67)

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$
#Analyses are adjusted for gender, ethnicity and deprivation

Table 7.19 displays the number of students in each of the eight combinations of parent, step-parent, and absent parent smoking, and the percentage of students reporting current smoking at any time point in each of these categories. Although numbers here are low, the greatest percentage of adolescent smokers was observed in those who live in a family where just the step-parent smokes.

Table 7.19 Percentage (n) of current smokers in each parent/step-parent/absent parent smoking category among students living in step-families (n = 402)

	No parent figure smokes	Just step-parent smokes	Just absent parent smokes	Step- & absent parent smoke	Just parent at home smokes	Parent at home & step-parent smoke	Parent at home & absent parent smoke	All parent figures smoke
Total N	130	29	47	35	35	37	19	69
Current smoking at any year % (n)	27.7 (36)	55.2 (16)	38.3 (18)	42.9 (15)	40.0 (14)	45.9 (17)	21.1 (4)	52.2 (36)

Logistic regression analyses controlling for confounding factors gender, ethnicity and deprivation confirm that adolescents who have just a step-parent who smokes were more likely to smoke than those with no parental figure who smokes (see Table 7.20). Having just a parent who smokes, present in or absent from the home, was not significantly associated with current smoking behaviour. These findings were repeated when using complex logistic regression procedures, taking account of school clustering.

Table 7.20 Year 7 parent/step-parent/absent parent smoking predicting current smoking at any study year among students living in step-families (n = 402), unadjusted and adjusted odds ratios

	No parent figure smokes	Just step-parent smokes	Just absent parent smokes	Step- & absent parent smoke	Just parent at home smokes	Parent at home & step-parent smoke	Parent at home & absent parent smoke	All parent figures smoke
Unadjusted								
N	130	29	47	35	35	37	19	69
OR	1	3.21**	1.62	1.96	1.74	2.22*	0.70	2.85**
(95% CI)	-	(1.41-7.34)	(0.80-3.27)	(0.91-4.24)	(0.80-3.79)	(1.05-4.71)	(0.22-2.24)	(1.55-5.24)
Adjusted#								
N	126	27	46	34	33	36	19	68
OR	1	3.50**	1.47	1.93	1.74	2.13	0.59	2.99**
(95% CI)	-	(1.44-8.50)	(0.70-3.10)	(0.85-4.36)	(0.76-4.00)	(0.96-4.75)	(0.17-1.98)	(1.53-5.83)

* $p < 0.05$ ** $p < 0.01$

#Analyses are adjusted for gender, ethnicity and deprivation

It should be noted that student reports of living with a step-parent who does or does not smoke were inconsistent from year to year, with as many as 50% of those reporting living with a step-parent at baseline not going on to report living with a step-parent one, two, three and four years later. Some degree of changing family structure is to be expected, but to ensure this did not distort results, analyses were repeated using data from those who reported living with a step-parent at least twice across the five years of the study, taking the parent/step-parent smoking behaviour from the first year that this data was available. Using this method, and controlling for gender, deprivation and ethnicity, the above findings were confirmed; a significant effect of just a step-parent smoking remained (OR = 1.82, $p = 0.041$, 95% CI = 1.03-3.24), having both a parent and a step-parent who smoked was also still associated with adolescent current smoking at any point (OR = 2.45, $p < 0.001$, 95% CI = 1.66-3.63), and the association between student smoking and smoking by just a biological parent again did not reach significance in this sub-sample (OR = 1.40, $p = 0.12$, 95% CI = 0.92-2.13). Similar analysis using the eight category variable of parents at home, step-parents and absent parents also replicated the above findings with a significant effect of just step-parent smoking (OR = 2.47, $p = 0.008$, 95% CI = 1.27-4.82) and of smoking by all parent figures (OR = 3.52, $p < 0.001$, 95% CI = 2.04-6.06), with smoking by a step-parent and an absent parent, and smoking by a parent and a step-parent also predicting current smoking at any time point (OR = 1.97, $p = 0.044$, 95% CI = 1.02-3.82, OR = 2.01, $p = 0.27$, 95% CI = 1.08-3.73). There was a significant effect of reporting living with a step-parent for two or more years on smoking behaviour, with those living with step-parents more likely to smoke than those not living with step-parents or reporting living with a step-parent only once (45.6% vs 33.0%, $p <0.001$).

7.3.3 Discussion

These results have shown that smoking by parental figures, biological or non-biological is associated with a higher incidence of smoking in adolescents. The failure to detect a significant association between adolescent smoking and smoking by a biological parent might at first be thought surprising. However, the effect size of parental smoking in this reduced sample of students living in step-families is similar to that observed in the whole population of students, i.e. those both with and without step-parents, which was significant. What these results suggest is that smoking by step-parents is at least as influential as smoking by biological parents. This might partially explain the higher rates of smoking often observed in children from step-families (Griesbach et al., 2003;

Bjarnason et al., 2003) and suggests that the role parents play in influencing adolescent smoking can be explained by either a biological or a non-biological influence mechanism. The lack of difference in effect size between smoking by just a step-parent and smoking by both biological parents and a step-parent suggests there is no further increase in vulnerability if there are both genetic and environmental risk factors.

Taking into account the high level of inconsistent reports of living with step-parents and restricting analyses to include those reporting step-parents on at least two occasions did weaken the strength of this finding. However, a similar pattern of results were observed and there remained a strong effect of step-parent smoking in contrast to smoking by biological parents, in the home and absent from the home, suggesting the effect of step-parent smoking observed is unlikely to be due to an artefact of misreporting.

Another explanation for the findings presented is that the step-parent effect observed is simply a function of the gender of the smoking parents. As the majority of step-parents present in the home were step-fathers it is plausible that the effect is simply due to fathers having a greater impact on smoking behaviour than mothers. However, analysis of parental influence on smoking by parent gender in the whole sample shows that it is mothers who have a greater influence on smoking among both boys and girls suggesting that this is not a likely explanation. Furthermore, if the effect was due to male smoking role models then some effect of absent parent smoking (by default also mainly fathers) would be expected. However, smoking by absent parents did not predict adolescent smoking behaviour, again supporting an environmental model of influence (although the sample size here is very low).

The availability of such a large data-set from which this data has been drawn has allowed examination of the role that smoking by step-parents plays in smoking behaviour. Even so, numbers were limited and the use of current smoking behaviour by adolescents at any point across the study is an obvious limitation when smoking data were available at each of the five study years. Assessment of persistence of smoking or increased dependence is therefore not possible, yet these conceptualisations of smoking behaviour are known to show greater heritability (Fowler, Lifford, Shelton, Rice, Thapar et al., 2007; Sullivan & Kendler, 1999). The small sample size also restricted the inclusion in the models of a larger number of factors that could potentially explain the association between step-parent smoking and adolescent smoking. Although analyses were adjusted for gender, ethnicity and deprivation other potential confounding variables, such as stress or problem behaviour, restricted the sample size still further and were consequently not included in the models. A further limitation is that information regarding the marital status of these step-families was not available. It is plausible that non-smoking step-parents were more likely to be married to the biological parent and this relative stability of family structure could explain the effect as opposed to the smoking behaviour of step-parents per se. Similarly no explicit information as to which biological parents participants were living with was available, although it has been inferred that if a participant is living with a step-father they are also living with their biological mother and not their biological father. The analyses based on these assumptions should therefore be interpreted with this in mind.

More research is needed to investigate why step-parent smoking appears to have such a strong impact on adolescent smoking behaviour comparative to that of biological parents. Perhaps step-parents actively try to make ‘friends’ with their step-children and play less of a ‘parent’ role, which might result in increased modelling by adolescents or maybe there is less concern by step-parents about the negative impact of their smoking behaviour on their step-children. Although we do not know when the step-parents have entered the home, this may also be at a time when adolescents are more vulnerable to the behaviour of other smokers, or maybe the movement of someone new into the home who smokes sanctions smoking in a way that might not arise in those whose parents already smoke.

In conclusion, smoking by step-parents has at least as great an association with adolescent smoking behaviour as smoking by biological parents, both those present in, and absent from the family home. This strongly suggests a social mode of smoking initiation transmission between parents and children, although does not preclude a role for biological predisposition. What is clear is that within step-families, where smoking incidence among adolescents is typically high, smoking by step-parents was associated with an increased risk of smoking behaviour. Attempts to work with parents in smoking prevention should therefore involve, and perhaps even pay particular focus to, step-parents who smoke.

7.4 Romantic relationships and smoking[3]

7.4.1 Method

7.4.1.1 Population

This section of chapter 7 uses baseline dating behaviour to predict smoking at each subsequent year. The analyses are therefore prospective but use all data available at each year (i.e. Year 7 and Year 8 when predicting Year 8 smoking, n = 2524; Year 7 and Year 9 when predicting Year 9 smoking, n = 2274; Year 7 and Year 10 when

[3] A version of section 7.4 was published in Addiction, 101, 1805-1813, 2006 (see Appendix VI)

predicting Year 10 smoking, n = 2203; and Year 7 and Year 11 when predicting Year 11 smoking, n = 2059).

7.4.1.2 Measures

Dating status was assessed at each year except Year 11. In Years 8 to 10 participants were asked 'Do you have a boyfriend or girlfriend now?' and could respond 'yes' or 'no'. In Year 7 students could also respond that they had had a boyfriend or girlfriend in the past.

Smoking behaviour here is again categorised as current smoking (smoking sometimes or more often) versus non-current smoking and responses are cotinine corrected.

Other variables included as control factors associated with both smoking and dating were deprivation (Townsend score), ethnicity (White, Black/mixed Black, Asian/mixed Asian, other), age, Strengths and Difficulties scores (Goodman, 1997), parental smoking (no parent smokes, father smokes, mother smokes, both parents smoke), sibling smoking, and pubertal status. Puberty was assessed using Petersen et al's (1988) Pubertal Development Scale, a summed score based on student ratings of growth spurt, pubic hair growth, skin changes, menarche and breast development (girls), and voice change and facial hair growth (boys).

7.4.1.3 Statistical analysis

The association between early dating and smoking was first investigated using crosstabulations, with Year 7 dating behaviour and smoking behaviour at each year included in the analyses. Logistic regression was then used to establish the impact of Year 7 dating status on later smoking behaviour, while controlling for other variables known to influence both smoking and dating behaviour. Four logistic regressions were performed, with Year 7 dating as an independent variable and Year 8, Year 9, Year 10 and Year 11 current smoking status entered as the dependent variables. Parental smoking, sibling smoking, friends smoking, deprivation, ethnicity, and Strengths and Difficulties scores and pubertal status, all as reported at Year 7, were included in the model as potential confounders. In addition Year 7 smoking experience was included to confirm that any effect of dating on later smoking was independent of the influence of past smoking behaviour. Further regression analyses using early smoking behaviour to predict later dating were performed to verify the direction of any relationship. Only a very small number of students reported current smoking behaviour in Year 7 and although this is a weaker test of the relationship, ever smoking in Year 7 was used as a predictor of dating status at Years 8, 9 and 10 (data on dating status was not available for Year 11). The same controlling factors were included as before.

7.4.2 Results

The percentage of students present at Year 7 who reported having a boyfriend or girlfriend, either currently or in the past, is displayed in Table 7.21. 28.8% (627) of boys and 18.1% (284) of girls reported that they were currently dating at Year 7, and 39.7% (864) and 41.8% (657) of boys and girls respectively reported that they had dated in the past. In general, having a boyfriend or girlfriend became more common as age increased, with boys more likely to report dating than girls at each time point.

Table 7.21 Percentage (n) of students reporting dating from Year 7 to Year 10

	Year 7	Year 8	Year 9	Year 10
Boys				
Currently dating	28.8 (627)	32.9 (700)	28.5 (526)	29.1 (500)
Not currently dating (yrs 8-11)	-	67.1 (1429)	71.5 (1320)	70.9 (1216)
Dated in the past (yr 7 only)	39.7 (864)	-	-	-
Never dated (yr 7 only)	31.5 (685)	-	-	-
Girls				
Currently dating	18.1 (284)	23.6 (348)	24.3 (330)	26.7 (337)
Not currently dating (yrs 8-11)	-	76.4 (1124)	75.7 (1027)	73.3 (925)
Dated in the past (yr 7 only)	41.8 (657)	-	-	-
Never dated (yr 7 only)	40.1 (631)			

The relationship between dating behaviour at Year 7 and current smoking at each study year is shown in Table 7.22. Boys and girls who reported that they currently had a boyfriend or girlfriend in Year 7 were more likely to report current smoking at each study year than those who reported having had a boyfriend or girlfriend in the past. In turn, those who reported having a boyfriend or girlfriend in the past were more likely to report smoking than those who had never dated. Chi-square tests indicated an overall significant difference across the three groups.

Table 7.22 Percentage (n) of current smoking at each study year by dating status at Year 7

	Currently dating	Dated in the past	Never dated	χ^2 test
Year 7				
Boys	4.8 (30)	2.1 (18)	1.0 (7)	$\chi^2(2) = 20.04$, $p<0.001$
Girls	8.8 (25)	2.1 (14)	0.5 (3)	$\chi^2(2) = 57.21$, $p<0.001$
Year 8				
Boys	14.0 (70)	6.8 (50)	2.2 (13)	$\chi^2(2) = 57.22$, $p<0.001$
Girls	20.3 (46)	12.0 (68)	2.6 (14)	$\chi^2(2) = 64.37$, $p<0.001$
Year 9				
Boys	20.7 (89)	13.9 (86)	5.2 (28)	$\chi^2(2) = 52.44$, $p<0.001$
Girls	32.0 (65)	22.3 (111)	8.5 (44)	$\chi^2(2) = 65.10$, $p<0.001$
Year 10				
Boys	31.6 (124)	27.3 (163)	13.0 (71)	$\chi^2(2) = 52.39$, $p<0.001$
Girls	45.8 (81)	37.7 (184)	15.4 (79)	$\chi^2(2) = 88.16$, $p<0.001$
Year 11				
Boys	41.0 (149)	31.4 (174)	19.1 (99)	$\chi^2(2) = 51.21$, $p<0.001$
Girls	44.2 (68)	43.7 (195)	20.5 (97)	$\chi^2(2) = 64.91$, $p<0.001$

To establish the impact of Year 7 dating status on later smoking behaviour while controlling for other variables known to influence both smoking and dating behaviour, logistic regression analyses were performed. Parental smoking, sibling smoking, friend smoking, deprivation, ethnicity, pubertal status, and Strengths and Difficulties Scores, all as reported at Year 7, were included in the model as potential confounders. In addition, analyses were restricted to never smokers at baseline to confirm that any effect of dating on later smoking was independent of the influence of past smoking behaviour.

The unadjusted and adjusted odds presented in Table 7.23 show early dating status to be a strong predictor of later smoking behaviour at each study year. Those reporting current dating in Year 7 had between 1.87 and 8.96 times higher odds of being a later smoker than those who reported never having had a boyfriend or girlfriend. These results remained highly significant when controlling for potential confounding factors, with only slight reductions in odds ratios. The effect is most apparent in relation to current dating, as opposed to dating in the past, and appears stronger in girls than in boys.

Table 7.23 Year 7 dating status predicting current smoking at each study year, unadjusted and adjusted odds ratios

		Year 8		Year 9		Year 10		Year 11	
		Boys (1429,1149)†	**Girls** (1095,921)	**Boys** (1258,1011)	**Girls** (1016,841)	**Boys** (1216,987)	**Girls** (987,815)	**Boys** (1148,953)	**Girls** (911,761)
Unadjusted odds	Never dated	1	1	1	1	1	1	1	1
	Dating currently	5.85** (1.91-17.92)	8.96*** (3.64-22.05)	2.84*** (1.63-4.94)	3.72*** (2.19-6.32)	1.87** (1.24-2.83)	3.91*** (2.51-6.09)	2.06*** (1.43-2.97)	3.03*** (1.95-4.71)
	Dated in the past	3.67* (1.21-11.14)	4.49*** (1.93-10.45)	2.25** (1.33-3.80)	2.63*** (1.69-4.07)	1.92*** (1.34-2.75)	2.83*** (2.02-3.98)	1.75** (1.26-2.43)	2.68*** (1.95-3.68)
Adjusted odds[1]	Never dated	1	1	1	1	1	1	1	1
	Dating currently	4.91* (1.25-19.32)	9.26*** (3.19-26.89)	3.16** (1.57-6.37)	3.48*** (1.86-6.51)	1.75* (1.04-2.94)	4.05*** (2.38-6.90)	2.05** (1.29-3.25)	2.65*** (1.56-4.49)
	Dated in the past	2.90 (0.77-10.86)	3.94** (1.47-10.59)	1.63 (0.84-3.14)	2.01** (1.19-3.37)	1.62* (1.06-2.49)	2.55*** (1.68-3.86)	1.39 (0.94-2.05)	2.29*** (1.56-3.36)

* p<0.05, **p<0.01, ***p<0.001
†(n in unadjusted analyses, n in adjusted analyses)
[1]Parental smoking, friends smoking, sibling smoking, deprivation, ethnicity, puberty and past smoking included as control variables

Having demonstrated the role dating plays in predicting later smoking behaviour, further regression analyses were performed to verify the direction of this relationship. Only a very small number of students reported current smoking behaviour in Year 7 and although this is a weaker test of the relationship, ever smoking in Year 7 was used as a predictor of dating status at Years 8, 9 and 10 (data on dating status were not available for Year 11). To rule out inverse causation, the analysis was restricted to those who had never had a boyfriend or girlfriend at Year 7 and the same controlling factors were included as before. Ever smoking at Year 7 was not predictive of later dating at any year.

To establish the influence of school clustering on these results all analyses were also run using complex samples logistic regression. While confidence intervals were slightly increased using this methodology, significance levels remained unaffected, with only one exception; the significant relationship between Year 7 current dating and Year 8 smoking among boys became borderline non-significant ($p = 0.05$). A further potential cause of bias may be due to the selective drop-out of participants. Those missing smoking or dating data were more likely to both smoke in Years 7 to 9, and also to report having a boyfriend or girlfriend at each year of the study ($p < 0.01$). However, the similarity of the direction of both smoking and dating status among those with missing data suggests that the strong effect of early dating on smoking in later years, and the non-significant relationship between early smoking and later dating, were unlikely to be differentially affected by the disproportionate loss of both smokers and daters from the data set. The difference in significance between these two directions of relationship is therefore unlikely to be a consequence of selection bias.

7.4.3 Discussion

Dating at age 11-12 significantly predicted later smoking behaviour up to five years later, even when controlling for other common predictors of smoking, including puberty and peer smoking. In contrast, early smoking was not associated with later dating.

In line with results from an early study by Murray et al. (1984) that looked at friendships with the opposite sex, the effect seemed particularly apparent among girls, with odds ratios and significance levels lower among boys. More boys reported dating than girls at each year, however, due to the self-report nature of the dating question this may represent over-reporting of dating by boys. If some boys had fictitiously reported dating, this might have weakened the result in boys. Alternatively girls who are dating may be spending time with older boys who are more likely to introduce smoking, or the concept of smoking to their younger girlfriends. A more recent cross-sectional study, published after a version of this section was accepted for publication, also found gender differences in the relationship between smoking and dating, with girls more susceptible to the smoking behaviour of romantic partners than boys. However, in contrast to the results presented here, girls without a romantic partner were more likely to become smokers than those in a relationship (Nofziger & Lee, 2006).

The effect of dating in the past on later smoking is lower in both boys and girls than the effect of current dating at each time point. However, the significance of dating in the past is unclear as this category will include both students who started dating in the recent past, but were not 'going out' with anyone at the time of assessment, as well as students who recalled dating when they were much younger. The impact of these differing examples of past dating on later smoking behaviour may be dissimilar, resulting in a muted effect.

By re-running the analyses using smoking status to predict later dating behaviour some conclusion can be reached as to the direction of the relationship. Smoking did not predict later dating at any year suggesting that dating may be a causal predictor of smoking. Ever-smoking was used as the marker because of the low numbers of current smokers at baseline. This is a weaker test of the association between smoking and later dating, but the paucity of current smokers at Year 7 suggests that dating precedes current smoking.

There are two potential explanations for this apparently causal effect. One is that early dating results in later smoking uptake, perhaps through a complex interplay of aspects of dating such as image formation and popularity among peers. Michell and Amos (1997) propose that social group leaders or 'top girls' need to maintain an image and identity consistent with their status. Whilst they may have gained this initial status through their popularity, smoking initiation could be a further requisite to remaining in this elevated position. Also, the act of dating may result in an altered self-image whereby daters may be more inclined to see themselves as the sort of person who might smoke, and the introduction to dating at an early age may place individuals in a social context conducive to smoking; for example, one that includes older peers.

A second explanation is that early dating simply temporally precedes early smoking. This is best understood in terms of the literature on 'anticipation of adulthood' (Bynner, 1969). Both smoking and dating are behaviours that belong to an adult world (Rugkasa et al., 2001) to which adolescents may aspire, as outlined by Problem Behaviour Theory (See Chapter 3). Opportunities for adolescents to experiment with interacting and forming relationships with the opposite sex may occur earlier than opportunities to experiment with smoking. The large number of dating adolescents compared to a relatively few smokers at age 11-12 in this study suggests this may be the case. Taking this view dating may be a marker, but not necessarily a causal predictor, of later smoking.

The lack of data on smoking status of boyfriends and girlfriends is an obvious limitation and restricts the ability to investigate whether the effect of dating on later smoking is mediated by the smoking behaviour of dating partners. As suggested by the findings of Nofziger and Lee described above, it is possible that the association between smoking and dating may display a converse relationship depending on the smoking status of the romantic partner (Nofziger & Lee, 2006). In addition the self-reported nature of dating means that the definition of 'having a boyfriend or girlfriend' may have been interpreted in a number of different ways, from simply having a close friend of the opposite sex, to participating in an adult-like romantic relationship. However, the strong predictive nature of dating suggests that it is the appraisal of oneself as someone with a boyfriend or girlfriend which is important.

The current finding contributes to the construction of a comprehensive profile of adolescents at risk for smoking and has a number of consequences for the design of targeted smoking interventions. Adolescents who report having a boyfriend or girlfriend at an early age should be a key focus for intervention programmes and attempts should be made to highlight the social undesirability of smoking. Such undesirability could be highlighted both in terms of strong odours and bad breath at the current time as well as longer term factors (such as increased wrinkles, hair loss and physical deformities caused by head and neck cancers).

Chapter 8: Psychological factors associated with smoking

8.1 Introduction

Understanding the psychological profile of young smokers is important in order to identify the types of young person most at risk of smoking uptake and consequently to inform the design of interventions that will both reach, and be perceived as relevant by, adolescents most likely to smoke. A large number of psychological factors have been addressed in relation to smoking in past literature (Tyas & Pederson, 1998) and research on stress, depression, self esteem, personality and attitudes is summarised below.

Stress is one of the main reasons given by adolescents when asked why they smoke (Pirkle & Richter, 2006; Siqueira et al., 2000; Tyas & Pederson, 1998) and an association has been documented between perceived stress and smoking behaviour (Tyas & Pederson, 1998). More recently Booker et al. (2004) reported a cross-sectional association between smoking and stress and Siqueira et al. (2000) found high levels of stress among adolescent current smokers, with lower levels among experimenting smokers and the lowest levels among never smokers.

Prospective studies have attempted to unravel the direction of relationship between smoking and stress. Parrot (1999) proposed that smoking causes subsequently raised stress levels. He noted that although smokers report that smoking helps them to feel more relaxed, smokers in general (both adults and adolescents) show perceived stress levels slightly higher than non-smokers. These stress levels fluctuate with smoking behaviour, with perceived stress rising on abstinence and falling once cigarettes are smoked again. Furthermore, Parrott cited research suggesting that stress levels in an adolescent sample increased on initiation and stress decreased in adult samples after successful quitting. This review of past research has led Parrott to conclude that smoking abstinence causes tension and stress levels to rise and it is the reduction of these elevated stress levels once smoking is resumed which produces a perceived calming effect of smoking (Parrott, 1999). However, Wills et al. (2002) disagree with Parrott, and question his interpretation of the literature. These authors present research following a cohort of adolescents from age 12 to age 16. They found that stress at baseline predicted an increase in smoking over time, but found no support for the reverse causation hypothesis proposed by Parrott (Wills et al., 2002). Other research has also supported this position, suggesting that smoking is perceived by some adolescents as a coping mechanism for dealing with stress (Koval et al., 2004; Byrne & Mazanov, 2003; Siqueira et al., 2000).

Smoking has also been associated with depression. For example Perkle and Richter (2006) found in a sample of teenage girls that smokers were more likely to show depressive symptoms than non-smokers. Poulin et al. (2005) also found a relationship between smoking and depression among girls only, and depression was associated with smoking experimentation and initiation in a range of ethnic groups in a sample of 12 year old boys and girls (Nezami et al., 2005). However, as with stress, the question now appears to be centred around the direction of this relationship and whether smoking plays a self-medicating role for those with depressed mood or is instrumental in the development of depression itself. The conclusion is still unclear (Steuber & Danner, 2006); some prospective studies find that smoking predicts new incidence of depression but not vice versa (Steuber & Danner, 2006; Goodman & Capitman, 2000; Wu & Anthony, 1999), but there is also support for the self-medication hypothesis that depression precedes smoking uptake (Clark, Haines, Head, Klineberg, Arephin et al., 2007; Fergusson, Goodwin, & Horwood, 2003; Wang et al., 1999; Patton, Carlin, Coffey, Wolfe, Hibbert et al., 1998a).

Inconsistent results are not surprising given the complexity of the situation. Rodriguez et al. (2005) identified different sub-populations of adolescents with various trajectories of depressive symptoms and found that where adolescents displayed high levels of depressive symptoms smoking was associated with a reduction in the rate of increase of their symptoms. Conversely, smoking among adolescents with moderate symptoms of depression was associated with an increase in symptoms. The authors concluded that smoking plays a self-medicating role in the association between smoking and depression for those with high symptoms only. In addition, although a relationship between smoking and depression exists, the association is often explained by shared protective and risk factors (Duncan & Rees, 2005; Fergusson et al., 2003) and McMahon (1999), in a review of the area, concludes there is comparable probability of smoking and depression predicting each other and that this bi-directional relationship is indicative of common factors that cause both depression and smoking behaviour.

Self-esteem has been associated with a number of problem health behaviours in adolescence (Glendinning & Inglis, 1999), including smoking (Croghan et al., 2006; Wilkinson & Abraham, 2004; Mazanov & Byrne, 2002; Glendinning, 2002; Carvajal et al., 2000; Tyas & Pederson, 1998). However, several studies have found no such association (Kokkevi, Richardson, Florescu, Kuzman, & Stergar, 2007; Bergman & Scott, 2001; Tomori, Zalar, Kores, Ziherl, & Stergar, 2001; McGee & Williams, 2000), or inconsistent associations (Glendinning & Inglis, 1999). The relationship between smoking and self-esteem may therefore be more complex than previously thought, and potentially mediated by other variables, such as stress (Croghan et al., 2006).

Glendinning and colleagues propose that the association between self-esteem and smoking is dependent on peer group context. They found that the expected direction of low self-esteem and low smoking was only apparent in adolescents within conventional peer groups. Within peer orientated youth high self-esteem was associated with smoking behaviour, and within socially isolated youth, the few smokers there were had a lower self esteem compared to non-smokers (Glendinning, 2002; Glendinning & Inglis, 1999). However, after follow-up 6 years later, the socially isolated group with low self-esteem went on to show raised levels of smoking behaviour as initially expected (Glendinning, 2002).

A number of different personality characteristics have been associated with smoking behaviour in adolescence. Several studies have found students who display rebellious and risk taking tendencies are more likely to become smokers at a later time point (Koval et al., 2004; Burt et al., 2000; Tyas & Pederson, 1998). High extraversion has also been found to predict smoking (Harakeh et al., 2006; Wilkinson & Abraham, 2004; White et al., 1996), as has low emotional stability (Harakeh et al., 2006), although the strength of these associations is often quite low (Harakeh et al., 2006). Audrain-McGovern et al. (2004) proposed that high novelty seekers were more likely to be on a trajectory towards regular smoking, while trait anxiety has also been associated with smoking (Audrain-McGovern et al., 2004; Comeau, Stewart, & Loba, 2001), which may help explain the use of smoking as a coping mechanism. Low social competence and an absence of optimism are other traits linked to smoking behaviour (Audrain-McGovern et al., 2004; Carvajal et al., 2000).

The wide range of personality constructs associated with smoking supports the notion that a particular 'type' of person is most at risk of becoming a smoker. Obviously an understanding of this nature is not of value in terms of changing adolescents' personalities to reduce their risk of later smoking behaviour, but may have implications for the development of interventions most likely to be of benefit to an 'at risk' population (Harakeh et al., 2006).

Theoretically, attitudes have an important part to play in the decision to start smoking (Piko, 2001; Andrews & Duncan, 1998). The role of attitudes in determining behaviour is to "evaluate judgements formed to summarise past experiences and simplify future behaviour patters" (Weber 1992, cited in Piko et al. 2001) and they play an important role in a number of theories of adolescent smoking, most notably the Theory of Reasoned Action (Ajzen & Fishbein, 1980). However, the use of attitudes in predicting behaviour has been called into question (Hogg & Vaughan, 1998). Indeed, the Theory of Reasoned Action was extended to incorporate perceived behavioural control in recognition that attitudes towards a behaviour are subject to certain perceived obstacles (Ajzen, 1991).

Similarly Piko, in her review of the role that attitudes play in the development of smoking in adolescence, notes that there is empirically less support for the importance of attitudes in predicting smoking than might be expected (Piko, 2001). Although there appears to be support for anti-smoking and negative smoking attitudes in predicting smoking behaviour, she found less evidence of an association between positive attitudes towards smoking and smoking behaviour. Likewise, Tyas and Pederson (1998) conclude that positive attitudes are sometimes, but not always, associated with smoking behaviour. McNeill et al. (1988), in their study of the factors that predict adolescent smoking, found that attitudes towards smoking were not prospectively associated with smoking behaviour. They argued that this questions the use of health education which aims to change attitudes in an attempt to prevent smoking behaviour. The stage of smoking involved may be important in understanding the relationship between attitudes and smoking. One study found that attitudes predicted movement to regular smoking, but not movement from non-smoking to experimentation, perhaps because of the younger age of the experimenters reflecting a lack of strong attitudes regarding smoking at this point in life (Wang et al., 1999).

This chapter addresses the cross-sectional and prospective associations between smoking and a number of psychological factors measured in the HABITS study; stress, positive attitudes towards smoking, Strengths and Difficulties scores, personality, self-esteem and depression. It examines the extent to which these variables were associated with smoking initiation, and, given the above literature review, whether any associations were stable or transient.

The specific questions addressed in this chapter therefore are:

1. Which psychological factors are cross-sectionally associated with smoking at each study year?
2. Which psychological factors at the beginning of the study predict smoking behaviour in the following years?
3. Which psychological factors are cross-sectionally associated with smoking initiation?
4. To what extent do different psychological factors predict and continue to be associated with smoking initiation?

8.2 Methods

8.2.1 Population

This chapter presents both cross-sectional analyses of the association between smoking and psychological factors at each year and prospective analyses documenting the relationship between baseline psychological factors and later smoking. Because associations are discussed in relation the how they change across the period of the study, analyses are not only presented using cross-sectional data at each year but also using data from only those students who were present and had full data on all variables at every time-point (n = 1513).

8.2.2 Measures

Strengths and Difficulties Scores

Strengths and Difficulties scores (Goodman et al., 1998) were included from Year 7 to Year 10. These scores, which assess psychological well-being, are split into the following five subscales;

1. A prosocial scale where high scores indicate people who are considerate and happy to share or help
2. A hyperactivity scale which measures restlessness, distraction and attention
3. An emotional symptoms scale which describes those who frequently feel scared, worried, upset and tearful and are prone to psycho-somatic symptoms
4. A conduct problems scale which assesses the extent to which individuals lie, steal, cheat, fight and have temper tantrums
5. A peer problems scale which describes individuals who are solitary, prefer adult to child company, and are prone to bullying

A total score summing each of the scales (excluding the prosocial scale) is also constructed. Students responded to 25 items addressing these subscales on a three point likert scale. The internal consistency of each of the individual scales was fairly high (Chronbach's α values ranged from 0.60 to 0.70), although consistency for the peer problems scale was low (Chronbach's α between 0.48 and 0.49). Internal consistency for the total score was also moderate to high (Chronbach's α ranging from 0.72 to 0.75).

Stress

Stress was assessed at each of the five years using the 4-item version of Cohen's Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) which measures the extent to which students have felt themselves to be under pressure in the last month, with higher scores indicating higher stress. The internal consistency of this scale is lower than recommended (Chronbach's α ranged from 0.50 to 0.65). This may be a result of the low number of items in the scale.

Depression

Depression was measured at Year 11 only using the Center for Epidemiologic Studies Depression scale (CESD), which has been validated for use among adolescents (Radloff, 1991). This consists of 20 items which are rated on a four point likert scale in terms of how participants felt in the last week. Scores range from 0 to 60 with increasing scores indicating greater depression. Scores over a cut-point of 16 typically indicate depression, although a higher cut-point of 24 has been recommended for adolescent samples (Roberts, Lewinsohn, & Seeley, 1991). The internal consistency for the CESD in this sample was high (Chronbach's $\alpha = 0.89$).

Self-esteem

Self-esteem was measured using the Rosenberg Self-Esteem scale (Rosenberg 1989) in Years 10 and 11 only. The 10 item Rosenberg scale is a widely used self-esteem measure developed for use with adolescents. Scores range from 10 to 40 with higher scores indicating lower self-esteem. Internal consistency for the scale was high (Chronbach's $\alpha = 0.86$ at Year 10 and 0.87 at Year 11).

Positive Attitudes to smoking

At each year of the study students were asked the extent to which they agreed with the following positive attitudes to smoking: 'Smoking helps you stop feeling hungry'; 'Smoking helps calm people down if they are stressed'; 'Smoking helps you stay awake'; 'Smoking helps you to keep slim'; and 'Smoking helps people cope better with life'. Participants responded on a five point scale ('strongly disagree', 'disagree', 'don't know', 'agree' or 'strongly agree'). The first three of these statements were created for the HABITS study, while the latter two were also used in Jarvis (1996).

Personality

Personality was assessed at Year 9 only as it was assumed this measure represented stable traits. Using an adapted version of the Tridimensional Personality subscales (Wills et al. 1998), social reward dependence (e.g. enjoying close relationships with friends, feeling better with friends than when alone), task reward dependence (e.g. working hard, not giving up), harm avoidance (e.g. worrying that things will go wrong), and novelty seeking (e.g. taking risks, doing things for a dare), as well as risk taking (Eysenck & Eysenck, 1977) were assessed. Students responded to 34 statements on a likert type 5-point scale; 'not true for me', 'a little true for me', 'somewhat true for me', 'pretty true for me' and 'very true for me'. Internal consistency was high (Chronbach's α ranging from 0.77 to 0.90).

Smoking

Current smoking, adjusted for cotinine, at each study year was used in the following analyses. The full six category smoking variable; 'I have never smoked'; 'I have only ever tried smoking once'; 'I used to smoke sometimes but I never smoke cigarettes now'; 'I sometimes smoke cigarettes now but I don't smoke as many as one a week'; 'I usually smoke between one and six cigarettes a week' and; 'I usually smoke more than six cigarettes a week' was also used.

Histograms were constructed for each of the scale variables above. Most of these scales showed a normal distribution, although some variables were skewed, but none displayed a bimodal distribution. Given the large size of the sample, all variables were considered appropriate to be analysed with parametric statistical procedures.

8.2.3 Statistical analysis

Means and standard deviations were calculated for each of the psychological variables at each year of the study. To understand the changing distribution of the attitudes scores at each year, bar charts of the percentage of students strongly disagreeing, disagreeing, not sure, agreeing and strongly agreeing to each of the statements at each year have also been presented.

To assess the association between the psychological variables and smoking a series of correlations were performed. Point-biserial correlations (when one variable is dichotomous) and tetrachoric correlations (when both variables are dichotomous), which are mathematically equivalent to Pearson's correlations, have been used throughout the chapter as correlation coefficients are comparable despite psychological variables being scored on different scales. To understand the association between smoking and attitudes more comprehensibly, associations between smoking and each of: having any opinion regarding the smoking attitudes; and having a positive opinion (no opinion or negative opinion vs positive opinion) were examined. Correlations were used again so coefficients were comparable with previous analyses. To investigate the extent to which psychological variables predict later current smoking, psychological variables at Year 7 (Year 9 for personality types and Year 10 for self-esteem, which were not measured at Year 7, and excluding depression which was only measured at Year 11) were correlated with current smoking at Year 11. These analyses were then repeated using partial correlations and controlling for gender, ethnicity (White/non-White) and deprivation (Townsend scores).

Finally, the role that psychological variables play in smoking initiation was examined by establishing the extent to which the different psychological variables predicted initiation, were cross-sectionally associated with initiated behaviour, and continued to be associated with the onset of smoking one year later. Current smoking among never smokers the previous year (indicating initiation of smoking) was correlated with attitudes, Strengths and Difficulties scores and stress, the year before initiation, the year of initiation and the year after initiation. Consequently these analyses could only be performed in relation to initiation at Year 8, Year 9 and Year 10 and only with variables for which data at more than one year was available (i.e. not depression or personality scales). To assess whether the correlations between these variables and smoking at the year of initiation, the year before initiation and the year after initiation differed in strength Williams T2 statistic was used, which tests whether two correlations sharing a common variable are significantly different from each other (Steiger et al. 1980). Analyses were then repeated using partial correlations controlling for gender, ethnicity and deprivation.

The above analyses were run using those participants available for each analysis. This obviously resulted in a different sample size for each correlation, which has been indicated in the tables below. However, in order to make valid comparisons over time a sample should consist of the same people from one year to the next. To ensure this, analyses were re-run using data from the 1513 participants with full data on each of the psychological variables, as well as smoking and demographic data at each of the study years. This reduced sample is not representative of the total sample, as it contains more smokers, more girls, more White students and more students from a deprived background ($p < 0.001$). The larger sample has therefore been retained as a main focus, but data from the reduced sample analyses have also been tabulated and are commented on where these results are notably different.

8.3 Results

8.3.1 Descriptive statistics

Table **8.1** displays the mean scores of each of the psychological variables tested at each year. Total Strengths and Difficulties scores were generally slightly higher than the average of 10.97 seen in a recent study of East London adolescents (Fagg, Curtis, Stansfeld, & Congdon, 2006). It was expected that Strengths and Difficulties scores would increase with age, especially conduct problems; however, this was not observed and scores decreased from 12.36 in Year 7 to 10.93 in Year 10. This could be due to differential drop-out by those with high Strengths and Difficulties scores, however, examination of scores from the reduced sample of those with full data at every year (Table 8.2) shows a similar pattern. In general, scores for each of the psychological variables using this reduced data-set in Table 8.2 are all slightly lower than reported in Table 8.1, but the same longitudinal pattern is retained, suggesting that differential drop out by those with high scores is not causing a distortion of results, although an increase in these scores among only those who do drop out remains possible.

Positive attitudes towards smoking (displayed as a mean score in Table 8.1 and Table 8.2, with a mean below three indicating average disagreement and a mean above three indicating agreement) appear fairly stable across years. A clearer overview of this attitude data and year by year changes can be seen in Figure 8.1, Figure 8.2, Figure 8.3, Figure 8.4, and Figure 8.5 (using data from all cases available – as in Table **8.1**). In general, participants were largely undecided as to whether smoking helps to stop hunger, although increasing numbers agreed with the statement in each successive year and the numbers disagreeing rose in Years 10 and 11 (see Figure 8.1). There was a general agreement that smoking helps people to calm down when they are stressed, with more students endorsing this view with age (Figure 8.2). Few students held an opinion in terms of smoking helping to keep you stay awake although, as Figure 8.3 shows, the percentage disagreeing with this statement increased over time. In the early years of the study a large number of students did not think that smoking helped to keep people slim, though Figure 8.4 shows there was a slight shift towards agreement here with age. A similar pattern was observed in terms of the statement 'smoking helps people to cope with life', with a strong tendency for students to disagree, but a slight increase in those agreeing with the statement towards the end of the study (see Figure 8.5).

Stress scores increased very slightly at each year, with a large increase in perceived stress observed between Years 10 and 11. Mean depression at Year 11 was 14.24, below the established cut-off point for depression both in adolescents and adults (Roberts et al., 1991; Radloff, 1991).

Table 8.1 Mean (standard deviation) of psychological factors at each study year measured

Psychological variables (range)	Year 7	Year 8	Year 9	Year 10	Year 11
SDQ scores (0-10)					
Pro-social	7.39(1.81)	7.09(1.93)	6.91(1.98)	6.82(1.97)	-
Hyperactivity	4.10(2.10)	4.1(2.3)	4.08(2.29)	4.12(2.31)	-
Emotional Symptoms	3.49(2.23)	2.96(2.17)	2.84(2.13)	2.73(2.12)	-
Conduct problems	2.77(1.84)	2.62(1.91)	2.48(1.86)	2.46(1.82)	-
Peer Problems	2.00(1.72)	1.76(1.64)	1.63(1.56)	1.62(1.51)	-
Total score	12.36(5.22)	11.44(5.27)	11.02(5.17)	10.93(5.00)	-
Attitudes (1-5)					
Stops hunger	3.02(0.99)	3.11(1.03)	3.15(0.98)	3.07(0.98)	3.05(0.96)
Helps calm down	3.42(1.17)	3.67(1.06)	3.71(1.02)	3.67(0.98)	3.65(0.95)
Helps stay awake	2.86(0.93)	2.94(0.87)	2.91(0.82)	2.85(0.8)	2.82(0.81)
Helps stay slim	2.46(1.10)	2.63(1.11)	2.68(1.05)	2.72(1.01)	2.73(0.97)
Helps cope better	2.21(1.09)	2.39(1.10)	2.45(1.08)	2.47(1.06)	2.5(1.06)
Stress (0-16)	5.56(2.95)	5.68(2.97)	5.77(2.99)	5.83(3.10)	6.40(2.94)
Personality (1-5)					
Novelty seeking	-	-	2.72(0.75)	-	-
Harm avoidance	-	-	2.27(0.85)	-	-
Task reward dependence	-	-	2.90(0.86)	-	-
Social reward dependence	-	-	2.82(0.92)	-	-
Risk taking	-	-	2.81(1.12)	-	-
Depression (0-58)	-	-	-	-	14.24(9.50)
Self esteem (10-40)	-	-	-	20.36(4.84)	20.35(4.82)

Table 8.2 Mean (standard deviation) of psychological factors at each study year measured – those with full data on all psychological variables, smoking status and demographic data at each study year (n = 1513)

Psychological variables (range)	Year 7	Year 8	Year 9	Year 10	Year 11
SDQ scores (0-10)					
Pro-social	7.43 (1.74)	7.27 (1.84)	7.09 (1.88)	7.05 (1.91)	-
Hyperactivity	3.97 (2.04)	3.95 (2.26)	3.97 (2.29)	4.05 (2.26)	-
Emotional Symptoms	3.43 (2.22)	2.95 (2.14)	2.86 (2.14)	2.78 (2.13)	-
Conduct problems	2.51 (1.71)	2.26 (1.69)	2.20 (1.73)	2.15 (1.69)	-
Peer Problems	1.85 (1.68)	1.61 (1.59)	1.50 (1.51)	1.45 (1.45)	-
Total score	11.76 (5.07)	10.77 (5.03)	10.53 (4.98)	10.43 (4.84)	-
Attitudes (1-5)					
Stops hunger	3.02 (0.91)	3.12 (0.99)	3.17 (0.95)	3.09 (0.93)	3.06 (0.92)
Helps calm down	3.33 (1.13)	3.59 (1.05)	3.69 (0.98)	3.66 (0.94)	3.65 (0.93)
Helps stay awake	2.89 (0.85)	2.94 (0.83)	2.88 (0.76)	2.86 (0.73)	2.81 (0.77)
Helps stay slim	2.37 (1.07)	2.53 (1.11)	2.60 (1.04)	2.67 (1.00)	2.70 (0.95)
Helps cope better	2.16 (1.05)	2.34 (1.09)	2.38 (1.08)	2.41 (1.06)	2.42 (1.07)
Stress (0-16)	5.38 (2.93)	5.44 (2.95)	5.65 (3.05)	5.63 (3.13)	6.34 (2.99)
Personality (1-5)					
Novelty seeking	-	-	2.69 (0.74)	-	-
Harm avoidance	-	-	2.25 (0.84)	-	-
Task reward dependence	-	-	2.89 (0.82)	-	-
Social reward dependence	-	-	2.82 (0.90)	-	-
Risk taking	-	-	2.76 (1.08)	-	-
Depression (0-54)					13.82(9.53)
Self esteem (10-40)	-	-		20.31(4.84)	20.36(4.85)

Figure 8.1 – Response to statement 'Smoking stops you feeling hungry' at each study year

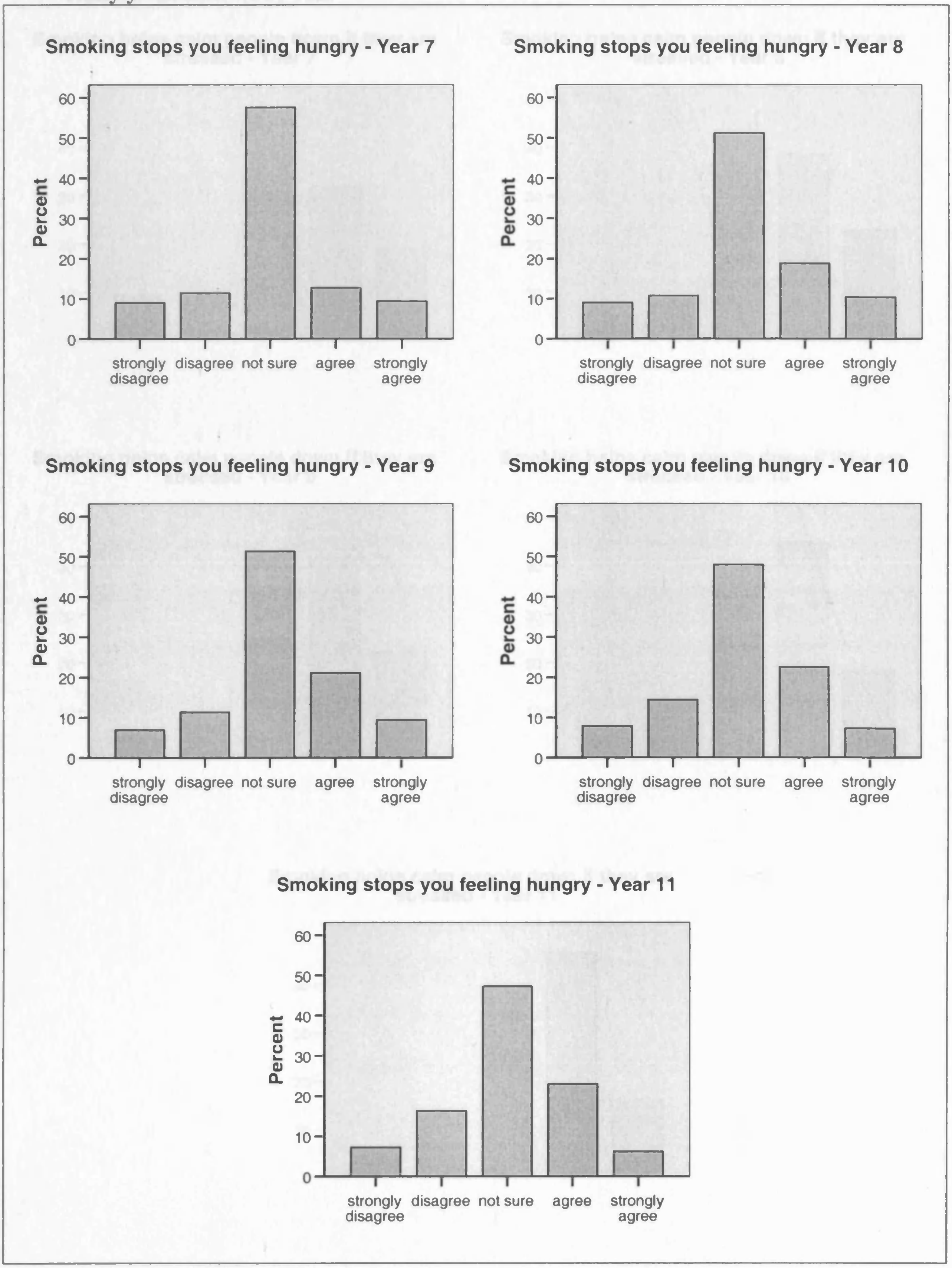


Figure 8.2 – Response to statement 'Smoking helps people calm down if they are stressed' at each study year

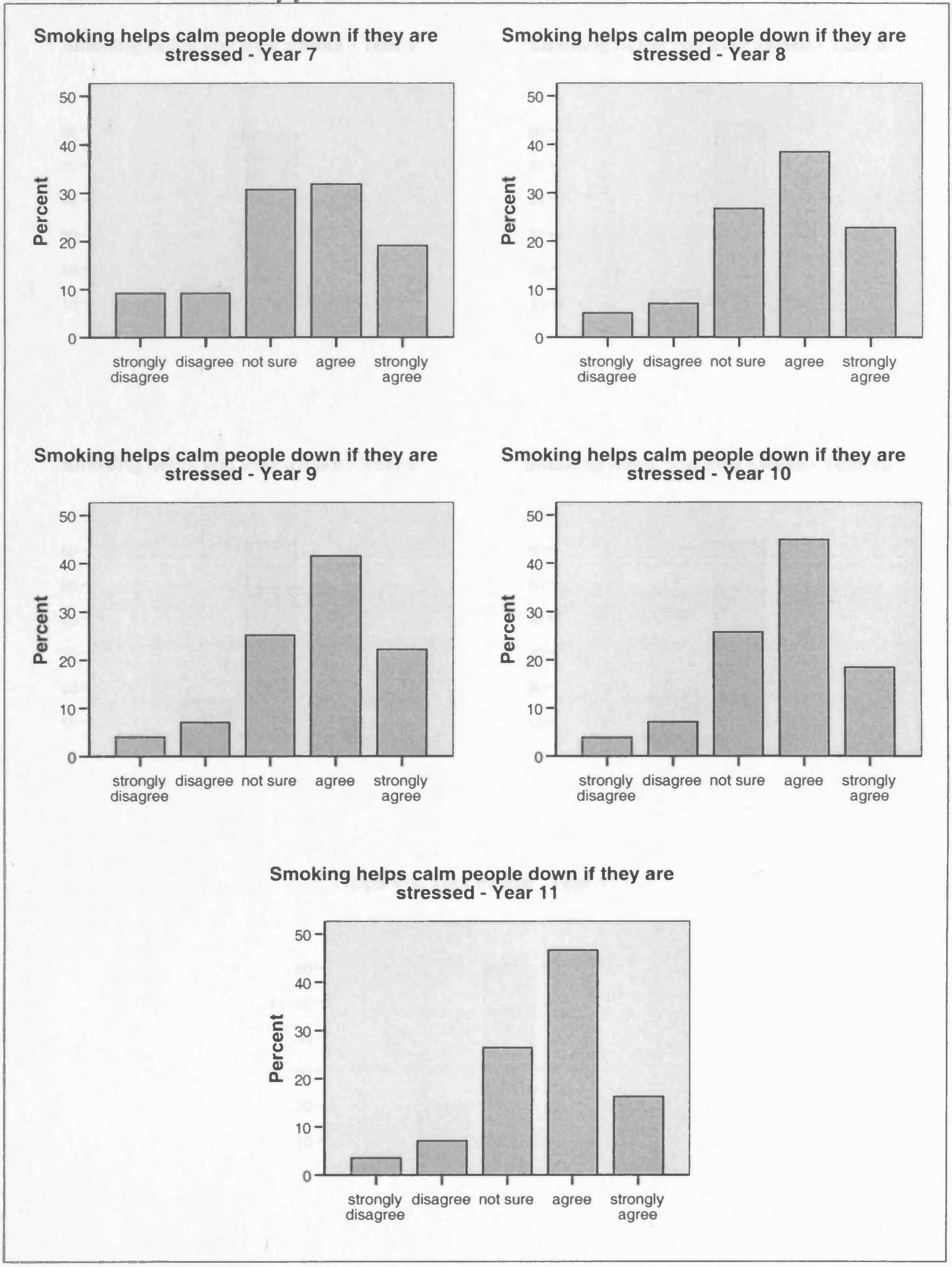


Figure 8.3 – Response to statement 'Smoking helps you stay awake' at each study year

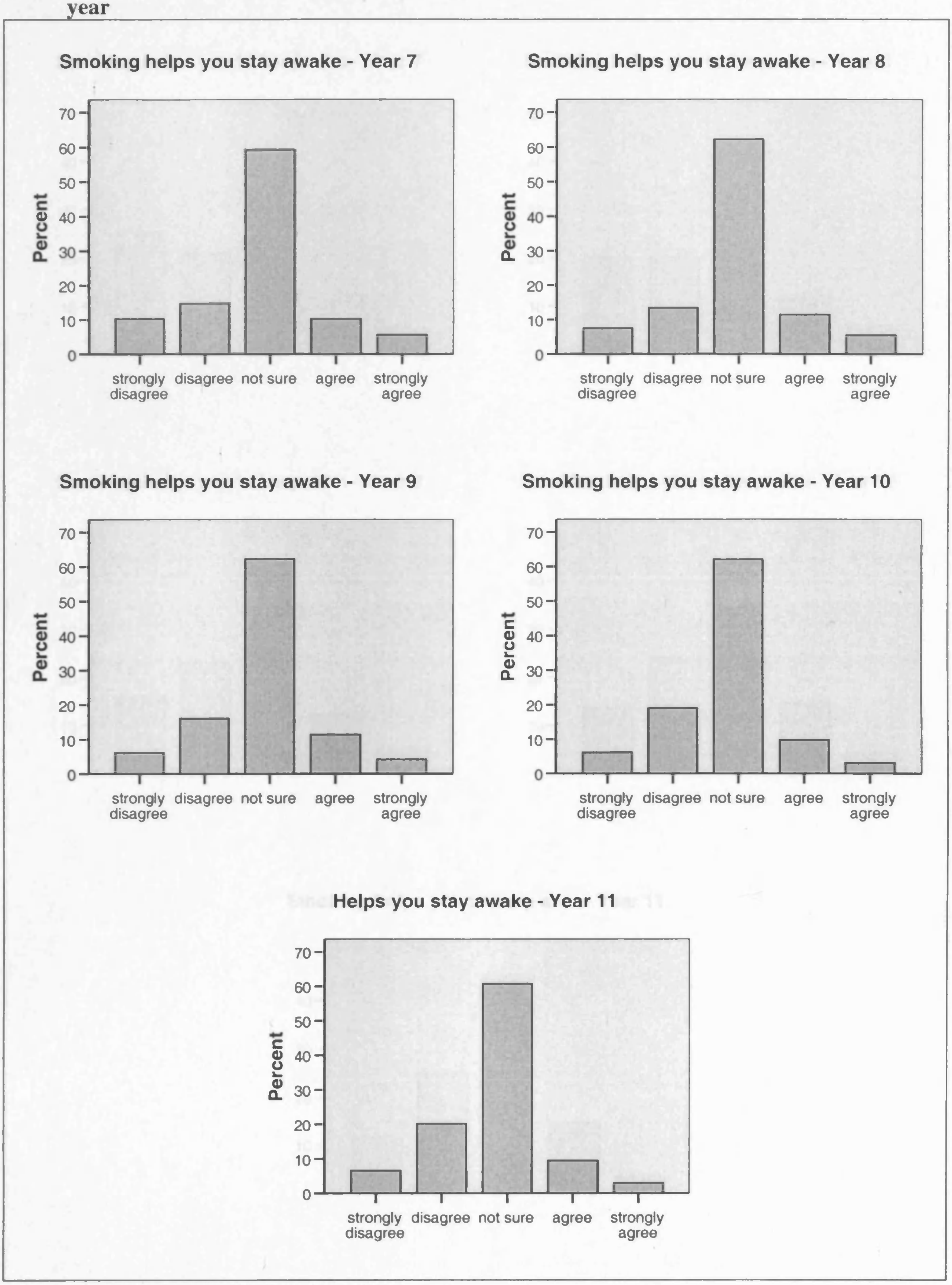


Figure 8.4 – Response to statement 'Smoking helps you to keep slim' at each study year

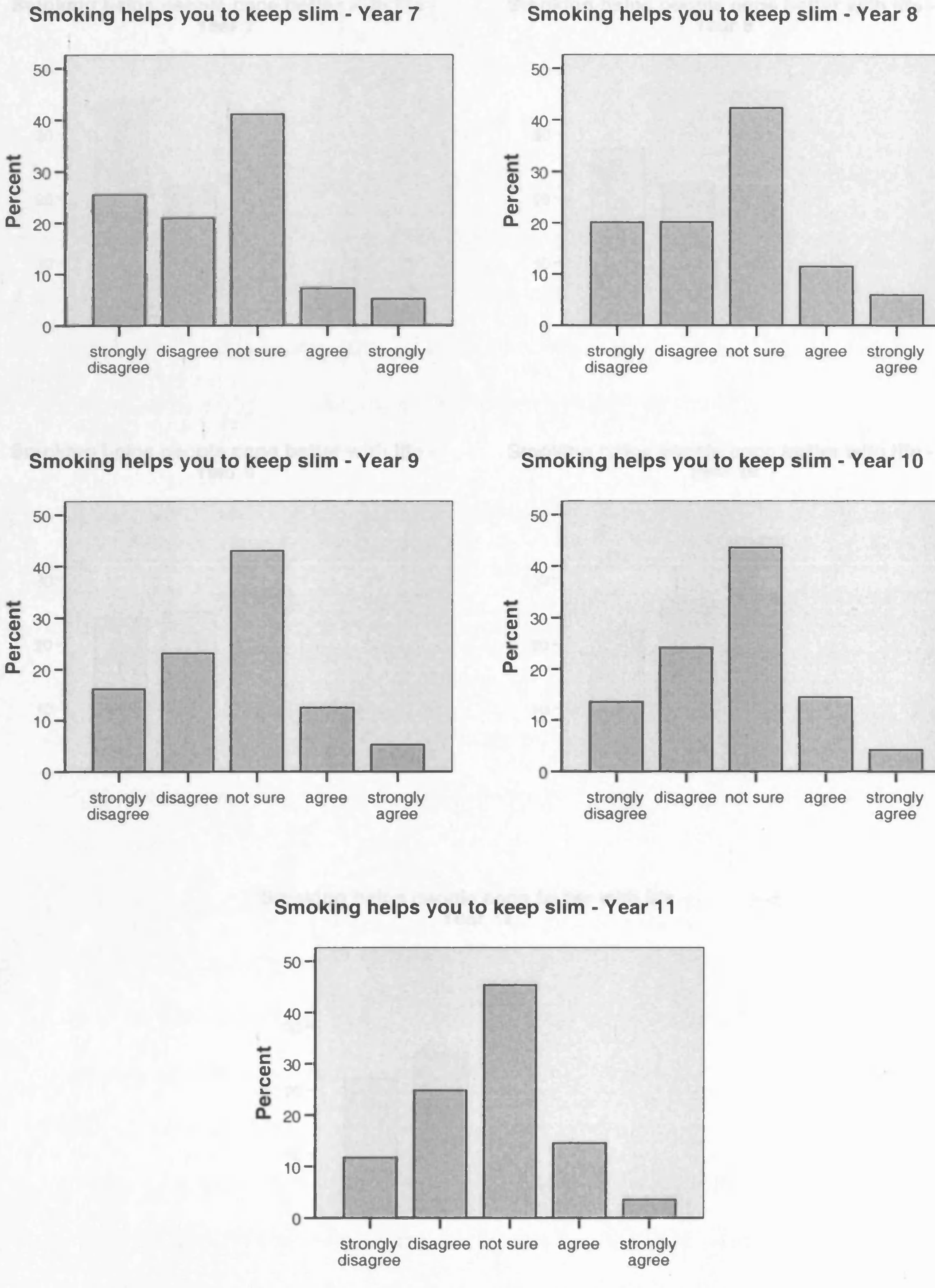
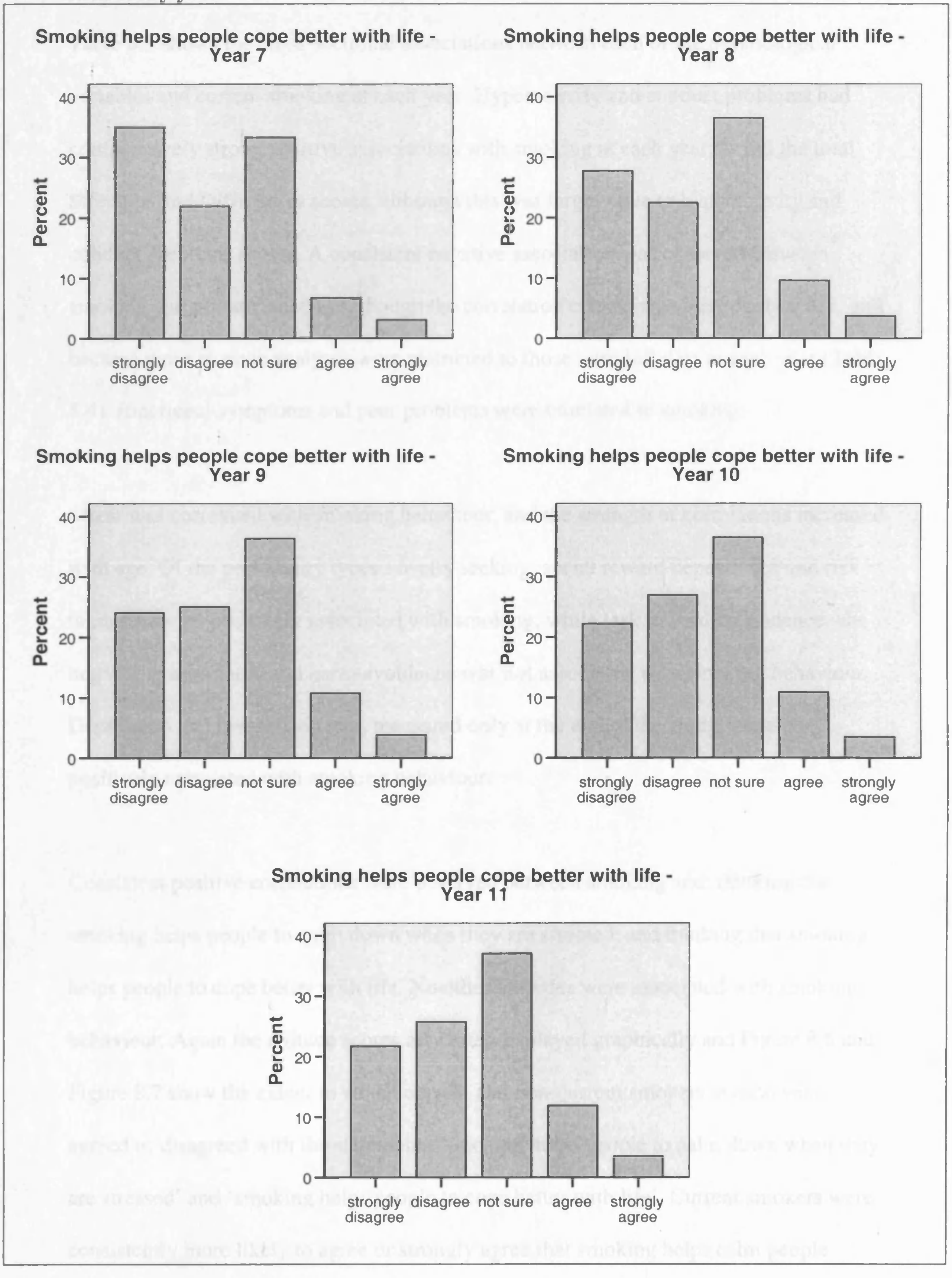


Figure 8.5 – Response to statement 'Smoking helps people cope better with life' at each study year



8.3.2 The association between psychological factors and smoking

Table 8.3 shows the cross-sectional associations between each of the psychological variables and current smoking at each year. Hyperactivity and conduct problems had comparatively strong positive associations with smoking at each year, as did the total Strengths and Difficulties scores, although this was largely due to hyperactivity and conduct problems scores. A consistent negative association was observed between smoking and pro-social scores, though the correlation coefficients were fairly weak, and became more so once analyses were restricted to those with full data at each year (Table 8.4). Emotional symptoms and peer problems were unrelated to smoking.

Stress was correlated with smoking behaviour, and the strength of correlations increased with age. Of the personality types novelty seeking, social reward dependence and risk taking were all positively associated with smoking, while task reward dependence was negatively associated and harm avoidance was not associated with smoking behaviour. Depression and low self-esteem, measured only at the end of the study, were also positively correlated with smoking behaviour.

Consistent positive correlations were observed between smoking and: thinking that smoking helps people to calm down when they are stressed; and thinking that smoking helps people to cope better with life. No other attitudes were associated with smoking behaviour. Again the attitude scores are better displayed graphically and Figure 8.6 and Figure 8.7 show the extent to which current and non-current smokers at each year agreed or disagreed with the statements 'smoking helps people to calm down when they are stressed' and 'smoking helps people to cope better with life'. Current smokers were consistently more likely to agree or strongly agree that smoking helps calm people down. Smokers were also more likely than non-smokers to agree with the statement 'smoking helps people to cope better with life', although the majority of both smokers and non-smokers were unsure as to their opinion on this statement.

Table 8.3 Cross sectional correlations between psychological variables and current smoking at each study year

Psychological variable at appropriate cross sectional year	Year 7	Year 8	Year 9	Year10	Year11
Strengths and Difficulties					
Pro-social	-.054*** (4140;111)†	-.128*** (3911;354)	-.064*** (3491;641)	-.094*** (3112;1018)	-
Hyperactivity	.103*** (4130;110)	.178*** (3905;354)	.191*** (3479;636)	.252*** (3101;1015)	-
Emotional symptoms	.023 (4134;111)	.018 (3908;352)	.020 (3488;640)	.004 (3108;1017)	-
Conduct problems	.139*** (4138;111)	.249*** (3907;356)	.233*** (3483;638)	.256*** (3102;1014)	-
Peer problems	.021 (4134;111)	.016 (3910;355)	-.017 (3482;638)	-.037* (3096;1015)	-
Total score	.107*** (4117;110)	.181*** (3896;352)	.170*** (3471;636)	.200*** (3093;1013)	-
Attitudes to smoking					
Stops hunger	.002 (4126;109)	-.026 (3913;358)	-.050** (3475;638)	-.023 (3107;1015)	-.026 (2540;1152)
Helps calm	.083*** (4139;111)	.115*** (3910;361)	.132*** (3442;635)	.181*** (3096;1014)	.188*** (2536;1153)
Helps stay awake	.011 (4128;110)	.002 (3906;361)	-.023 (3455;634)	-.016 (3103;1013)	-.088*** (2537;1152)
Helps stay slim	.010 (4131;111)	.016 (3912;358)	-.004 (3475;639)	.004 (3102;1014)	-.032 (2541;1154)
Helps cope better	.089*** (4139;111)	.120*** (3909;360)	.129*** (3474;639)	.126*** (3103;1014)	.107*** (2542;1154)
Stress	.039* (3551;92)	.096*** (3801;348)	.118*** (3422;625)	.127*** (2999;994)	.111*** (2524;1147)
Personality					
Novelty seeking	-	-	.183*** (3334;597)	-	-
Harm avoidance	-	-	.013 (3307;595)	-	-
Task reward dependence	-	-	-.146*** (3301;596)	-	-
Social reward dependence	-	-	.158*** (3278;591)	-	-
Risk taking	-	-	.252*** (3272;591)	-	-
Depression	-	-	-	-	.131*** (2300;1059)
Self esteem	-	-	-	.157*** (2795;958)	.129*** (2452;1108)

† n of non-smokers, n of smokers
*p<0.05, **p<0.01, ***p<0.001

Table 8.4 Cross sectional correlations between psychological variables and current smoking at each year for those with full data on all variables at each study year (n = 1513)

Psychological variable at appropriate cross sectional year	**Year 7** 1497,16†	**Year 8** 1432,81	**Year 9** 1324,189	**Year10** 1143,370	**Year11** 1065,448
Strengths and Difficulties scores					
Pro-social	-.030	-.065*	.008	-.079**	-
Hyperactivity	.059*	.134***	.145***	.211***	-
Emotional symptoms	-.003	.026	-.005	.035	-
Conduct problems	.102***	.192***	.204***	.211***	-
Peer problems	-.019	.008	-.059*	-.069*	-
Total score	.050	.138***	.118***	.167***	-
Positive attitudes to smoking					
Stops hunger	-.030	.038	-.029	.000	.009
Helps calm	.061*	.072**	.158***	.177***	.185***
Helps stay awake	.029	.011	-.005	-.008	-.057*
Helps stay slim	-.029	.052*	.010	-.016	-.035
Helps cope better	.077**	.121***	.102***	.157***	.120***
Stress	.051*	.115***	.116***	.166***	.152***
Personality					
Novelty seeking	-	-	.145***	-	-
Harm avoidance	-	-	.012	-	-
Task reward dependence	-	-	-.175***	-	-
Social reward dependence	-	-	.138***	-	-
Risk taking	-	-	.206***	-	-
Depression	-	-	-	-	.154***
Self-esteem				.182***	.136***

† n of non-smokers, n of smokers
*p<0.05, **p<0.01, ***p<0.001

Figure 8.6 Response to statement 'Smoking helps calm people down if they are stressed' by current smoking status at each study year

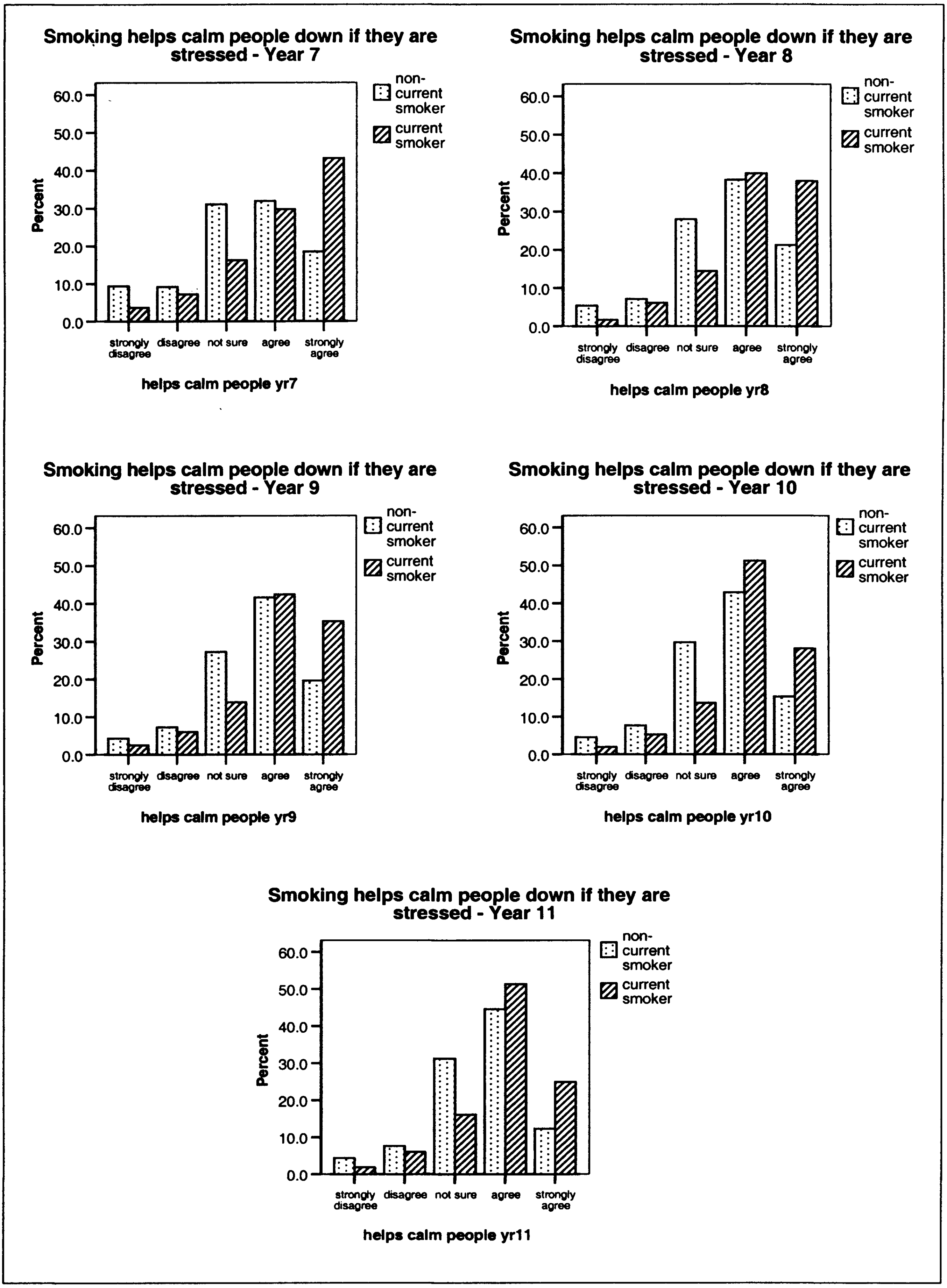
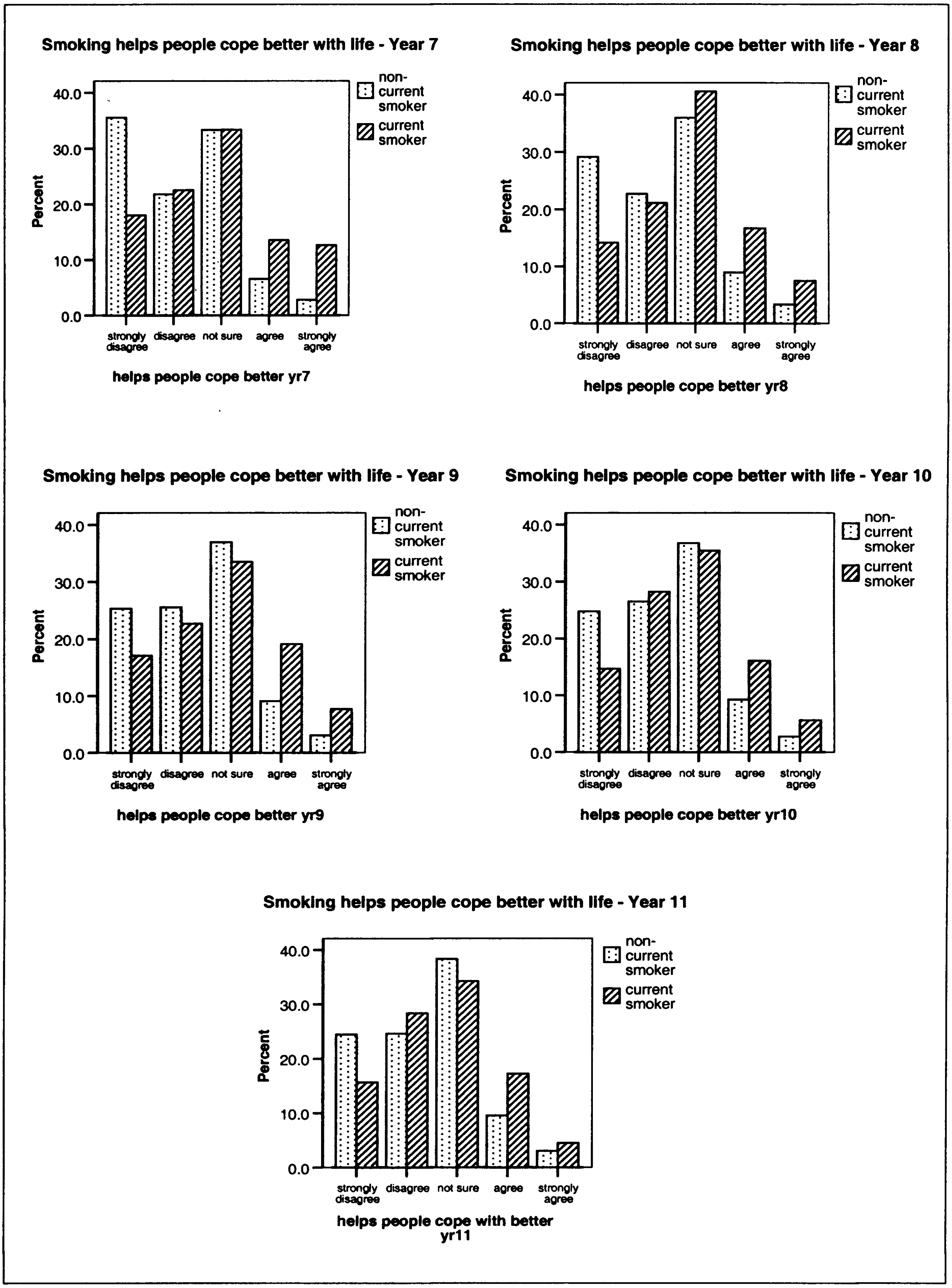


Figure 8.7 Response to statement 'Smoking helps people cope better with life' by current smoking status at each study year



It might be expected that non-smokers would respond 'don't know' to attitude statements to a greater extent than those who have experience with cigarettes. The percentages of smokers and non-smokers who formed any opinion regarding attitudes to smoking were therefore calculated. Table 8.5 shows the percentage of current and non-current smokers at each year who had an opinion, positive or negative, regarding each of the 5 attitude statements, as well as the correlation coefficients between smoking and holding an opinion. Smokers were more likely to have an opinion regarding smoking controlling hunger, helping to stay calm, and helping to stay awake. These findings were supported when examining those with full data at each study year (see Table 8.6), although a reduced statistical significance was observed in Years 7 and 8 when numbers of current smokers were low. Table 8.6 also shows that the strength of correlation increased with age. Smokers were initially no more likely than non-smokers to hold an opinion regarding 'smoking helps to keep you slim' but as age increased smokers were more likely to have formed an opinion than non-smokers, although this was not replicated in the reduced data-set of those providing data at each study year. Both smokers and non-smokers were equally likely to have an opinion regarding smoking helping people to cope better with life.

These correlations do not tell us the direction of opinion, just that smokers were, in general, more likely to have formed an opinion on the statements. Table 8.7 below looks at the correlation between smoking behaviour and having a positive attitude to the statements. At each of the five years smoking was correlated with thinking that smoking helps to keep people calm and that smoking helps people to cope. Thinking that smoking helps people to stay awake was weakly correlated with smoking, and the statistical significance of these correlations reduced still further when analyses were repeated using those with full data only, although the strength of coefficients was maintained (see Table 8.8).

Agreement with these attitudes differs from the findings on holding any opinion regarding the statements in two respects. First, although having an opinion regarding smoking stopping hunger was associated with smoking, having a positive opinion was not. Smokers therefore appear more likely to think that smoking does not have an effect on hunger, perhaps from their own experience. Second, having an opinion regarding smoking helping people to cope with life was not associated with smoking, whereas having a positive opinion about this was clearly correlated with smoking behaviour at every year.

Table 8.5 Percentage (n) of non-current and current smokers reporting opinions towards each attitude question and associated correlations at each study year

Have an opinion at appropriate cross sectional year by smoking at that year	Year 7	Year 8	Year 9	Year 10	Year 11
Stops hunger					
Non-current smoker	42.0	47.6	46.4	48.4	47.0
	(1734)	(1864)	(1614)	(1503)	(1194)
Current smoker	54.1	60.3	60.2	63.2	65.0
	(59)	(216)	(384)	(641)	(749)
Correlation coefficient	.039*	.070***	.100***	.127***	.167***
Helps calm					
Non-current smoker	68.9	72.0	72.8	70.3	68.8
	(2852)	(2815)	(2505)	(2177)	(1744)
Current smoker	83.8	85.6	86.1	86.4	84.0
	(93)	(309)	(547)	(876)	(968)
Correlation coefficient	.051**	.085***	.112***	.159***	.160***
Helps stay awake					
Non-current smoker	40.2	36.5	35.5	33.9	33.0
	(1659)	(1426)	(1227)	(1051)	(838)
Current smoker	59.1	49.0	49.7	50.5	52.9
	(65)	(177)	(315)	(512)	(609)
Correlation coefficient	.061***	.072***	.106***	.148***	.188***
Helps stay slim					
Non-current smoker	59.0	57.8	56.9	54.9	52.1
	(2437)	(2261)	(1977)	(1702)	(1324)
Current smoker	54.1	57.3	57.1	61.1	60.1
	(60)	(205)	(365)	(620)	(694)
	-.016	-.003	.002	.055***	.075***
Helps cope better					
Non-current smoker	66.7	64.0	63.1	63.3	61.7
	(2760)	(2503)	(2191)	(1963)	(1568)
Current smoker	66.7	59.4	66.5	64.6	65.8
	(74)	(214)	(425)	(655)	(759)
Correlation coefficient	.000	-.027	.026	.012	.039*

*p<0.05, **p<0.01, ***p<0.001

Table 8.6 Percentage (n) of non-current and current smokers reporting opinions towards each attitude question and associated correlations for those with full data on all variables at each study year (n = 1513)

Have an opinion at appropriate cross sectional year by smoking at that year	Year 7	Year 8	Year 9	Year 10	Year 11
Stops hunger					
Non-current smoker	38.3	46.6	46.3	48.9	48.8
	(573)	(667)	(613)	(559)	(520)
Current smoker	50.0	61.7	58.7	57.0	62.5
	(8)	(50)	(111)	(211)	(280)
Correlation coefficient	.025	.068**	.082**	.070**	.125***
Helps calm					
Non-current smoker	67.7	73.5	73.3	70.9	71.5
	(1014)	(1053)	(967)	(810)	(762)
Current smoker	93.8	76.5	85.2	84.3	85.3
	(15)	(62)	(161)	(312)	(382)
Correlation coefficient	.057*	.015	.092***	.132***	.146***
Helps stay awake					
Non-current smoker	36.5	34.4	34.2	30.8	33.1
	(546)	(492)	(453)	(352)	(353)
Current smoker	50.0	38.3	45.0	43.5	52.5
	(8)	(31)	(85)	(161)	(235)
Correlation coefficient	.029	.019	.074**	.115***	.181***
Helps stay slim					
Non-current smoker	61.6	62.3	60.6	59.6	56.5
	(922)	(892)	(803)	(681)	(602)
Current smoker	75.0	56.8	53.4	63.0	61.4
	(12)	(46)	(101)	(233)	(275)
Correlation coefficient	.028	-.026	-.049	.030	.045
Helps cope better					
Non-current smoker	67.7	66.3	67.1	67.0	66.9
	(1013)	(949)	(888)	(766)	(713)
Current smoker	43.8	59.3	65.1	66.8	69.9
	(7)	(48)	(123)	(247)	(313)
Correlation coefficient	-.052*	-.033	-.014	-.002	.029

*p<0.05, **p<0.01, ***p<0.001

Table 8.7 Percentage (n) of non-current and current smokers reporting a positive opinion towards each attitude question and associated correlations at each study year

Have a positive opinion at appropriate cross sectional year by smoking at that year	Year 7	Year 8	Year 9	Year 10	Year 11
Stops hunger					
Non-current smoker	21.9	29.0	29.9	28.5	27.3
	(905)	(1133)	(1040)	(884)	(694)
Current smoker	28.4	30.7	32.6	33.8	33.1
	(31)	(110)	(208)	(343)	(381)
Correlation coefficient	.025	.011	.021	.050**	.059***
Helps calm					
Non-current smoker	40.0	59.5	61.2	58.1	56.8
	(2086)	(2325)	(2107)	(1800)	(1441)
Current smoker	50.4	77.8	77.6	79.2	76.1
	(81)	(281)	(493)	(803)	(878)
	.072***	.105***	.124***	.188***	.185***
Helps stay awake					
Non-current smoker	15.6	16.2	14.8	11.4	11.4
	(642)	(633)	(513)	(355)	(290)
Current smoker	28.2	21.6	18.5	17.1	14.5
	(31)	(78)	(117)	(173)	(167)
Correlation coefficient	.055***	.040**	.036*	.073***	.056**
Helps stay slim					
Non-current smoker	12.5	17.3	17.7	18.1	18.0
	(516)	(676)	(616)	(561)	(458)
Current smoker	9.9	17.3	16.9	21.0	18.3
	(11)	(62)	(108)	(213)	(211)
	-.012	.000	-.088	.032*	.003
Helps cope better					
Non-current smoker	9.4	12.2	12.2	12.0	12.6
	(388)	(478)	(423)	(373)	(320)
Current smoker	26.1	24.2	26.8	21.7	21.8
	(29)	(87)	(171)	(220)	(251)
	.090***	.098***	.150***	.119***	.117***

*p<0.05, **p<0.01, ***p<0.001

Table 8.8 Percentage (n) of non-current and current smokers reporting a positive opinion towards each attitude question and associated correlations for those with full data on all variables at each study year (n = 1513)

Have a positive opinion at appropriate cross sectional year by smoking at that year	Year 7	Year 8	Year 9	Year 10	Year 11
Stops hunger					
Non-current smoker	19.4 (290)	28.0 (401)	30.7 (406)	29.4 (336)	28.0 (298)
Current smoker	18.8 (3)	39.5 (32)	33.9 (64)	33.0 (122)	34.4 (154)
Correlation coefficient	-.002	.057*	.023	.033	.064*
Helps calm					
Non-current smoker	47.8 (715)	59.6 (854)	61.1 (809)	59.1 (675)	59.1 (629)
Current smoker	75.0 (12)	67.9 (55)	81.0 (153)	77.6 (287)	77.9 (349)
Correlation coefficient	.056*	.038	.136***	.165***	.180***
Helps stay awake					
Non-current smoker	14.4 (215)	15.3 (219)	12.5 (165)	9.6 (110)	10.2 (109)
Current smoker	31.3 (5)	18.5 (15)	16.4 (31)	14.9 (55)	15.0 (67)
Correlation coefficient	.049	.020	.039	.072**	.067**
Helps stay slim					
Non-current smoker	11.1 (166)	16.3 (233)	17.3 (229)	19.2 (220)	18.5 (197)
Current smoker	6.3 (1)	19.8 (16)	14.3 (27)	19.5 (72)	17.2 (77)
Correlation coefficient	-.016	.021	-.027	.002	-.016
Helps cope better					
Non-current smoker	8.5 (127)	12.1 (173)	12.8 (170)	11.7 (134)	12.4 (132)
Current smoker	28.8 (3)	25.9 (21)	21.2 (40)	23.2 (86)	22.5 (101)
Correlation coefficient	.037*	.093***	.080**	.140***	.128***

*p<0.05, **p<0.01, ***p<0.001

8.3.3 The prospective relationship between psychological factors and smoking

Table 8.9 displays correlations between the psychological variables at Year 7 (Year 9 for personality type and Year 10 for self-esteem, which were not measured at Year 7, and excluding depression which was only measured at Year 11) and current smoking at each subsequent year. Partial correlations adjusting for gender, ethnicity (White/non-White) and deprivation were also run and are presented in Table 8.10. Analyses were then repeated using data from only those participants who were present and provided data on all variables at each study year (see Table 8.11 and Table 8.12). High conduct problems and hyperactivity scores at Year 7 were predictors of current smoking behaviour at each subsequent year, while pro-social scores and peer problems at Year 7 were negatively correlated with later smoking behaviour, although correlation coefficients were weak. The predictive abilities of these Strengths and Difficulties scores were largely attenuated when using results from only those with complete data at each year and the negative correlation between smoking and pro-social scores disappeared. However, the positive correlations between peer problems and later smoking became stronger. The only attitude with strong predictive abilities in both analyses (using all data available and when restricting data to those with responses at every year) was thinking that smoking helps people to stay calm. Stress was also positively correlated with smoking behaviour in the future, although the association was weak and only significant at Year 8 and Year 11, and only at Year 11 when using those with complete data at each year. Low self-esteem at Year 10 was positively correlated with smoking one year later in Year 11. Finally, novelty seeking, social reward dependence and risk taking (all as measured at Year 9) were significantly positively correlated with smoking behaviour one and two years later while task reward dependence (again measured at Year 9) was significantly negatively correlated with smoking in Years 10 and 11. Adjusting for gender, ethnicity and deprivation made little difference to results (see Table 8.10 and 8.12).

Table 8.9 Correlations between baseline psychological factors and current smoking at each study year

Year 7 psychological factors	Year 8	Year 9	Year 10	Year 11
SDQ scores				
Pro-social	-.045** (3289;293)†	-.059** (2681;473)	-.039* (2264;759)	-.028* (1914;848)
Hyperactivity	.100*** (3279;293)	.087*** (2675;472)	.096*** (2257;759)	.098*** (1909;848)
Emotional Symptoms	.035* (3286;293)	.012 (2677;472)	-.002 (2259;759)	.019 (1911;848)
Conduct problems	.126*** (3286;293)	.089*** (2682;472)	.117*** (2263;760)	.104*** (1912;848)
Peer Problems	-.003 (3284;293)	-.039* (2680;471)	-.042* (2261;759)	-.066** (1912;847)
Total score	.099*** (3270;293)	.059** (2668;470)	.066*** (2251;756)	.062** (1905;846)
Attitudes				
Stops hunger	.025 (3265;291)	.013 (2665;469)	.030 (2250;759)	.028 (1902;846)
Helps calm down	.068*** (3278;293)	.064*** (2676;470)	.080*** (2262;758)	.077*** (1909;849)
Helps stay awake	.004 (3271;292)	.001 (2668;467)	.017 (2251;757)	.031 (1902;848)
Helps stay slim	.032** (3271;292)	.015 (2668;469)	.004 (2255;757)	.018 (1905;845)
Helps cope better	.074*** (3277;292)	.027 (2673;469)	.051** (2258;758)	.037 (1907;848)
Stress	.053** (2857;252)	.028 (2336;408)	.023 (1972;689)	.046* (1704;769)
Personality				
Novelty seeking	-	-	.162*** (2485;814)	.165*** (2120;929)
Harm avoidance	-	-	.024 (2464;812)	.026 (2108;924)
Task reward dependence	-	-	-.169*** (2458;812)	-.158*** (2106;923)
Social reward dependence	-	-	.144*** (2443;804)	.126*** (2094;918)
Risk taking	-	-	.226*** (2437;804)	.240*** (2091;917)
Self-esteem	-	-	-	.134*** (2121;941)

† (n of non-current smokers;n of current smokers)
*p<0.05, **p<0.01, p<0.001

Table 8.10 Partial correlations adjusting for gender, ethnicity and deprivation between baseline psychological factors and current smoking at each study year

Year 7 psychological factors	Year 8	Year 9	Year 10	Year 11
SDQ scores				
Pro-social	-.059*** (3273;288)†	-.087*** (2674;471)	-.059** (2259;755)	-.041* (1909;843)
Hyperactivity	.098*** (3265;288)	.084*** (2668;470)	.084*** (2252;755)	.087*** (1904;843)
Emotional Symptoms	.024 (3270;288)	-.009 (2670;470)	-.025 (2254;755)	.004 (1906;843)
Conduct problems	.133*** (3271;288)	.107*** (2675;470)	.134*** (2258;756)	.116*** (1907;843)
Peer Problems	-.003 (3269;288)	-.035* (2673;469)	-.040* (2256;755)	-.064** (1907;842)
Total score	.095*** (3256;288)	.056** (2661;468)	.057** (2246;752)	.055** (1900;841)
Attitudes				
Stops hunger	.026 (3250;286)	.015 (2658;467)	.032 (2245;755)	.031 (1897;841)
Helps calm down	.067*** (3263;288)	.063*** (2669;468)	.076*** (2257;754)	.073*** (1904;844)
Helps stay awake	.005 (3256;287)	-.001 (2661;465)	.013 (2246;753)	.025 (1897;843)
Helps stay slim	.036* (3256;287)	.020 (2661;467)	.013 (2250;753)	.025 (1900;840)
Helps cope better	.070*** (3262;287)	.020 (2666;467)	.039* (2253;754)	.029 (1902;843)
Stress	.049** (2849;249)	.023 (2332;407)	.019 (1968;687)	.049* (1701;768)
Personality				
Novelty seeking	-	-	.162*** (2478;810)	.169*** (2113;927)
Harm avoidance	-	-	.013 (2457;808)	.027 (2101;922)
Task reward dependence	-	-	-.146*** (2451;808)	-.137*** (2099;921)
Social reward dependence	-	-	.120*** (2436;800)	.116*** (2088;916)
Risk taking	-	-	.232*** (2430;800)	.238*** (2085;915)
Self-esteem	-	-	-	.110*** (2110;940)

† (n of non-current smokers;n of current smokers)
*p<0.05, **p<0.01, ***p<0.001

Table 8.11 Correlations between baseline psychological factors and current smoking at each study year for those with full data on all variables at each study year

Year 7 psychological factors	**Year 8** n's = 1432,81†	**Year 9** n's = 1324,189	**Year 10** n's = 1143,370	**Year 11** n's = 1065,448
SDQ scores				
Pro-social	-.015	-.047	-.025	-.018
Hyperactivity	.040	.058*	.075**	.062*
Emotional Symptoms	.065*	-.003	.010	.026
Conduct problems	.061*	.028	.086**	.071**
Peer Problems	-.010	-.087**	-.081	-.090***
Total score	.062*	.003	.037	.030
Attitudes				
Stops hunger	.048	.031	.009	.021
Helps calm down	.029	.067**	.121***	.074**
Helps stay awake	-.007	-.002	-.007	.005
Helps stay slim	.050	.038	.000	.003
Helps cope better	.042	.007	.043	.017
Stress	.027	.045	.046	.066**
Personality				
Novelty seeking	-	-	.128***	.155***
Harm avoidance	-	-	.018	.027
Task reward dependence	-	-	-.176***	-.159***
Social reward dependence	-	-	.126***	.105***
Risk taking	-	-	.198***	.199***
Self-esteem	-	-	-	.147***

† (n of non-current smokers;n of current smokers)
*p<0.05, **p<0.01, ***p<0.001

Table 8.12 Partial correlations adjusting for gender, ethnicity and deprivation between baseline psychological factors and current smoking for those with full data on all variables at each study year

Year 7 psychological factors	**Year 8** n's = 1432,81†	**Year 9** n's = 1324,189	**Year 10** n's = 1143,370	**Year 11** n's = 1065,448
SDQ scores				
Pro-social	-.031	-.081**	-.051	-.034
Hyperactivity	.043	.056*	.066*	.051*
Emotional Symptoms	.059*	-.018	-.003	.016
Conduct problems	.069**	.043	.099***	.079**
Peer Problems	-.008	-.080**	-.074**	-.084**
Total score	.063*	.002	.034	.026
Attitudes				
Stops hunger	.047	.031	.010	.022
Helps calm down	.030	.067*	.120***	.071**
Helps stay awake	-.007	-.005	-.012	-.002
Helps stay slim	.048	.040	.005	.010
Helps cope better	.042	.005	.040	.011
Stress	.024	.041	.046	.070**
Personality				
Novelty seeking	-	-	.133***	.161***
Harm avoidance	-	-	.011	.026
Task reward dependence	-	-	-.160***	-.144**
Social reward dependence	-	-	.108***	.092**
Risk taking	-	-	.210***	.207**
Self-esteem	-	-	-	.126***

† (n of non-current smokers;n of current smokers)
*p<0.05, **p<0.01, ***p<0.001

8.3.4 Psychological factors and smoking initiation

This section establishes the extent to which these psychological factors were cross-sectionally and prospectively associated with smoking initiation (i.e. new smoking), and also the extent to which smoking initiation at a given year continued to be associated with (or went on to predict) psychological variables the year after initiation (indicating stability). Correlations were carried out between smoking at Years 8, 9 and 10 among never smokers the year previously and psychological factors: the year before smoking was initiated; at the year smoking initiation was recorded; and the year after smoking initiation. These analyses were run using only psychological variables which were significantly correlated with smoking at above a coefficient of 0.1 cross-sectionnally (excluding total Strengths and Difficulties scores where the significant relationship with smoking is likely to be due to the two subscales hyperactivity and peer problems, which have been included here separately).

Piko (2001) recommends the use of an intensity of smoking behaviour variable to assess the influence of attitudes on smoking. As only never smokers the year before assessment were included in analyses, the full 6-category smoking variable could be used as a quantitative variable in correlations; the removal of ex-smokers (who were either not included, or had become smokers and stopped smoking during the intervening year) made this variable an indicator of increasing intensity of smoking behaviour. To take these analyses further, Williams T2 tests (Steiger, 1980) were used to examine whether the correlation coefficients at each measurement point were significantly different from each other. Finally the same analyses were re-run controlling for deprivation, ethnicity and gender using partial correlations.

The unadjusted and adjusted correlations (which were almost identical) in Table 8.13 and Table 8.14 show that the attitude ‘smoking helps calm people down if they are stressed’ the year before smoking initiation occurred was not correlated with smoking initiation (except at Year 9) and the correlation coefficients were significantly lower than those at the year of initiation. Once smoking was initiated, however, a correlation between smoking at that year and thinking that smoking helps calm people down one year later was still observed, and remained consistent in magnitude (again except at Year 9). Similar findings were observed for the attitude ‘Smoking helps people cope better with life' in terms of smoking initiation at Year 10 only; attitude prior to initiation was not significantly associated with initiation, but once smoking behaviour commenced this attitude was both associated with initiation at the year of initiation and one year later. This was not the case in terms of earlier smoking initiation however, with thinking that smoking helps people cope better with life showing a greater and more significant correlation with smoking initiation at the year of initiation rather than the year prior or following initiation, while smoking initiation at Year 9 was associated with this attitude both before, at, and following initiation.

The hyperactivity and conduct problems subscales of the Strengths and Difficulties questionnaires were correlated with smoking before, at, and after smoking initiation. However, the strength of correlation was significantly greater at the year of initiation than the year before, although after initiation the correlation coefficients were no different to those at initiation (except in Year 9 in the case of conduct problems).

Stress before initiation was only weakly, if at all, correlated with smoking initiation one year later. Once initiation had occurred, stress was cross-sectionally correlated with smoking and remained correlated with initiation one year later.

These analyses were repeated using data from only those participants who provided full psychological, smoking and demographic data at each study year (see Table 8.15 and Table 8.16). Although a few correlations differed in strength and/or significance level, the overall pattern was the same as reported above.

Table 8.13 Correlations between degree of new smoking behaviour at Year 8, Year 9 and Year 10 and psychological factors the year prior to initiation, the year of initiation and the year after initiation

	New smoking behaviour		
	Year 8	**Year 9**	**Year 10**
Think smoking calms people			
Pre-initiation	.041	.064**a	.046a
At initiation	.087***	.138***	.114***
Post initiation	.082***	.081***a	.112***
Think smoking helps cope			
Pre-initiation	.044*a	.086**	.018
At initiation	.123***	.123***	.061*
Post initiation	.045*a	.101***	.076**
Stress			
Pre-initiation	.023a	.057*	.075**a
At initiation	.110***	.100***	.136***
Post initiation	.120***	.103***	.121***
Hyperactivity score			
Pre-initiation	.088***a	.111***a	.090***a
At initiation	.185***	.181***	.150***
Post initiation	.153***	.172***	-
Conduct problems score			
Pre-initiation	.089***a	.092***a	.104***a
At initiation	.188***	.207***	.166***
Post initiation	.182***	.148***a	-

*p< 0.05, **p<0.01, ***p<0.001

a = Williams T2 test of difference of correlation coefficients: coefficients are significantly different to the coefficient 'at initiation', p < 0.05

Table 8.13b N's of above correlations

	Never smoked	Tried once	Used to smoke	Sometimes smoke	Smoke 1-6 per week	Smoke > 6 per week	Total
Think calms							
Year 8	1811	359	60	46	16	2	2294
Year 9	1465	265	56	59	22	6	1873
Year 10	1169	239	31	71	16	10	1536
Helps cope							
Year 8	1827	362	59	46	14	2	2310
Year 9	1484	268	55	60	22	6	1895
Year 10	1179	241	32	71	17	10	1550
Stress							
Year 8	1607	314	48	41	14	1	2025
Year 9	1418	254	54	56	21	6	1809
Year 10	1162	230	32	71	16	9	1520
Hyperactivity							
Year 8	1821	360	58	45	15	2	2301
Year 9	1481	266	55	57	23	6	1888
Year 10	1391	284	45	87	23	10	1840
Conduct problems							
Year 8	1829	363	59	45	16	2	2314
Year 9	1483	267	56	58	23	6	1893
Year 10	1393	283	45	87	23	10	1841

Table 8.14 Partial correlations controlling for deprivation, ethnicity and gender between degree of new smoking behaviour at Year 8, Year 9 and Year 10 and psychological factors the year prior to initiation, the year of initiation and the year after initiation

	New smoking behaviour		
	Year 8	Year 9	Year 10
Think smoking calms people			
Pre-initiation	.040a	.065**a	.044a
At initiation	.089***	.138***	.115***
Post initiation	.082***	.080**a	.112***
Think smoking helps people cope			
Pre-initiation	.042*a	.083***	.022
At initiation	.122***	.125***	.071**
Post initiation	.048*a	.108***	.088***
Stress			
Pre-initiation	.019a	.052*	.072**a
At initiation	.107***	.095***	.127***
Post initiation	.11***	.093***	.112***
Hyperactivity score			
Pre-initiation	.094***a	.105***a	.084***a
At initiation	.187***	.175***	.141***
Post initiation	.153***	.167***	-
Conduct problems score			
Pre-initiation	.101***a	.105***a	.116***a
At initiation	.204***	.217***	.181***
Post initiation	.191***	.160***a	-

*p< 0.05, **p<0.01, ***p<0.001

a = Williams T2 test of difference of correlation coefficients: coefficients are significantly different to the coefficient 'at initiation', p < 0.05

Table 8.14b N's of above correlations

	Never smoked	Tried once	Used to smoke	Sometimes smoke	Smoke 1-6 per week	Smoke > 6 per week	Total
Think calms							
Year 8	1811	359	60	46	16	2	2294
Year 9	1465	265	56	59	22	6	1873
Year 10	1169	239	31	71	16	10	1536
Helps cope							
Year 8	1827	362	59	46	14	2	2310
Year 9	1484	268	55	60	22	6	1895
Year 10	1179	241	32	71	17	10	1550
Stress							
Year 8	1607	314	48	41	14	1	2025
Year 9	1418	254	54	56	21	6	1809
Year 10	1162	230	32	71	16	9	1520
Hyperactivity							
Year 8	1821	360	58	45	15	2	2301
Year 9	1481	266	55	57	23	6	1888
Year 10	1391	284	45	87	23	10	1840
Conduct problems							
Year 8	1829	363	59	45	16	2	2314
Year 9	1483	267	56	58	23	6	1893
Year 10	1393	283	45	87	23	10	1841

Table 8.15 Correlations between degree of new smoking behaviour at Year 8, Year 9 and Year 10 and psychological factors the year prior to initiation, the year of initiation and the year after initiation for those with full data on all variables at each study year

	New smoking behaviour		
	Year 8	**Year 9**	**Year 10**
Think smoking calms people			
Pre-initiation	.068*	.060*a	.051
At initiation	.089**	.143***	.110**
Post initiation	.095**	.085***	.103**
Think smoking helps cope			
Pre-initiation	.050a	.070*	.004
At initiation	.113***	.096**	.055
Post initiation	.066*	.098**	.078*
Stress			
Pre-initiation	.002a	.065*a	.056a
At initiation	.135***	.127***	.126***
Post initiation	.091**	.134***	.122***
Hyperactivity score			
Pre-initiation	.073**a	.131***a	.091**a
At initiation	.194***	.198***	.162***
Post initiation	.136***a	.186***	-
Conduct problems score			
Pre-initiation	.076**a	.080**a	.105**
At initiation	.209***	.192***	.139***
Post initiation	.206***	.135***	-

*p<0.05, **p<0.01, ***p<0.001

a = Williams T2 test of difference of correlation coefficients: coefficients are significantly different to the coefficient 'at initiation', p < 0.05

Table 8.15b N's of above correlations

	Never smoked	Tried once	Used to smoke	Sometimes smoke	Smoke 1-6 per week	Smoke > 6 per week	Total
Year 8	1056	185	27	25	8	-	1301
Year 9	870	130	30	38	12	2	1082
Year 10	694	132	14	53	6	7	906

Table 8.16 Partial correlations controlling for deprivation, ethnicity and gender between degree of new smoking behaviour at Year 8, Year 9 and Year 10 and psychological factors the year prior to initiation, the year of initiation and the year after initiation for those with full data on all variables at each study year

	New smoking behaviour		
	Year 8	**Year 9**	**Year 10**
Think smoking calms people			
Pre-initiation	.068*	.063*a	.049
At initiation	.091**	.145***	.113**
Post initiation	.098***	.088**	.102**
Think smoking helps people cope			
Pre-initiation	.050a	.073*	.005
At initiation	.113***	.099**	.064
Post initiation	.071*	.106***	.087**
Stress			
Pre-initiation	-.002a	.062*	.053a
At initiation	.131***	.121***	.115***
Post initiation	.081**	.120***	.112***
Hyperactivity score			
Pre-initiation	.080**a	.127***a	.087**a
At initiation	.198***	.195***	.153***
Post initiation	.141***a	.180***	-
Conduct problems score			
Pre-initiation	.089**a	.107***a	.116***
At initiation	.223***	.209***	.160***
Post initiation	.217***	.158***	-

*p< 0.05, **p<0.01, ***p<0.001
a = Williams T2 test of difference of correlation coefficients: coefficients are significantly different to the coefficient 'at initiation', p < 0.05

Table 8.16b N's of above correlations

	Never smoked	Tried once	Used to smoke	Sometimes smoke	Smoke 1-6 per week	Smoke > 6 per week	Total
Year 8	1056	185	27	25	8	-	1301
Year 9	870	130	30	38	12	2	1082
Year 10	694	132	14	53	6	7	906

8.4 Discussion

In line with past literature in this area, these results have shown that some psychological variables can contribute to a 'psychological profile' of students who are at risk of smoking behaviour. Hyperactivity and conduct problems, as assessed using the Strengths and Difficulties questionnaire, were both cross-sectionally and prospectively associated with smoking behaviour, as were stress, self-esteem, novelty seeking, social reward dependence and risk taking; while task reward dependence was associated with non-current smoking. Depression was also cross-sectionally associated with smoking behaviour.

Attitudes towards smoking were not, in general, associated with smoking (although in some cases smokers were more likely to have attitudes towards smoking, these were not necessarily positive). This supports conclusions from past literature (Piko, 2001; McNeill et al., 1988). However, the perhaps most commonly held belief regarding smoking, that smoking helps people to stay calm, was consistently associated with smoking both cross-sectionally, and in later years. Thinking that smoking helps people to cope better with life was also cross-sectionally, though not prospectively, associated with smoking. However, the wording of this question was perhaps too vague and participants this age may not have been able to connect with the statement 'help people cope better with life'.

In terms of smoking initiation some interesting patterns emerged. All the psychological factors included in these analyses (those which were consistently cross-sectionally associated with smoking) were significantly cross-sectionally associated with smoking initiation, as might be expected. In addition, as predicted, attitudes the year before initiation were largely not correlated with smoking initiation – a finding in line with the early work of McNeill et al. (1988). However, attitudes after initiation remained significantly associated with smoking initiation. This suggests that attitudes towards smoking either develop after smoking initiation has occurred, or very shortly beforehand – but once they have been formed they remain consistent. This has implications for prevention strategy in that global attempts to change adolescents' attitudes towards smoking are unlikely to have any effect on smoking behaviour, either because attitudes change as a result of smoking uptake, or because these attitudes are only associated with smoking behaviour immediately around the time of initiation. The precision required to intervene at this point would therefore be substantial.

Conduct problems and hyperactivity were associated with initiation before, at, and after initiation, as might be expected for these more stable characteristics. However, the strength of correlations between initiation and both of these Strengths and Difficulties sub-scales was significantly smaller before smoking initiation had occurred. It remains uncertain as to whether this potential change precedes smoking initiation or is perhaps a function of smoking initiation itself.

Stress was generally a weak predictor of smoking initiation, but was significantly cross-sectionally associated with initiation and continued to be associated with initiation one year later. This is interesting given the general acceptance by smokers that smoking helps to calm people down. Although not going as far as to imply that smoking causes stress (as claimed by Parrot, 1999), these results would certainly suggest that smoking does not appear to not relieve it in any way.

The above analyses suffer from a number of limitations. The lack of particular psychological variables included in the study questionnaires in some years prevented the exploration of a number of interesting questions, such as the direction of relationship between smoking and depression, and limited some of the analyses presented. In addition, as with all analyses based on the HABITS study data, there was a degree of attrition. Therefore, to ensure accurate comparison across years, data for both those students with data available and data from those with full data at each year have been presented. However, the analyses including all data available are considered of most value as these include all the students of most interest (i.e. smokers who were more likely to have missing data). As expected there was very little association between positive attitudes towards smoking and smoking behaviour. However, it is worth noting an important difference between the wording of the attitudes questions. When students were asked whether smoking helps to calm people down and helps people to cope better with life the emphasis was on 'people'. The remaining attitudes questions asked participants to respond in terms of whether smoking helped 'you' to stay awake, keep slim, and to stop feeling hungry. These were the attitudes where participants largely responded that they were unsure, or disagreed with the statement. Perhaps smokers were reluctant to admit that smoking had any effect on them personally and non-smokers obviously felt unable to comment about the personal effect of cigarettes, as opposed to the effect on other people. However, despite these limitations, the data available have allowed confirmation that psychological factors are associated with and do predict smoking behaviour. A novel approach to the association between psychological factors and smoking initiation has also enabled observation of how psychological variables predict and continue to be associated with smoking uptake.

In conclusion this chapter has shown that psychological factors are associated with adolescent smoking behaviour. This is important as those most at risk can be identified and targeted, even though these adolescents may not think about smoking for some years. It would appear, however, that attitudes towards smoking are somewhat transient and efforts to change these attitudes may not be worthwhile. If positive attitudes towards smoking do precede smoking uptake, interventions may need to be precisely timing to coincide with potential smoking initiation. There exists a challenge for school based smoking interventions as school attendance may be low in individuals scoring highly on some psychological measures, suggesting that methods of targeting these adolescents specifically need to be considered.

Chapter 9: Anthropometric factors associated with smoking[4]

9.1 Introduction

Past research has shown that many adolescents, especially teenage girls, believe that smoking helps keep them slim (Fulkerson & French, 2003; Boles & Johnson, 2001; Klesges, Elliott, & Robinson, 1997), although this finding was not replicated using the HABITS dataset (see findings in Chapter 8). Furthermore, studies have shown that adolescents are more likely to take up smoking if they hold this view (Klesges et al., 1997) (although again not replicated in this dataset, see Chapter 8), perceive being thin as important (Honjo & Siegel, 2003), are concerned about their weight (Stice & Shaw, 2003; Field et al., 2002; Tomeo et al., 1999; French & Jeffrey, 1995), or are trying to lose weight (Austin & Gortmaker, 2001; Strauss & Mir, 2001; French & Jeffrey, 1995).

However, little is known about the actual effect of smoking on weight change among adolescents. Animal studies have shown nicotine to suppress weight gain in rats (Bishop, Parker, & Coscina, 2004; Miyata, Meguid, Varma, Fetissov, & Kim, 2001) and studies on adults have typically found that smokers weigh between 1.1 and 6.8 kg (2.4 - 15 lb) less than non-smokers (Klesges, Meyers, Klesges, & La Vasque, 1989), although this difference is most apparent at older ages (Akbartabartoori, Lean, & Hankey, 2005; Klesges et al., 1989).

There is no consensus as to the mechanism behind the role that smoking plays in reduced weight gain; Cabanac and Frankham (2002) hypothesise that smoking lowers the body's set weight point, while others discuss varied diet and metabolic changes

[4] A version of this chapter was published in Addiction, 102, 1493-1501, 2007 (see Appendix VII)

associated with smoking (Crawley & While, 1995; Perkins, 1992; Clearman & Jacobs, Jr., 1991). Bamia et al. (2004) suggest that the observed difference in weight between smokers and non-smokers is a result of differing personalities and characteristics of smokers. In order to rule out such confounding factors, and ensure that people who take up smoking are not already on a trajectory of lower body weight, longitudinal studies are required. Short of conducting unethical experimental studies, the best way to determine whether smoking results in a lower body weight is to follow weight trajectories from before smoking initiation and control for as many confounding variables as possible.

A recent review (Potter et al., 2004) concluded that adolescent smokers either have a higher BMI (Klesges, Robinson, & Zbikowski, 1998; Halek, Kerry, Humphrey, Crisp, & Hughes, 1993), or are no different in weight from non-smokers (Robinson, Klesges, Zbikowski, & Glaser, 1997; Crawley & While, 1995). Several reasons have been proposed for this, including more overweight adolescents taking up smoking, the effect of smoking on body weight taking a long time to accrue, and risk behaviours such as smoking and eating an unhealthy diet clustering together (Potter et al., 2004).

However, most of this research is cross-sectional. Only two longitudinal studies have assessed whether smoking affects weight change over time among adolescents, Cooper et al. (2003) followed 1697 12 to 13 year olds for four years finding that smokers of up to three years showed no reduction in BMI, while those smoking for just two years increased in BMI compared with never-smokers. However, this study relied on self-reported smoking, height and weight, which may lack the precision required to detect small but significant changes in weight between smokers and non-smokers, and did not measure pubertal stage or socioeconomic deprivation, which are important confounding variables. Stice and Martinez assessed the effect of persistent daily smoking on growth over a one year period among 496 girls aged 11 to 15 (Stice & Martinez, 2005). They found 'retarded' growth in weight, height and BMI equivalent to 1.5 kg in weight and 1.0 cm in height in analyses which controlled for ethnicity, parental education, timing of menarche, age, intake of high fat foods and baseline height, weight and BMI. In addition they observed a dose response relationship, with increased levels of smoking frequency associated with greater reduced gains in height, weight and BMI. Although the observed effect was not large, Stice and Martinez argued that the cumulative effect of smoking behaviour on growth over a number of years could be substantial.

This chapter addresses some of the limitations of the above research by examining the association between smoking behaviour and waist circumference as well as BMI and height. It considers both boys and girls over a period of 4 years.

The specific questions addressed are:

1. What is the cross-sectional association between smoking and
    a. BMI?
    b. Waist circumference?
    c. Height?
2. What is the longitudinal relationship between smoking and BMI, waist circumference and height over the period of the HABITS study?

9.2 Methods

9.2.1 Population

This chapter assesses the extent to which smoking affects weight change over the five years of the study. The analyses document change in anthropometric measures from Year 7 to Year 11 in relation to smoking behaviour at the end of the study. Consequently the data used are from those present at Year 7 and Year 11 (excluding Year 7 current smokers to avoid an effect of smoking on weight before the study period). Sample sizes varied from 2503 to 2681 depending on the anthropometric measure in question.

9.2.2 Measures

Anthropometric measures

At each year weight measurements were taken to the nearest 0.1 kg using TANITA scales. Height was measured using Leicester freestanding stadiometers, and waist circumference measured, with a non-elastic tape, to the nearest 0.5 cm. Students were measured in light indoor clothing with no shoes. Height and weight were then converted into Body Mass Index (BMI) (weight (kg)/height $(m)^2$). In addition, to control for gender and age differences in the natural increase in BMI across the adolescent years, age specific BMI 'standard deviation scores' (BMI SD scores), as well as waist and height SD scores were calculated according to the British 1990 growth reference curves, where scores in 1990 had a mean of zero and a standard deviation of one (Cole, Freeman, & Preece, 1995). BMI SD scores above zero therefore show a BMI greater than expected for a boy or girl of a specific age compared to the 1990 reference population. As BMI SD scores are age-adjusted, they should theoretically remain stable with age. Observed increases in SD score with age therefore suggest more rapid growth than adolescents of the same age in 1990.

Smoking

For these analyses the full six level smoking variable, ('I have never smoked'; 'I have only ever tried smoking once'; 'I used to smoke sometimes but I never smoke cigarettes now'; 'I sometimes smoke cigarettes now but I don't smoke as many as one a week'; 'I usually smoke between one and six cigarettes a week'; 'I usually smoke more than six cigarettes a week') was used as a categorical variable. This enabled examination of the effect of smoking on increasing levels of smoking intensity. Obviously, this variable was not cotinine adjusted as high cotinine values could indicate a variety of responses. Therefore analyses were repeated using cotinine data, dichotomised at 15 ng/ml, the value typically used to indicate smoking behaviour (McNeill et al., 1987).

Other variables included as confounding factors which may be related to both smoking and weight were as follows.

Pubertal status

Pubertal stage was assessed using the Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988), a summed score based on student ratings of growth spurt, pubic hair growth, skin changes, menarche and breast development (girls), and voice change and facial hair growth (boys). In these analyses puberty is designated as 'early', 'average' or 'late', defining 'average' relative to the modal school year when 'mid-puberty' (scoring 11-15 on Peterson's scale) is reached for each sex.

Diet and exercise

Diet and exercise variables included as confounding factors were: physical activity, where students were asked 'on how many of the past 7 days did you do hard exercise or physical activities for at least 20 minutes that made you sweat and breathe hard (e.g. football, running, swimming)' (Centres for Disease Control and Prevention, 1993); sedentary behaviour, in terms of the total number of hours of television watched per week (Currie, 1998); restrained eating, as assessed by the Dutch Eating Behaviour Questionnaire (DEBQ) (Van Strien, Frijters, Bergers, & Defares, 1986) and; dieting, whether students reported dieting to lose weight.

Sociodemographic factors

Deprivation (Townsend quintiles) and ethnicity (White, Black/mixed Black, Asian/mixed Asian and other), as well as gender, were also included in analyses.

9.2.3 Statistical analysis

As some of the intra-class correlation coefficients for anthropometric measures were high (see Chapter 4), at between 0.02 and 0.40 (Zyzanski et al., 2004), linear mixed model analyses in SPSS 14 were used to test whether smoking in Year 11 was associated with BMI, waist circumference and height in Year 11 using Year 7 BMI, waist circumference and height respectively as covariates. This procedure takes account of clustering within schools. Using just Year 11 smoking data minimised loss of subjects due to non-inclusion in the intervening years, at the cost of not being able to assess the effect of number of years of smoking or changes in smoking status in the intervening years. However, the majority of Year 11 smokers had reported current smoking for two or more years. The use of smoking behaviour at the end of the study therefore was the most practical method of identifying students who started and maintained cigarette smoking for a number of years while minimising loss due to missing data. All analyses were restricted to those who were not current smokers at

Year 7 (i.e. never smokers, one time triers and ex smokers), to ensure no effect of smoking on weight before the study period.

Analyses were repeated replacing smoking status with Year 11 saliva cotinine scores, dichotomised at 15ng/ml, giving an objective indication of nicotine intake. Finally, adjusted analyses were run including age, pubertal status, dieting, restrained eating and exercise behaviour at Year 11 as well as gender, ethnicity and deprivation. The procedure was then repeated using BMI SD, waist SD and height SD scores. Where outliers resulted in departure from the normal distribution, variables were transformed using the log transformation.

As a further check on the robustness of the models, the mixed model analyses were repeated using a 'stacked' dataset, with smoking, BMI, waist and height measurements in each year that data were available. Interactions were then run between smoking and study year. This permitted data to be included for any years in which students were present, even though they may not have been present on all occasions. It provides an indication of the difference in BMI, waist and weight trajectories by smoking status. Using Year 11 BMI, waist and height as the main outcome allows a transparency of findings that are accessible and simple to interpret.

9.3 Results

Mean BMI, waist circumference and height at Year 7 and Year 11, by gender and by Year 11 smoking status, are shown in Table 9.1, along with equivalent BMI SD, waist SD and height SD scores. There were no significant differences in the raw means of these measures across smoking categories.

Table 9.1 Mean (SD) BMI, waist circumference and height by gender and Year 11 smoking status

	Boys	Girls	Total	Year 11 smoking status: Never smoked	Tried once	Used to smoke	Sometimes smoke	Smoke 1-6 per week	Smoke > 6 per week
BMI									
Year 7	18.9	19.8	19.3	19.3	19.2	19.4	19.1	18.8	19.7
	(3.2)	(3.7)	(3.4)	(3.5)	(3.4)	(3.5)	(3.3)	(2.8)	(3.5)
Year 11	21.8	22.6	22.1	22.2	22.1	22.4	21.9	21.8	22.0
	(3.7)	(4.0)	(3.8)	(4.0)	(3.8)	(4.1)	(3.5)	(3.4)	(3.7)
BMI SD score									
Year 7	0.43	0.44	0.43	0.43	0.44	0.47	0.35	0.31	0.58
	(1.18)	(1.20)	(1.18)	(1.23)	(1.17)	(1.20)	(1.14)	(1.00)	(1.2)
Year 11	0.52	0.56	0.53	0.55	0.54	0.59	0.48	0.46	0.50
	(1.10)	(1.11)	(1.10)	(1.15)	(1.09)	(1.16)	(1.02)	(1.02)	(1.05)
Waist (cm)									
Year 7	67.6	67.7	67.6	67.9	67.6	67.7	67.1	66.0	68.1
	(8.0)	(8.2)	(8.1)	(8.3)	(7.8)	(8.3)	(8.1)	(6.7)	(8.0)
Year 11	78.4	74.5	76.8	77.1	76.9	77.3	76.3	76.0	75.7
	(9.4)	(9.0)	(9.5)	(10.0)	(9.1)	(10.3)	(8.8)	(9.0)	(8.5)
Waist SD score									
Year 7	0.78	1.15	0.93	0.95	0.94	0.94	0.87	0.76	1.03
	(0.97)	(1.09)	(1.03)	(1.04)	(1.02)	(1.07)	(1.07)	(0.94)	(1.01)
Year 11	0.89	1.41	1.11	1.10	1.13	1.18	1.10	1.04	1.06
	(1.00)	(1.16)	(1.10)	(1.11)	(1.07)	(1.19)	(1.05)	(1.09)	(1.08)
Height (cm)									
Year 7	149.7	151.9	150.6	150.5	150.5	151.4	150.2	150.8	150.9
	(7.3)	(7.5)	(7.5)	(7.8)	(7.5)	(7.2)	(7.1)	(7.0)	(6.9)
Year 11	174.0	163.2	169.5	169.6	169.5	169.6	169.3	169.6	168.8
	(7.2)	(6.4)	(8.7)	(9.2)	(8.4)	(8.3)	(8.1)	(9.0)	(8.2)
Height SD score									
Year 7	0.33	0.42	0.37	0.38	0.36	0.45	0.27	0.37	0.41
	(1.00)	(1.00)	(1.00)	(1.07)	(0.99)	(0.96)	(0.95)	(0.96)	(0.93)
Year 11	0.19	0.03	0.12	0.08	0.12	0.19	0.15	0.16	0.11
	(0.93)	(1.04)	(0.98)	(1.05)	(0.95)	(0.94)	(0.93)	(0.99)	(0.90)

Note: There were no significant differences across smoking categories in the raw means for any of the above measures

Mixed model analysis showed that smoking status was significantly associated with Year 11 BMI after adjusting for Year 7 BMI ($p = 0.001$). Pubertal status, dieting behaviour, vigorous exercise, sedentary behaviour and restrained eating were associated with both smoking and BMI. However, the inclusion of these variables in the model, as well as gender, ethnicity, age, and deprivation, did not change the results. Year 11 BMI was significantly associated with higher Year 7 BMI ($p < 0.001$), dieting to lose weight ($p < 0.001$), sedentary behaviour ($p = 0.007$) and younger age ($p < 0.001$), and the effect of smoking remained significant ($p = 0.002$). Post-hoc tests (Table 9.2) showed that the adjusted Year 11 BMI of those smoking six or more cigarettes a week ('daily' smokers) was lower than that of all other smoking groups (never smokers, $p = 0.001$; once only triers, $p = 0.009$; ex-smokers, $p = 0.005$; sometimes smokers, $p = 0.014$; and those smoking one to six cigarettes a week, $p = 0.036$). The BMI of 'daily' smokers in this fully adjusted analysis was 0.66 BMI points (95% CI, 0.18-1.13) less than never smokers – a value equivalent to 1.84 kg (95 % CI, 0.52-3.17) in a person of this age range of average height. As there was no effect of gender, and no interaction between gender and smoking status, separate analyses for boys and girls are not presented. Similarly there was no interaction between ethnicity and smoking, nor between deprivation and smoking, therefore analyses were not stratified by these variables.

To confirm this finding using an objective measure of nicotine intake, analyses were carried out using cotinine levels ($n = 1751$). The association between high cotinine and lower Year 11 BMI, adjusted for Year 7 BMI and all other confounding factors, was significant ($p < 0.001$). There was no evidence for a dose-response relationship above the 15ng/ml cut-off value for smoking.

Table 9.2 Estimated Marginal Means (95% confidence intervals) of BMI, waist circumference and height in Year 11 by smoking status

	Never smoked	Tried once	Used to smoke	Sometimes smoke	Smoke 1-6 per week	Smoke > 6 per week
BMI						
Mean 1* (95% CI)	22.2[a‡]	22.1[a]	22.2[a]	22.1[a]	22.2[a]	21.5[b]
(n = 2665)	(22.0;22.4)	(21.9;22.3)	(21.9;22.5)	(21.9;22.4)	(21.9;22.6)	(21.2;21.8)
Mean 2† (95% CI)	22.4[a]	22.3[a]	22.4[a]	22.3[a]	22.4[a]	21.7[b]
(n = 2495)	(22.1;22.6)	(22.0;22.6)	(22.1;22.7)	(22.0;22.6)	(22.0;22.9)	(21.4;22.1)
BMI SD score						
Mean 1 (95% CI)	0.55[a]	0.54[a]	0.56[a]	0.55[a]	0.55[ab]	0.38[b]
(n = 2665)	(0.49;0.60)	(0.48;0.60)	(0.48;0.64)	(0.48;0.63)	(0.44;0.66)	(0.29;0.46)
Mean 2 (95% CI)	0.59[a]	0.57[a]	0.59[a]	0.60[a]	0.59[ab]	0.41[b]
(n = 2495)	(0.52;0.66)	(0.49;0.65)	(0.49;0.68)	(0.51;0.69)	(0.46;0.71)	(0.31;0.52)
Waist circumference (cm)						
Mean 1 (95% CI)	76.6[a]	76.6[a]	76.9[a]	76.7[a]	77.1[a]	74.9[b]
(n = 2674)	(75.7;77.4)	(75.7;77.5)	(75.9;78.0)	(75.7;77.7)	(75.8;78.4)	(73.8;76.0)
Mean 2 (95% CI)	76.6[ab]	76.7[ab]	77.1[a]	76.6[ab]	77.3[a]	75.2[b]
(n = 2504)	(75.8;77.4)	(75.8;77.5)	(76.1;78.1)	(75.7;77.6)	(76.0;78.6)	(74.1;76.3)
Waist SD score						
Mean 1 (95% CI)	1.08[a]	1.12[a]	1.15[a]	1.14[a]	1.18[a]	0.99[a]
(n = 2673_	(1.00;1.16)	(1.03;1.21)	(1.04;1.26)	(1.04;1.25)	(1.04;1.32)	(0.87;1.10)
Mean 2 (95% CI)	1.12[a]	1.15[a]	1.17[a]	1.15[a]	1.18[a]	0.99[a]
(n = 2503)	(1.03;1.22)	(1.04;1.25)	(1.05;1.29)	(1.04;1.27)	(1.03;1.33)	(0.87;1.12)
Height (cm)						
Mean 1 (95% CI)	169.1[a]	169.1[ab]	169.1[ab]	169.5[a]	168.6[ab]	167.9[b]
(n = 2681)	(167.2;171.0)	(167.2;171.0)	(167.2;171.1)	(167.5;171.4)	(166.6;170.7)	(165.9;169.9)
Mean 2 (95% CI)	167.4[a]	167.9[ab]	167.8[ab]	168.2[b]	167.9[ab]	167.4[ab]
(n = 2511)	(166.9;167.8)	(167.4;168.3)	(167.3;168.4)	(167.7;168.8)	(167.2;168.7)	(166.8;168.1)
Height SD score						
Mean 1 (95% CI)	0.07[a]	0.13[ab]	0.14[ab]	0.20[b]	0.13[ab]	0.08[ab]
(n = 2681)	(-0.00;0.14)	(0.05;0.21)	(0.05;0.23)	(0.12;0.29)	(0.02;0.25)	(-0.02;0.18)
Mean 2 (95% CI)	-0.07[a]	0.02[ab]	0.02[ab]	0.08[b]	0.02[ab]	-0.05[ab]
(n = 2511)	(-0.13;-0.01)	(-0.05;0.09)	(-0.07;0.10)	(-0.00;0.16)	(-0.09;0.14)	(-0.14;0.04)

*Mean 1 adjusted for baseline BMI, waist or height measure.
†Mean 2 adjusted for baseline BMI, waist or height measure plus age, gender, deprivation, ethnicity, pubertal stage, diet and exercise behaviour.
‡Means not sharing letters with each other are significantly different at the $p < 0.05$ level.

Repeating the analysis using age and gender adjusted BMI SD scores showed a similar pattern: 'daily' smoking was associated with lower Year 11 BMI SD score after adjusting for Year 7 BMI SD score ($p = 0.006$) and other potential confounding variables ($p = 0.009$).

The same methodology was used to examine waist circumference. Controlling for waist circumference at Year 7, 'daily' smokers at Year 11 had smaller waists ($p = 0.003$). In the fully adjusted model, the overall effect of smoking remained ($p = 0.014$), but significant differences between groups were restricted to the comparison between 'daily' smokers and ex-smokers ($p = 0.015$) and 'daily' smokers and those smoking 1-6 cigarettes a week ($p = 0.034$) (see Table 9.2). There were no significant interactions between smoking and gender, ethnicity or deprivation. Considering waist SD scores, the main effect of smoking on adjusted Year 11 waist circumference was not significant ($p = 0.073$ adjusting for Year 7 waist SD score, $p = 0.096$ including all covariates). However, a high cotinine value was associated with lower waist circumference ($p = 0.011$) and waist SD score ($p = 0.027$), with the mean adjusted waist circumference being 1.2 cm (95% CI, 0.28-2.16) lower among those with a high cotinine score.

Daily smokers at Year 11 were shorter than other students adjusting for Year 7 height ($p = 0.017$). An overall association remained with other potential confounding variables included ($p = 0.009$), but by pairwise comparison 'daily' smokers showed no difference in adjusted height compared to other smoking groups. Again, there were no significant interactions between smoking and gender, ethnicity or deprivation. These results were replicated when using height SD scores ($p = 0.013$, $p = 0.001$, see Table 9.2) but there was no significant association between cotinine and fully adjusted height ($p = 0.500$) or height SD score ($p = 0.529$).

A small number of BMI and waist circumference outliers were identified, therefore analyses were re-run using log transformations of BMI and waist values to correct for the departure from normality of the distribution. The results changed only slightly, with the difference between 'daily' smokers and those smoking one to six cigarettes a week disappearing in both BMI ($p = 0.61$) and waist circumference ($p = 0.099$) analyses. This brought the BMI findings in line with those observed for BMI SD scores and reduced the inconsistent association between self-reported smoking and waist circumference still further.

The robustness of the findings was checked by repeating the mixed model analysis using a stacked data-set and including BMI, waist and height data from all available years and students. The results remained similar to those reported above, with significant smoking status by study year interactions again showing the yearly increase in BMI and BMI SD score among 'daily' smokers to be lower than that of other smoking groups and never smokers ($p < 0.001$). These findings were also replicated using cotinine values ($p< 0.001$). The results for waist circumference also showed a clear effect of smoking, with 'daily' smokers showing lower gains in waist circumference and waist SD score over time than other students ($p < 0.001$, $p < 0.007$). The association between cotinine-defined smoking and waist circumference and waist SD score was also significant ($p = 0.009$, $p = 0.022$). No associations were found involving height and smoking status.

9.4 Discussion

Students who smoked six or more cigarettes a week at age 15-16 had a lower BMI than other students, controlling for ethnicity, socioeconomic deprivation, pubertal status, self-reported diet and exercise and BMI at age 11-12. There was no evidence for an interaction by gender. Although the findings were less consistent across all models and dependent variables, daily smoking at age 15-16 was also associated with lower waist circumference. There was no detectable consistent relationship between daily smoking and height.

While there were no significant differences in anthropometric measures between smoking groups at either Year 7 or Year 11 cross-sectionally, a finding consistent with past cross-sectional studies in this area, which have found teenage smokers to either be no different, or greater in weight to non-smokers (Potter et al., 2004), these longitudinal findings support the more recent work of Stice and Martinez who found weight, height and BMI growth to be reduced in persistent smokers over a one year period (Stice & Martinez, 2005). However, unlike Stice and Martinez no clear relationship between smoking and height was observed. This chapter extends these findings by: showing an effect of smoking on adiposity among boys as well as girls; examining BMI and height over a longer period; and including waist circumference as a more direct index of adiposity.

Despite the clear statistical differences observed, for BMI, and to some extent waist circumference, the effect size is small and equivalent to a difference in growth over a 4 year period of 1.8kg between smokers and non-smokers and 1.2cm in waist circumference. The clinical significance of these differences is uncertain as there is currently no consensus regarding clinically significant weight change among child and adolescent populations who are still growing (Edwards, Nicholls, Croker, Van, Viner et al., 2006). It is also unknown how perceivable or how relevant such changes will be to adolescents themselves. However, given the comparable 'actual' BMI and waist measurements of all smoking groups, the cosmetic difference between smokers and non-smokers is unlikely to be apparent. Nevertheless, previous findings that adolescents believe that smoking will help them to stay slim and that weight concern and smoking behaviour are often correlated, have led to recommendations that smoking prevention approaches among adolescents need to aim to alter perceptions of smoking as an effective weight control tool (Plotnikoff, Bercovitz, Rhodes, Loucaides, & Karunamuni, 2007). This study suggests a need for prevention strategies with alternative recommendations for healthy weight maintenance. An additional point worth noting is that smoking cessation in adults is associated with a weight gain of between 4.8 kg (10.6 lb) and 5.9 kg (13.0 lb) (Klesges, Winders, Meyers, Eck, Ward et al., 1997). The association between smoking and weight found here is therefore likely to be considerably smaller than the weight gain that will be experienced by adolescents who quit smoking after reaching adulthood.

This chapter offers several strengths over other studies in this area including: the use of BMI standard deviation scores to control for the natural increase in BMI over time, which varies by both age and gender; the availability of waist measurements, which had not previously been assessed longitudinally; its 4-year duration, use of objective height and weight data, as well as of nicotine intake; and the inclusion of both boys and girls. The inevitable attrition that occurs with all longitudinal studies is an obvious limitation. To reduce the impact of this, and ensure the greatest number of more regular smokers have been included, analyses were limited to just baseline data at Year 7 and final year data at Year 11. However, this means that an examination of the effect of increasing duration and intensity of smoking on weight change was not been possible. As with all findings based on a correlational analysis, the finding that smoking is associated with a reduced weight gain relative to that which the model predicts could be due to the existence of confounding variables that have not been measured, or not been measured with sufficient precision, and should be kept in mind when interpreting these findings.

In summary, this chapter has shown a significant association between smoking and BMI change among adolescents over a period of 4 years, with some evidence for an association between smoking on waist circumference, and no clear association with height. Whether the difference is apparent to adolescents, and whether it is clinically significant is uncertain. However, the clinical significance of smoking on an adolescent's current and future health is well established (Doll et al., 2004; Royal College of Physicians, 1992). Adolescents who are concerned about their weight should be strongly advised that smoking is not an appropriate solution and made aware of alternative, healthier approaches towards maintaining their weight. They should also be warned of the likelihood of a larger weight increase when quitting is inevitably considered.

Chapter 10: A parsimonious model of smoking uptake

10.1 Introduction

Previous chapters have examined the extent to which varied factors are associated with smoking in adolescence. However, as Dierker et al. (2004) point out, there is 'no single risk factor or constellation that is necessary or sufficient for the development of substance use' (p169). A large number of studies have attempted to assess the degree to which a range of factors predict smoking when combined together, as well as seeking to identify the factors which explain the greatest variance in adolescent smoking behaviour (Hoving et al., 2007; Carvajal & Granillo, 2006; Dierker et al., 2004; Wilkinson & Abraham, 2004; Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004; Scal, Ireland, & Borowsky, 2003; Zweig, Phillips, & Lindberg, 2002; Epstein, Griffin, & Botvin, 2000; Koval & Pederson, 1999; Wahlgren, Hovell, Slymen, Conway, Hofstetter et al., 1997).

These models have often been developed in relation to a particular theoretical basis e.g. The Theory of Planned Behaviour (Wilkinson & Abraham, 2004), Social Learning Theory (Epstein et al., 2000; Wahlgren et al., 1997), the Health Belief Model (Von Ah et al., 2004) and the I-change (or ASE) model (Hoving et al., 2007) and have used a range of statistical techniques including classification trees (Kitsantas, Moore, & Sly, 2007; Dierker et al., 2004), structural equation analysis (Epstein et al., 2000), and stepwise regression procedures (Carvajal & Granillo, 2006; Scal et al., 2003). Studies have also examined the explanatory role of different types of factors, with the most common distinction being the division of risk and protective factors for smoking into distal and proximal sub-groups (Carvajal & Granillo, 2006; Kremers, Mudde, de Vries, Brug, & de, 2004; Brynin, 1999). Kremers et al. (2004) describe distal level predictors of smoking as general characteristics of a person, including psychological, social and cultural, biological, and behavioural factors. Proximal factors have a more immediate relationship with decisions to smoke and are typically constructs from social cognitive theories of behaviour, such as attitudes, self-efficacy and perceived social influences.

The aim of this chapter is to construct a parsimonious model of smoking behaviour guided by concepts from a new theory, the PRIME theory of motivation (West, 2006b). As described in Chapter 3, this individual level theory posits that the development of a behaviour pattern is a dialectic process of dispositions interacting with events to change behaviour and further change dispositions. This process can be modelled by an epigenetic landscape, as seen in Figure 10.1, where a certain path or trajectory is followed until environmental forces push the path one way or the other at certain points (or forks in 'chreods'). Some chreods may be deep and the path followed will therefore be unaffected by small forces. However, positioning on the path may be such that travel is 'on the cusp' of a chreod, when smaller forces may tip the path more easily one way or another. The 'classic' cross section of the chreod is curvilinear suggesting that a particular motivational force will have greater impact in individuals already close to the cusp.

At a population level this suggests that it is fruitful to look at two types of factor: 'vulnerability' factors, personal characteristics that place an individual at a certain level of vulnerability to develop a disposition to smoke (much like the 'distal' factors listed above); and 'trigger' factors, environmental or situational cues that may trigger experimentation or further experience with cigarettes. Such trigger factors are akin to the changing internal and external environments that, as described by West (2006b), may alter the balance of motivational forces to change dispositions and consequently action (see figure 10.2). In terms of the epigenetic landscape, more 'vulnerable' individuals are set on a path that is more likely to lead to smoking, they may also be on a more 'precarious' path and more susceptible to the influence of additional triggers. From this it has been further hypothesised that trigger factors will have a greater impact on smoking behaviour among those already vulnerable to smoking.

Figure 10.1 Waddington's epigenetic landscape (taken from www.primetheory.com)

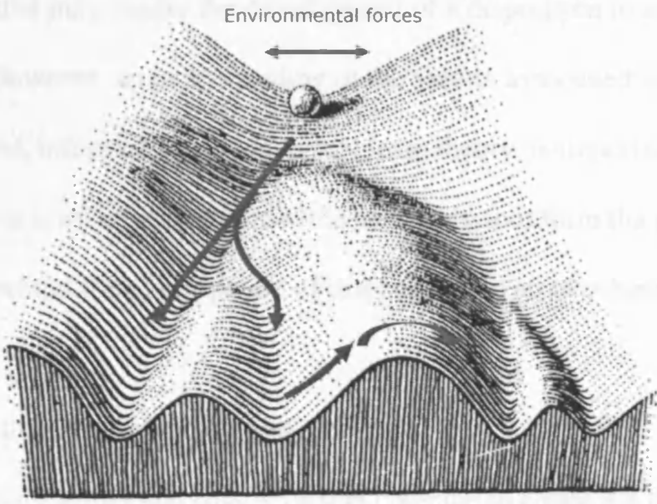
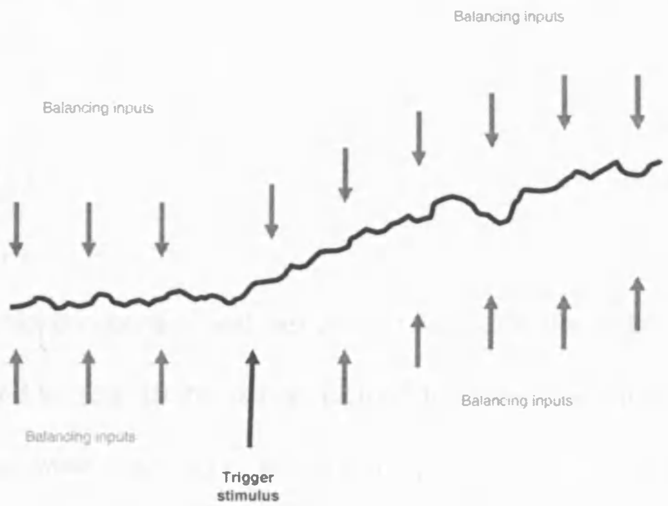


Figure 10.2 Example of a trigger stimulus influencing a trajectory (taken from www.primetheory.com)



In summary, the aim of this final chapter is to assimilate the factors discussed throughout the thesis by placing them into a theoretically informed structure of vulnerability and trigger factors, establishing the extent to which together these factors can explain smoking behaviour parsimoniously, and testing the hypothesis that trigger factors will be particularly associated with smoking behaviour among those most vulnerable. It is important to note that such a population level model will exclude numerous events that may trigger the development of a disposition to smoke at an individual level. However, an understanding of the factors associated with smoking at the population level, informed by an individual level theory, is important to develop effective population level interventions, while beginning to inform the individual level dialectic process behind the development of dispositions to smoke during adolescence.

More specifically the questions addressed are:

1. Which vulnerability and trigger factors combine to create the most parsimonious population level model of smoking behaviour?
2. Are significant interactions observed between these vulnerability and trigger factors?

10.2 Method

10.2.1 Population

This chapter describes prospective analyses using Year 7 data (for vulnerability factors) and data from Year 8 to Year 10 (for trigger factors) to predict current smoking at Year 11. Initially analyses were restricted to White participants only and sample sizes ranged from 126 to 1274 depending on the variables included or excluded from the models.

10.2.2 Measures

All potential predictors of smoking behaviour examined in earlier chapters of this thesis were split into vulnerability and trigger factors as discussed above. The division of these variables is based on the premise that vulnerability factors are personal characteristics that have the potential to make someone more likely to start smoking, and trigger factors are environmental or situational cues which may trigger experimentation or further experience with cigarettes. Vulnerability factors are hence those characteristics of an individual which are more stable, pre-determined and deep-rooted. These factors have therefore been taken at baseline (Year 7) and include; gender, age, deprivation (Townsend scores – see Chapter 5), personality (which was assessed at Year 9, see Chapter 8), Strengths and Difficulties scores (see Chapter 8), and parental smoking (no parent smokes, father smokes, mother smokes, both parents smoke, see Chapter 7). Having ever tried smoking at baseline (see Chapter 5) was also defined as a vulnerability factor, as was having a boyfriend or girlfriend at baseline (see Chapter 7). These variables, as shown in earlier chapters of this thesis, increased vulnerability to later smoking uptake and may define a certain 'type' of person who is likely to be more at risk of later smoking.

Trigger factors have been conceptualised more by a change in status or differences in environment that occur during adolescence itself and, as such, were measured during the period between baseline and the final assessment. Trigger factors included were friend smoking and sibling smoking (see Chapter 7), assessed here as having any friends/siblings who smoke between Year 8 and Year 10 or no friends/siblings who smoking during this period. The year mid-puberty was reached (see Chapter 9) and experiencing high levels of stress (see Chapter 8), defined here as the mean of all stress scores from Year 8 to Year 10, were also characterised as trigger factors. All the above vulnerability and trigger variables have been described in detail in earlier chapters of this thesis and are listed in Table 10.1.

Two factors discussed in previous chapters have not been included in the model; depression was only measured at the end of the study, at the same time as the final smoking measurement, and therefore can not be conceptualised as a trigger or vulnerability factor; and self-esteem was also only measured in the last two years of the study and therefore unable to be included as a vulnerability factor as defined above. Anthropometric factors, addressed in Chapter 9 as dependent variables, have also not been included as predictors of smoking for the purpose of this model.

Current smoking (adjusted for cotinine) at Year 11 was used as the dependent variable.

Table 10.1 Vulnerability and trigger factors included in model construction

Vulnerability Factors (measured at Year 7)	
Gender	Risk taking personality
Age	Novelty seeking personality
Deprivation	Harm avoidance personality
Parental smoking	Task reward dependence
Ever tried smoking	Social reward dependence
Dating	Attitude: smoking stops hunger
Conduct problems	Attitude: smoking keeps awake
Emotional symptoms	Attitude: smoking helps cope
Hyperactivity	Attitude: smoking helps calm
Peer problems	Attitude: smoking keeps slim
Pro-social scale	
Trigger Factors (measured at Years 8-10)	
Friend smoking	Year reached mid-puberty
Sibling smoking	Mean stress score

10.2.3 Statistical analysis

Univariate logistic regression analyses were run, with each vulnerability and trigger factor predicting smoking at Year 11 individually. Only those of White ethnic background were included in order to ensure a homogeneous sample.

Backwards stepwise regression analyses were then performed including all significant factors (at $p < 0.05$) from the univariate analyses. Interactions with gender were performed for each variable, however no significant interactions were observed, so analyses were run combining boys and girls and including gender as a vulnerability factor. Forwards stepwise regression was then used as a sensitivity analysis, including all significant and non-significant factors from the univariate analyses, and the final models from these analyses compared.

Once the final, most parsimonious model, was identified (including only factors significant at $p < 0.01$ to adjust for multiple comparisons), significant scale variables were dichotomised (using median splits) so that comparisons of odds ratios could be made. To test the prediction that trigger factors would have more impact on smoking behaviour among those already vulnerable, interaction terms were run between each vulnerability factor and trigger factor. Complex samples logistic regression was then used to confirm there was no difference in results when taking account of school clustering.

10.3 Results

The results of the univariate logistic regression analyses are shown in table 10.2. Six vulnerability factors showed a non-significant ($p > 0.05$) relationship with smoking at Year 11: age; emotional symptoms; harm avoidance personality; and the attitudes thinking that smoking helps stop hunger, thinking that smoking helps to keep you awake and thinking that smoking helps to keep you slim. All trigger factors showed significant univariate relationships with smoking.

Table 10.2 Univariate relationships between vulnerability and trigger factors and current smoking at Year 11

	Odds Ratio	95% CI	Significance
Vulnerability factors			
Gender			
Boys	1	-	-
Girls	1.27	1.07-1.52	p = 0.007
Deprivation	1.07	1.00-1.14	p = 0.042
Age	1.22	0.95-1.56	p = 0.114
Parental smoking			
No parent smokes	1	-	-
Father smokes	1.70	1.31-2.21	p = 0.000
Mother smokes	1.68	1.22-2.32	p = 0.002
Both smoke	1.98	1.48-2.65	p < 0.001
Ever tried smoking			
No	1	-	-
Yes	3.30	2.57-4.23	p < 0.001
Dating status			
No boy/girl friend	1	-	-
Have boy/girl friend	3.02	2.28-4.00	p < 0.001
Used to have boy/girlfriend	2.35	1.85-3.00	p < 0.001
Strengths and difficulties			
Conduct problems	1.16	1.09-1.22	p < 0.001
Emotional symptoms	1.00	0.96-1.05	p = 0.937
Hyperactivity	1.09	1.04-1.15	p < 0.001
Peer problems	0.92	0.87-0.98	p = 0.006
Pro-social	0.94	0.89-1.00	p = 0.037
Personality			
Risk taking	1.55	1.42-1.69	p < 0.001
Novelty seeking	1.73	1.52-1.97	p < 0.001
Harm avoidance	1.12	1.00-1.25	p = 0.051
Task reward dependence	0.69	0.61-0.78	p < 0.001
Social reward dependence	1.33	1.20-1.47	p < 0.001
Attitudes towards smoking			
Think stops hunger	1.08	0.97-1.20	p = 0.155
Think helps calm	1.15	1.05-1.26	p = 0.002
Think keeps awake	1.02	0.91-1.14	p = 0.790
Think keeps slim	1.04	0.95-1.14	p = 0.392
Think helps cope	1.10	1.00-1.20	p = 0.053
Trigger factors			
Puberty			
Early	1	-	-
Normal	1.20	0.99-1.47	p = 0.068
Late	1.32	1.06-1.66	p = 0.015
Friend smoking			
No smoking friends Yrs 8-10	1	-	-
Smoking friends Yrs 8-10	9.11	5.72-14.51	p < 0.001
Sibling smoking			
No smoking siblings Yrs 8-10	1	-	-
Smoking siblings Yrs 8-10	2.36	1.93-2.88	p < 0.001
Mean stress score Yrs 8-10	1.14	1.10-1.18	p < 0.001

Backwards stepwise regression was performed using only those variables significantly associated with smoking at Year 11 in univariate analyses (using $p < 0.05$). Table 10.3 displays the final model created during step 11 of this procedure which correctly classifies 70.6% of students (77.7% of non-current smokers and 58.1% of current smokers), with a Nagelkerke R^2 of 0.26. A forward stepwise logistic regression was also run as a sensitivity analysis, entering all trigger and vulnerability factors as potential model items. The same nine factors were included in the final model as shown in table 10.3, and hence the pseudo R^2 remained the same at 0.26, confirming the structure of this final model.

Table 10.3 Vulnerability and trigger factors predicting Year 11 current smoking - final model from stepwise regression analysis (n = 1263)

	Odds Ratio	95% CI	Significance
Vulnerability factors			
Ever tried smoking			
No	1	-	-
Yes	2.05	1.48-2.85	p < 0.001
Yr 7 Dating status			
No boy/girl friend	1	-	-
Have boy/girl friend	2.04	1.43-2.90	p < 0.001
Used to have boy/girlfriend	1.54	1.14-2.08	p = 0.005
Peer problems	0.89	0.82-0.97	p = 0.006
Risk taking	1.39	1.23-1.57	p < 0.001
Task reward dependence	0.71	0.60-0.84	p < 0.001
Social reward dependence	1.20	1.04-1.39	p = 0.015
Trigger factors			
Friend smoking			
No smoking friends Yrs 8-10	1	-	-
Smoking friends Yrs 8-10	4.16	2.47-7.00	p < 0.001
Sibling smoking			
No smoking siblings Yrs 8-10	1	-	-
Smoking siblings Yrs 8-10	1.62	1.24-2.12	p < 0.001
Mean stress score Yrs 8-10	1.13	1.07-1.20	p < 0.001

In order to compare odds ratios, and therefore the degree to which the variables included in this final model contributed in strength towards the prediction of Year 11 smoking, all variables were dichotomised. Scale variables were dichotomised using median splits and responses of current dating and dating in the past were combined. Using these dichotomous variables the model was re-run and results are displayed in table 10.4. Due to the large number of analyses used in the construction of this model a reduced value of $p < 0.01$ was taken as the cut-off for significance to give a level of adjustment for multiple comparisons. This analysis suggested that two factors, the peer problems subscale from the Strengths and Difficulties questionnaire and the personality dimension social reward dependence, should be removed from the model. All other factors showed high significance in their prediction of Year 11 smoking and therefore the model in Table 10.5 has been taken as the final parsimonious model and is displayed in Figure 10.3. This final model includes four vulnerability factors and three trigger factors. Having friends who smoke is clearly the strongest predictor in the model (OR = 4.78), followed by having ever tried smoking, while having a task reward personality trait is a protective factor (OR = 0.63). Overall the model correctly classified 69.8% of participants (74.6% of non-current smokers and 61.3% of current smokers), with a pseudo R^2 of 0.23. Complex samples logistic regression did not alter the significance values of this final model.

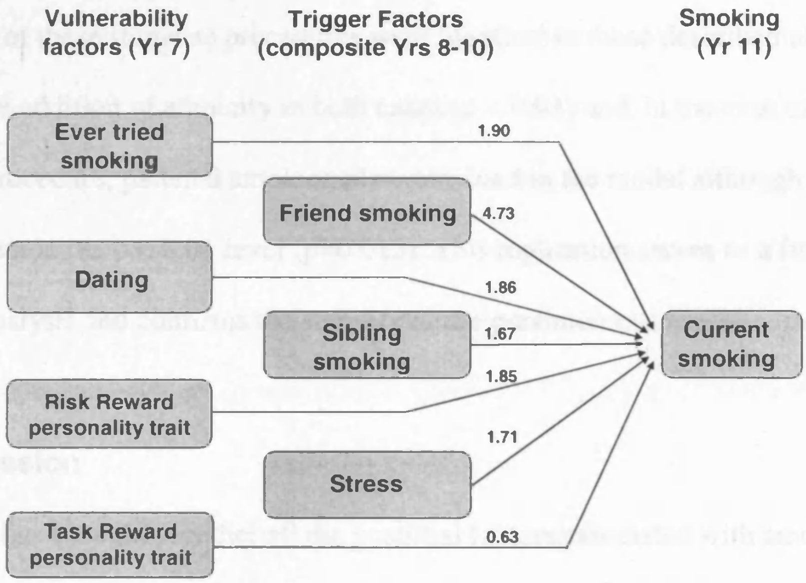
Table 10.4 Vulnerability and Trigger factors predicting current smoking at Year 11 – dichotomised variables (n = 1273)

	Odds Ratio	95% CI	Significance
Ever tried smoking	2.09	1.51-2.89	p < 0.001
Ever had boy/girlfriend	1.75	1.33-2.32	p < 0.001
High peer Problems score	0.78	0.58-1.04	p = 0.089
High risk taking personality	1.83	1.42-2.37	p < 0.001
High task reward dependence	0.61	0.48-0.79	p < 0.001
High social reward dependence	1.32	1.02-1.71	p = 0.034
Friends smoke (Yrs 8-10)	4.59	2.74-7.68	p < 0.001
Siblings smoke (Yrs 8-10)	1.63	1.25-2.12	p < 0.001
High stress (Yrs 8-10)	1.75	1.35-2.26	p < 0.001

Table 10.5 Vulnerability and trigger factors predicting smoking – final model (n = 1274)

	Odds Ratio	95% CI	Significance
Ever tried smoking	2.06	1.49-2.84	p < 0.001
Ever had boy/girlfriend	1.77	1.35-2.34	p < 0.001
High risk taking personality	1.91	1.48-2.46	p < 0.001
High task reward dependence	0.63	0.49-0.81	p < 0.001
Friends smoke (Yrs 8-10)	4.78	2.86-7.99	p < 0.001
Siblings smoke (Yrs 8-10)	1.60	1.23-2.08	p < 0.001
High stress (Yrs 8-10)	1.68	1.31-2.17	p < 0.001

Figure 10.3 The final, parsimonious model of smoking behaviour



Using this final model the hypothesis that individuals who are already vulnerable to smoking would be more susceptible to the influence of trigger factors was tested. Interaction terms were run between each vulnerability factor and trigger factor. None of these interaction terms were significant suggesting that each of the seven vulnerability and trigger factors in the model are additive in their prediction of smoking behaviour. The null hypothesis, that individuals vulnerable to smoking are not more susceptible to smoking uptake in the presence of trigger factors, cannot therefore be rejected.

It was initially assumed that for the purposes of constructing such a parsimonious model as described above, the data should be from as homogenous a sample as possible. Therefore only data from White participants has been included in the construction of the model. However, to investigate the extent to which the model might vary once ethnicity was included, the modelling process was repeated with ethnicity (White/non-White) added as a vulnerability factor (Chapter 5 illustrated that higher levels of smoking behaviour were observed among White participants). As before backwards and forwards stepwise regression analyses were run, including ethnicity as a vulnerability factor. The final models of these stepwise procedures were identical to those described above, except for the addition of ethnicity in both cases ($p < 0.01$) and, in the case of the backwards procedure, parental smoking also remained in the model although it was just non-significant at the $p < 0.01$ level ($p=0.013$). This replication serves as a further sensitivity analysis and confirms the stability of the parsimonious model constructed.

10.4 Discussion

This chapter has brought together all the potential factors associated with smoking introduced throughout the thesis and organised them into a theoretically grounded, parsimonious model of adolescent smoking behaviour. The final model consisted of seven factors, four vulnerability factors (early smoking experience, early dating behaviour, a risk reward personality trait, and a task reward personality trait) and three trigger factors (having friends who smoke, having siblings who smoke and experiencing a high level of stress). Overall, the model explained 23% of the variance in smoking behaviour. All variables showed strong relationships with smoking, but having friends who smoked was confirmed as an especially important factor. That Year 7 dating remained in the model also suggests that this relatively unstudied correlate of smoking could play an important role in understanding adolescent smoking behaviour, as discussed in Chapter 7. The model itself was found to be particularly robust, with identical results from both backwards and forwards stepwise regressions, as well as the replication of the model structure when including data from non-White ethnic groups.

Contrary to the hypothesis based on the 'classic' version of PRIME theory, there was no evidence of significant interactions between the vulnerability and trigger factors in the final model. The effect of each of the factors included in the model was therefore additive. This suggests that the impact of trigger factors between baseline and Year 11 is not greater among those who are already more vulnerable to smoking at baseline and that having friends who smoke, siblings who smoke, and experiencing high levels of stress during adolescence are independent risk factors for smoking. This suggests that the shape of the chreod of 'non-smoking' is not curvilinear in cross-section as drawn in the example epigenetic landscape but V-shaped in that the effect of an increase in motivation to try smoking is the same whether one is lower or higher on the side of the valley.

However, it is worth noting that the model tested is not a model of smoking behaviour at the individual level with an ability to predict the extent to which students with certain characteristics will progress to smoking, nor is it a complete explanation of why some adolescents smoke and others do not and variables not included are not necessarily unimportant. Rather it is a statistical model of the factors of smoking available, measured at the times available, and split into vulnerability and trigger factors using set criteria, which albeit informed by individual data can only be interpreted at a population level. All that can be said at this stage is that the model provides a framework into which the large variety of individual factors assessed throughout this thesis may be important when considered together. With only 23% of the variance in smoking behaviour explained (although this is comparable with other models of this kind) the model also sets down a 'base camp' of the situation in our population and at a particular time which can be built upon and improved on in the future.

There are a number of other limitations. Some factors which would likely play an important role in the model could not be included, either because of the timing of their measurement in the HABITS study, e.g. depression and self-esteem, or because they were not included in the study at all, e.g. school environment. The model is also limited by its design around the time-points available, e.g. the use of Year 7 measurements as vulnerability factors and the grouping of all trigger factor measurements between Year 8 and Year 10 together. The accurate measurement of vulnerability and trigger factors will obviously be constrained by this. Turner (2004) describes ecological momentary assessment (EMA), or diary methodology as the most precise method of assessing the real-time determinants of adolescent smoking, however this is beyond the scope of most large studies of the adolescent population. The model is also limited to the understanding of current smoking at age 15/16, different factors may be revealed as important if more regular smoking was chosen as the dependent variable, or if smoking at a younger or older age was modelled. Parental smoking especially was not in the final model, although was one of the last variables to be removed, and on the basis of research summarised in chapter 7 might be expected to play a greater role in the understanding of both more regular smoking and smoking among older adolescents (Bricker et al., 2007; Hill et al., 2005; Avenevoli & Merikangas, 2003). Finally, the sample used in these analyses was obviously restricted to those with full data on each of the variables assessed and is much reduced with a sample size of 1274. It is known from previous chapters that those participants missing one or more years of data collection differed from those participants with full data on a number of factors, for example they were more likely to be smokers, to be more deprived, to be boys, and to report early dating. As discussed in Chapter 4 it was decided that missing values should not be imputed and therefore this reduced sample size should be taken into consideration when interpreting the model presented.

In conclusion, the combination of all the factors presented throughout this thesis into a theoretically derived structure results in a parsimonious, statistical, population level model containing both vulnerability and trigger factors. Each of these factors were additive in nature and the hypothesis that trigger factors would have a greater impact on smoking behaviour among those more vulnerable was not supported. This model is not definitive, however, but is proposed as a 'base camp' for future further progression of the understanding of adolescent smoking behaviour.

Chapter 11: General discussion and conclusions

The aim of this thesis was to summarise the smoking data from the HABITS study, track how smoking behaviour develops over time, and investigate the impact that sociodemographic, social, psychological and anthropometric factors have on adolescent smoking. A final aim was to use the available data to develop a theoretically grounded model of adolescent smoking behaviour. This concluding chapter summarises the main findings of the thesis and their contribution to current literature and smoking prevention practice, notes some important limitations, and proposes a number of new directions for future research.

11.1 Main findings and their contribution to literature and practice

Smoking was relatively uncommon in the first year of the HABITS study, when students were age 11-12, however levels increased rapidly and by age 15-16 well over half of students reported having ever smoked and nearly a third were current smokers. The extent of smoking in the HABITS study was broadly comparable to the national Smoking Drinking and Drug use surveys and the percentage of ever smokers, both at age 11-12 and at age 15-16 in the HABITS study was virtually identical to that of these nationally representative surveys. Regular smoking at age 15-16 was somewhat lower than SDD data, probably because of the greater representation of non-White students in the HABITS sample. This serves to underline the fact that the HABITS study is not, and was never intended to be, a representative sample, but provides a unique opportunity to study the factors associated with adolescent smoking in a socioeconomically and ethnically diverse population. The product of this opportunity has been presented in this thesis and the main findings and their contributions to the literature and practice are summarised below.

1. Asian girls smoke as much as Asian boys

Smoking among Asian women is rare (Markham et al., 2004; Bush et al., 2003), however recent concerns that Asian girls are increasingly more likely to smoke (ASH Scotland, 2005; Bush et al., 2003) has been supported in this ethnically diverse sample. As shown in Chapter 5 Asian girls in the HABITS study, though less likely to have ever smoked than Asian boys, were more likely to be current smokers. While limited by low numbers, this appeared particularly the case among Indian and Pakistani sub-groups. This finding suggests that young Asian girls should not be assumed to be less at risk from smoking uptake and attempts to reduce adolescent smoking prevalence should not ignore this increasingly vulnerable group.

2. The path from experimentation to current smoking can take up to three years – with no smoking in between

Examination of an understudied group, 'one time triers', who report that they have only smoked once or twice at age 11-12 has shown that these individuals are significantly more likely to become current smokers than those who report having never tried smoking at this age (see Chapter 6). Although the link between past and future smoking is well known (Jackson & Dickinson, 2004; Choi et al., 2001; Patton et al., 1998b; Russell, 1990) this finding makes a significant contribution to the literature by demonstrating that there may be a protracted period of dormancy of up to three years between the first experimentation and uptake of current smoking when no reported smoking occurs. There are several explanations for this 'sleeper effect' or personal propensity or vulnerability to smoke but there are clear implications for practice. First the finding suggests that preventing children from trying even one cigarette is an important goal, and prevention efforts could usefully be focused at an early age. Second, given that previous experimentation is a strong predictor of later smoking uptake, health care providers and those designing targeted interventions should pay particular attention to adolescents who report having tried cigarettes, even just once, and some time in the past.

3. <u>If an adolescent has no friends who smoke they are extremely unlikely to be a smoker</u>

Peer smoking is a strong, established, predictor of adolescent smoking behaviour, although the direction of the relationship between peer and adolescent smoking remains unclear (Kobus, 2003; Avenevoli & Merikangas, 2003; Tyas & Pederson, 1998; Conrad et al., 1992). The HABITS study was not designed to unravel this relationship. However, a stark finding from the basic analyses presented in Chapter 7 is that if an adolescent reports having no friends who are smokers, be that because they have not been exposed to smoking friends or have chosen to not associate with smokers, the chances of them being a smoker themselves are virtually non-existent. In addition, other social sources of influence have little impact on adolescent smoking among those with no friends who smoke. This highlights a group of adolescents who are particularly unlikely to become smokers.

4. <u>Mothers who smoke are an important influence on the smoking behaviour of both boys and girls</u>

Past research has been relatively inconclusive as to the extent to which smoking by mothers and fathers differentially influence the smoking behaviour of girls and boys (Peterson, Jr. et al., 2006; Nofziger & Lee, 2006; Avenevoli & Merikangas, 2003; Vink et al., 2003b; Wang et al., 1999). However, the data presented in Chapter 7 suggest that mothers play a greater role in determining whether their child smokes than fathers, regardless of the gender of the adolescent. This conclusion supports the position of Vink (2003b) and Nofziger and Lee (2006) and suggests that attempts to make parents aware of the effect of their smoking on their adolescent children should be targeted to mothers especially.

5. Step-parents who smoke have at least as great an influence on adolescent smoking as biological parents who smoke

The relationship between parental smoking and adolescent smoking behaviour is well known but less focus has been placed on the importance of smoking by non-biological parental figures (Avenevoli & Merikangas, 2003). Although a link between living with a step-parent and an increased risk of adolescent smoking has previously been shown (Griesbach et al., 2003; Bjarnason et al., 2003; Tyas & Pederson, 1998), results in Chapter 7 have extended this research by examining the actual smoking behaviour of step-parents. It was concluded that living with just a step-parent who smokes was associated with at least as high an incidence of smoking among adolescence as living with a biological parent who smokes. This strongly suggests a social mode of transmission of smoking behaviour between parents and children, although it does not preclude a role for biological predisposition. Attempts to work with parents in smoking prevention should therefore involve, and perhaps pay particular attention to, step-parents who smoke.

6. Early dating is a very strong predictor of later smoking behaviour

Early studies have highlighted the association between smoking and having a boyfriend or girlfriend (McNeill et al., 1988; Tucker, 1985; Murray et al., 1984; Bynner, 1969). However, the findings in Chapter 7 are the first to show that dating at age 11-12 is a significant predictor of smoking behaviour up to five years later, and that, in contrast, early smoking is not associated with later dating. Although the direction of the relationship suggests it is possible that early dating leads to later smoking, perhaps though a complex interplay of image formation and popularity among peers, it is more likely that both smoking and dating are behaviours that belong to an adult world that adolescents may aspire to be part of, and that opportunities for forming relationships with the opposite sex simply occur before opportunities to smoke. Taking this view dating may be a marker, but not necessarily a causal predictor, of later smoking. DiFranza and Wellman (2006) debate the reasons for this marker in an editorial of the published version of this finding and note that teenage exposure to the use of tobacco by glamorous role models and targeted tobacco company advertising may foster the relationship. Understanding the presence of dating as a strong marker of smoking behaviour contributes to the construction of a comprehensive profile of adolescents at risk for smoking and has important implications for the design of targeted smoking interventions.

7. Positive attitudes towards smoking develop very shortly before, or after smoking initiation

There is less empirical support for the importance of attitudes in directing smoking behaviour than may be predicted from theories of behaviour change (Piko, 2001; Tyas & Pederson, 1998). Findings from Chapter 8 support the work of McNeill et al. (1988) who found that attitudes towards smoking were not prospectively associated with smoking initiation. However these results also show that once smoking initiation had occurred positive attitudes towards smoking became, and remained, significantly associated with smoking uptake. This suggests that attitudes towards smoking either develop after smoking initiation has occurred, or very shortly beforehand, but once they have been formed remain consistent. This finding has implications for prevention strategy in that global attempts to change the attitudes of adolescents towards smoking are unlikely to have any effect on smoking behaviour as these attitudes are only associated with smoking behaviour immediately around the time of initiation. As the precision required to intervene at this point would be substantial, it may be that resources spent trying to change the attitudes of potential smokers are better directed elsewhere.

8. Smoking is associated with a small reduction in BMI over a four-year period

Many adolescents, though especially teenage girls, believe that smoking helps to keep them slim and past studies have shown that adolescents are more likely to take up smoking if they hold this view (Fulkerson & French, 2003; Boles & Johnson, 2001; Klesges et al., 1997). However, although studies have typically found a relationship between smoking and weight in adults, little is known about the effect of weight change among adolescents (Potter et al., 2004). Only two longitudinal studies have assessed this issue, both suffering from several limitations (Stice & Martinez, 2005; Cooper, Klesges, Robinson, & Zbikowski, 2003). The findings in Chapter 9 show that there is a significant association between smoking and BMI, and to some extent waist circumference, over a four-year period among 'daily' smokers only. There was no clear association with height. However, the reduction in BMI and waist gain is small and equates to a difference in growth of 1.8kg and 1.2 cm respectively over this period. Whether this difference is apparent to adolescents, and whether it is clinically significant, is uncertain. However, these findings suggest that approaches of informing adolescents that smoking has no effect of their weight (Plotnikoff et al., 2007) may not be accepted by teenagers and rather those concerned about their weight should be strongly advised that smoking is not an appropriate solution and made aware of alternative, healthier approaches. It may also be effective to warn these adolescents of the likelihood of a larger weight increase when quitting is inevitably considered.

9. <u>A parsimonious model of smoking behaviour consists of four vulnerability and three trigger factors, which are additive in nature</u>

Through bringing together the wide range of potential factors associated with smoking addressed throughout the thesis a theoretically driven population level model was constructed. Using elements from PRIME theory (West, 2006b) potential factors were split into vulnerability and trigger factors with the hypothesis that trigger factors would have a greater impact on smoking among those already vulnerable. The final model consisted of four vulnerability factors; past smoking, early dating behaviour, a risk reward personality trait, and a task reward personality trait, and three trigger factors; having friends who smoke, having siblings who smoke and experiencing a high level of stress. Unlike hypothesised from PRIME theory each of these factors played an additive role in the model and there was no evidence that high vulnerability increased the impact of trigger factors. The construction of the model itself has highlighted important correlates of smoking behaviour and provides a building ground for further research in this area.

11.2 General Limitations

As with any study, findings presented in this thesis are associated with a number of limitations. Specific issues have been addressed in each individual chapter, but it is necessary to highlight some important general limitations in this final discussion.

11.2.1 Design issues

When using established data-sets there are obviously constraints as to the data available for analysis. Some of the analyses described in earlier chapters would benefit from additional information not gathered in the HABITS study, for example the number of cigarettes smoked per day by the more regular smokers would have strengthened examination of the effect of smoking on weight particularly. The lack of Strengths and Difficulties scores, as well as information on whether students had a boyfriend or girlfriend, in the last year of the study also limited the extent of longitudinal analyses using these variables. In addition some variables were included in later years of the study only, for example depression and self-esteem, but a full understanding of the role that this these variables played in smoking behaviour was not possible because baseline data was not available.

Analyses were also constrained by the time points that data were collected. The tracking of students from age 11-12 to age 15-16 on an annual basis offers a more detailed understanding of the development of adolescent smoking than many other studies available, however, it is clear that adolescent smoking is dynamic in nature and an adolescent may move in and out of smoking categories over a short period of time (Petraitis et al., 1995; Goddard, 1990). The year long gaps between each assessment in the HABITS study limit the extent to which the transition from experimentation to regular smoking can be understood, as well as the definitive placement of adolescents in set smoking categories at each study year.

11.2.2 Sample issues

A particular strength of the HABITS study is the socioeconomically and ethnically diverse sample which allows a better understanding of health behaviours in often under-represented groups. However, this strength means that the findings presented cannot be generalised to the population as a whole. Because the sample was selected to be diverse in this way no attempt has been made to weight the data to make it representative of the general population and this must be taken into consideration when interpreting the results. As such, each of the findings outlined above should be taken as answers to specific questions asked of this particular data-set which may or may not be the case in the population as a whole. Replication in a nationally representative population should therefore occur before results are assumed to apply population wide.

Despite the over-sampling of particular ethnic and socioeconomic groups the sample size of some groups was still too small to perform adequate analyses. Therefore although the HABITS study remains one of the best samples for looking at ethnic differences in smoking, numbers of smokers once the sample was split by gender and by sub-groups within the Asian group as a whole were still very small. Nonetheless the data presented on high levels of smoking among some Asian girls suggests that further examination of this issue is warranted. Similarly the HABITS data-set provides a unique opportunity to examine smoking in step-families, however the small sample size of this group limited the extent to which fully adjusted analyses could be performed.

11.2.3 Analysis issues

Perhaps the most important limitation to address is the extent of missing data throughout the HABITS study. As with all prospective studies a degree of attrition is inevitable and, as might be expected (Bovet et al., 2006; Michaud et al., 1998; Conrad et al., 1992), the extent of missing data was more prolific among certain groups, most notably smokers, non-White students and more deprived students. It was decided to avoid imputing missing values as smoking is a discrete, yet fluctuating variable which makes the prediction of missing values problematic. Where analyses required the same individuals to be tracked from year to year (such as tracking the behaviour of Year 7 one-time triers in Chapter 6) only those with complete data on the variables of interest were included. This necessarily excluded a sizable proportion of students and arguably excludes those students of most interest. These findings are therefore typical only of the sample presented and, although where possible analyses were re-run using the maximum number of students available, results should be interpreted with caution. In other analyses the sample was purposely not restricted to those with complete data only so that as many smokers would be included as possible (e.g. predicting smoking from early dating in Chapter 7) and it should be recognised that the sample for these analyses differs from year to year.

The sample also reduced in size as the study progressed. Two schools dropped out of the study at Year 8 and Year 11 due to time commitments and changing staff, and a greater proportion of students were not present in class-rooms in Year 11 because of coursework and exam commitments. This obviously introduces further bias and also limits the extent to which analyses can be effectively followed through to Year 11, for example the reduced sample size at Year 11 in Chapter 6 may explain why the 'sleeper effect' was not observed in this final year and the reduced increase in smoking behaviour at Year 11 may not be due to a natural stabilising of smoking behaviour by this age but rather an artefact of sample bias.

11.3 Further work

The findings presented in this thesis have raised a large number of further questions and directions for future research. Some specific questions arise in direct response to findings presented in earlier chapters. Most notably, perhaps, the strong relationship between adolescents who report having a boyfriend or girlfriend at an early age and later smoking behaviour clearly isolates a particular 'type' of person who is at risk of smoking uptake. Whether this is a function of status, popularity, image, maturity, personality, or social desirability needs further exploration, perhaps initially in a qualitative manner. The impact of having a boyfriend or girlfriend who does, or does not, smoke could also usefully be explored.

The role of step-parents who smoke in influencing adolescent smoking behaviour is another area which could particularly benefit from additional research. Although the present findings have highlighted step-parents as important role models, and the HABITS data set provided comparatively detailed data in this area, there were many limitations to the analyses. Targeted sampling to ensure a larger sample with more detailed information regarding exactly who adolescents reside with, the proportion of time spent in contact with biological parents and step-parents and the marital status of parents and step-parents would enable a stronger statement as to the extent to which step-parents have an important role to play in the development of adolescent smoking. Qualitative research would also help to explore the potential reasons why step-parents have such a strong influence on adolescent smoking.

Other areas for further research are prompted by potential additions and extensions to overcome methodological limitations of the HABITS study. More detailed understanding of a number of issues could be achieved by increasing the number of assessments in between each academic year. For example: the timing of attitude change in relation to smoking uptake; and the extent to which no further experimentation with smoking really occurs among one time-triers. The most extreme form this could take would be some form of ecological momentary assessment (EMA) or diary study. This methodology would allow, for example, the association of real-time thoughts and feelings across a pre-defined period with changing attitudes and behaviour towards smoking (Turner, Mermelstein, & Flay, 2004). A more precise understanding of the relationship between vulnerability and trigger factors could also be gained using this approach.

The limited detail of data on smoking among friends and siblings in the HABITS study also means few firm conclusions can be drawn in this area, yet some interesting findings have been noted. Extension of the HABITS design to include more detail through social network analysis, for example, would enable more definitive conclusions regarding these social influences. Such an approach may also be informative in relation to the role of dating on smoking behaviour. In addition, although the ages of 11 to 16 cover the exponential increase in smoking behaviour across adolescence (Fuller, 2006) some findings addressed in the thesis could usefully extended by examining both younger and older age ranges, for example the length of the 'sleeper effect' and the role of smoking on weight change across a longer period.

A final inspiration for future research direction is driven by the need for empirical examination of the effectiveness of the practical recommendations suggested throughout this thesis. This is important to ensure the findings of quantitative research are driven through into practice. For example; does targeting children who have tried smoking just once, even if they are not currently smoking to any extent, make a difference to the number of adolescents who go on to smoke?; is working with step-parents a viable strategy?; what is the best way to target the high risk 'early daters'?; and how should issues of smoking and weight be addressed in the adolescent population, if at all? In relation to this last point I have already attained funding from Cancer Research UK for a qualitative exploration of the opinions of adolescents about the relationship between smoking and weight, the findings from which are currently in preparation.

11.4 Final Remarks

This thesis has examined the pattern, correlates, and predictors of smoking in adolescence and presented a number of findings which have important practical applications for adolescent smoking prevention. Given the current limited success of adolescent smoking prevention programmes, these results have the potential to have a significant impact on the development of effective approaches and techniques in this area. However the successful reduction of smoking among adolescents requires a global approach of not only effective prevention, but also a reduction in adult role-model smoking and effective policy implementation. Only through these combined efforts can a significant reduction in population smoking prevalence be attained.

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Working together with Cancer Research UK

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February 2003

Dear Parent or Guardian,

Re: Health and Behaviour in Teenagers Study (HABITS study)

School is taking part in a major scientific research project being carried out by Cancer Research UK (the UK's largest cancer charity). At Cancer Research UK we realise the importance of a healthy lifestyle and we think it is very important to learn how individuals develop their choices during their teenage years. Information is being collected on a group of Year 7 students each year until they are in Year 11 (i.e. from age 11 to 16). Last year information was collected from nearly 5000 Year 10 students in South London. The vast majority of students at **School** took part last year and we are keen to see this continue. We would very much like your child to take part in this study.

All information is being collected by qualified researchers. Pupils, now in Year 11, will be asked to complete a questionnaire asking about diet, smoking, physical exercise and psychological well-being. Height, weight and waist size will be measured and they will be asked to give a sample of saliva to enable us to measure exposure to tobacco smoke. All the information that is collected will be treated in strict confidence. No one outside the research team will be able to link the information provided to the child's name.

Taking part in the research project is voluntary. Any child taking part in the research is free to withdraw at any time without having to give a reason. **If you are willing for your child to take part in this research project, no further action is necessary.** If you do not wish your child to take part, please return the tear-off slip to your child's school in the next few days.

Further information about the study is shown overleaf.

Yours sincerely,

Professor Jane Wardle

✂ ---

No further action is necessary if you are happy for your child to participate. If you do not wish your child to take part, please return the tear-off slip to School in the next few days.

I DO NOT wish my child to take part in the Health and Behaviour in Teenagers Study.

Name of child: ....

Signature of Parent/Guardian: ....

Health and Behaviour in Teenagers Study

The **HABITS study** is a school-based project examining smoking, food choice and exercise in adolescents.

The **HABITS study** will provide up-to-date information on a large sample of British teenagers that will help us to understand the development of healthy lifestyles in adolescence, and enable us to develop more effective interventions.

The background to the study

Smoking, unhealthy dietary patterns and a lack of exercise are among a number of behaviours that contribute significantly to obesity, heart disease, cancer and other chronic diseases.

By age 15:

- 25% of adolescents have started smoking regularly
- fewer than 20% will be eating the recommended amount of fruit and vegetables
- more than 25% will be overweight
- many will be entirely sedentary.

Adolescents are an important target group for preventive health measures as they have more potential for lifestyle change than adults.

Most previous research has been limited to describing adolescent lifestyle, the HABITS study will investigate how different lifestyles develop and how smoking, diet and inactivity relate to one another. The study will also identify factors that increase the likelihood of developing an unhealthy lifestyle.

Who is taking part in the HABITS study?

Approximately 5000 students from 36 secondary schools in and around South London.

How is the information collected?

Questionnaires are administered by qualified researchers during a class period at school. The survey will be repeated annually with the same students until they are in Year 11.

Is the information kept confidential?

All the information that is collected is treated in strict confidence. No-one outside the research team can link the information to the child's name.

How do the students and school benefit?

Summaries of the results are made available as a classroom resource for students and teachers. Students can then follow any changes in lifestyle from year to year and will be able to explore differences, for example between boys' and girls' health behaviours.

Who are the research group?

The HABITS study is funded by Cancer Research UK – the largest UK cancer charity, and is based at the Cancer Research UK Health Behaviour Unit at University College London. The research group includes: Professor Jane Wardle, , Jennifer Fidler

e.

For more information contact: The HABITS team at the Health Behaviour Unit, University College London,

YEAR 11

Health and Behaviour in Teenagers Study

Do you agree to help us with the study? Yes ☐ No ☐

Please fill in the following....

First and last name (**IN CAPITAL LETTERS**):

____

Address and postcode (**IN CAPITAL LETTERS**) :

____

____

____

Today's date: ________________________________

Name of your school: ______________________________

Although this is the last visit, if you agree we may like to contact you in the future to ask you how things have changed. If you would be willing to be contacted, at the above address, please tick here ☐ If you would be willing to be contacted at another address please write it on the other side.

If you have a permanent e-mail address (i.e. not via school), please write it below

____

If you have any questions please ask one of the researchers.

Please start filling in your questionnaire now

Year 11 Questionnaire **MALE**

A: About you

(1) Are you... Male ☐ Female ☐

(2) What year were you born? 1 9 8 ☐

(3) When is your birthday?
for example: 12th July ☐

B: About your school...

Do you agree or disagree with the following statements?	strongly agree	agree	neither agree nor disagree	disagree	strongly disagree
(4) In our school the students take part in making rules	☐	☐	☐	☐	☐
(5) The students are treated too severely/strictly in this school	☐	☐	☐	☐	☐
(6) The rules in this school are fair	☐	☐	☐	☐	☐
(7) Our school is a nice place to be	☐	☐	☐	☐	☐
(8) I feel I belong at this school	☐	☐	☐	☐	☐
(9) I feel safe at this school	☐	☐	☐	☐	☐
And your teachers...					
(10) I am encouraged to express my own views in classes	☐	☐	☐	☐	☐
(11) Our teachers treat us fairly	☐	☐	☐	☐	☐
(12) When I need extra help I can get it	☐	☐	☐	☐	☐
(13) My teachers are interested in me as a person	☐	☐	☐	☐	☐
And your classmates...					
(14) Most of the students in my classes enjoy being together	☐	☐	☐	☐	☐
(15) Most of the students in my classes are kind and helpful	☐	☐	☐	☐	☐
(16) Most other students accept me as I am	☐	☐	☐	☐	☐
And what is expected of you at school...					
(17) My parents expect too much of me at school	☐	☐	☐	☐	☐
(18) My teachers expect too much of me at school	☐	☐	☐	☐	☐

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And how do you get on with your parents...

How much do you think the following statements are true for you? Please answer about the parent (mother or father) you speak to the most often.

	not at all true	a little true	somewhat true	pretty true	very true
(19) I can share my feelings with my parent	☐	☐	☐	☐	☐
(20) I feel I can trust my parent as someone to talk to	☐	☐	☐	☐	☐
(21) When I feel bad about something, my parent will listen	☐	☐	☐	☐	☐
(22) If I talk to my parent, I think he/she tries to understand how I feel	☐	☐	☐	☐	☐
(23) When I talk to my parent, he/she tries to make me feel better	☐	☐	☐	☐	☐
(24) If I talk to my parent, he/she has suggestions about how to handle problems	☐	☐	☐	☐	☐
(25) If I need help with my schoolwork, I can ask my parent about it	☐	☐	☐	☐	☐
(26) If I need help in getting somewhere, I can ask my parent for a way to get there	☐	☐	☐	☐	☐
(27) If I have a problem with my health, I think I can talk to my parent about it	☐	☐	☐	☐	☐
(28) If I'm feeling bored, my parent has suggestions about things to do	☐	☐	☐	☐	☐
(29) If I'm having a problem with a friend, my parent would have advice about what to do	☐	☐	☐	☐	☐
(30) I have a lot of arguments with my parent	☐	☐	☐	☐	☐
(31) I often feel my parent is giving me a "hard time"	☐	☐	☐	☐	☐
(32) I feel my parent doesn't understand me	☐	☐	☐	☐	☐

C: Smoking

(33) Does your mother smoke now? yes ☐ no ☐ don't know ☐

(33a) If no - has your mother ever been a smoker?

yes ☐ no ☐ don't know ☐

(33b) If you live with your stepmother - does she smoke?

yes ☐ no ☐ Don't have a stepmother ☐ Don't live with stepmother ☐

(34) Does your father smoke now? yes ☐ no ☐ don't know ☐

(34a) If no - has your father ever been a smoker?

yes ☐ no ☐ don't know ☐

(34b) If you live with your stepfather - does he smoke?

yes ☐ no ☐ Don't have a stepfather ☐ Don't live with stepfather ☐

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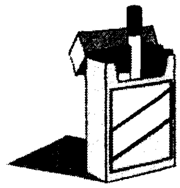
(35) How do you think your parents at home would feel if you smoked?



- ☐ they would stop me
- ☐ they would try to persuade me not to smoke
- ☐ they would do nothing
- ☐ they would encourage me to smoke

(36) Do you have any brothers or sisters who smoke (including half and step brothers and sisters)? yes ☐ no ☐

(37) How many of your close friends smoke?

☐ all ☐ most ☐ some ☐ a few ☐ none

(38) Do you think you will smoke a cigarette in the next 12 months?

☐ yes definitely ☐ yes probably ☐ probably not ☐ definitely not

(39) If one of your best friends were to offer you a cigarette, would you smoke it?

☐ yes definitely ☐ yes probably ☐ probably not ☐ definitely not

Do you think...?	strongly agree	agree	not sure	disagree	strongly disagree
(40) Smoking makes people worse at sports	☐	☐	☐	☐	☐
(41) Smoking stops you feeling hungry	☐	☐	☐	☐	☐
(42) Smoking helps calm people down if they are stressed	☐	☐	☐	☐	☐
(43) Smoking helps you stay awake	☐	☐	☐	☐	☐
(44) If you start smoking, it's very difficult to give up	☐	☐	☐	☐	☐
(45) Smoking helps you to keep slim	☐	☐	☐	☐	☐
(46) Smoking helps people cope better with life	☐	☐	☐	☐	☐

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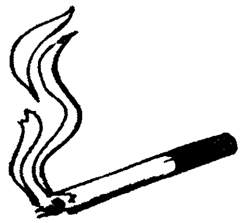
(47) Which of the following statements best describes you?...

- I have never smoked ☐
- I have only ever tried smoking once ☐
- I used to smoke sometimes but I never smoke cigarettes now ☐
- I sometimes smoke cigarettes now but I don't smoke as many as one a week ☐
- I usually smoke between one and six cigarettes a week ☐
- I usually smoke more than six cigarettes a week ☐



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(48) Just to check, please tick the box next to the statement which best describes you again...

- I have never tried smoking a cigarette, not even a puff or two ☐
- I did once have a puff or two of a cigarette, but I never smoke now ☐
- I do sometimes smoke cigarettes ☐

---

(49) How many cigarettes have you smoked altogether in your life?

☐ one	☐ between six and 19
☐ tw ☐ one	☐ between 20 and 49
☐ th ☐ two	☐ between 50 and 99
☐ four	☐ 100 or more
☐ five	☐ none

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(50) When did you last smoke a cigarette?

- [ ] earlier today
- [ ] yesterday
- [ ] between 2 and 7 days ago
- [ ] more than a week but less than a month ago
- [ ] more than a month ago
- [ ] never

---

(51) How old were you when you first tried a cigarette? [ ] years

- [ ] never tried a cigarette

---

(52) Thinking back to the first cigarette you tried, how much did you like it?

- [ ] I really liked it
- [ ] I liked it a bit
- [ ] I neither liked it nor disliked it
- [ ] I disliked it a bit
- [ ] I really disliked it
- [ ] never tried a cigarette

---

(53) When you tried that first cigarette, were the effects...

- [ ] very strong
- [ ] fairly strong
- [ ] fairly weak
- [ ] very weak
- [ ] I didn't feel any effect
- [ ] never tried a cigarette

---

(54) After you had tried the first cigarette, did you...

- [ ] want to try another again soon
- [ ] think you might try smoking again at some stage
- [ ] not think you would try smoking again
- [ ] know you would not try smoking again
- [ ] never tried a cigarette

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Did that first cigarette...	A lot	A bit	Not at all	Never tried a cigarette
(55) make you cough	☐	☐	☐	☐
(56) make your throat burn	☐	☐	☐	☐
(57) give you a headache	☐	☐	☐	☐
(58) make you feel sick	☐	☐	☐	☐
(59) make you feel dizzy	☐	☐	☐	☐
(60) give you a buzz	☐	☐	☐	☐
(61) calm you down	☐	☐	☐	☐
(62) make you more alert	☐	☐	☐	☐

(63) How much of your first cigarette did you smoke?

☐ 1 puff ☐ 2 or 3 puffs ☐ 4 puffs or more ☐ never tried a cigarette

(64) Did you inhale your first cigarette (take the smoke down into your lungs)?

☐ yes ☐ no ☐ never tried a cigarette

(65) How long was it before you tried another cigarette?

- ☐ never smoked another cigarette
- ☐ tried another the same day
- ☐ the next day
- ☐ a few days later
- ☐ a few weeks later
- ☐ a few months later
- ☐ between 6 months and a year later
- ☐ more than a year later
- ☐ never tried a cigarette

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Current smoking

(66) What brand of cigarette do you smoke?

☐ or ☐ I do not smoke

(67) How soon after waking do you usually smoke your first cigarette of the day?

- ☐ less than 5 minutes
- ☐ between 5 and 14 minutes
- ☐ between 15 and 29 minutes
- ☐ between 30 minutes and an hour
- ☐ between 1 and 2 hours
- ☐ 2 hours or more
- ☐ I do not smoke

When you smoke ...	Not at all	A bit	A lot	I do not smoke
(68) do you usually feel dizzy?	☐	☐	☐	☐
(69) do you usually feel sick?	☐	☐	☐	☐
(70) do you usually feel a buzz?	☐	☐	☐	☐
(71) do you usually feel more alert?	☐	☐	☐	☐
(72) do you usually feel calmer?	☐	☐	☐	☐

(73) On occasions when you can't smoke or you haven't got any cigarettes on you, do you feel a craving for one?

☐ always ☐ often ☐ sometimes ☐ rarely ☐ never ☐ I do not smoke

(74) How easy or difficult do you think you would find it to go without smoking for as long as a week?

☐ very difficult ☐ fairly difficult ☐ fairly easy ☐ very easy ☐ I do not smoke

(75) Have you ever tried to give up smoking? ☐ yes ☐ no ☐ I do not smoke

(76) Would you like to give up smoking altogether? ☐ yes ☐ no ☐ I do not smoke

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D: Your health

(77) Over the last 12 months would you say that your health has on the whole been....

☐ good ☐ fairly good ☐ not good

(78) When did you last see a doctor because you were ill?

☐ last week
☐ last month
☐ in the last 3 months
☐ in the last 6 months
☐ 6 to 12 months ago
☐ over a year ago
☐ never

E: Stress

In the last month how often have you...

	never	rarely	sometimes	often	very often
(79) been upset because of something that happened unexpectedly?	☐	☐	☐	☐	☐
(80) felt confident you could handle your personal problems?	☐	☐	☐	☐	☐
(81) felt nervous and stressed?	☐	☐	☐	☐	☐
(82) felt that you couldn't control the important things in your life?	☐	☐	☐	☐	☐
(83) felt that things were going your way?	☐	☐	☐	☐	☐
(84) felt that you could not cope with all the things you had to do?	☐	☐	☐	☐	☐
(85) been able to control irritations in your life?	☐	☐	☐	☐	☐
(86) felt that you were on top of things?	☐	☐	☐	☐	☐
(87) been angered because of things that happened that were outside of your control?	☐	☐	☐	☐	☐
(88) felt that difficulties were piling up so high that you could not overcome them?	☐	☐	☐	☐	☐

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Section F: Puberty

(89) Do you think you are......?

- [ ] much too thin
- [ ] a bit too thin
- [ ] about the right weight
- [ ] a bit too fat
- [ ] much too fat

(90) Do you think you are......?

- [ ] much too short
- [ ] a bit too short
- [ ] about the right height
- [ ] a bit too tall
- [ ] much too tall

(91a) Do you agree or disagree with the following statements?

	agree	disagree
I think that my stomach is too big	☐	☐
I think that my thighs (top of legs) are too big	☐	☐
I think that my bottom is too big	☐	☐
I think that my hips are too big	☐	☐
I think that my muscles are too small	☐	☐

	agree	disagree
(92) I feel satisfied (happy) with the shape of my body	☐	☐

(93b) Would you say that your growth in height...

- [ ] has not yet begun to spurt ('spurt' means to grow more than usual)
- [ ] has just started to spurt
- [ ] is definitely underway
- [ ] seems completed

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(94b) Have you noticed any deepening of your voice?

- [ ] not yet started changing
- [ ] has just started changing
- [ ] voice change is definitely underway
- [ ] voice change seems completed

(95b) Would you say that your body hair growth...
('body hair' means hair under your armpits and pubic hair)

- [ ] has not yet started
- [ ] has just started
- [ ] is definitely underway
- [ ] seems completed

(96b) Have you begun to grow hair on your face?

- [ ] not yet started growing hair
- [ ] have just started growing hair
- [ ] facial hair growth is definitely underway
- [ ] facial hair growth seems completed

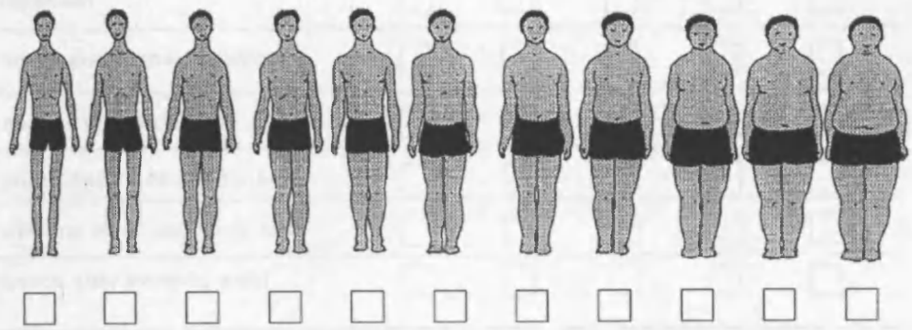
(97b) Have you noticed any skin changes, especially pimples or spots?

- [ ] not yet started showing any changes
- [ ] just started showing changes
- [ ] skin changes are definitely underway

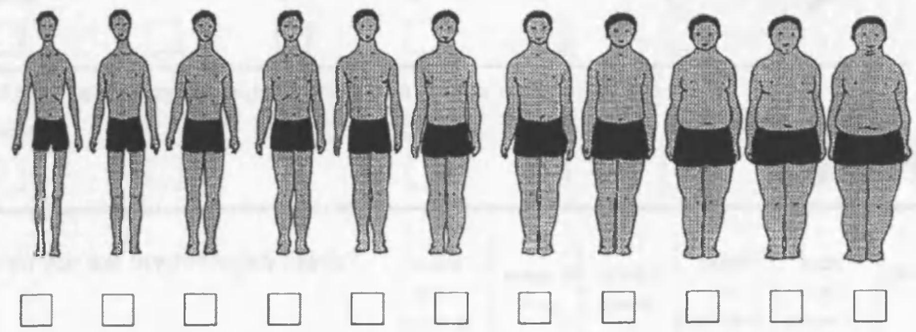
(98b) Do you think you are more or less developed than other boys your age?

- [ ] much more
- [ ] a bit more
- [ ] about the same
- [ ] a bit less
- [ ] much less

(99b) Tick the box under the figure which is most <u>similar to you</u> now.



(100b) Tick the box under the figure which you would <u>like to look like</u> now.



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G: What you eat

How often do you usually eat the following meals or snacks?

	every day	5 or 6 days a week	3 or 4 days a week	1 or 2 days a week	less than once a week
(101) breakfast	☐	☐	☐	☐	☐
(102) snack during the morning	☐	☐	☐	☐	☐
(103) midday meal or lunch	☐	☐	☐	☐	☐
(104) snack before evening meal	☐	☐	☐	☐	☐
(105) evening meal (dinner or tea)	☐	☐	☐	☐	☐
(107) snack after evening meal	☐	☐	☐	☐	☐

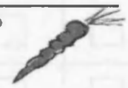
(108)Where do you usually eat lunch?

☐ in the school canteen ☐ at home ☐ from a shop ☐ bring a packed lunch

(109) Which type of bread do you eat most often?

☐ white bread ☐ brown bread

(110) About how many servings (lots) of vegetables do you usually eat in a day?



none	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

(111) About how many servings (lots) of fruit do you eat usually in a day?

none	1	2	3	4	5 or more
☐	☐	☐	☐	☐	☐

How often do you eat the following foods?	more than once a day	once a day	most days	once or twice a week	less than once a week	never
(112) crisps or savoury snacks	☐	☐	☐	☐	☐	☐
(113) sweets or chocolate	☐	☐	☐	☐	☐	☐
(114) biscuits	☐	☐	☐	☐	☐	☐
(115) cereals (all types of breakfast cereals)	☐	☐	☐	☐	☐	☐

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How often do you eat the following foods?	more than once a day	once a day	most days	once or twice a week	less than once a week	never
(116) chips	☐	☐	☐	☐	☐	☐
(117) other potatoes (not chips)	☐	☐	☐	☐	☐	☐
(118) pasta or rice or spaghetti or noodles	☐	☐	☐	☐	☐	☐
(119) sausage or burgers	☐	☐	☐	☐	☐	☐
(120) tinned meat or meat pies or pasties	☐	☐	☐	☐	☐	☐
(121) bread	☐	☐	☐	☐	☐	☐
(122) cheese	☐	☐	☐	☐	☐	☐
(123) cakes	☐	☐	☐	☐	☐	☐
(124) puddings or desserts	☐	☐	☐	☐	☐	☐
(125) diet soft drinks	☐	☐	☐	☐	☐	☐
(126) regular (non-diet) soft drinks	☐	☐	☐	☐	☐	☐
(127) beef or lamb or pork or ham or bacon	☐	☐	☐	☐	☐	☐
(128) chicken or turkey	☐	☐	☐	☐	☐	☐
(129) fish	☐	☐	☐	☐	☐	☐

(130) Are you a vegetarian? yes ☐ no ☐

(131) Are you dieting to lose weight now? yes ☐ no ☐

(132) Have you ever dieted to lose weight? yes ☐ no ☐

(133) During the past 6 months how important has your weight been in how you feel about yourself?

☐ not very important ☐ a bit important ☐ fairly important ☐ very important

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How often.....

	never	rarely	sometimes	often	very often
(134) if you see others eating do you also want to eat?	☐	☐	☐	☐	☐
(135) do you feel more like eating when you are emotionally upset (fed up/depressed)?	☐	☐	☐	☐	☐
(136) do you feel more like eating when you are anxious, worried or tense?	☐	☐	☐	☐	☐
(137) do you deliberately eat less in order not to become heavier?	☐	☐	☐	☐	☐
(138) if food smells and looks good do you eat more than usual?	☐	☐	☐	☐	☐
(139) do you deliberately eat foods that are slimming?	☐	☐	☐	☐	☐
(140) if you have something delicious do you eat it straight away?	☐	☐	☐	☐	☐
(141) if you walk past a snack bar or a cafe do you have the desire to buy something?	☐	☐	☐	☐	☐
(142) do you try to eat less at mealtimes than you would like to eat?	☐	☐	☐	☐	☐
(143) do you refuse food or drink offered because you are concerned about your weight?	☐	☐	☐	☐	☐
(144) do you feel more like eating when you are cross?	☐	☐	☐	☐	☐
(145) do you feel more like eating when things are going against you or have gone wrong?	☐	☐	☐	☐	☐

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H: Activities

(146) Do you usually take part in any sports or other physical activities on Saturdays?

yes ☐ no ☐

(147) Do you usually take part in any sports or other physical activities on Sundays?

yes ☐ no ☐

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(148) After school, how much time do you usually spend watching television or videos, playing video games or playing on the computer?

☐ none ☐ up to 1 hour ☐ up to 2 hours ☐ up to 4 hours ☐ more than 4 hours

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(149) At the weekend how much time do you usually spend watching television or videos, playing video games or playing on the computer?

On Saturday?

☐ none ☐ up to 2 hours ☐ up to 4 hours ☐ up to 7 hours ☐ more than 7 hours

And on Sunday?

☐ none ☐ up to 2 hours ☐ up to 4 hours ☐ up to 7 hours ☐ more than 7 hours

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(150) How much of your free time do you spend doing things which are physically active?

(e.g riding a bicycle, running around, dancing, sports, playing active games)

☐ all or most ☐ quite a bit ☐ a little ☐ none

---

(151) How many of the past 7 days did you do...

(a) hard exercise
or physical activities for
at least 20 minutes that made you sweat and breathe hard.
(e.g. football, running, swimming)

☐ 0 days
☐ 1 day
☐ 2 days
☐ 3 days
☐ 4 days
☐ 5 days
☐ 6 days
☐ 7 days

(b) moderate exercise
or physical activity for
at least 30 minutes.
(e.g. fast walking, cycling)

☐ 0 days
☐ 1 day
☐ 2 days
☐ 3 days
☐ 4 days
☐ 5 days
☐ 6 days
☐ 7 days

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(152) How many of the past 7 days did you do...

(a) exercises to strengthen or tone your muscles
(e.g. push-ups, sit-ups or weight lifting?)

- ☐ 0 days
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

(b) stretching exercises
(e.g. toe touching, knee bending or leg stretching?)

- ☐ 0 days
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

---

(153) In an average week when you are in school, on how many days do you go to physical education (P.E.) classes or games?

☐ 0 days ☐ 1 day ☐ 2 days ☐ 3 days ☐ 4 days ☐ 5 days

---

(154) During an average physical education (P.E.) or games class, how many minutes do you spend actually exercising or playing sports?

- ☐ I do not take PE
- ☐ Less than 10 minutes
- ☐ 10 to 20 minutes
- ☐ 21 to 30 minutes
- ☐ 31 minutes to 40 minutes
- ☐ 41 minutes to 50 minutes
- ☐ 51 minutes to 60 minutes
- ☐ More than 60 minutes

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(155) During the past 12 months, on how many sports teams did you play? (Include any teams run by your school or community groups).

☐ 0 teams ☐ 1 team ☐ 2 teams ☐ 3 or more teams

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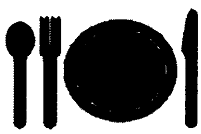
I: More about you...

Do you agree or disagree with the following statements?

	Strongly agree	Agree	Disagree	Strongly disagree
(156) On the whole, I am satisfied with myself	☐	☐	☐	☐
(157) At times I think I am no good at all	☐	☐	☐	☐
(158) I feel that I have a number of good qualities	☐	☐	☐	☐
(159) I am able to do things as well as most other people	☐	☐	☐	☐
(160) I feel I have much to be proud of	☐	☐	☐	☐
(161) I certainly feel useless at times	☐	☐	☐	☐
(162) I feel that I'm a person of worth, at least equal to others	☐	☐	☐	☐
(163) I wish I could have more respect for myself	☐	☐	☐	☐
(164) All in all, I am inclined to feel that I am a failure	☐	☐	☐	☐
(165) I take a positive attitude toward myself	☐	☐	☐	☐

(166) How often do you sit down with other members of your family to eat dinner or supper at home?

☐ Every day ☐ Most days ☐ Some days ☐ Never



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In the last six months did you...	never	less than once a week	about once a week	two or more times a week
(167) Weigh yourself? (do not include being weighed by researchers)	☐	☐	☐	☐
(168) eat an unusually large amount of food in a short space of time (binge eat)?	☐	☐	☐	☐
(169) feel that you cannot stop eating once you have started?	☐	☐	☐	☐
(170) make yourself sick after eating to avoid gaining weight?	☐	☐	☐	☐
(171) take laxatives (pills that make you go to the toilet) to avoid gaining weight?	☐	☐	☐	☐
(172) take water pills to avoid gaining weight?	☐	☐	☐	☐
(173) fast (starve) to avoid gaining weight?	☐	☐	☐	☐
(174) take diet pills to avoid gaining weight	☐	☐	☐	☐
(175) do extra exercise after eating to avoid gaining weight?	☐	☐	☐	☐

(176) In the past week how often did you eat something from a fast food restaurant **with an adult** (e.g. a parent or guardian)?
[fast food includes McDonalds, Burger King, KFC or similar]

- ☐ Never
- ☐ 1-2 times
- ☐ 3-4 times
- ☐ 5-6 times
- ☐ 7 times
- ☐ More than 7 times

(177) In the past week how often did you eat something from a fast food restaurant **without an adult** (e.g. a parent or guardian)?
[fast food includes McDonalds, Burger King, KFC or similar]

- ☐ Never
- ☐ 1-2 times
- ☐ 3-4 times
- ☐ 5-6 times
- ☐ 7 times
- ☐ More than 7 times

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Do you agree or disagree with the following statements:

	Strongly agree	Agree	Disagree	Strongly disagree
(178) I just eat the food I like and I don't worry about whether it's healthy or not	☐	☐	☐	☐
(179) People of my age don't need to worry about the food they eat	☐	☐	☐	☐
(180) I find healthy foods boring	☐	☐	☐	☐
(181) Unhealthy foods are the tastiest	☐	☐	☐	☐
(182) The food I eat could affect my health	☐	☐	☐	☐
(183) The food I eat could affect how I look	☐	☐	☐	☐
(184) The food I eat could affect my weight	☐	☐	☐	☐
(185) The food I eat could affect how well I do in sports	☐	☐	☐	☐
(186) The food I eat could affect how well I do in school	☐	☐	☐	☐

(187) How many servings of fruit and vegetables a day do you think experts are advising people to eat? (One serving could be, e.g. an apple or carrot) ☐

Do you think these foods are high or low in fat? (Tick ONE box for each food)

	High fat	Low fat	Not sure
(188) Pasta	☐	☐	☐
(189) Cheese	☐	☐	☐
(190) Bread	☐	☐	☐
(191) Sausages	☐	☐	☐
(192) Baked beans	☐	☐	☐
(193) Peanuts	☐	☐	☐

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J: About how you feel...

In the past week, how often were the following statements true for you?

	rarely or none of the time (less than 1 day)	some of the time (1-2 days)	a moderate amount of the time (3-4 days)	most or all of the time (5-7 days)
(194) I was bothered by things that ususally don't bother me	☐	☐	☐	☐
(195) I felt that I was just as good as other people	☐	☐	☐	☐
(196) I did not feel like eating; my appetite was poor	☐	☐	☐	☐
(197) I felt that I could not shake off the blues even with help from my family or friends	☐	☐	☐	☐
(198) I had trouble keeping my mind on what I was doing	☐	☐	☐	☐
(199) I felt depressed	☐	☐	☐	☐
(200) I felt that everything I did was an effort	☐	☐	☐	☐
(201) I felt hopeful about the future	☐	☐	☐	☐
(202) I thought my life had been a failure	☐	☐	☐	☐
(203) I felt fearful	☐	☐	☐	☐
(204) my sleep was restless	☐	☐	☐	☐
(205) I was happy	☐	☐	☐	☐
(206) I talked less than usual	☐	☐	☐	☐
(207) I felt lonely	☐	☐	☐	☐
(208) people were unfriendly	☐	☐	☐	☐
(209) I enjoyed life	☐	☐	☐	☐
(210) I had crying spells	☐	☐	☐	☐
(211) I felt sad	☐	☐	☐	☐
(213) I felt that people disliked me	☐	☐	☐	☐
(214) I could not "get going"	☐	☐	☐	☐

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K: About the future...

(215) Do you have access to the internet at home? ☐ yes ☐ no

(216) How many GCSE exams are you planning to take (include any which you have already taken)? ☐

(217) What grades are you predicted/expecting to get in your GCSE exams this year?

☐ mostly A* or A ☐ mostly A or B ☐ mostly B or C ☐ mostly C or D

☐ mostly D or E ☐ mostly E or F ☐ mostly F or G

(218)Do you think you will continue with school/college after the end of this year?
☐ yes, I think so ☐ no, I don't think so

(219) Do you think you will study for A-Levels?
☐ yes, I think so ☐ no, I don't think so

(220) Do you think you will study for vocational qualifications (e.g. HND, NVQ)?
☐ yes, I think so ☐ no, I don't think so

(221) Do you think you will go to university?
☐ yes, I think so ☐ no, I don't think so

L: More about you...

Here are some things people may say about themselves. How true are they for you?.

	not at all	a little true	somewhat true	pretty true	very true
(222) I can easily calm down when I am excited or "wound up."	☐	☐	☐	☐	☐
(223) If I get annoyed about something, I can get over it pretty quick.	☐	☐	☐	☐	☐
(224) I like to plan things way ahead of time.	☐	☐	☐	☐	☐
(225) When I promise to do something, I you can count on me to do it	☐	☐	☐	☐	☐
(226) When I have to wait in a queue, I do it patiently	☐	☐	☐	☐	☐
(227) I stick with what I'm doing until I'm finished with it	☐	☐	☐	☐	☐
(228) I usually think before I act.	☐	☐	☐	☐	☐
(229) I prefer to concentrate on one thing at a time	☐	☐	☐	☐	☐
(230) I usually sit still in class	☐	☐	☐	☐	☐

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	not at all	a little true	somewhat true	pretty true	very true
(231) I get my homework done as soon as I get home, so I can enjoy some free time later	☐	☐	☐	☐	☐
(232) I can control myself when I have to wait for something important	☐	☐	☐	☐	☐
(233) I can say "No" to a good time when I know there is work I have to do first	☐	☐	☐	☐	☐
(234) I am able to wait for things if I know my waiting will be rewarded	☐	☐	☐	☐	☐
(235) I can do boring work if I know it will pay off later	☐	☐	☐	☐	☐
(236) I am good at saving money rather than spending it straight away	☐	☐	☐	☐	☐
(237) If I get bored while waiting for something, I will think of something interesting	☐	☐	☐	☐	☐
(238) I plan ahead beacuse I am the one who decides what my future will be like	☐	☐	☐	☐	☐

Here are some things people may do when they have a problem at school or home, how much do you do these things?

	never	a little	sometimes	pretty often	usually
(239) I get as much information as I can	☐	☐	☐	☐	☐
(240) I think hard about what steps to take	☐	☐	☐	☐	☐
(241) I think about the choices before I do anything	☐	☐	☐	☐	☐
(242) I think of different ways to take care of it	☐	☐	☐	☐	☐
(243) I try different ways to solve the problem	☐	☐	☐	☐	☐
(244) I do something to try to solve the problem	☐	☐	☐	☐	☐
(245) I make an action plan and follow it	☐	☐	☐	☐	☐
(246) I tell myself 'Stop and think before you do anything'	☐	☐	☐	☐	☐

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Here are some things people may say about themselves. How true are they for you?.	not at all	a little true	somewhat true	pretty true	very true
(247) I have to be reminded several times to do things	☐	☐	☐	☐	☐
(248) I often have days when I find it difficult to do my school work	☐	☐	☐	☐	☐
(249) I am easily distracted from my school work	☐	☐	☐	☐	☐
(250) I like to switch from one thing to another	☐	☐	☐	☐	☐
(251) If I find that something is really difficult, I get frustrated and quit	☐	☐	☐	☐	☐
(252) I often do things without stopping to think	☐	☐	☐	☐	☐
(253) I am an impulsive person	☐	☐	☐	☐	☐
(254) I often talk quickly, before thinking things out	☐	☐	☐	☐	☐
(255) I often get involved in things I later wish I could get out of	☐	☐	☐	☐	☐
(256) I need to use a lot of self-control to keep out of trouble	☐	☐	☐	☐	☐
(257) I often get into trouble because I do things without thinking	☐	☐	☐	☐	☐
(258) I get carried away by new and exciting ideas, but I don't think of the possible problems	☐	☐	☐	☐	☐

Thank you very much for your help - we really appreciate it!

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RESEARCH PAPER

Vulnerability to smoking after trying a single cigarette can lie dormant for three years or more

J A Fidler, J Wardle, N Henning Brodersen, M J Jarvis, R West

Tobacco Control 2006;15:205–209. doi: 10.1136/tc.2005.014894

RESEARCH REPORT

doi:10.1111/j.1360-0443.2007.02086.x

Smoking status of step-parents as a risk factor for smoking in adolescence

Jennifer A. Fidler, Robert West, Cornelia H. M. van Jaarsveld, Martin J. Jarvis & Jane Wardle

Cancer Research UK Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, UK

Appendix V: Published paper (in press) based on data from Chapter 7.3

RESEARCH REPORT

doi:10.1111/j.1360-0443.2006.01613.x

Early dating predicts smoking during adolescence: a prospective study

Jennifer A. Fidler, Robert West, Martin J. Jarvis & Jane Wardle

Cancer Research UK Health Behaviour Unit, Department of Epidemiology and Public Health, University College London, London, UK

RESEARCH REPORT doi:10.1111/j.1360-0443.2007.01910.x

Does smoking in adolescence affect body mass index, waist or height? Findings from a longitudinal study

Jennifer A. Fidler, Robert West, Cornelia H. M. Van Jaarsveld, Martin J. Jarvis & Jane Wardle
Cancer Research UK Health Behaviour Unit, Department of Epidemiology and Public Health, University College London, London, UK

