

Marjaana Pennanen

School achievement, family factors and smoking prevention

A three-year follow-up of a smoking
prevention programme in Helsinki

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Marjaana Pennanen

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prevention programme in Helsinki**

ACADEMIC DISSERTATION

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Abstract

Marjaana Pennanen. School achievement, family factors and smoking prevention. National Institute for Health and Welfare (THL). Research 78/2012. 154 pages. Helsinki, Finland 2011.

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Cigarette smoking is one of the main preventable causes of premature death in the world. Adolescence is a significant period of risk in the progression of lifelong smoking behaviours. Although adolescent smoking has declined over the past decade in Finland, one in five 16 year-olds still smoke daily. Numerous studies indicate that adolescent school achievement is strongly related to smoking behaviour. Students who do better academically are less likely to smoke. Other significant factors impacting on adolescent smoking include the influence of parents and peers.

The aim of the present study was to examine the effects of a three-year smoking prevention programme on adolescent smoking in Finland and to increase the knowledge and understanding of the association between adolescent smoking, school achievement and family factors.

The data was drawn from the European Smoking prevention Framework Approach (ESFA) programme. This three-year, schools-based smoking prevention programme was carried out in six European countries: Denmark, Finland, the Netherlands, Portugal, Spain and the UK. In Finland, twenty seven upper comprehensive schools in the Helsinki area participated in the programme, based on a randomized control trial in which schools were randomly placed into treatment and control groups. The study took four measurements: one at the baseline when the adolescent started their seventh grade of comprehensive school, two more at the beginning of the eighth and ninth grades with the final measurement taking place when the adolescents completed their ninth grade. The number of participants was 1821 and the response rate was 65%.

This three-year, schools-based prevention programme prevented the onset of smoking. The effects of the programme did not differ according to the students' background characteristics, level of school achievement, parental smoking status, or best friend's smoking status. The strongest determinant of smoking was poor school achievement. Among ninth graders, adolescents who had poor grades smoked six times more than students with excellent grades. This relationship between smoking behaviour and school achievement is likely to be bi-directional. In other words, deterioration in school achievement and smoking uptake are both predictive of each other. The results also showed that at baseline, students with poor grades reported more favourable trends towards smoking, stronger social influence from peers and weaker refusal self-efficacy in respect to smoking. Moreover, during the study period, the self-efficacy outcome indicators decreased more among students with low grades compared to students with excellent grades.

Parental smoking and single parenting were related to adolescents' lower levels of school achievement. Additionally, school achievement deteriorated more among adolescents who lived with a single parent or had a smoking parent than those living with both parents or with non-smoking parents during the follow-up study. Initially,

no prominent associations between anti-smoking parental practices and parental smoking or single parenting were found. However, at the ninth grade a lack of smoking rules at home and a more lenient perceived parental punishment for smoking was related to both parental smoking and single parenting. The only preventative anti-smoking parental practice was implementing home smoking rules.

These results support the findings of earlier studies that social influence approaches, including a community component, may prevent an adolescent from smoking. Students with poor school achievement were at highest risk of the progression of regular smoking. They may be more vulnerable to smoking, since they have more people in their social environment who smoke and they may feel less able to resist the various temptations to smoke. It is suggested that future smoking prevention programmes should be based on social influence approaches, including refusal skills training. Moreover, future prevention programmes should include interventions for parents which focus on motivating smoking parents toward smoking cessation and toward upholding anti-smoking parental practices.

Keywords: smoking behaviour, adolescents, school achievement, smoking prevention, school- and community-based intervention, parental smoking, peer smoking, single parenting, anti-smoking parental practices

Tiivistelmä

Marjaana Pennanen. Koulumenestys, perhetekijät ja tupakoinnin ehkäisy. Terveyden ja hyvinvoinnin laitos (THL). Tutkimus 78/2012. 154 sivua. Helsinki, Finland 2011. ISBN 978-952-245-628-1 (printed); ISBN 978-952-245-629-8 (pdf)

Tupakointi aloitetaan usein nuorena, ja on yleistä, että tupakointia jatketaan nuoruudesta aikuisuuteen. Nuorena aloitettu tupakointi on useiden tutkimusten mukaan suuri terveysriski, se aiheuttaa useita sairauksia sekä työkyvyttömyyttä. Hyvin koulussa menestyvillä nuorilla on terveellisemmät elintavat kuin heikosti koulussa menestyvillä nuorilla. Ne nuoret, jotka menestyvät heikosti koulussa, aloittavat herkemmin tupakoinnin kuin ne nuoret, jotka menestyvät paremmin koulussa. Muita tärkeitä tekijöitä, jotka vaikuttavat nuorten tupakoinnin aloittamiseen, ovat vanhempien ja ystävien tupakointi.

Tämän tutkimuksen tavoitteena oli tarkastella Suomessa toteutetun kolmevuotisen tupakoinnin ehkäisyohjelman vaikutuksia nuorten tupakointiin sekä lisätä tietoa koulumenestyksen ja perhetekijöiden yhteydestä nuorten tupakointiin.

Tutkimuksessa käytettiin The European Smoking prevention Framework Approach (ESFA) – aineistoa. ESFA – ohjelma oli yläkouluissa toteutettu kolmevuotinen nuorten tupakoinnin ehkäisyohjelma, johon osallistui yhteensä kuusi maata: Alankomaat, Espanja, Iso-Britannia, Portugali, Suomi ja Tanska. Suomessa ohjelmaan osallistui 27 helsinkiläistä yläkoulua, jotka jaettiin satunnaisesti ohjelma- tai vertailukouluihin. Tutkimukseen kuului yhteensä neljä eri kyselymittauskertaa. Ensimmäinen toteutettiin, kun nuoret aloittivat yläkoulun ja seitsemännen luokan, kaksi seuraavaa kyselyä vuoden välein kahdeksannen ja yhdeksännen lukuvuosien aikana sekä viimeinen kysely yhdeksännen luokan keväällä. Yhteensä nuoria osallistui tutkimukseen 1821, ja vastausprosentti oli 65 %.

Tulosten mukaan tällä tupakoinnin ehkäisyohjelmalla pystyttiin ehkäisemään nuorten tupakoinnin aloittamista. Niillä nuorilla, jotka menestyivät huonosti koulussa, joiden vanhemmat tupakoivat tai paras ystävä tupakoi, oli suurempi todennäköisyys tupakoida yhdeksännellä luokalla muihin nuoriin verrattuna. Ohjelman vaikutukset olivat kuitenkin samansuuntaiset kaikilla nuorilla riippumatta siitä, miten he menestyivät koulussa tai tupakoivatko heidän vanhempansa tai ystävänsä. Heikko koulumenestys seitsemännellä luokalla ennusti vahvasti säännöllistä tupakointia yhdeksännellä luokalla. Tämän tutkimuksen mukaan huono koulumenestys ei ainoastaan ennustanut tupakointia vaan tupakointi myös ennusti koulumenestyksen heikkenemistä. Seitsemännellä luokalla yleisempää oli, että alle seitsemän koulukeskiarvon omaavat nuoret raportoivat useammin tupakoinnin hyvistä puolista, ystävien vaikutuksesta tupakointiin sekä heikommasta kyvykkyydestä kieltäytyä tupakoinnista verrattuna kiitettävän koulukeskiarvon oppilaisiin. Lisäksi kyvykkyys kieltäytyä tupakoinnista heikkeni tutkimuksen aikana enemmän niillä nuorilla, joiden koulukeskiarvo oli alle seitsemän verrattuna kiitettävän koulukeskiarvon omaaviin nuoriin.

Vanhempien tupakointi ja yksinhuoltajaperheessä asuminen olivat yhteydessä nuorten heikkoon koulumenestykseen ja koulumenestyksen heikkenemiseen tutkimuksen aikana. Ensimmäisessä kyselyssä eroja ei juuri löytynyt vanhempien tupakoinnin vastaisista toimista lastensa tupakointiin nähden riippumatta siitä, tupakoiko

vanhempi itse tai oliko hän yksinhuoltaja. Yhdeksännellä luokalla ne nuoret, joiden vanhempi tupakoi tai jotka asuivat yksinhuoltajaperheissä, raportoivat yleisemmin siitä, että heidän kodeissaan ei ollut tupakointikieltoa tai että heidän vanhempiensa rangaistuskäytännöt nuorten tupakointiin nähden olivat löystyneet. Kotien tupakointikiellolla oli ennaltaehkäisevä vaikutus nuorten vakituisen tupakoinnin aloittamisessa.

Tämän tutkimuksen tulokset tukevat sosiaaliseen vaikuttamiseen perustuvien koulu- ja yhteisöpohjaisten menetelmien tärkeyttä, kun nuorten tupakointia pyritään ehkäisemään. Heikosti koulussa menestyneet nuoret olivat suurimmassa vaarassa aloittaa tupakoinnin. Tähän syynä voidaan pitää muun muassa sitä, että heidän sosiaalisessa ympäristössään tupakointi on yleisempää ja eri sosiaaliset tilanteet tarjoavat enemmän mahdollisuuksia aloittaa tupakoinnin. Tulevaisuudessa olisikin hyvä pohtia sosiaaliseen vaikuttamiseen pohjautuvien tupakoinnin ehkäisyohjelmien käyttöä. Näissä ohjelmissa tulisi vahvistaa nuoren kykyä vastustaa tupakointiin tähtäävää sosiaalista painetta ja harjoitella kieltäytymistaitoja. Tärkeää olisi myös motivoida ja tukea tupakoivia vanhempia tupakoinnin lopettamiseen sekä antaa vanhemmille työkaluja tukea lastensa tupakoimattomuutta.

Avainsanat: tupakointi, nuoret, koulumenestys, tupakoinnin ehkäisy, koulu- ja yhteisöpohjainen ehkäisyohjelma, vanhempien tupakointi, ystävien tupakointi, yksinhuoltajuus, vanhempien rankaisukäytännöt lastensa tupakointiin nähden

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List of original papers

This thesis is based on the following original articles referred to in the text by their Roman numerals:

- I Erkki Vartiainen, Marjaana Pennanen, Ari Haukkala, Froukje Dijk, Riku Lehtovuori, Hein De Vries. (2007). The effects of a three-year smoking prevention programme in secondary schools in Helsinki. *The European Journal of Public Health*, 17(3):249–256.
- II Marjaana Pennanen, Ari Haukkala, Hein De Vries, Erkki Vartiainen. (2011). Longitudinal Study of Relations Between School Achievement and Smoking Behavior Among Secondary School Students in Finland: Results of the ESFA Study. *Substance Use & Misuse*, 46(5):569–579. Epub 2010 Sep 27.
- III Marjaana Pennanen, Ari Haukkala, Hein De Vries, Erkki Vartiainen. (2011). Academic achievement and smoking: Is self-efficacy an important factor to understand social inequalities in Finnish adolescents? *Scandinavian Journal of Public Health*, Nov;39(7):714-22. Epub 2011 Sep 5.
- IV Marjaana Pennanen, Erkki Vartiainen, Ari Haukkala. (2012). The role of family factors and school achievement in the progression of adolescents to regular smoking. *Health Education Research*, Feb;27(1):57-68. Epub 2011 Nov 2.

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Abbreviations

ESFA	European Smoking prevention Framework Approach
ASE	Attitudes, Social influence and self-Efficacy Model
SES	Socioeconomic Status
SPSS	Statistical Package for the Social Sciences
PASW	Predictive Analytics Software
AMOS	Analysis of Moment Structures
SA	School Achievement
SM	Smoking behaviour
OR	Odds Ratio
CI	Confidence Interval

1 Introduction

Cigarette smoking is a major public health concern. Tobacco is known to cause more preventable deaths than any other drug (Mathers et al., 2006). Numerous studies have found strong evidence that tobacco smoking influences physical diseases such as cancers (Stämpfli et al., 2009), diabetes (Patja et al., 2005) and cardiovascular diseases (Prescott et al., 1998; Taylor et al., 1998). According to the World Health Organization (WHO), tobacco kills over 5 million people each year worldwide (WHO, 2009) and in Finland about 4000 to 6000 smokers a year (EU, 2010). In Finland in 2010, some 23% of men and 16% of women smoked on a daily basis (Helakorpi et al., 2011). Ten years earlier these numbers were 28% and 20% respectively (Helakorpi et al., 2011). Most smokers begin and develop their smoking behaviour in adolescence (Brown et al., 1996), a major risk factor contributing to the progression of lifelong smoking behaviours (Gilman, et al., 2009). The latest figures from the Adolescent Health and Lifestyle Survey 2011 reveals that the prevalence of daily smoking among 16 year-old Finnish boys and girls is 19%. Ten years ago, 29% of boys and 31% of girls smoked daily (Raisamo et al., 2011).

According to social learning theory, adolescents are more likely to smoke if they associate with others who are smokers (Akers et al., 1996; Bandura, 1986). Evidence shows that parental smoking and peer smoking both have a particular impact on adolescent smoking (Conrad et al., 1992; Gilman et al., 2009; Kobus, 2003). It is not only parental smoking behaviour that influences adolescent smoking but also parental attitudes towards smoking and parental anti-smoking practices (Andersen et al., 2004; Henriksen et al., 1998; Jackson et al., 1997). Peer influence is associated with being a member of a group (Clasen et al., 1985) and adolescent smoking reflects choices about fitting in, social approval and popularity (Kobus, 2003). Moreover, family structure, such as living in single parent households, is a risk factor for adolescent smoking (Salami et al., 2000).

Some evidence shows that parental smoking (Hanson et al., 2007; Kalesan et al., 2006), single parenting (Salami et al., 2000) and permissive anti-smoking parental practices (Rainio et al., 2007; Ennett et al., 2001) are more prevalent in families with low socioeconomic status (SES). Moreover, associations between smoking-related cognitions and adolescent socioeconomic backgrounds have been found, indicating that students from low socioeconomic families experience stronger norms and social pressure towards smoking as well as weaker self-efficacy to refuse smoking when compared with students from high SES families (De Vries, 1995a; Mathur et al., 2008). Adolescents from low SES families more often have lower levels of school achievement compared to other adolescents (Sun et al., 2001). Low SES parents are more likely have low education levels themselves and possibly may not expect their children to do well in school as often as parents with high education levels (Campbell et al., 1991). School achievement has been shown to be a strong predictor of smoking behaviour (Bryant et al., 2000). Lower achievers are more likely to start smoking and at an earlier age

(Conrad et al., 1992), smoke more frequently and consume greater numbers of cigarettes (Jarvelaid, 2004) as well as quit smoking less often (Hu et al., 1998) than higher achievers.

Since the effect of social influence during adolescence is strong (Botvin, 2000), many smoking prevention programmes have focused on strengthen adolescents' knowledge and skills to resist social influence related to smoking. Social influence approaches have proved to be the most effective methods of preventing adolescent smoking (Cuijpers, 2002a; Flay, 2009). Social influence approaches contain information about smoking and address social norms, social modelling and pressure from peers and family members on smoking behaviour as well as teaching smoking refusal skills and encouraging students to make public commitments not to smoke (Thomas et al., 2006). A school- and community-based smoking prevention programme, the European Smoking prevention Framework Approach (ESFA), was developed based on social influence approaches (De Vries et al., 1998; De Vries et al., 1988). The ESFA programme used the Attitude, Social influence, self-Efficacy Model (ASE) as a theoretical framework which is based on various other psychological models such as the social learning theory of Bandura (Bandura, 1986), the model of reasoned action by Fishbein and Ajzen (Fishbein et al., 1975), the theory of planned behaviour (Ajzen, 1991) and the Prochaska's Transtheoretical Model (Prochaska et al., 1997), included social modelling and social pressure measurements (De Vries et al., 1998; De Vries et al., 1988). The ASE model was upgraded to I-Change Model (De Vries et al., 1998; De Vries et al., 1988) which addresses motivational and behavioural change (De Vries et al., 2003b). The ESFA programme was implemented over a period of three years in the Helsinki area.

The present study aims to outline the effects of the ESFA programme on smoking among Finnish adolescents. Moreover, a goal is to examine whether well known risk factors for adolescent smoking, such as poor school achievement, parental smoking and best friends' smoking predicted adolescents' subsequent smoking.

The relationship between smoking and poor grades is well studied but studies that explore the mechanisms between school achievement and smoking are lacking. It has not been fully explored whether there is a possible temporal order for these two concepts: adolescents' smoking behaviour and school achievement. Therefore, this study aims to examine the relationship between school achievement and smoking behaviour in longitudinal setting.

Furthermore, earlier studies have indicated that adolescents with low socioeconomic backgrounds perceived stronger norms and social pressure towards smoking as well as weaker self-efficacy to refuse smoking compared to students with high socioeconomic backgrounds (De Vries et al., 1995a; Mathur et al., 2008). School achievement is associated with adolescents' future socioeconomic status (Waldron et al., 1990), but to one's knowledge no studies that examine associations between smoking-related cognitive variables and school achievement exist. Therefore, the present study aims to examine the effects of smoking-related cognitions (attitude, social influence, self-efficacy and intention to smoke) in relation to school achievement.

In addition, previous studies show that adolescent smoking is more prevalent in single parent households (Otten et al., 2007), in families where parents smoke (Fergusson et al., 2007) and have lax anti-smoking practices (Andersen et al., 2004). Moreover, there is some evidence that children whose parents smoke or who live with a single parent may be at risk of making less academic progress (Charlton, 1996; Charlton et al., 1989a; Downey, 1994). Nevertheless, studies that examine the associations between parental smoking and school achievement as well as single parenting and school achievement are scarce. Therefore, this study aims to investigate how parental smoking and single parenting are related to adolescents' school achievement and anti-smoking parental practices as well as how these factors predicted later smoking.

2 Literature review

2.1 Adolescents' smoking

The prevalence of smoking among Finnish adolescents has been examined by two different surveys: the Adolescent Health and Lifestyle Survey (NTTT) and School Health Promotion Study (SHP).

The Adolescent Health and Lifestyle Survey monitors health and health behaviours in the adolescent population aged 12 to 18 years. It focuses on the use of tobacco products, exposure to environmental tobacco smoke, tobacco addiction, the use of nicotine replacement therapy products and the use of alcohol. The latest survey was conducted in 2011, to which a total of 4566 adolescents responded (47 %) (Raisamo et al., 2011).

The School Health Promotion Study (SHP) aims to strengthen the planning and evaluation of health promotion activities at the level of municipalities and schools. The study was launched in 1996 and the data is gathered biannually by a questionnaire in all 8th and 9th grades of upper comprehensive schools and 1st and 2nd grades of upper secondary and vocational schools. The age range of the respondents is 14 to 20 years. The latest survey was conducted in 2011, to which a total of 102,545 eighth and ninth graders responded (THL, 2011; Luopa et al., 2010).

2.1.1 Smoking experiments

The number of adolescents who have tried smoking has declined in recent years. The Adolescent Health and Lifestyle Survey (NTTT) reported that in 1983, 81% of males and 78% of females aged 16 years had tried smoking. By 2011, these proportions had decreased to 51% and 57% respectively. Among 18 year olds in 1983, some 87% of males and 80% of females had tried smoking. In 2011, the corresponding prevalence was 61% and 68% respectively (Raisamo et al., 2011) (Table 1).

2.1.2 Daily smoking

Daily smoking prevalence among adolescents decreased over the last decade in Finland. According to Adolescent Health and Lifestyle Survey (NTTT) in 1983, 27% of males and 23% of females aged 16 years reported smoking daily. In 2011 corresponding prevalence was 19% in both sexes (Raisamo et al., 2011). School Health Promotion Study reported that among 8th and 9th graders in 1999, 24% of the boys and 21% of the girls reported smoking daily. By 2011, daily smoking had declined to 17% and 14% respectively (THL, 2011; Luopa et al., 2010) (Table 2).

Table 1. Percentages (%) of adolescents who have tried smoking, 1995 to 2011, by age and sex

Age	NTTT							
	Boys				Girls			
	12	14	16	18	12	14	16	18
1983	45	66	81	87	24	60	78	80
1987	35	62	78	83	20	57	77	82
1991	42	67	80	85	24	63	78	84
1995	33	62	81	85	26	63	78	82
1999	30	60	78	83	21	64	81	83
2003	18	47	67	82	12	50	75	82
2007	16	33	58	74	10	39	63	75
2011	10	32	51	61	8	31	57	68

NTTT= The Adolescent Health and Lifestyle Survey

Table 2. Percentages (%) of adolescent smoking daily, 1983 to 2011, by age and sex

Age or grade	NTTT				SHP
	12	14	16	18	8 th and 9 th graders
Boys					
1983	1	15	27	34	-
1987	1	14	33	37	-
1991	1	14	32	36	-
1995	1	12	30	35	-
1999	0	12	28	34	24
2003	1	7	23	35	22
2007	0	5	20	28	16
2011	0	4	19	25	17
Girls					
1983	1	13	23	25	-
1987	0	10	28	32	-
1991	1	15	27	28	-
1995	1	13	26	28	-
1999	0	17	30	30	21
2003	-	11	29	35	20
2007	1	7	23	28	14
2011	0	6	19	23	14

NTTT= The Adolescent Health and Lifestyle Survey; SHP= The School Health Promotion Study

2.1.3 International comparisons of daily smoking

International comparisons of smoking prevalence - in which Finland has participated - have been conducted by two different surveys: The Health Behaviour in School-Aged Children (HBSC) and the European School Survey Project on Alcohol and Other Drugs (ESPAD).

The Health Behaviour in School-aged Children (HBSC) survey aims to increase understanding of young people's health and well-being, health behaviours and their social context. HBSC was initiated in 1982 by researchers from three countries and there are now 41 countries or regions included across Europe and North America. The latest survey was conducted in 2005-2006, to which a total of 204,534 adolescents aged 11, 13 and 15 responded (Currie et al., 2008).

In Table 3 the HBSC survey presents prevalence of daily smoking among 13 and 15 year olds in 26 countries or regions between 1997-2006. On average, 6% of both boys and girls aged 13 smoked on a daily basis. In 2005-2006, the corresponding prevalence was 3% and 4% respectively. In 13 countries or regions altogether, the prevalence of daily smoking among 13 year olds decreased between 1997 and 2006: Belgium, Canada, England, Finland, France, Greece, Germany, Greenland, Ireland, Norway, Scotland, Switzerland and USA. In Portugal and Sweden daily smoking decreased among boys but among girls it remained constant, in addition in Denmark daily smoking decreased among girls but among boys it remained constant. In Estonia and Russia, daily smoking increased slightly. The highest daily smoking prevalence in 2005-2006 can be observed in Russian boys 11%, and Greenlander girls 12%. The lowest daily smoking prevalence was in Norway, with boys 0% and girls 1%. Figures for 1997-1998 from Iceland, Italy, Malta, the Netherlands and Slovenia were not available (Currie et al., 2000; Currie et al., 2008) (Table 3).

On average, in 1997-1998, among adolescents aged 15 some 18% of boys and 20% of girls smoked on a daily basis. In 2005-2006 the corresponding prevalence was 13% and 14% respectively. Altogether, in 15 countries or regions, daily smoking decreased between 1997 and 2006: Austria, Belgium, Canada, Denmark, England, France, Germany, Greenland, Ireland, Norway, Portugal, Scotland, Sweden, Switzerland and USA. In Finland daily smoking decreased among girls but among boys it remained constant. In Estonia and in Russia daily smoking increased slightly. The highest daily smoking prevalence in 2005-2006 can be observed in Greenland, with boys at 30% and girls at 38%, and the lowest prevalence in the USA, with boys at 3% and girls at 4% (Currie et al., 2000; Currie et al., 2008) (Table 3).

In Finland in 1997-1998, among adolescents aged 13, some 7% of the boys and 8% of the girls reported smoking on a daily basis. In 2005-2006 the corresponding prevalence was 3% and 5% respectively. In 1997-1998, a higher daily smoking prevalence was found in five countries compared to Finnish boys: Canada, Germany, Greenland, Ireland and Latvia; and two countries compared to Finnish girls: Germany and Greenland. In 2005-2006, seven countries reported a higher daily smoking prevalence for boys: Austria, Estonia, Greenland, Latvia, Lithuania,

Malta and Russia; and four countries for girls: Greenland, Latvia, Malta and Russia (Currie et al., 2000; Currie et al., 2008) (Table 3).

Among Finnish adolescents aged 15 in 1997-1998, some 19% of the boys and 20% of the girls smoked daily. In 2005-2006, the corresponding prevalence was 19% and 15% respectively. In 1997-1998, a higher daily smoking prevalence was found in eight countries or regions compared to Finnish boys: Austria, Belgium, England, France, Germany, Greenland, Latvia and Russia; and nine countries or regions compared to Finnish girls: Austria, Canada, Denmark, England, France, Germany, Greenland, Norway and Scotland. In 2005-2006, five countries reported a higher daily smoking prevalence among boys: Estonia, Greenland, Latvia, Lithuania and Russia; and six countries or regions among girls: Austria, France, Germany, Greenland, the Netherlands and Scotland (Currie et al., 2000; Currie et al., 2008) (Table 3).

The European School Survey Project on Alcohol and Other Drugs (ESPAD) examines adolescent substance use in Europe from a comparative and longitudinal perspective. Data collections within the ESPAD project are conducted every fourth year. The first was carried out in the spring of 1995 and the fourth during the spring of 2007, to which a total of 5,043 adolescents responded (91%) (Hibell et al., 2007). In Table 4 the ESPAD project presents daily smoking at the age of 13 or younger across 23 countries between 2003 and 2007.

On average, 11% of the participants reported daily smoking in 2003. In 2007 the corresponding prevalence was 8%. The prevalence of daily smoking declined in 18 countries between 2003 and 2007: Austria, Belgium, Estonia, Finland, Germany, Greece, Iceland, Ireland, Latvia, Lithuania, The Netherlands, Norway, the UK, Portugal, Russia, Slovenia, Sweden and Switzerland. A small increase in daily smoking can be seen among Maltese boys.

In Finland in 2003, some 15% of both boys and girls reported smoking on a daily basis. In 2007, the daily smoking prevalence was 9% for boys and 7% for girls. In 2003, a higher daily smoking prevalence was found in five countries compared to Finnish boys: Estonia, Germany, Latvia, Lithuania and Russia, and four countries compared to Finnish girls: Germany, Greenland, Ireland and the UK. In 2007, five countries reported a higher daily smoking prevalence than Finland among boys: Austria, Estonia, Latvia, Lithuania and Russia, and eight countries for girls: Austria, Estonia, Germany, Ireland, Latvia, the Netherlands, the UK and Russia (Table 4).

Table 3. International comparison of daily smoking at the ages 13 and 15 by Health Behaviour in School-aged Children (HBSC) surveys 1997-1998 and 2005-2006 (%)

Country	Age 13				Age 15			
	Boys		Girls		Boys		Girls	
	1997/ 1998	2005/ 2006	1997/ 1998	2005/ 2006	1997/ 1998	2005/ 2006	1997/ 1998	2005/ 2006
Austria	5	4	3	4	20	17	26	22
Belgium	6	2	4	2	21	12	20	12
Canada	8	2	6	2	17	4	21	7
Denmark	3	3	4	2	15	10	21	10
England	7	3	8	5	21	9	24	13
Estonia	4	6	1	4	17	21	8	12
Finland	7	3	8	5	19	19	20	15
France	5	3	6	2	20	13	25	16
Germany	9	3	9	4	22	13	25	16
Greece	3	1	2	1	13	14	14	11
Greenland	19	7	29	12	45	30	56	38
Iceland	-	2	-	1	-	11	-	10
Ireland	8	3	6	3	19	14	16	15
Italy	-	2	-	2	-	14	-	14
Latvia	8	7	3	6	27	23	12	15
Lithuania	6	7	1	3	-	21	-	12
Malta	-	4	-	6	-	10	-	14
Netherlands	-	2	-	2	-	11	-	17
Norway	5	0	4	1	18	7	21	9
Portugal	3	2	2	2	13	5	10	8
Russia	7	11	3	11	20	22	14	15
Scotland	5	3	8	5	19	12	24	18
Slovenia	-	1	-	1	-	14	-	12
Sweden	2	1	2	2	10	4	16	6
Switzerland	3	2	4	1	17	11	17	10
USA	5	2	3	2	13	3	12	4

Table 4. Daily smoking at the age of 13 or younger. European School Survey Project on Alcohol and Other Drugs (ESPAD) in 2003 and 2007 (%)

	Boys		Girls	
	2003	2007	2003	2007
Austria	13	10	14	9
Belgium	10	4	9	6
Denmark	11	-	13	-
Estonia	21	17	13	8
Finland	15	9	15	7
France	-	7	-	7
Germany	18	9	19	11
Greece	4	3	4	1
Greenland	9	-	21	-
Iceland	9	4	9	5
Ireland	12	6	16	10
Italy	6	6	6	5
Latvia	19	16	10	8
Lithuania	19	10	7	4
Malta	5	6	8	6
Netherlands	10	5	14	8
Norway	10	5	12	6
UK	9	7	18	11
Portugal	8	5	10	5
Russia	18	12	13	10
Slovenia	7	6	7	5
Sweden	8	6	11	7
Switzerland	9	6	9	5

2.1.4 Adolescent smoking and school achievement

The link between school achievement and smoking behaviour is well studied (Bryant et al., 2000; Ellickson et al., 2001). The better students do academically, the less likely they are to smoke (Bryant et al., 2000; Young et al., 1986). Poor grades early on in life predicts strongly increased tobacco use at a later date (Bryant et al., 2000) and difficulties in quitting smoking (Chassin et al., 1996). Furthermore, other studies have indicated that onset of smoking may result in a decline in school achievement. Bryant et al. (2000) tested this bi-directional relationship between school achievement and smoking, among other indicators such as alcohol use, school bonding and misbehaviour. They argued that smoking might lead indirectly to poor school performance (Bryant et al., 2000). Moreover, Ellickson et al. (2001) showed that early smoking experimenters were at a higher risk of poor grades later on.

Some authors have presented comparisons of adolescent smoking between different school achievement groups. A study based on the California Youth Tobacco Survey conducted in 1990 demonstrated that among 12 to 18 year-old current smokers, some 5% belonged to much better than average school performance groups and some 31% to below average school performance groups. The odds of being a former smoker among students in the better than average group was 0.91 and in the below average group, the odds ratio was 0.26 (Hu et al., 1998). A more recent study based on The Northwest Ohio Youth Tobacco Survey conducted in 2003 showed that about 24% of the students with excellent (A) grades and 55% of students with poor (D or F) grades reported ever being smokers. The reported odds ratios revealed that the likelihood of ever being smokers was 3.02 times greater for D or F grade students than for A grade students (Khuder et al., 2008). Another American study based on the 2009 National Youth Risk Behavior Survey shows that among grade A high school students about 10% smoked daily. The corresponding prevalence for students with D or F grades was 45% (USDHHS, 2009).

European studies have also reported adolescent smoking based on different school achievement groups. Miller et al. (1996) studied young people aged 15 to 16 in the United Kingdom and stated that of students with above average grades some 20% reported smoking during the past 30 days, whilst the figure for students with below average school performance who reported smoking during the past 30 days was 44%. In their more recent study among the same study population, 62% of students with above average grades and 4% of students with below average grades indicated being never smokers (Miller et al., 1999). One Finnish study shows that of 12 to 14 year-old students who had poorer than average school achievement the odds of smoking (two or more cigarettes during their lifetime) among boys was 4.9 and for girls 5.9 times greater than students with much better than average school achievement (Doku et al., 2010).

2.2 Family and other factors related to adolescent smoking

A range of psychosocial factors have been the focus of several researchers since early studies showed the importance of these factors on adolescent smoking (Tyas et al. 1998; Cresswell et al. 1970). Previous evidence shows that such psychosocial factors that are conventionally related to adolescents smoking are: family factors, peer factors and personal factors (Tyas et al. 1998; Markham et al., 2004; Tucker et al., 2003).

2.2.1 Family influence and adolescent smoking

Interest in social influence on adolescent smoking has conventionally included family influence (Tyas et al., 1998). Social influences can be described as the processes whereby people directly or indirectly influence the thoughts, feelings and actions of others (De Vries et al., 1995b). Social influence constitutes social norms, modelling and perceived pressure (Markham et al., 2004). Social norms are

adolescents' expectations of people's reactions to specific behaviour and the support that they experience from others in carrying out a certain type of behaviour (De Vries et al., 1995b). 'Modelling' as a term denotes perceiving a prevalence of smoking among influential people and 'pressure' denotes an experience of direct pressure to smoke. Social influence can be direct (social norm and perceived pressure) or indirect (modelling) (Markham et al., 2004). Recently, contextual variables at the macro level, such as the influence of the neighbourhood, have also been shown to affect adolescent smoking (Backer et al., 2004).

Parental smoking

Several studies have shown that parental smoking has an impact resulting in a higher risk of smoking initiation (Gilman et al., 2009), escalation and the persistence of adolescent smoking (Baska et al., 2010; Can et al., 2009; Paul et al., 2008). However, not all studies agree. For instance, Conrad et al. (1992) reported that parental smoking did not consistently predict the onset of adolescent smoking and Kandel et al. (1995) found a significant effect only between mothers and daughters. Furthermore, studies with non-significant association can be found (de Leeuw et al., 2009; Avenevoli et al., 2003). A debate in the literature exists over whether the possible influence of parental smoking is consistent throughout adolescence. Some authors suggest that the influence of parental smoking on adolescent smoking declines over time, whereas peer influence increases (de Leeuw et al., 2009; Kandel et al., 1972; Mayhew et al., 2000) and others have argued that as children become older they may be more motivated to model their parents' smoking behaviour in order to help them feel like an adult (Otten et al., 2007).

Parents' smoking history, also former smoking, may be an important predictor of adolescent smoking (den Exter Blokland et al., 2004; Farkas et al., 1999; Otten et al., 2007). Parental smoking cessation may help lower the risk of adolescent smoking (Chassin et al., 2002). Some evidence can be found of links between the moment of parental smoking cessation and children's smoking behaviour which has suggested that parental cessation when the child is at an early age reduces the likelihood of adolescent smoking initiation (den Exter Blokland et al., 2004; Farkas et al., 1999). According to Otten et al. (2007) parental cessation before the child was born was the most preventive.

Several studies suggest that maternal smoking plays a greater role in adolescent smoking than paternal smoking (Kandel et al., 1995; Rainio et al., 2008; Scragg et al., 2007). However, some evidence can be found indicating that paternal smoking does influence adolescent smoking. Dusenbury et al. (1992) found a significant association between paternal smoking and adolescents' current smoking but not for experimenting. The authors stated that maternal smoking was significant for both. Another study suggests that paternal smoking plays a significant role for sons' but not for daughters' smoking and the authors stated that sons imitate their fathers' smoking and daughters their mothers' smoking (Loureiro et al., 2006). It is likely that smoking choices for single parents

more often affect the smoking behaviour of their daughters than sons, given that most single parents are actually single mothers (Loureiro et al., 2006).

Sibling smoking

When browsing studies that focus on the effects of siblings' smoking on adolescent smoking strong evidence supports the suggestion that siblings' smoking increases the likelihood of smoking among adolescents (Khuder et al., 2008; Oygard et al., 1995; Zhu et al., 1996). Some evidence can also be found that the impact of siblings' smoking was even stronger than parental smoking (Botvin et al., 1992). However, some evidence suggests that the impact of siblings' smoking disappears over time while that of friends' smoking remains (Oygard et al., 1995).

Sex difference may also be apparent when assessing siblings' influence on adolescent smoking. Wang et al. (1995) suggested that the risk of becoming a male smoker increased when an older brother smoked but not if an older sister did. Likewise risk of becoming a female smoker increased if an older sister were a smoker but not if an older brother was (Wang et al., 1995).

Parental anti-smoking practices

Parental attitudes and behaviour toward tobacco use are important social factors associated with adolescents' smoking (Komro et al., 2003). Findings within previous literature related to parental anti-smoking practices have supported the assumption that parental anti-smoking practices may protect an adolescent from smoking. Certain anti-smoking strategies, such as reacting constructively when parents find out that their child experiments with smoking, has a preventative effect on adolescent smoking initiation (Engels et al., 2004a). Moreover, parental anger and punishment have been found to be associated with a decreased likelihood of adolescent smoking maintenance (den Exter Blokland et al., 2006). A longitudinal study suggests that specific smoking conversations were associated with a lower likelihood of adolescents beginning smoking (Jackson et al., 1997). However, some divergent results can also be found. For instance, a study by Chassin and colleagues did not find an association between parental punishment and adolescent smoking escalation (Chassin et al., 2005) nor did another study uncover an association between smoking conversations and a lower likelihood of adolescent smoking (den Exter Blokland et al., 2006).

The importance of parents' opinions about smoking can be influential even if the parents themselves smoke (Castrucci et al., 2002). Nevertheless, there is a debate in the literature over whether parental anti-smoking actions towards their children's smoking is more relevant in reducing adolescent smoking than a parent's own smoking. Some authors have stated that even if parents smoke themselves they can have a positive impact on their children's smoking by engaging anti-smoking parental practices (Andersen et al., 2004; Henriksen et al., 1998; Jackson et al., 1997). However, these findings are not conclusive. Chassin et al. (2005) argue that smoking-related discussions were related to a lowered smoking

risk for adolescents of non-smoking parents but not adolescent children of smoking parents.

There is also some evidence that parents who smoke may project less anti-smoking socialization than parents in non-smoking households (Henriksen et al., 1998; Otten et al., 2008) or that smoking parents may produce more lenient anti-smoking actions as a result of their children experimenting with smoking than would non-smoking parents (Huver et al., 2007). Parents who smoke may not perceive themselves as having legitimate authority to regulate their child's smoking behaviour because they may not feel comfortable demanding behaviour from their children that is different from their own (Chassin et al., 2002). Therefore, they may relinquish their efforts to keep their children from smoking as they reach adolescence (Huver et al., 2007). A Dutch longitudinal study suggested that parents increased smoking related discussions with their children and anti-smoking house rules were decreased as a result of adolescent smoking increase (Huver et al., 2007). Moreover, Sargent and Dalton stated that during their follow-up study it became apparent that those students who perceived that their parents became more lenient were significantly more likely to become established smokers themselves (Sargent et al., 2001). Some authors have suggested that parents may change their practices not as a result of adolescent smoking but as a response to adolescents becoming older and being granted more autonomy (Huver et al., 2007; Steinberg, 1990) and therefore parents may anticipate and contribute to this more relaxed trend (Henriksen et al., 1998). Others have argued that some parents may believe that restrictive practices may stimulate their adolescents to rebel and so they underemphasise or loosen their parental practices so as not to worsen the situation (Engels et al., 2004a). Alternatively, parents who perceive anti-smoking practices as contradictory to their attempts to maintain a permissive relationship with their adolescent may altogether avoid practices that restrict their adolescents' behaviour (Henriksen et al., 1998).

There is some evidence in the literature that parental anti-smoking practices may also have negative outcomes. For instance, Ennett et al. (2001) suggest that parent-child communication may predict an escalation of use. Moreover, parental punishments related to smoking have been seen to increase the risk of smoking escalation among adolescents, although this phenomenon was only found among students who had parents who were smokers (Chassin et al., 2005).

Family socioeconomic status and living arrangements

Family socioeconomic status, including the parental education level, family income and parents' occupations, influence adolescents' smoking behaviour (Hanson et al., 2007; Sweeting et al., 2001). Adolescents in low socioeconomic status (SES) families tend to take up smoking more often than adolescents in higher SES families (Hanson et al., 2007).

One Finnish study has shown how parental education levels affect their offspring's smoking behaviour. Moreover, the effect of parental education was also mediated through the children's own education, which was strongly associated with their smoking (Kestilä et al., 2006). Low family income has been associated

with early cigarette smoking and delinquency (Blum et al., 2000). Income is inversely associated with smoking since those with low income more often smoke than those with higher incomes (Laaksonen et al., 2005). Previous studies suggest that people may smoke due to the stress caused by disadvantaged circumstances, such as low income resources (Stronks et al., 1997) with the consequence that smoking parents model smoking behaviour for their children (Hanson et al., 2007; Kalesan et al., 2006). Moreover, adolescents growing up in families under economic stress may be poorly supervised and often gain autonomy too early (Dornbusch et al., 1985). Unsupervised adolescents are more likely to smoke cigarettes and engage in risky behaviours (Richardson et al., 1993). In addition, some studies have suggested that adolescents in low SES families might experience more negative events (Mickelson et al., 2003) or depressive symptoms (Hanson et al., 2007; Wills et al., 2002), which may lead them to initiate smoking (Booker et al., 2008; Kim et al., 2009).

Family structure may have unfavourable outcomes leading to adolescents' smoking. For instance, the risk of smoking can be higher among adolescents whose parents have been divorced (Isohanni et al., 1991; Nikolakopoulos et al., 2008) and in single-parent families (Brown et al., 2010; Otten et al., 2007). Parents divorcing may be followed by further stress such as residential change and a deterioration in the economic situation (Sauvola, 2001). Obtaining tobacco from parents is potentially more common in single-parent families than in families with both biological parents (Rainio et al., 2009), as is a lack of a total smoking ban in homes (Rainio et al., 2007).

Neighbourhood deprivation is a significant independent predictor of smoking status (Kleinschmidt et al., 1995; Shohaimi et al., 2003). Authors have found several possible explanations for links between living in areas of deprivation and a greater likelihood of smoking. Smoking is more acceptable and more prevalent in deprived areas (Wang, 2001), and a lack of income may result in residents being less likely to venture beyond their neighbourhood social circles (Shohaimi et al., 2003). Disadvantaged physical environments (Shohaimi et al., 2003) and a lack of income resources (Stronks et al., 1997) may increase levels of stress and the usage of smoking as a stress reliever.

The links between low SES and adolescent smoking, however, are not completely congruent. Some studies have noted an inverse relationship between SES and adolescent smoking (Conrad et al., 1992; Tyas et al., 1998) or have failed to find support for this association (Flint et al., 1998; Paavola et al., 2004). Moreover, Paavola et al. (2004) suggest that family SES does not associate with adolescent smoking behaviour, instead it is the adolescent's own SES in their adulthood.

2.2.2 Peer influence and adolescent smoking

Peer influence is associated with being a member of a group (Clasen et al., 1985). A robust finding in the literature is the association between peers and adolescent smoking (Conrad et al., 1992; Kobus, 2003). In some cases, peer influence promotes smoking and in other cases it deters smoking (Kobus, 2003). Peers' and best friends' smoking (Kobus, 2003; Tyas et al., 1998) and boyfriend's or girlfriend's

smoking promote adolescent smoking (Kobus, 2003). Adolescent decisions related to smoking behaviour have been found to reflect predetermined choices about fitting in, social approval, popularity and autonomy (Kobus, 2003). Adolescents may alter their smoking behaviour in ways that conforms to their friends' smoking behaviour, including the number and frequency of cigarettes smoked (Kniskern et al., 1983; Kobus, 2003).

Some sex differences related to influence of peer smoking on adolescent smoking can be found (Hoving et al., 2007; Hu et al., 1995). Hoving et al. (2007) suggested that girls experiencing higher social pressure to smoke from friends were more likely to start smoking. Furthermore, Mercen et al. (2010) suggest that only girls are influenced to smoke by their peer group (Mercken et al., 2010). This phenomenon could be explained by the different friendship patterns of boys and girls. More often, girls have more intimate friendships than boys (Camarena et al., 1990), which could result in stronger peer influence for girls (Mercken et al., 2010).

There is also some evidence that adolescents tend to choose friends who have similar smoking habits to their own rather than change their smoking habits depending on their friends' smoking status (Engels et al., 2004b; Mercken et al., 2010). Hoffman et al. (2007) suggest that both social selection and social influence explain the similarities in friends' smoking behaviours, although peer influence was more salient than the peer selection. The results of another study indicate that adolescents who were initially non-smokers are more likely to become smokers if they belong to a smoking group and group members who change groups between phases were more likely to select groups with smoking behaviour congruent to their own (Go et al., 2010). A Dutch study examined the roles of social selection and social influence within reciprocal and non-reciprocal friendships. The authors suggest that within non-reciprocal friendships only social selection explains the similarities in smoking among friends, whereas within reciprocal friendships it is social influence as well as possibly also social selection (Mercken et al., 2007).

Results vary when showing whether parental or peer smoking has more influence on adolescent smoking. Some studies suggest that peers have a stronger influence (Hu et al., 1995; Rose et al., 1999) and some that parents have an influence at least as strong as peers (Bauman et al., 2001). The strength of the influence from parents and friends may depend on the quality of their social bond with the adolescents. Taking into account that adolescence is a period of increasing bonds with peers and possibly of weakening bonds with parents, smoking among friends might, on balance, have more influence on adolescent smoking behaviours (Flay et al., 1994).

2.2.3 Attitudes, self-efficacy and intention to smoke

According to Eagly et al. (1993), 'attitudes' represent the degree of like or dislike for an object. Attitudes are generally positive or negative views of a person, place, thing or event (Larson, 2007). Attitudes may be learned, they can be affected or driven by feelings and they may be indicators of future actions (De Vries et al.,

1986). Typically attitudes are combined with beliefs and behaviours. Beliefs represent what we have learned or come to know through experience and behaviours represent the actions that are taken or will take place (Eagle et al., 1993).

Attitudes, beliefs and behaviours should be related. A dislike of smoking would be associated with negative beliefs about smoking and negative intentions to smoke (Andrews et al., 1998; Markham et al., 2004; Tucker et al., 2003). However, sometimes these elements are not related. For example, a systematic review by Tyas et al. (1998) failed to find significant longitudinal associations between smoking attitudes and behaviours. In addition, some mixed results can be found based on sex differences. Carlton et al. (1989b) found associations between positive attitudes towards smoking and initiation of smoking amongst girls only, and Hoving et al. (2007) found this association only for boys. There is also some evidence that past smoking may affect subsequent attitudes, suggesting that adolescents who previously smoked developed less negative attitudes towards smoking. In other words, adolescents did not have positive attitudes towards smoking before its onset, but the attitudes changed to positive after initiation (de Leeuw et al., 2008). Clearly, the possible relationships between attitudes and behaviour are complex.

The concept of self-efficacy is based on Bandura's social cognitive theory (Bandura, 1997). Perceived self-efficacy is related to people's beliefs in their capabilities to practice control over their own functioning and over events that affect their lives (Bandura, 1994). Low levels of self-efficacy increases the likelihood of health risk behaviour (Bandura, 1989). In the literature there is some evidence that self-efficacy obtained from smoking can be a strong predictor of smoking behaviour but mainly via intention (De Vries et al., 1995b; Godin et al., 1996). Nevertheless, some evidence can be also found that self-efficacy can explain smoking behaviour directly (Godin et al., 1996).

Theories such as the theory of reasoned action (Ajzen et al., 1969) and the theory of planned behaviour (Ajzen, 1985) indicate that intention is a key factor in predicting a specific behaviour. Intention points out how hard people are willing to try and how much effort they are planning to put in, in order to perform the behaviour (Ajzen et al., 1980; Ajzen, 1991; Godin et al., 1996). Several studies have examined the intention to smoke cigarettes. Some studies have found that the intention to smoke is a significant predictor of subsequent adolescent smoking behaviour (Choi et al., 2001; McNeill et al., 1989; Stanton et al., 2005). While other studies show that the intention to smoke is associated with adolescents' current smoking (Jarvis et al., 1990; van Roosmalen et al., 1992) or it may be a predictor of the maintenance of smoking rather than the onset of smoking (Sussman et al., 1998).

2.2.4 Age and sex

The prevalence of adolescent smoking typically grows with increased age. Smoking initiation at an early age increases the risk of becoming a regular smoker (Escobedo et al., 1993) and of having difficulties in smoking cessation (Breslau et al., 1996). Previously, it has been assumed that if young adults reach their adult-

hood without smoking, the risk of smoking initiation is relatively small (USDHHS, 1994). However, some evidence shows that smoking initiation among young adults may be increasing (Haddock et al., 2005).

In the past, boys have smoked more in comparison to girls. The difference between the sexes in this respect has almost disappeared (Galanti et al., 2001) and in many western countries girls smoke more than boys (De Vries et al., 2006b). The understanding of the reasons behind these differences is limited (Amos et al., 2007). A literature review suggests that female smoking is associated with self-confidence, social experience and rebellion, whereas male smoking is associated with social insecurity (Clayton, 1991). Another literature review proposes that the increase in smoking rates among western girls probably includes such factors as focused advertising and concerns about weight control (Tyas et al., 1998).

2.3 Family, school and personal factors related to school achievement

Earlier studies indicate that a strong predictor of smoking is low levels of school achievement (Tyas et al. 1998). There is a growing body of literature that distinguishes psychosocial factors in terms of their influences over school achievement. Previous studies have commonly focused on three psychosocial factors that have been considered to be associated with adolescents' school achievement: family factors (Schnohr et al., 2009; Kohl, 2000), school factors (Akey, 2006; Baker, 1999) and personal factors (Alatupa et al., 2007; Akey, 2006).

2.3.1 Family influence and school achievement

There is some evidence of family socioeconomic status (SES) being associated with children's school achievement (Schnohr et al., 2009), education level (Mathur et al., 2008) and smoking behaviour (Schnohr et al., 2009). Children from low SES families tend to start smoking more often and achieve lower levels of school grades compared to children from higher SES families (Schnohr et al., 2009). The Coleman Report concluded that family background characteristics account for the majority of the variation in students' school achievement (Coleman, 1966).

Family SES is often measured by income, occupation and parental education (Winkleby et al., 1992). Lower levels of family income may lead to negative consequences for children's education such as a decline in the standard of living (Duncan et al., 1985), a shortage of educational goods and services (Downey, 1995) and an increased likelihood of living in an economically deprived neighbourhood (Pong, 1997). All of these may increase the risk of children's academic failure (Sun et al., 2001). Moreover, for adolescents from families who live in deprived areas, where smoking is more acceptable, the likelihood of smoking is increased (Wang, 2001).

Lower parental education increases both the risk of childhood adversities and parental smoking which in turn are associated with adolescent smoking (Kestilä et al., 2006). The literature also shows that parental education is an important predictor of children's school achievement (Klebanov, 1994). Luster et al. (1989) suggests that parents put greater emphasis on things they value for their children. Well educated parents often value high education for their children and emphasize supportive functions of parenting for their children's education (Campbell et al., 1991). Moreover, parents' beliefs and expectations for their children's education may influence their children's education (Fan et al., 2001). For instance, Alexander et al. (1994) suggested that parents with higher SES may have stronger beliefs and higher expectations for their children's education and these beliefs and expectations may influence higher levels of school achievement for their children. Conversely, parental supervision and monitoring has only a weak association with adolescents' school achievement (Fan et al., 2001), except for adolescents living with single parents (Coley et al., 1996).

Finnish education policy targets the promotion of educational equality by providing all population groups and regions of the country with equal educational opportunities (Malin, 2005). However, Finnish family SES (Malin, 2005) and parental education levels (Kärkkäinen, 2004) do predict the levels achieved by their children. In a report compiled by Statistics Finland, it is stated that although in general the education level has risen in Finland, children tend to choose education tracks similar to that of their parents (Myrskylä, 2009).

Family structure has a significant impact on children's educational attainment (Kim, 2004). Children of single parent families more often have lower levels of school achievement than children of two parent families (Miller et al., 1999; Salami et al., 2000). Children with single-parent families are more likely to perform more poorly on standardized tests, have lower education aspirations and have lower chances of graduating from high school than children with two-parent families (Downey, 1994; Finn et al., 1994; McLanahan, 1994). This may be explained by previous evidence suggesting that single parents may not have enough time to help children with homework and have a shortage of financial support for their children's education (Salami et al., 2000).

Fortunately, the association between family SES and their children's school achievement is not that unambiguous and some protective factors that influence this association have been found. Redding et al. (1991) indicate that potential limitations associated with poor economic circumstances can be overcome by parents who provide a stimulating and supportive living environment for their children. Moreover, Smith et al. (1995) stated that warm and supportive parenting can substantially diminish the risks related to poverty. In addition, quality parenting, the maintenance of structure, rules and expectations in the household with high monitoring of children may increase success at school among high-risk children and youths (Gizir, 2004; McLoyd, 1990; Peng, 1994). Furthermore, parents placing a high value on their children's schooling and high but realistic expectations for their children's education may also be a protective factor (Benard, 1991; Chao, 2000).

2.3.2 School factors and school achievement

Certain school-level factors have been suggested as particular influences on students' school achievement. For instance, strong leadership, an orderly atmosphere, an emphasis on basic skills and effective monitoring of students' achievement may positively affect students' levels of school achievement (Marzano, 2000). Moreover, caring and supportive relationships in school may have positive effects on academic attitudes and values leading students to be more satisfied with school (Akey, 2006; Baker, 1999; Skinner et al., 1993). Such students are likely to learn more (Akey, 2006; Bryk et al., 1988). Having high, clear and consistent expectations for students may also support their beliefs that their efforts will lead to better success (Akey, 2006; Gambone et al., 2004).

There is some evidence that teachers' subjective evaluations of students' school achievement may be influenced by the degree to which teachers see students as self-confident and obedient. Students who exhibit a better fit with the teacher's discipline expectations achieve higher grades, largely independent of their true intellectual abilities (Boehnke, 2008). There is also some evidence that the evaluation by teachers of their students' knowledge and skills can be influenced by students' background characteristics. Timperley et al. (2001) show that teachers from poor schools underestimated the knowledge and skills of the children they taught. Alvidres et al. (1999) state that students from high SES families were evaluated by their teacher more positively than their IQ tests indicated and students from low SES families more negatively. Furthermore, students from low SES families more often considered their school achievement to be average or below average and were less satisfied with school (Schnohr et al., 2009).

Previous studies indicate that students who do not meet the demands of the school system may not be simply passive percipients of negative stigmas (Van Laar et al., 2001). Instead, students with low school achievement may leave situations in which they are underrated and lower their social identity concerns in ways that lower their motivation to perform well at school (Derks et al., 2009; Van Laar et al., 2001). Adopting the behaviour and acceptance of their own group is a strategy for enhancing personal and social power (Unger, 2000) as is using social identity protecting strategies to attach their values to alternative values (Crocker et al., 1989), such as smoking. Little evidence exists relating to the relationship between stigmatization, school achievement and smoking. Stuber et al. (2008) argue that people with a higher education status are more likely to perceive smoker-related negative stigmas than individuals of lower education status. This would indicate that smoking is more acceptable for people in low education groups than people in higher education groups (Stuber et al., 2008).

There is some evidence in the literature that the differences in students' school outcomes can be dependent on which school they attend (Sellstrom et al., 2006). According to Malins' dissertation (2005) in Finnish schools, the variation between schools for students' outcomes is very small (less than 6 %). Malin suggested that small differences between the schools mean that the students' school performance (in reading) is largely unrelated to the schools they attend. This may largely be due

to the fact that Finland has a non-selective school system that provides all students with the same comprehensive schooling (Malin, 2005).

Friendships have been shown to be positively related to academic motivation and performance (Altermatt et al., 2003; Wentzel et al., 2004) and negatively related to behaviour problems in school (Poulin et al., 1999) as well as weak school achievement (Santor et al., 2000). As adolescents tend to choose friends who have similar smoking habits (Engels et al., 2004b; Mercken et al., 2010), so some children also prefer to affiliate with others who show the same level of engagement for school and they tend to select friends based on the same level of academic performance (Kindermann, 2007). Moreover, Buhs et al. (2001) suggested that children may be excluded from peer groups whose interest in school differs from their own.

Some evidence can be found in previous studies that peers may affect students' school achievement at the classroom level. For instance, Kang et al. (2007) suggest that classroom peers may be positively associated with a student's school achievement. This would indicate that for students with weak school achievement, their learning can be delayed by the presence of worst-performing students. Conversely, for students with strong school achievement, their learning can be improved by the presence of best-performing peers (Kang, 2007). Additionally, the study by Carman et al. (2008) found out that students at the middle of the ability distribution tend to benefit from better peers, whereas students at both ends do not.

2.3.3 Personal factors and school achievement

Personal factors, such as persistence, low impulsiveness, good concentration skills, low negative emotionality and positive mood are associated with good grades (Alatupa et al., 2007). Moreover, a high motivation for education and high self-esteem correlate with good grades (Alatupa et al., 2007). Students' positive attitudes towards school and positive attitudes towards their teachers are also associated with good grades (McCoach, 2002).

'Academic self-efficacy' can be described as a student's beliefs in their capabilities to organize and execute courses of action in order to attain designated types of educational performances (Zimmerman, 1995). Several studies have reported a positive association between academic self-efficacy and school achievement and therefore showed that academic self-efficacy is an important factor in successful learning (Bandura et al., 1996; Carroll et al., 2009; Greene et al., 2004). Moreover, according to one study from Austria, self-regulatory self-efficacy (personal norms when facing peer pressure) and social self-efficacy (a willingness to initiate behaviour in social situations) also have a direct relationship with school achievement (Carroll et al., 2009).

2.4 School-based smoking prevention programmes

Since 1970, schools have been considered a favourable place for focusing efforts on reducing youth smoking initiation and escalation. Almost all children and adolescents can be reached through schools and oftentimes smoking prevention programmes form a natural fit with existing school curricula (Thomas et al., 2006).

Over the years, several different theoretical curricula have been used for school-based smoking prevention programmes. Social competence models are based on Bandura's social learning theory (Bandura, 1977) and Jessor's problem behaviour theory (Jessor et al., 1977). The theory hypothesizes that children and adolescents learn smoking by modelling, imitation and reinforcement. In addition, the risk of smoking uptake is increased by poor self-image as well as poor personal and social skills. The theory uses cognitive-behavioural skills to enhance self-management, personal and social skills. These include goal setting, problem-solving and decision making, including cognitive skills to resist media and interpersonal influence (Botvin, 2000; Thomas et al., 2006).

Social influence approaches are based on McGuire's persuasive communications theory (McGuire, 1968) and Evans's theory of psychological inoculation (Evans, 1976). Social influence is the build-up of the modelling of smoking by peers, family, other adults and the media (Botvin, 2000). Social influence approaches include normative education methods and smoking resistance skills training. They contain information about smoking and high-risk situations, whilst increasing awareness of media, peers and family influence. Furthermore, they teach refusal skills and encourage students to make a public commitment not to smoke (Thomas et al., 2006). Multi-model programmes combine school curricula approaches within and beyond the school, including programmes for parents, schools, communities or state (taxation, sale, availability and use of tobacco) (Thomas et al., 2006).

The search protocol for the systematic literature review of school-based smoking prevention programmes presented here targeted randomized control trials addressing school-based smoking prevention programmes. These incorporated comparison groups that did not receive smoking prevention interventions. Studies published between January 2000 and December 2010 and studies addressing boys and / or girls under 18 years of age of any ethnic origin were included. Any peer-reviewed articles in the English language that drew on data regarding prevention programmes, randomizing, control conditions, students' smoking behaviour before and after the programmes were included. The search strategy identified one hundred and fifty three studies. After removing any studies that did not fully meet the criteria, twenty nine studies were perceived to be relevant. Their details are presented in Appendix A.

Overall, findings demonstrated that school-based smoking prevention interventions may be effective in reducing adolescents' smoking behaviour when comparing control groups. In particular, the evidence shows that the most effective prevention programmes are those that use social influence approaches. The social influence approaches contain information about smoking, peers and family influ-

ence, and they teach refusal skills and encourage students to make a public commitment not to smoke (Thomas et al., 2006).

In this review, from a total of seven studies that addressed programmes that exclusively used social influence approaches, six of them had a positive significant effect on adolescents' smoking (Botvin et al., 2001; Brown et al., 2002; Chou et al., 2006; Hamilton et al., 2005; Sussman et al., 2007). Three of the programmes achieved one-year post intervention positive results in smoking, indicating that adolescents in the intervention groups smoked less than in the control groups (Botvin et al., 2001; Hamilton et al., 2005; Sussman et al., 2007). These findings are consistent with those reported by others. Botvin and Griffin (2004) reviewed thirteen studies that focused on the findings of Life Skills Training (LST) programmes aimed at preventing adolescents' smoking behaviour, and of these, eight studies reported a reduction in adolescents' tobacco use. The programmes emphasized resistance skills training within the context of a general personal and social skills training model. Cuijpers et al. (2002b) reviewed twenty five studies and they argue that the smoking prevention programmes that are based on social influence approaches are the best we have. Flay (2009) reviewed seventeen studies and asserts that school-based smoking prevention programmes can have significant long-term effects if they are interactive with social influence or social skills programmes.

The results of the present review indicate that social influence approaches were in many studies combined with other approaches such as social competence models and community based interventions. Social competence models hypothesize that adolescents learn smoking by modelling and reinforcement. They use cognitive-behavioural skills to enhance self-management, personal and social skills (Botvin, 2000; Thomas et al., 2006). In the present review five programmes used both social competence and social influence approaches were found and two of them had a significant effect on adolescents' smoking (Botvin et al., 2003; Griffin et al., 2003). Four programmes that used solely social competence models were found and two of them managed to reduce smoking among the intervention group students more effectively than when compared to the control group students (Crone et al., 2003; Sussman et al., 2003).

Altogether, twelve programmes that included a multi-model component were found. Multi-model programmes typically include programmes for parents, schools and / or communities (Thomas et al., 2006). Eight out of these ten studies showed that intervention groups smoked less than control groups (Ellickson et al., 2003; Furr-Holden et al., 2004; Johnson et al., 2005; Josendal et al., 2005; Perry et al., 2009; Simons-Morton et al., 2005; Spoth et al., 2008; Vigna-Taglianti et al., 2009). Four of these eight programmes were combined with social influence approaches (Ellickson et al., 2003; Josendal et al., 2005; Vigna-Taglianti et al., 2009) and three of them with both social influence approaches and social competence models (Perry et al., 2009; Simons-Morton et al., 2005; Spoth et al., 2008). One study out of these eight studies used a multi-model programme combined with a social competence model (Furr-Holden et al., 2004).

Positive short-term effects are important. However, the true measure of success is the absence of smoking post-adolescence (Dobbins et al., 2008). Most studies

focus on younger age groups and did not follow adolescents until age 18 or older. Therefore, little evidence exists of the longer-term effects of the school-based prevention programmes.

The present review found only a few studies that reported longer-term results of programmes for adolescent smoking. Furr-Holden et al. (2004) report a seven-year post-intervention positive effect on smoking. The intervention used multi-model approaches combined with a social competence model. However, this study followed students only until the eighth grade (age 14) (Furr-Holden et al., 2004). Three more studies (Peterson et al., 2000; Sloboda et al., 2009; Sussman et al., 2003) reported two-year post-intervention results and one of these (Sussman et al., 2003) reported effect in adolescent smoking, after using social competence approaches. In their follow-up analyses, some of the participants were over 18 years of age; however, the effects of the programme are not shown separately for different age groups.

One study reported results from 18 months post-intervention, using the social competence model. This programme did not prevent smoking initiation or generate lower relapse rates among ex-smokers (Schulze et al., 2006). Six studies presenting results 12 months post-intervention, four of which showed that intervention groups smoked less than control groups (Ausems et al., 2004; Botvin et al., 2001; Hamilton et al., 2005; Sussman et al., 2007). Three of these four programmes used social influence approaches (Botvin et al., 2001; Hamilton et al., 2005; Sussman et al., 2007) and one used computer tailoring approaches (Ausems et al., 2004).

Searching for explanations as to why so few longer-term follow-up studies exist, some comments can be found. The lack of evidence is due to the great deal of effort that long-term follow-up studies require. Performing a long-term follow-up requires a great deal of necessary time and financial resources and only a few researchers are capable or willing to undergo such studies (Wiehe et al., 2005). However, there are some suggestions that short-term studies that have produced differences between intervention and control conditions would be more likely to maintain their effects compared to studies that failed to find positive effects. This possibility would suggest that many more existing prevention programmes may also be effective in reducing or preventing adolescents smoking over the longer-term (Skara et al., 2003).

Some studies were found in which a smoking prevention programme was implemented for students with low SES (Ausems et al., 2004; Botvin et al., 2001; Crone et al., 2003; Griffin et al., 2003). Three of these studies showed that intervention groups smoked less than control groups using social influence and social competence approaches (Ausems et al., 2004; Botvin et al., 2001; Griffin et al., 2003). However, little evidence overall exists of the effectiveness of smoking prevention programmes amongst economically disadvantaged adolescents. A methodological criticism against the studies that do has been that they have typically represented only a relatively small portion of a wider study (Botvin et al., 2001). An issue is how to develop curricula targeted at addressing issues relevant to low SES without labelling the participants as such and perpetuating undesirable stereotypes and discrimination (Johnson et al., 2005).

In thirteen studies, smoking prevention was part of a wider substance abuse prevention programme. These programmes not only focused on preventing tobacco use but either also alcohol or alcohol and drug abuse. Seven studies out of these thirteen programmes showed that intervention groups smoked less than control groups (Botvin et al., 2003; Botvin et al., 2001; Ellickson et al., 2003; Furr-Holden et al., 2004; Griffin et al., 2003; Spoth et al., 2008; Sussman et al., 2003). Six out of these seven programmes used social influence approaches solely or combined with multi-model or social competence approaches. There is some evidence that multiple substance prevention programmes may be more effective in preventing smoking than other substance use. This could be due to fact that these programmes often have a principal focus on smoking prevention (Paavola, 2006; Rundall et al., 1988).

Some programmes have used peer leaders to strengthen their effects. In this review three studies used peer leaders and had a positive effect on adolescent smoking (Brown et al., 2002; Perry et al., 2009; Vigna-Taglianti et al., 2009). This result is consistent with findings reported by Cuijpers (2002a). In addition, using booster lessons may also have a positive influence in terms of strengthening the effects of the programme (Ellickson et al., 2003; Furr-Holden et al., 2004; Spoth et al., 2008). However, controversial results can also be found (Muller-Riemenschneider et al., 2008).

In the present study the number of lessons or the length of the programme appears not to affect the results of the prevention programme. On the other hand, Flay et al. (2009) suggest that in order for programmes to achieve long-term effects they should include fifteen or more lessons over several years. It should be noted that in this present review not all studies offer exact details of numbers of lessons held or time period for the intervention. Therefore, it is difficult to study the relative influence of the intensiveness of smoking reduction programmes.

An important observation when comparing different smoking prevention programmes is that there was great variability in the selection and use of outcome measures. Moreover, the variability of the programme study designs and inadequate reporting within the resultant studies made it difficult to make accurate comparisons between programmes. In some studies, exact timelines for follow-up measurements were either difficult to find or absent and it was difficult to find information about randomization, as suggested by previous reviews (Cuijpers, 2002a; Skara et al., 2003). Moreover, as Flay et al. (2009) suggest, some studies did not adequately report student attrition and / or classification of the intervention approach. According to statistical analyses not all studies offer adequate information on statistical methods used and adjustment to proceed when conducting the analyses.

Furthermore, little information was provided to ascertain the quality and content of programming. Some studies failed to report the exact duration of the intervention. In addition, little information on booster programming could be found, as suggested by one previous review (Skara et al., 2003). Moreover, several studies did not adequately report whether the schools had adequate resources for programmes or whether the teachers or other group leaders had enough training, as suggested by previous reviewers (Cuijpers, 2002a).

The overall conclusion to draw from this literature review is that schools-based smoking prevention programmes may prevent adolescents smoking. Using social influence approaches appear to have some impact in terms of achieving a reduction in adolescent smoking. However, based on current evidence and multiple limitations this conclusion is still somewhat tenuous. In order to improve the knowledge of the effectiveness of smoking prevention programmes future longitudinal research is needed.

2.5 Summary of the literature review

The prevalence of adolescent smoking has declined in Finland. Two different surveys conducted in Finland have shown the same pattern (Rainio et al., 2011; THL, 2011; Luopa et al., 2010). The trend can be stated to be favourable; however, according to the Finnish Government Resolution on Health 2015 (a public health programme) there is still much to do. A key goal of the Resolution is to decrease daily smoking among 16 to 18 year-olds to 15% (Ministry of Social Affairs and Health, 2001). This would represent a reduction from the latest figures which demonstrate that among 16 year-olds 20% smoke on a daily basis (Raisamo et al., 2011).

Children from families of low SES more often have people in their social environment who smoke, such as parents (Hanson et al., 2007; Kalesan et al., 2006) and peers (Fergusson et al., 2007). They also more often live in single parent households (Salami et al., 2000) and live in disadvantage neighbourhoods (Kalff et al., 2001). In turn, these factors are associated with an increased risk of smoking (Fergusson et al., 2007; Otten et al., 2007; Wang, 2001). Previous studies suggest that people may smoke due to stress caused by disadvantaged circumstances, such as low income resources (Stronks et al., 1997) and smoking parents model smoking behaviour to their children (Hanson et al., 2007; Kalesan et al., 2006).

Children's circumstances affect their education (Blanden et al., 2005). Children of families with low levels of income (Sun et al., 2001) and low levels of parental education (Klebanov, 1994) as well as children of single-parent families (Miller et al., 1999; Salami et al., 2000) more often have poor grades than other children. Well educated parents often value high education for their children and emphasize the supportive functions of parenting toward their children's education (Campbell et al., 1991). Parents with higher SES may have higher beliefs and expectation for their children's education and these beliefs and expectations may influence higher levels of school achievement for their children (Alexander et al., 1994).

Evaluation of students by teachers can be influenced by the students' background characteristics (Timperley et al., 2001). Students from high SES families may be evaluated more positively than students from low SES families (Alvidrez et al., 1999). Students with low school achievement may leave situations in which they are underrated and lower their social identity concerns in ways that lower their motivation to perform well at school (Derks et al., 2009; Van Laar et al., 2001). To enhance personal and social power (Unger, 2000) students with poor

school achievement may use social identity protecting strategies and attach their values to alternative values (Crocker et al., 1989), such as smoking. Poor school achievement predicts lower education levels in adulthood (Koivusilta et al., 2003) and educational level is associated with smoking in adolescence and adulthood (Graham et al., 1999). Education influences adult SES (Bynner et al., 1997) with poor adult circumstances adding further to the risk of smoking in adulthood (Jefferis et al., 2003) and reducing the odds of smoking cessation (Graham et al., 1999).

Peer influence is associated with both adolescent smoking behaviour and school achievement. Adolescent decisions related to smoking behaviour have been found to reflect predetermined choices about fitting in, social approval, popularity and autonomy (Kobus, 2003). Adolescents may alter their smoking behaviour in ways that conform to their friends' smoking behaviour (Kniskern et al., 1983; Kobus, 2003) or choose friends who have similar smoking habits to their own (Engels et al., 2004b; Mercken et al., 2010). Similar mechanisms can also be found related to peer influence and school achievement. Spending time with lower achieving friends may influence a deterioration in the school achievement of higher achieving students (Kang, 2007). Evidence also shows that adolescents tend to select friends based on the same level of academic performance (Kindermann, 2007). It is likely that children's SES also plays a role in the peer influence and peer selection processes (Madarasova Geckova et al., 2005; Zambon et al., 2006). Children with similar socioeconomic backgrounds tend to spend time together and are influenced by their families' socioeconomic circumstances (Madarasova Geckova et al., 2005).

The association between childhood circumstances affecting adolescent smoking behaviour and school achievement is complex, and some protective factors that influence these associations can be found. Poor childhood circumstances may be overcome by parents who provide a stimulating and supportive living environment for their children (Redding, 1991). Maintaining rules and expectations in the household with high monitoring of children may increase success at school and protect adolescents from smoking (Castrucci et al., 2002; Gizir, 2004; Jackson et al., 1997; McLoyd, 1990; Peng, 1994). Furthermore, parents highly valuing their children's schooling and with high but realistic expectations for their children's education may also be a protective factor (Benard, 1991; Chao, 2000).

Moreover, there is some evidence that adolescents' positive attitudes towards schooling and their negative attitudes towards smoking may contribute to better success at school and prevent adolescents from smoking (McCoach, 2002; Tucker et al., 2003). Some studies have shown that a person's belief in their own competence is related both to school achievement and smoking behaviour. Academic self-efficacy is an important factor in successful learning (Bandura et al., 1996; Carroll et al., 2009; Greene et al., 2004) just as refusal self-efficacy may be a protective factor against smoking (Godin et al., 1996).

Various schools-based smoking prevention programmes have been implemented in order to reduce adolescent smoking. Some evidence can be found that schools-based smoking prevention programmes that use social influence approaches may be effective (Thomas et al., 2006). Social influence approaches

contain curricula for addressing smoking-related peer and family influences as well as training in refusal skills (Thomas et al., 2006). Social influence approaches are in many studies combined with other approaches such as social competence models and community based interventions. However, most of the programmes that managed to reduce smoking among adolescents reported only short-term results. This could be because performing long-term follow-up requires a great deal of time and financial resources (Wiehe et al., 2005). The current evidence supporting the effectiveness of schools-based smoking prevention programmes faces multiple limitations, such as variability of programme study designs and inadequate reporting.

In order to prevent adolescent smoking initiation and maintenance there is still more knowledge needed on the importance of family factors and school achievement influencing adolescent smoking. Particularly, the mechanisms lying behind school achievement in adolescent smoking have received little attention in previous literature. Moreover, to improve knowledge of the effectiveness of smoking prevention programmes, future longitudinal research is needed.

3 Aims of the study

The overall aim of the present study was outlining the effects of the European Smoking prevention Framework Approach (ESFA) programme on Finnish adolescent smoking and to increase the knowledge and understanding of the associations between adolescent school achievement and family factors on adolescent smoking.

The specific aims of the study were as follows:

1. To evaluate the effects of a long-term, school- and community-based smoking prevention programme (ESFA) on adolescent weekly smoking and how well-known risk factors (i.e. low school achievement, parental and peer smoking) predicted adolescents' subsequent weekly smoking.
2. To examine whether the relationship between school achievement and smoking behaviour was bi-directional.
3. To examine the effects of smoking-related cognitions (i.e. attitude, social influence, self-efficacy and intention to smoke) on school achievement.
4. To investigate how parental smoking and single parenting were related to adolescents' school achievement and anti-smoking parental practices as well as how these factors predicted subsequent weekly smoking.

4 Materials and methods

4.1 Study design and methods

The European Smoking prevention Framework Approach (ESFA) programme was based on the Attitude, Social influence, self-Efficacy Model (ASE) (De Vries et al., 1998; De Vries et al., 1988) as a theoretical framework. The ASE Model has been used to assess the determinants of various health behaviours (Brug et al., 1995; De Vries et al., 1998) and in determining predictors for smoking behaviour (De Vries et al., 1995b). The ASE-model subsumes various other psychological models such as the social learning theory of Bandura (Bandura, 1986), the model of reasoned action by Fishbein and Ajzen (Fishbein et al., 1975), the theory of planned behaviour (Ajzen, 1991) and the Prochaska's Transtheoretical Model (Prochaska et al., 1997), including social modelling and social pressure measurements (De Vries et al., 1998; De Vries et al., 1988).

The ASE model was integrated into the I-Change Model which addresses motivational and behavioural change. It asserts that an individual's health related behaviour is the result of their intentions and abilities (De Vries et al., 2003b). An individual's intentions can be explained by five stages of change: precontemplation (no intention to change), contemplation (awareness of a problem but no commitment yet to take action), preparation (intending to take action in the next month and having unsuccessfully taken action in the past year), action (modifying behaviour, experiences or environment in order to overcome problems) and maintenance (working to prevent relapse and persisting with new behaviour) (Prochaska, 1997).

According to I-Change Model intentions and abilities are determined by psychosocial determinants (motivation factors), such as attitudes, perceived social influences and self-efficacy expectations (De Vries et al., 2003b; Markham et al., 2004). Attitudes comprise the cognitive and emotional advantages and disadvantages of a specific behaviour, such as smoking (Bandura, 1994). Social influence includes social modelling, social norms and social support that are confronted when practicing that specific behaviour (Bandura, 1994). Self-efficacy is related to people's beliefs in their capabilities to practice control and to carry out a specific behaviour (Bandura, 1994).

In addition, the I-Change Model distinguishes four types of influence: psychological factors (e.g. parental and peer smoking), social and cultural factors (e.g. family structure, parenting style, socioeconomic position and school factors), behavioural factors (e.g. school achievement and lifestyle) as well as biological factors (e.g. sex and genetic predisposition) (Kremers, 2002). Based on the I-Change model, motivational factors are also defined by information factors (the quality of messages, channels and sources used) as well as awareness factors - which are

knowledge and risk perceptions of an individual's own behaviour as well as cues in their environment (Kremers, 2002, De Vries et al., 2003b) (Figure 1).

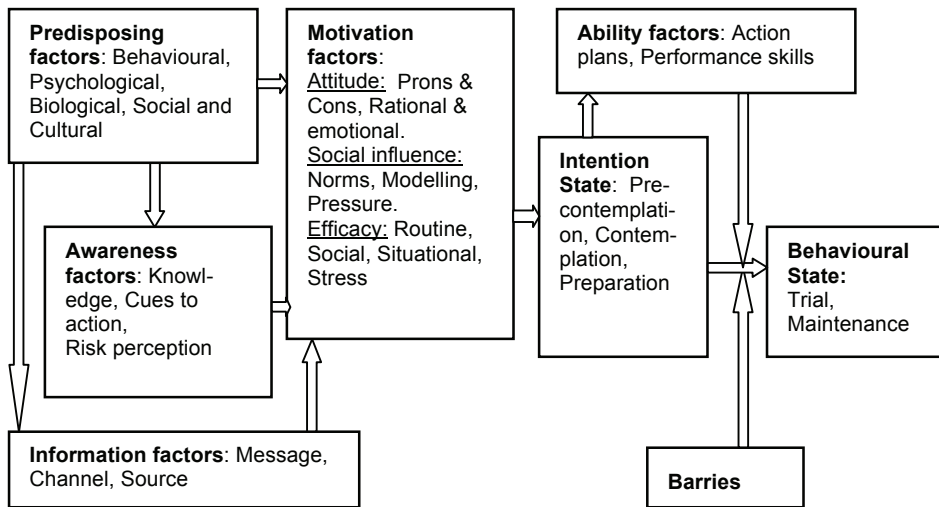


Figure 1. I-Change Model (De Vries et al., 2003b)

The ESFA programme was carried out in six European countries: Denmark, Finland, the Netherlands, Portugal, Spain and the UK. The programme's significant overall effect was found in relation to weekly smoking among those who were non-weekly smokers (students who smoked less than once a week) at the baseline (i.e. at the programme's first measurement).

A significant difference in weekly smoking was found in Portugal whilst borderline effects were observed in Finland and in Spain. In the Netherlands, the ESFA programme was effective amongst non-native adolescents. However, an opposite effect was found in native Dutch adolescents, with more new weekly smokers in the treatment group than in the control group (De Vries et al., 2006b).

At the final measurement, Denmark, Portugal, Spain and the UK reported higher situational self-efficacy in refusing smoking than adolescents from the control groups. Moreover, the treatment groups from the UK and Portugal reported significantly more negative intentions to smoke in the next year than did the respective control groups (De Vries et al., 2006b).

In Finland, twenty seven upper comprehensive schools in the Helsinki area participated in the study. It was based on randomized control trials in which the twenty seven schools were randomly divided into thirteen treatment groups and fourteen control groups. Data was collected four times altogether: once at the beginning of school years in 1998 (the 'baseline', seventh grade), then again in 1999 (eighth grade), once more in 2000 (ninth grade, autumn) and fourthly at the end of the third programme year in 2001 (ninth grade, spring). The number of partici-

pants in the baseline survey was 2816. Due to dropouts at seventh grade the number of participants was 2745 (97.5%), in the eighth grade it was 2430 (86.3%), at the beginning of the ninth grade 2188 (77.7%), and end of the ninth grade 1821 (64.7%) of the students took part. At each stage, the participants completed a questionnaire which was then available for analysis (Figure 2).

Intervention

The programme was implemented over a period of three years. It was launched when the adolescents began their seventh grade (age 13) and continued until they finished the ninth grade (age 16). The programme comprised fourteen information lessons about smoking, including refusal skills training. The students attended five lessons annually during the first and second years and four lessons during the third year. Smoking prevention was also integrated into mainstream subjects such as mathematics.

During the first and second years, students produced and displayed anti-smoking posters in public places and received newsletters in which young people described their ways of refusing to smoke (McAlister, 1995). Students also had opportunities to participate in no-smoking competitions. Teachers participated annually in two to three training days. These training days comprised information about the programme, smoking prevention and practical training for the lessons.

Parents were offered information about the programme and about adolescents' smoking by mail and in parental meetings. Parents who smoked were encouraged to participate in an annual Quit and Win contest. Church confirmation camps, in which most of the treatment group students participated, were included in the programme. Camp leaders were informed about the programme and trained to motivate students to complete anti-smoking activities during the camps, such as anti-smoking contests.

In the third year, school dentists, who hold regular two-minute dental appointments with students, informed them during their appointments of the hazardous effects of smoking on their teeth and gums (Figure 2).

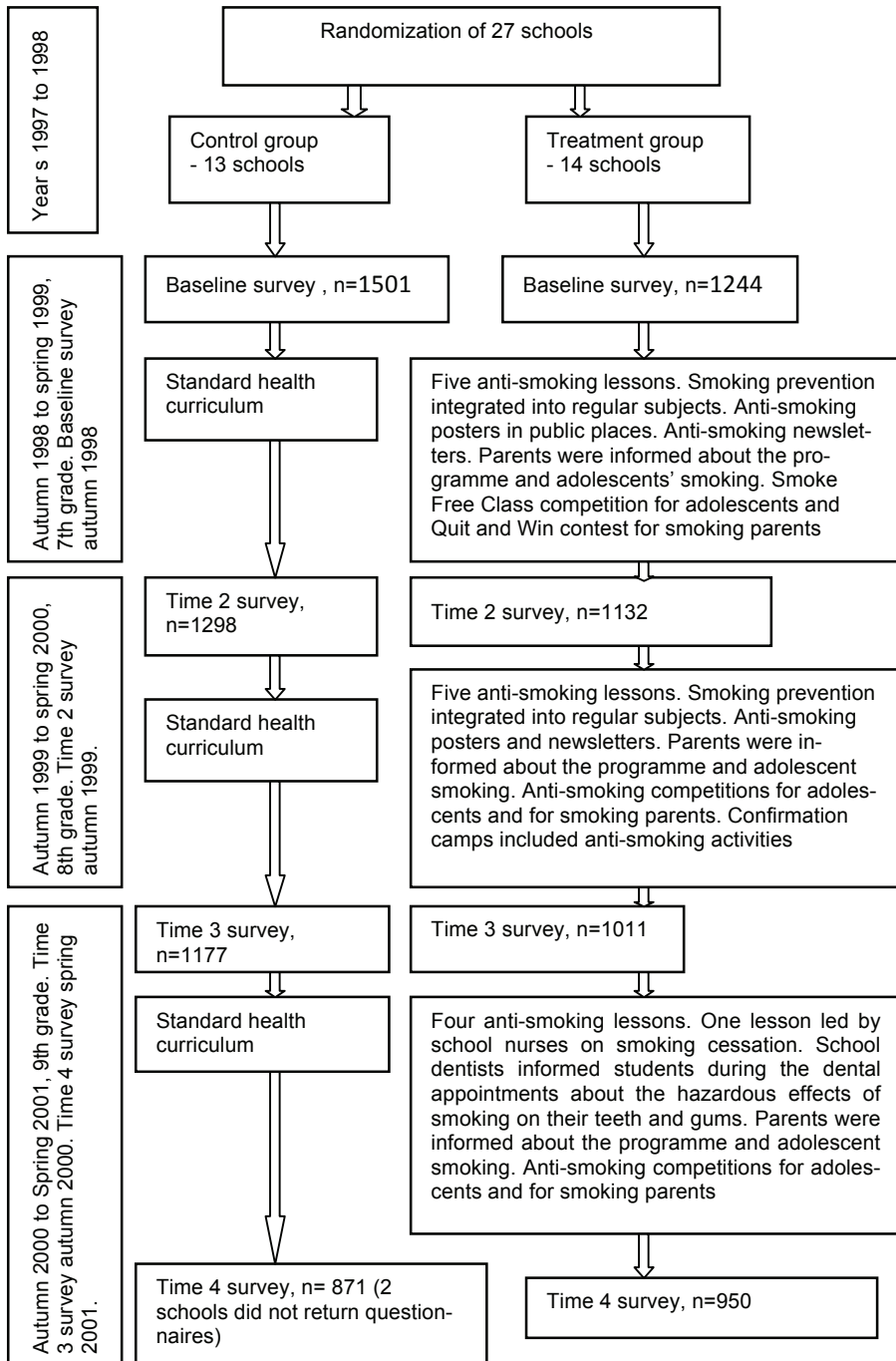


Figure 2. Programme flowchart

4.1 Study variables

A questionnaire was produced, based on a review of the literature (Vries et al., 2003a; Dijkstra et al., 1999). Students received these questionnaires in open, bar-coded envelopes, filled in the questionnaires during teacher-led lessons and put them in envelopes which had barcodes for students' identification. The envelopes were collected into a mail bag which was closed in the presence of the students and instantly mailed to the researchers (Vartiainen et al., 2007).

4.1.1 Smoking behaviour

The students were asked to indicate their smoking status by choosing one of the nine statements presented: 1) I smoke at least once a day, 2) I don't smoke once a day but at least once a week, 3) I don't smoke once a week but at least once a month, 4) I smoke less than once a month, 5) I have tried smoking once in a while, 6) I have quit after having smoked at least once a week, 7) I have quit after having smoked less than once a week, 8) I have tried smoking once in a while but I don't smoke anymore, and 9) I have never smoked a cigarette, not even a puff (De Vries et al., 2003a; De Vries et al., 2003b). Responses were cross validated using an algorithm, consisting of concepts measuring current smoking and lifetime smoking. In the case of incongruent answers, the adolescents were allocated the most unfavourable response. For example, if the adolescents reported being experimental smokers but indicated having smoked more than 100 cigarettes in their lives, the respondents were classified as regular smokers (De Vries et al., 2003a; Kremers, 2002).

For studies I, III and IV adolescents were classified as 1) weekly smoking (smoking at least once a week) and 0) non-smokers (never having smoked, having experimented with smoking but had quit experimenting, experimenting with smoking but not smoking weekly and those who had quit). For study I, classification for never smoking was as follows: 1) rest (all students who have at least tried smoking) and 0) never smoking (never having smoked, not even a puff).

For study II, the respondents' smoking status was recorded for the requirements of structural equation analyses with a 4-point scale: 1) not at all, 2) less than once a month, 3) at least once a month, 4) at least once a week. The 'not at all' category included all students who reported to never have smoked, not even a puff or to having quit. 'Less than once a month' included all who smoked once in a while, nevertheless less than once a month. Students who reported smoking 'at least once a month' included students who did not smoke weekly but at least once a month. Weekly smokers, including daily smokers, reported smoking at least once a week.

4.1.2 School achievement

Students were asked to state their last term's average grade score in each measurement. Based on adolescents' average grade they were categorised as follows: 1) 9-10; 2) 8-8.99; 3) 7-7.99; 4) 6-6.99; and 5) under 6. In studies I, III and IV,

grades were re-coded as follows: 1) 9-10 (excellent); 2) 8-8.99 (good); 3) 7-7.99 (satisfactory); and 4) under 7 (poor).

4.1.3 Family variables

Parental smoking status (Studies I and IV) was explored using four category-questions: 1) yes, my mother/father smokes; 2) no, my mother / father does not smoke; 3) I don't know; and 4) I don't have one/don't live at home, and recoded as: 1) both parents are non-smokers; 2) only father smokes; 3) only mother smokes; 4) both parents smoke. In study IV parental smoking status was re-coded as follows: 1) both parents are non-smokers; and 2) both or one of the parents smoke.

Single parenting was examined with four category-questions: Who lives together with you in your house: 1) my mother; 2) my father; 3) other female carer; 4) other male carer, and recoded as: 1) I live with two biological parents or one biological parent and one step parent; and 2) only a single parent lives with me.

Reporting of perceived anti-smoking parenting practices (Study IV) comprised three different constructs. Firstly, perceived parental punishment for smoking included two different questions: 1) would your parents be angry if they found out that you had smoked; and 2) would your parents punish you if they found out that you had smoked. Answers ranged from 1) they would not be angry with me / not punish me, to 5) they would be very angry with me / punish me a lot. These scores were totalled. Secondly, students were asked to state whether they were allowed to smoke in different places in their homes: 1) in their own room; 2) the living room; 3) the kitchen; 4) bathrooms and toilets; 5) the hall, corridor or staircases; and 6) outside in the garden, yard, garage or shed. Answers were divided into two groups: 0) students who may smoke in at least one of the six places; and 1) students who may not smoke in any of the six places. Thirdly, a variable related to parent-child communication was created asking students to indicate the frequency of discussions about smoking with their parents during the preceding year: 1) never to 6) often.

4.1.4 Smoking related cognitive variables

Smoking-related cognitions (Study III) in the study were the pros and cons of smoking, the social influence of peers and refusal self-efficacy. Attitudes towards smoking were measured against twelve items, creating a scale in which half were the advantages of smoking and half the disadvantages. The advantages of smoking were arranged as three seven-point scale items: +3 (much more) to -3 (much less); and three four-point scale items: +3 (a lot) to 0 (does not); such as: "If I smoke I am much more confident in company." The disadvantages of smoking were arranged as three seven-point scale items: +3 (very wrong) to -3 (very right); and three five-point scale items 3 (very bad) to -2 (not bad); such as: "If I smoke it is very bad for my health" (De Vries et al., 2006a).

The social influence of peers included two constructions: social norms of peers and peer pressure. Social norms of peers included seven-point items that included

friends' opinions on whether students should smoke or not: +3 (definitely should smoke) to -3 (definitely should not smoke); such as: "My best friend thinks that I definitely should smoke." Peer pressure was arranged as two five-point scale questions: 4 (very often) to 0 (never), such as: "Have you ever felt pressure to smoke from your friends?"

Twelve items on a seven-point scale measured self-efficacy: stress self-efficacy (four items on a seven-point scale measuring self-efficacy when stressed), social self-efficacy (four items on a seven-point scale about refraining from smoking in social situations) and situational self-efficacy (four items on a seven-point scale about refraining from smoking in various situations). For instance, students were asked whether they thought they are able not to smoke when they are with friends who smoke. These twelve items were answered with a seven-point scale +3 (I'm sure I won't smoke) to -3 (I'm sure I will smoke). Intention to smoke in the future included the question: "Do you intend to smoke in the future?" with responses in the range: +3 (definitely) to -3 (definitely not) (De Vries et al., 2006b).

4.1.5 Best friends' smoking

Best friends' smoking status (Study I) was explored using four category-questions: 1) yes, my best friend smokes; 2) no, my best friend does not smoke; 3) I don't know whether they smoke; and 4) I don't have one. These responses were re-coded as follows: 1) no, my best friend does not smoke; and 2) yes, my best friend smokes. Those students who did not know whether their best friend smoked or did not have one were re-coded as 1) no, my best friend does not smoke.

4.2 Statistical methods

Analysis of the ESFA programme's longitudinal effects on students' weekly smoking onset was conducted for baseline 'never smokers' (never having smoked, not even a puff) and for 'non-weekly smokers' (never having smoked, have smoked but do not smoke anymore, smoke less than once a week). Sex, school achievement, parental smoking and best friends smoking were added to the models to test whether these factors predicted onset of weekly smoking. Among baseline never smokers too few best friends' smoked, therefore, these analyses were not conducted. The analysis took place at the beginning of the eighth and ninth grades and again at the end of the ninth grade. Interaction terms between experimental condition and baseline variables: sex, students' school achievement, parental smoking and peer smoking were tested to explore whether the programme impacted differently according to the students' sex, school achievement, parental smoking or best friends' smoking when predicting adolescents' ninth grade weekly smoking. Analyses for baseline non-weekly smokers and interaction analyses were adjusted for baseline smoking behaviour. All analyses were conducted using logistic regression models by the SPSS programme. (I)

When testing the bi-directional relationship between current smoking behaviour and school achievement, all models were conducted using path analyses in AMOS 7.0. Modification indices were used to improve the models, using full information maximum likelihood estimation. Analyses were run using sex and experimental condition as grouping factors. Analyses included the first three measurements. To define the suitability of the models, four structural equation model fit indices were chosen for the study: The Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Akaike Information Criterion (AIC) and Root Mean Square Error of Approximation (RMSEA). TLI and CFI values close to 1, and AIC low scores according to the criterion, and RMSEA values 0.05 or less, indicate a good fit for the data (Arbuckle, 2008). (II)

Analyses using linear mixed models were conducted to determine differences in smoking-related cognitions (i.e. attitude, social influence, self-efficacy and intention to smoke) among varying school achievement groups. Differences in smoking-related cognitions based on students' school achievement at baseline point (the seventh grade) were run first, using linear mixed models. Moreover, the differences in change at three follow-up points (from the seventh grade to autumn of the ninth grade) were assessed using repeated linear mixed model analyses. Baseline weekly smokers were excluded and only the control group was used in analyses. Analyses were adjusted for sex and conducted using SPSS 17. (III)

Spearman's rank correlation coefficients were used to examine the associations between parental smoking and anti-smoking parental practices as well as single parenting and anti-smoking parental practices. To test how parental smoking and single parenting associated with changes in school achievement during the follow-up study, repeated linear mixed models were used. Multivariate logistic regression analyses were used to determine the effects of seventh grade parental smoking, single parenting, anti-smoking parental practices and school achievement in predicting ninth grade weekly smoking. Baseline weekly smokers were excluded from the analyses and only the control group was used in analyses. Analyses used the first three measurements. Sex was adjusted. All analyses were conducted using PASW 18. (IV).

In studies I, III and IV p-values less than 0.05 were considered significant and 95% confidence intervals are presented. Dropouts from the study were assessed using the logistic regression models and the results indicated that dropout was not associated with sex (OR 0.27, CI 95% 0.04-1.72), school achievement (OR 1.71, CI 95% 0.50-5.91), parental smoking (OR 1.22, CI 95% 0.17-8.95) or best friends' smoking (OR 0.22, CI 95% 0.03-1.54) when predicting ninth grade (spring) weekly smoking.

5 Results

The distributions of different variables used in the analysis are presented in Table 5. Table 5 shows that at the baseline the treatment schools included 45.4% of the students and 44.4% of them were boys. The participants' average age at the baseline was 13.8. Weekly smoking increased annually. At baseline, in the treatment group 7.5% of the students smoked weekly and in the control group 11.0%, by the ninth grade weekly smoking was 31.5% and 37.2%, respectively. Never smoking halved during the programme. At baseline, 60.8% of adolescents in both treatment and control groups reported never smoking, by ninth grade the proportion of never smoking was 28.3% in the treatment group and 27.9% in the control group. Weekly smoking was more frequent among control group students compared to treatment group students and more frequent among girls than boys.

At the baseline, 19.7% of the treatment group and 19.6% of the control group reported that both of their parents smoked whilst 23.6% and 22.7%, respectively, reported living with a single parent. Best friends' smoking increased annually. At the baseline, 12.6% of the treatment group and 15.0% of the control group reported having a best friend who smoked and by the ninth grade, the figure was 38.6% and 35.1% respectively (Table 5).

Table 6 shows the proportions of adolescent weekly smoking from the seventh grade to the end of the ninth grade arranged by: students' level of school achievement, parental smoking, single parenting and best friends' smoking. The results indicate that of students who had poor school grades in the ninth grade, 62.0% in the treatment group and 71.4% in the control group smoked weekly compared to students with excellent school grades of whom 11.0% and 12.3%, respectively, smoked weekly. Weekly smoking was more frequent among students whose parents smoked than among students with non-smoking parents and was also more frequent with students who lived with single-parent households compared to students who lived with two parents. A prominent difference can be observed in proportions of weekly smoking based on whether a best friend smoked or not. By the ninth grade, of students who were weekly smokers, 69.1% in the treatment group and 77% in the control group reported having a best friend who smoked (Table 6).

Table 5. Smoking prevalence, school achievement and demographic variables (%)

	Seventh grade		Eighth grade		Ninth grade (autumn)		Ninth grade (spring)	
	Treat	Cont	Treat	Cont	Treat	Cont	Treat	Cont
Valid cases N	1244	1501	1132	1298	1011	1177	950	871
Sex								
Total	45.4	54.6	46.0	54.0	45.7	54.4	51.2	48.8
Boys	44.4	55.6	44.3	55.7	43.2	56.8	48.9	51.1
Girls	46.4	53.6	47.7	52.3	48.1	51.9	53.5	46.5
Age (year)	13.8	13.8	14.8	14.8	15.7	15.8	-	-
Weekly smoking								
Total	7.5	11.0	17.0	22.8	27.8	35.3	31.5	37.2
Boys	7.1	8.8	15.2	19.1	25.8	32.0	29.0	34.0
Girls	7.9	13.7	19.0	27.2	29.8	39.3	33.8	40.7
Never smoking								
Total	60.8	60.8	45.9	44.3	32.7	31.1	28.3	27.9
Boys	59.4	60.4	47.2	46.9	35.5	33.0	32.0	31.3
Girls	62.3	61.4	44.5	41.2	29.7	28.7	24.7	24.2
School achievement								
Excellent	14.5	13.3	14.2	12.6	15.8	12.1	16.6	14.2
Good	47.8	44.2	41.6	41.2	36.8	36.7	33.9	31.4
Satisfactory	31.2	34.5	31.8	34.1	28.8	32.2	30.1	32.6
Poor	6.5	8.1	12.5	12.1	18.5	19.0	19.5	21.8
Parental smoking								
Non-smokers	46.9	49.8	48.0	50.6	51.5	52.2	51.5	51.1
Father smokes	19.7	18.5	20.5	19.1	18.4	16.9	18.8	18.0
Mother smokes	13.6	12.1	12.9	11.0	13.1	10.7	12.9	11.2
Both smoke	19.7	19.6	18.6	19.2	17.0	20.2	16.8	19.7
Single parenting	23.6	22.7	24.1	24.1	23.6	22.7	25.9	26.4
Best friend smokes	12.6	15.0	22.1	27.4	33.5	37.6	38.6	35.1

Treat=Treatment group; Cont=Control group; Father smokes: those families were only the father smokes; Mother smokes: those families were only the mother smokes; Both smoke: those families were both parents smoke

Table 6. Proportions of weekly smoking by: students' school achievement, parental smoking, single parenting and best friends' smoking (%)

	Seventh grade		Eighth grade		Ninth grade (autumn)		Ninth grade (spring)	
	Treat	Cont	Treat	Cont	Treat	Cont	Treat	Cont
Valid cases of weekly smokers	96	168	231	342	319	468	321	353
School achievement								
Excellent	2.3	3.1	4.7	9.0	9.1	11.3	11.0	12.3
Good	4.3	7.4	9.4	16.2	19.6	23.1	18.2	25.4
Satisfactory	12.3	14.7	25.8	25.1	34.8	41.6	42.8	39.6
Poor	22.1	31.0	48.0	60.6	54.2	63.5	62.0	71.4
Parental smoking								
Non-smokers	4.2	6.0	11.7	15.9	21.2	24.0	22.0	24.0
Father smokes	4.8	12.9	19.8	29.6	29.2	44.3	37.4	45.8
Mother smokes	8.1	17.9	26.7	27.5	39.6	46.2	47.5	57.4
Both smoke	18.1	18.1	29.9	35.0	41.1	49.5	49.7	54.4
Parenting								
Two-parent	5.5	10.0	15.6	20.2	25.2	32.5	28.1	34.4
Single-parent	12.4	12.4	25.8	31.6	38.5	43.9	41.8	46.9
Best friend smokes								
No	2.5	3.4	7.6	7.4	11.1	14.0	12.8	13.4
Yes	43.4	54.1	57.7	66.6	62.7	69.4	69.1	77.0

Treat=Treatment group; Cont=Control group; Father smokes: those families were only the father smokes; Mother smokes: those families were only the mother smokes; Both smoke: those families were both parents smoke

5.1 Effects of the ESFA study (I)

Logistic regression models were used in order to evaluate the long-term, school- and community-based ESFA smoking prevention programme's effects on adolescent weekly smoking. This included evaluation of how a group of well-known risk factors (i.e. low school achievement, parental and peer smoking) predicted adolescents' subsequent weekly smoking.

The results indicate that the ESFA programme had a positive effect on preventing weekly smoking initiation. A difference in weekly smoking initiation among baseline never smokers between the treatment and the control groups was found in the ninth grade (OR=0.63, CI 95% 0.45 to 0.90, $p<0.01$). Weekly smoking was associated with school achievement. This indicates that students with lower grades were more likely to smoke weekly (OR=1.87, CI 95% 1.49 to 2.35, $p<0.001$). Weekly smoking was more frequent among students whose parents were smokers (OR=1.95, CI 95% 1.23 to 3.10, $p<0.01$) and among girls than boys (OR=1.69, CI 95% 1.18 to 2.40, $p<0.01$) (Table 7).

Among baseline non-weekly smokers (who smoked less than once a week) the ESFA programme prevented weekly smoking initiation only until beginning of the ninth grade, autumn (OR=0.78, CI 95% 0.63 to 0.97, $p<0.05$) but not by the end of ninth grade (OR=0.86, CI 95% 0.67 to 1.10, $p>0.05$). Among baseline non-weekly smokers, ninth grade weekly smoking was related to low school grades (OR=2.24,

CI 95% 1.91 to 2.64, $p < 0.001$), parental smoking (OR=1.76, CI 95% 1.26 to 2.50, $p < 0.001$) and female gender (OR=1.70, CI 95% 1.31 to 2.20, $p < 0.001$) (Table 7).

When predicting ninth grade (autumn) weekly smoking, no statistically significant interactions between baseline variables and experimental condition were found: sex and experimental condition (OR=0.69, CI 95% 0.46 to 1.05), school achievement and experimental condition (OR=1.06, CI 95% 0.83 to 1.34), parental smoking and experimental condition (OR=0.79, CI 95% 0.54 to 1.17), best friends' smoking and experimental condition (OR=1.15, CI 95% 0.74 to 1.80). The similar results can be observed when predicting ninth grade (spring) weekly smoking: sex and experimental condition (OR=0.74, CI 95% 0.46 to 1.21), school achievement and experimental condition (OR=0.90, CI 95% 0.69 to 1.19), parental smoking and experimental condition (OR=0.95, CI 95% 0.63 to 1.54), best friends' smoking and experimental condition (OR=1.36, CI 95% 0.81 to 2.29). This indicates that the effects of the programme did not differ according to students' background characteristics, level of school achievement, parental or best friends' smoking.

Table 7. Weekly smoking from eight grade to ninth grade predicted by: seventh grade experimental condition, school achievement, best friend smoking, parental smoking and sex

	OR (CI 95%)	OR (CI 95%)	OR (CI 95%)
Weekly smoking among baseline never smokers	8 th grade (n=1402)	9 th grade (autumn) (n=1286)	9 th grade (spring) (n=968)
Control group (1)	0.41*** (0.25-0.66)	0.70* (0.51-0.95)	0.63** (0.45-0.90)
School achievement	2.28*** (1.74-2.98)	1.75*** (1.44-2.13)	1.87*** (1.49-2.35)
Parental smoking			
Non- smokers	1	1	1
Father smokes	1.20 (0.65-2.20)	1.48 (0.99-2.23)	1.85** (1.20-2.87)
Mother smokes	2.23* (1.18-4.20)	1.94** (1.20-3.11)	1.63 (0.95-2.78)
Both smoke	1.54 (0.85-2.77)	1.61* (1.06-2.45)	1.95** (1.23-3.10)
Sex (1=boy; qgirl=2)	2.63*** (1.65-4.18)	1.66** (1.21-2.30)	1.69** (1.18-2.40)
Weekly smoking among baseline non-weekly smokers	(n=2222)	(n=1992)	(n=1461)
Control group (1)	0.68** (0.53-0.88)	0.78* (0.63-0.97)	0.86 (0.67-1.10)
School achievement	2.10*** (1.80-2.45)	1.87*** (1.63-2.14)	2.24*** (1.91-2.64)
Best friend smokes	2.45*** (1.71-3.50)	2.20*** (1.54-3.15)	2.25*** (1.45-3.49)
Parental smoking			
Non-smokers	1	1	1
Father smokes	1.30 (0.93-1.82)	1.47** (1.10-1.95)	1.74*** (1.26-2.40)
Mother smokes	1.48* (1.01-2.18)	1.85*** (1.33-2.58)	1.69** (1.15-2.47)
Both smoke	1.61** (1.16-2.23)	1.71*** (1.29-2.28)	1.76*** (1.26-2.50)
Sex	1.91*** (1.47-2.48)	1.50*** (1.20-1.87)	1.70*** (1.31-2.20)

OR=Odds Ratio; CI=Confidence Interval; * P-value < 0.05; ** P-value < 0.01; ***P-value < 0.001; Father smokes: those families were only the father smokes; Mother smokes: those families were only the mother smokes; Both smoke: those families were both parents smoke. Analyses for baseline weekly smokers adjusted for baseline smoking behaviour

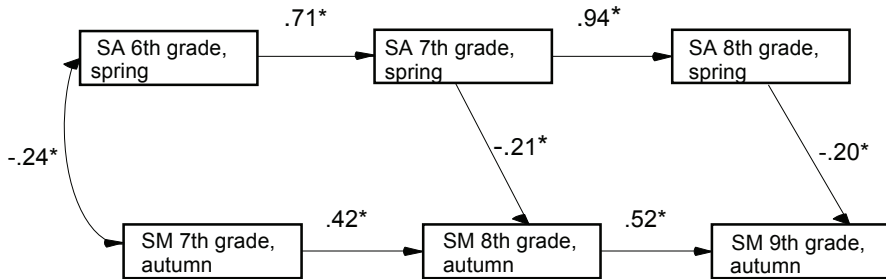
5.2 Association between school achievement and smoking behaviour (II)

To examine whether the relationship between school achievement and smoking behaviour was bi-directional, structural equation models were used with two separate models: A) Smoking behaviour-driven model and B) School achievement model. Model A aimed to explain whether smoking uptake was a predictor of poor school achievement over time. Model B sought to test whether a deterioration in school achievement was a predictor of the smoking uptake. Results revealed that model A (Chi-square=589.61, DF=12, $p<0.001$, CFI=0.951, AIC=673.61, TLI=0.827, RMSEA=0.083) or model B (Chi-square=339.12, DF=12, $p<0.001$, CFI=0.972, AIC=423.12, TLI=0.902, RMSEA=0.062) did not offer an acceptable fit for the data.

To enhance these two nested models, modification indices were used. The modification indices demonstrated need to add in model B a direct path from ‘smoking behaviour 7th grade (autumn)’ to ‘school achievement 7th grade (spring)’, and a path from ‘smoking behaviour 8th grade (autumn)’ to ‘school achievement 8th grade (spring)’. These suggested modulations were added and the final model was completed (Chi-square=37.53, DF=8, $p<0.001$, CFI=0.997, AIC=129.53, TLI=0.987, RMSEA=0.023). All standardized path coefficients were statistically significant at the 0.001 level (two-tailed) (Figure 3).

The final model indicates that not only did a deterioration of school achievement affect smoking uptake, but also vice versa: the smoking uptake deteriorated school achievement over time. No differences were found between girls and boys or between treatment and control groups in the hypothesized models.

Model B School achievement model



The Final model

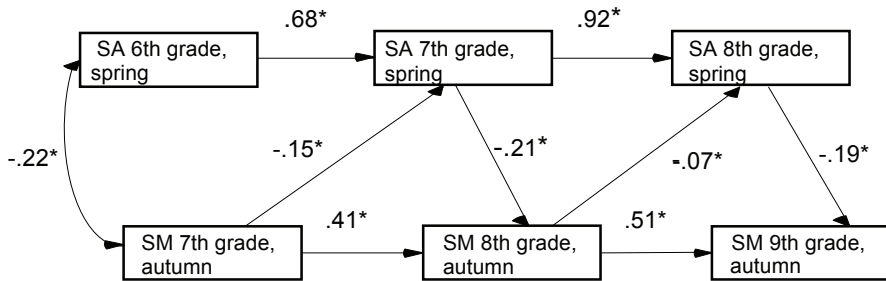


Figure 3. Model B and Final model. School achievement (SA): 1) under 5, 2) 5.00-5.99 3) 6.00-6.99, 4) 7.00-7.99, 5) 8.00-8.99, and 6) 9.00-10.00. Smoking behaviour (SM): 1) not at all, 2) less than once a month, 3) at least once a month, 4) at least once a week. *=regression weight is significantly different from zero at the .001 level (two-tailed)

5.3 Association between smoking-related cognitions and school achievement (III)

To examine the effects of smoking-related cognitions (i.e. attitude, social influence, self-efficacy and intention to smoke) on adolescent school achievement. Linear mixed models were used to assess baseline differences in smoking-related cognitions based on students' school achievement. Furthermore, repeated linear mixed models were used to examine whether any changes in smoking-related cognitions based on students' school achievement during the follow-up study could be found.

The results show that at the baseline students with poor grades reported more favourable trends towards smoking in: 'pros of smoking' (Coefficient =1.04, CI 95% 0.23 to 1.85, $p<0.05$); 'social norms of peers' (Coefficient=0.81, CI 95% 0.12 to 1.49, $p<0.05$); 'peer pressure' (Coefficient =0.56, CI 95% 0.25 to 0.86, $p<0.001$); 'stress self-efficacy' (Coefficient =-1.60, CI 95% -2.61 to -0.59, $p<0.001$); 'social self-efficacy' (Coefficient=-2.25, CI 95% -3.33 to -1.17, $p<0.001$); 'situational self-efficacy' (Coefficient=-1.68, CI 95% -2.38 to -0.97, $p<0.001$) and 'intention to smoke' (Coefficient=1.04, CI 95% 0.67 to 1.41, $p<0.001$) when compared to students with excellent grades. There were no statistically significant differences between 'cons of smoking' and different school achievement groups.

Moreover, Table 8 shows that during the study time, the self-efficacy outcome indicators decreased significantly among students with satisfactory and poor grades (all $p<0.05$) compared to students with excellent grades (Table 8). There were no significant differences between the different school achievement groups in any other tested smoking-related cognitions.

In order to correct the influence of smoking behaviour on these follow-up results, ninth grade smoking behaviour was added to the model. Significant changes could still be found among adolescents with satisfactory grades (vs. excellent grades) in: 'stress self-efficacy' (Coefficient=-0.92, CI 95% -1.58 to -0.26, $p<0.01$); 'social self-efficacy' (Coefficient=-0.74, CI 95% -1.37 to -0.10, $p<0.05$) and 'situational self-efficacy' (Coefficient=-0.73, CI 95% -1.19 to -0.27, $p<0.01$). Significant changes could also still be found among adolescents with poor grades (vs. excellent grades) in: 'stress self-efficacy' (Coefficient=-1.77, CI 95% -2.71 to -0.83, $p<0.001$); 'social self-efficacy' (Coefficient=-1.41, CI 95% -2.33 to -0.48, $p<0.01$) and 'situational self-efficacy' (Coefficient=-1.30, CI 95% -1.96 to -0.64, $p<0.001$).

Table 8. Results of the baseline and 24 –month follow-up for self-efficacy by different school achievement (SA) groups. Baseline weekly smokers excluded and sex adjusted

	Stress self-efficacy	Social self-efficacy	Situational self-efficacy
Coefficients (CI 95%)			
Baseline (n=1313)			
SA			
Excellent	0	0	0
Good	-0.30 (-0.99 to 0.39)	-0.49 (-1.25 to 0.28)	-0.28 (-0.76 to 0.20)
Satisfactory	-0.69 (-1.43 to 0.04)	-0.75 (-1.55 to 0.06)	-0.44 (-0.95 to 0.07)
Poor	-1.60*** (-2.61 to -0.59)	-2.25*** (-3.33 to -1.17)	-1.68*** (-2.38 to -0.97)
Follow-up (n=1096)			
SA			
Excellent	0	0	0
Good	-0.25 (-0.96 to 0.46)	-0.29 (-0.97 to 0.38)	-0.18 (-0.65 to 0.30)
Satisfactory	-0.94* (-1.68 to -0.20)	-0.77 * (-1.47 to -0.08)	-0.68** (-1.17 to -0.18)
Poor	-1.94*** (-2.96 to -0.93)	-1.41** (-2.39 to -0.44)	-1.33*** (-2.02 to -0.64)

* P-value < 0.05; ** P-value < 0.01; ***P-value < 0.001; SA=School achievement

5.4 Association between family factors, school achievement and smoking (IV)

To investigate how parental smoking and single parenting were related to adolescents' school achievement and anti-smoking parental practices, Spearman's correlation rank coefficients were used.

Cross-sectional correlations showed that at the beginning of the seventh grade, parental smoking was related to both adolescents' lower levels of school achievement ($r=0.16$, $p<0.001$) and lack of smoking rules at home ($r= -0.07$, $p<0.01$). Single parenting was associated with lower levels of school achievement ($r= -0.14$, $p<0.001$). At the beginning of the ninth grade, parental smoking was associated with parental punishment for smoking ($r= -0.14$, $p<0.001$) and lack of home smoking rules ($r= -0.16$, $p<0.001$) as well as adolescents' lower levels of school achievement ($r= 0.17$, $p<0.001$). Single parenting was also related to parental punishment for smoking ($r= -0.09$, $p<0.01$), lack of home smoking rules ($r= -0.13$, $p<0.001$) and adolescents' lower levels of school achievement ($r= 0.17$, $p<0.001$). Conversations at home about smoking were not associated with parental smoking or single parenting ($p<0.05$) (Table 9).

Table 9. Spearman's correlation rank coefficient matrix of the measured variables of seventh and ninth graders. Baseline weekly smokers excluded

	1	2	3	4	5	6	7	8	9	10	11
7 th grade											
1 PS	1										
2 SP	.14*	1									
3 PP	-.02	-.01	1								
4 HS	-.07*	-.05	.12*	1							
5 AC	.02	-.05	-.03	.00	1						
6 SA	.16*	.14*	-.01	.01	-.04	1					
9 th grade											
7 PS	.81*	.15*	-.02	-.09*	-.01	.17*	1				
8 SP	.14*	1.00*	-.01	-.05	-.05	.14*	.15*	1			
9 PP	-.08*	-.09*	.31*	.10*	-.02	-.18*	-.14*	-.09*	1		
10 HS	-.10*	-.13*	.08*	.20*	-.02	-.18*	-.16*	-.13*	.33*	1	
11 AC	-.02	.03	.02	-.02	.12*	-.02	-.03	.03	.06*	.00	1
12 SA	.16*	.18*	.04	.00	-.04	.77*	.17*	.17*	-.19*	-.23*	-.01

PS=Parental smoking; SP= Single parenting; PP= Parental punishment for smoking; HS=Home smoking rules; AC=Anti-smoking conversations; SA=Low school achievement; *=P-value < 0.05

To test how parental smoking and single parenting were related to changes in school achievement during the follow-up, repeated linear mixed models were used. These analyses showed that the deterioration of school achievement was greater among adolescents whose parents smoked (Coefficient=0.008, CI 95% 0.004 to 0.016, $p<0.01$) or who lived with a single parent (Coefficient=0.010, CI 95% 0.005 to 0.018, $p<0.01$) compared to those whose parents did not smoke or who lived with both parents.

Multivariate logistic regression analyses were used to determine the effects of seventh grade parental smoking, single parenting, anti-smoking parental practices and school achievement in predicting ninth grade weekly smoking. The analyses revealed that students who had at least one parent who smoked (OR=1.52, CI 95% 1.12 to 2.07, $p<0.01$) and had poor grades (OR=9.19, CI 95% 4.36 to 19.39, $p<0.001$) were more likely to smoke weekly after 24 months than were students whose parents did not smoke or who had achieved excellent school grades. Students' whose families had home smoking rules were less likely to smoke (OR=0.60 CI 95% 0.42 to 0.87, $p<0.01$). Nevertheless, perceived parental punishment against adolescents' smoking was positively related to adolescents' weekly smoking 24 months later (OR=1.09, CI 95% 1.02 to 1.18, $p<0.01$) (Table 10).

Table 10. Multivariate logistic regression analysis for ninth grade weekly smoking predicted by seventh grade parental factors and school achievement. Baseline weekly smokers excluded and sex adjusted

	OR	CI 95%	P-value
Parental smoking			
No	1		
Yes	1.52	1.12 to 2.07	0.008
Single parenting			
No	1		
Yes	1.32	0.92 to 1.90	0.129
Parental punishment for smoking	1.09	1.02 to 1.18	0.015
Home smoking rules	0.60	0.42 to 0.87	0.006
Conversations about smoking	1.02	0.91 to 1.14	0.770
School achievement			
Excellent	1		
Good	2.30	1.31 to 4.05	0.004
Satisfactory	3.67	2.04 to 6.59	<0.001
Poor	9.19	4.36 to 19.39	<0.001

OR=Odds Ratio; CI=Confidence Interval; Parental smoking: No=both non-smokers; Yes=at least one of the parents smoke

6 Discussion

6.1 Main findings

There were five main findings of this study. Firstly, the results revealed that the programme prevented the onset of weekly smoking among adolescents. No statistically significant interactions between high-risk factors (school achievement, parental smoking and best friend smoking) and the experimental condition were found, which indicates that intervention had similar effects on all students, including high-risk students.

Secondly, the results showed that the strongest determinant of progression of smoking behaviour was poor school achievement. Further analyses revealed that the relationship between smoking behaviour and school achievement is likely to be bi-directional, suggesting that deterioration in school achievement and smoking uptake are both predictive of each other during the first two years of upper comprehensive school.

Thirdly, the results indicate that seventh grade students with lower levels of school achievement reported more positive attitudes towards smoking, a stronger social influence from peers, weaker refusal self-efficacy and more intention to smoke in the future than students with excellent school achievement. During the follow-up period, lower achievers reported more negative changes in refusal self-efficacy than high achievers.

Fourthly, adolescents who had a parent who smoked or were from a single-parent family more likely realized lower levels of school achievement than those whose parents did not smoke or who lived with two parents. Living with a single parent and having a parent who smoked was also associated with substandard changes in school achievement during the follow-up period.

Finally, parents who smoked or were single parents tried to uphold anti-smoking practices. Yet, by the ninth grade, parents who smoked or were single parents were unable to maintain these practices as effectively as other parents.

6.2 Discussion of the findings

6.2.1 Effects of the ESFA study (I)

The aim was to evaluate the effects of a school- and community-based smoking prevention programme (the ESFA) on weekly smoking among adolescents and how student school achievement, parental smoking and best friend smoking can predict later weekly smoking. The results revealed that the programme prevented the onset of weekly smoking. The analysis included well-known high-risk factors

such as poor school achievement (Bryant et al., 2000), parental (Farkas et al., 1999) and best friend smoking (Tyas et al., 1998) indicating that the intervention influenced all students similarly regardless of their level of school achievement or parental or best friend smoking status.

These positive results show that this type of school- and community-based smoking prevention programme can prevent smoking initiation among all adolescents, including high-risk students. Several possible explanations for these positive results can be found in earlier studies. For instance, the ESFA programme used social influence approaches, including resistance skills training, which have achieved some positive long-term results in terms of adolescent smoking reduction (Biglan et al., 2000; Vartiainen et al., 1998). Moreover, the ESFA programme included a community component which may increase the effects of the smoking prevention programmes (Cuijpers, 2002a; Muller-Riemenschneider et al., 2008). Furthermore, to achieve an effective smoking prevention programme it is recommended to implement the programme adequately in schools and that teachers should be trained for the programme (Tortu et al., 1989). For the ESFA programme, all participating teachers were trained by taking part in two to three training days each year. Leaders of church confirmation camps were also trained for the programme, as well as school dentists who during dental appointments informed students about the hazards of smoking regarding teeth and gum health. Nevertheless, the programme did not influence smoking among students who had at least tried smoking by the baseline stage. Two control schools did not return their questionnaires to the researchers and the exclusion of these two control schools from the last measurement may have affected these results.

As previous studies have shown (Bryant et al., 2000), the present study also proposes that poor school achievement increases the likelihood of smoking onset. It is suggested by Pederson et al. (1997) that adolescents who have lower levels of school achievement may also have lower educational goals, which may influence their education level and socioeconomic level later in life (Koivusilta et al., 2003).

The result of our study raises great concern, since the odds ratio of becoming a weekly smoker was nine times greater among students who had poor grades than among those with excellent grades. Consequently, smoking is known to cause more preventable deaths than any other drug (Mathers et al., 2006). Numerous relevant studies have found strong evidence that tobacco smoking influences physical diseases such as cancer (Stämpfli et al., 2009), cardiovascular disease (Taylor et al., 1998), chronic bronchitis and emphysema (Patel et al., 2008) as well as hypertension (Turk et al., 2009) and diabetes (Patja et al., 2005). There is also growing evidence that active and passive smoking during childhood and adolescence produces significant immediate health problems such as cough, rhinitis and phlegm (Burr et al., 1999), an increase in the number and severity of respiratory illnesses (Lounsbury et al., 2009), decreased physical fitness (Flouris et al., 2008), an unfavourable lipid profile (Guedes et al., 2007) and potential retardation in the level of maximum lung function (Carta et al., 2007). To reduce health inequalities, reduction of high smoking prevalence among adolescents with lower levels of school achievement is an urgent public health goal.

Parental smoking was also associated with adolescent smoking. As in a previous study (Kandel et al., 1995), maternal smoking had a stronger influence on adolescent smoking than paternal smoking. This study is in line with previous studies, suggesting that being a female (Pinilla et al., 2002) and having a best friend who smoked (Kobus, 2003) increased the likelihood of adolescent smoking.

Based on earlier studies and the results of the present study, it is recommended that smoking prevention programmes should consider using social influence approaches including resistance skills training (Biglan et al., 2000; Vartiainen et al., 1998). Although the Finnish ESFA smoking prevention programme prevented adolescents' weekly smoking, it is uncertain whether it had any long-term effects on adolescent smoking. Therefore, to improve knowledge of the effectiveness of smoking prevention programmes, future longitudinal research is needed.

6.2.2 Association between school achievement and smoking behaviour (II)

The aim was to explain whether the relationship between school achievement and smoking behaviour was bi-directional. The results suggest that deterioration in school achievement and the smoking uptake continuum are both predictive of each other. The temporal order of the changes in these two variables has not been tested previously.

Previous evidence shows that students who experience academic failure may feel less commitment to school and may form attachments to delinquent peers who enhance substance use, school misbehaviour and delinquents acts. Truancy and school misbehaviour are found to be predictors of cigarette use (Diem et al., 1994; Bryant et al., 2000). In turn, smoking initiation and other associated behaviours may also influence in school misbehaviour and decrease in school achievement by being part of risky health behaviours that set the stage for ongoing school-related problems (Bryant et al., 2000). Bryant et. al. (2000) tested relationship of school achievement and smoking with other indicators (alcohol use, school bonding and misbehaviour). The results of these analyses showed that poor grades predicted later tobacco use, and that smoking might lead indirectly to poor school performance (Bryant et al., 2000). It is also suggested that early smoking experimenters may be at higher risk of having poor school grades later on (Ellickson et al., 2001).

The results of the present study, indicating that the association between poor school achievement and adolescent smoking is likely to be bi-directional, are probably influenced by other possible mediating factors (family socioeconomic level, parents' education level, parental smoking and school factors). For example, family is considered to be an important socialization bond for children, and children tend to adopt health behaviours, such as smoking, from their parents (Garmiene et al., 2006). Parental socioeconomic status is also related to adolescent smoking (Tyas et al., 1998). Despite the fact that the Finnish educational system offers students equal learning opportunities at school (Domovic et al., 2005), children tend to choose education tracks similar to their parents (Myrskylä, 2009).

According to Malin's (2005) dissertation, only small variations in student outcomes between schools exist in Finland. Furthermore, results of the PISA study show that in student outcomes the proportion of between-school variance in Fin-

land is about one tenth of the OECD average (Sahlberg, 2007). Nevertheless, Jakku-Sihvonen et al. (2002) suggest that polarization of education results between schools may exist in certain areas in Finland, such as the Helsinki area.

Smoking initiation may be a sign of school-related problems in adolescence, and maybe manifested before deterioration of school achievement. This phenomenon needs to be taken into account when planning future anti-smoking action for adolescents.

6.2.3 Association between smoking-related cognitions and school achievement (III)

To examine the different effects of smoking-related cognitions (i.e. attitude, social influence, self-efficacy and intention to smoke) in relation to school achievement, the results showed that at the baseline, students with poor school achievement reported more favourable attitudes towards smoking, stronger social influence of peers, weaker refusal self-efficacy with regard to smoking and more intention to smoke in the future than students with excellent grades. During the follow-up period, refusal self-efficacy became weaker among students with low levels of school achievement compared to students with excellent grades.

Smoking-related self-efficacy beliefs were somewhat weaker among students with low levels of school achievement. The relationship between school achievement and self-efficacy in general has been well studied (Lent et al., 1986). Research indicates that students who develop strong self-efficacy beliefs are better able to manage their learning skills and to resist the social pressures related to inadvisable behaviour (Bandura et al., 2001). Moreover, it is likely that students with low grades have more smokers in their social environment (De Vries et al., 1995b) and may be more vulnerable to outside influences that encourage smoking (Mathur et al., 2008). With regard to associations between self-efficacy beliefs and intention to smoke, it is suggested that young smokers may believe smoking offers emotional or social benefits and that this may lead these adolescents to smoke (Sterling et al., 2007). Furthermore, experiencing social pressure to smoke may foster adolescents' intentions to smoke (De Vries et al., 1995b). Moreover, students who do poorly in school are not just passive bystanders (Van Laar et al., 2001). Instead, those students who do not meet the demands of the school system may invoke social identity protection strategies and attach themselves to alternative values (Crocker et al., 1989), like smoking, and choose friends with similar smoking habits (De Vries et al., 2006a).

However the results of the present study showed that during the follow-up study, attitudes towards smoking, the social influence of peers and intention to smoke did not change or become more generalised among students with low levels of school achievement compared to students with excellent levels of school achievement. This may be due to the fact that students with lower levels of school achievement reported higher benefits of smoking and higher social influence of peers towards smoking as well as more intention to smoke already at the baseline. Therefore, the changes in these smoking-related cognitions during the follow-up

study were not significant when comparing students with different levels of school achievement.

The relationship between smoking and poor grades is well studied, but studies that explore the mechanisms between school achievement and smoking are scarce. Hence, to diminish health inequalities, future research should endeavour to gain a better understanding of the mediating mechanisms between poor grades and smoking behaviour among adolescents. The results of the present study suggest that low achievers may be more susceptible to smoking because they may feel less capable of resisting the various temptations to smoke.

6.2.4 Association between family factors, school achievement and smoking behaviour (IV)

The fourth aim was to investigate how parental smoking and single parenting were related to adolescent school achievement and anti-smoking parental practices, as well as how these factors predicted later weekly smoking.

The results suggest that adolescents who had a parent who smoked or were from a single parent family were more likely to have lower levels of school achievement compared to those whose parents did not smoke or who lived with two parents. Previous evidence shows that parents who smoke often have lower levels of education and parents' education may have an impact on their children's level of school achievement (Davis-Kean, 2005). Our other finding suggesting that adolescents with single parents more frequently obtain low levels of school achievement is supported by previous studies (Kim, 2004). The empirical evidence suggests that single parents may have limited time and financial resources and cannot therefore easily cope with the consequences of lack of attention to their children and lack of financial support for their children's education (Salami et al., 2000). This explanation may also have an effect on the other results of the present study which showed that among adolescents who lived with a single parent or had a smoking parent, school achievement deteriorated more during the follow-up period compared to others.

The results also showed that when adolescents were seventh graders, parents who smoked or were single parents employed similar anti-smoking practices regarding their children's smoking as other parents. Nevertheless, by the time the adolescents reached the ninth grade, those with smoking parents or single parents reported lower levels of punishment for smoking and were less likely to have smoking rules at home than other adolescents. These results indicate that even parents who smoked or were single parents tried to employ anti-smoking parental practices in order to decrease their children's interest in smoking, as suggested elsewhere (Kegler et al., 2005). Nonetheless, when the adolescents' smoking experimentation was more generalized, parents who smoked or were single parents may have had more trouble in maintaining these anti-smoking practices (Huver et al., 2006; Huver et al., 2007).

Parental smoking and lower levels of school achievement were significant predictors of adolescents' later weekly smoking, this result is in agreement with previous studies (Otten et al., 2007; Tyas et al., 1998). Analysis of the effects of pa-

rental anti-smoking practices revealed that the only preventive practice implemented was maintaining home smoking rules. This finding is in line with other studies in the literature (Huver et al., 2007; Rainio et al., 2009). Moreover, analyses also revealed that perceived parental punishment for smoking was positively related to adolescents' later smoking, as suggested by others (Chassin et al., 2005; Ennett et al., 2001). Previous authors also suggest that not only do adolescents react to parenting practices, but parents are also affected by adolescents' behaviour (Huver et al., 2006). As the present study data included some adolescents who had already experimented with smoking, it may be that the issue of smoking had already been raised in these families and these adolescents' parents may have expressed their readiness to punish their children for smoking if necessary (Huver et al., 2006).

Parental smoking, single parenting and low levels of school achievement are indicators of a disadvantaged family environment in the current society. These indicators are likely to continue to be part of multidimensional socioeconomic health behaviour differences (Adler et al., 1999). A challenge is to find out what effective prevention strategies for disadvantaged families are needed to narrow these health behaviour differences. A promising finding suggested by the present study is that during the students' early adolescence, parents who smoked or were single parents tried to uphold anti-smoking practices. Motivating parents to hold and act out these beliefs offers a prospective intervention opportunity (Jackson et al., 1997; Kegler et al., 2005).

6.3 Methodological consideration

This longitudinal data offers good opportunities to study the predictors and associations of Finnish adolescent smoking, since the data were collected during a period when many adolescents tend to change their smoking behaviour and start experiencing smoking (Vartiainen et al., 2007). Moreover, the longitudinal design of the data enabled predictors to be analysed and an order of events to be defined. The study utilized standardized self-reported questionnaires that were based on a review of the literature and on earlier smoking prevention work (De Vries et al., 2003a; Dijkstra et al., 1999).

The study conducted four measurements: at the beginning of the seventh, eighth and ninth grades as well as at the end of the ninth grade. The study used the same standardized questionnaires in first three measurements. The final measurement did not include all questions related to attitudes, social influence and self-efficacy (ASE items) and anti-smoking parental practices. Furthermore, the final measurement did not contain all control schools (two control schools did not return their questionnaires), therefore, the final measurement was not used in sub-studies II, III and IV. The response rate was acceptable, at 77.7% of ninth grade autumn term students, and 64.7% of ninth grade spring term students.

Self-reports of smoking behaviour could not be biologically validated due to logistical and financial limitations (De Vries et al., 2003a). There is some evidence, however, that in Finland the validity of self-reports of smoking is high (Vartiainen

et al., 2002). Moreover, studies also indicate that self-reported smoking behaviour is a reliable tool in measuring smoking when asked using variety of questions (Barnea et al., 1987; Stacy et al., 1990) as done in this study (De Vries et al., 2003a). Furthermore, the prevalence of smoking in the ESFA study between the four different measurement periods is in line with the prevalence of adolescent smoking prevalence in Finland (Rimpelä et al., 2007). Nonetheless, there is no evidence of the validity of smoking measurements between different school achievement groups.

Moreover, little evidence can be found regarding the reliability of school grade point averages in Finland. That is, do school grade point averages really measure student learning outcomes, skills and motivation? Some evidence can be found that in Finland teachers' evaluations can be influenced by student temperament, ambition and social position in class as well as teacher expectations of how students should perform (Alatupa et al., 2007). There is also evidence in the literature to suggest that teacher evaluation of student knowledge and skills can be influenced by student background characteristics, so that students from low socioeconomic backgrounds may be underrated and students from high socioeconomic backgrounds overrated (Alvidrez et al., 1999; Timperley et al., 2001). Furthermore, student outcomes can depend on which school they attend (Sellstrom et al., 2006). However, in Finland variation in student outcomes between schools is very small (Malin, 2005).

Another limitation of the study was that we could only use adolescents' reports and not include parents' reports of parental smoking and anti-smoking parenting practices. However, it is suggested that adolescents' reports can be reliable, since parents' responses regarding their parental practices are effective only to the extent that they have been perceived by the adolescents (Chassin et al., 2005). Moreover, family socioeconomic status (SES) could not be used in the analyses. Nevertheless, it is noteworthy that, due to several reasons stated in previous literature, student school achievement is an indicator of family SES as well as the future SES of the student. For instance, evidence by Mathur et al. (2008) indicates that family SES level associates with children's education level. It is also suggested that children in low SES families more often have lower levels of achievement than children in higher SES families in terms of achievement test scores, course failures, placement in special education, school dropout rate and completed years of schooling (McLoyd, 1998; Nurmi et al., 2001). Students' school achievement is positively and linearly associated with education level and future SES is visible already in early adolescence (Koivusilta et al., 2003).

Smoking-related attitudes, social influence on smoking behaviour and refusal self-efficacy related to smoking (ASE items) were used to measure perceived smoking-related cognitions. These ASE items showed acceptable criterion for reliability. Adolescents' attitudes towards smoking were assessed by measuring the pros (Cronbach alpha 0.63) and cons (Cronbach alpha 0.68) of smoking, which were identified using factor analyses (De Vries et al., 2003a; Kremers et al., 2001a; Kremers et al., 2001b). Influences from peers included two constructions: social norm of peers (Cronbach alpha 0.66) and peer pressure (Cronbach alpha 0.77). Measurements included three self-efficacy constructions which were identi-

fied through previous research (De Vries et al., 2003a; Lawrance, 1989): stress self-efficacy (Cronbach alpha 0.95); social self-efficacy (Cronbach alpha 0.92) and situational self-efficacy (Cronbach alpha 0.89).

The ESFA programme was originally developed to evaluate the effects of the programme on adolescent smoking behaviour. It is possible that some background variables, such as parental smoking, were influenced by the programme. In such cases, treatment condition was used as covariate variable, analyses were conducted separately, or only the control group was used in the analysis. The programme was not developed for high-risk students and, therefore, analyses aimed at testing whether the programme had a different effect on high-risk students, such as students with substandard school achievement, may have had a lack of statistical power. Moreover, the exclusion of two control schools (n=258) from the last measurement may have affected the results of the analyses conducted using this last measurement. As the sample size decreases, the margin of error increases. In this study it is possible that if the sample size would have been bigger, the results indicating that the programme did not influence weekly smoking among students who had already experienced smoking by the baseline could have become significant. To avoid Type II errors, sub-studies II, III and IV did not use the final measurement when conducting the analyses. Another reason for not using the final measurement was that in sub-studies III and IV, not all data variables needed to conduct the analyses were available, since they were not included in the final measurement.

For practical reasons, only Helsinki was chosen to participate in the study. For this reason, the results may not be fully representative nationally. On the other hand, Finland has a comparatively homogenous population and, moreover, smoking prevalence among Finnish adolescents is similar throughout Finland (Luopa et al., 2010).

Some randomly chosen schools were located close to one another. Therefore, some of the elements of the community programme, such as strong media involvement could not be utilized fully. It is also possible that some students in the control group participated in church confirmation camps that were planned only for students in the treatment group. However, students mostly participated in confirmation camps provided by their own local church and therefore the camps differed for the most part between the treatment and the control groups (Vartiainen et al., 2007). Collaboration between various bodies succeeded well. The City of Helsinki educational administration and the principals of the different schools supported the programme well, thus facilitating implementation of the study. Teachers were trained for the programme and participated in 2–3 training days annually. Moreover, church camp leaders and school dentists were trained to motivate students towards non-smoking.

6.4 Ethical considerations

The study was reviewed and approved by the Ethics Committee of the National Institute for Health and Welfare, Finland (former Ethics Committee of the

National Public Health Institute) and City of Helsinki Education Department. Students were invited to participate in the study and to read an introductory letter. Before the questionnaires were distributed, the teachers explained the procedure. Students were informed that the questionnaires would be treated confidentially and that they could refuse to participate (De Vries et al., 2003a). Each student received the questionnaire in an open bar-coded envelope, filled in the questionnaire and then placed the questionnaire in the envelope. The envelopes were collected in a mail bag and immediately mailed to the researchers. The barcode enabled student identification (Vartiainen et al., 2007).

The data was collected by means of self-administered questionnaires according to the general ethical rules applied by the National Institute for Health and Welfare. The data was re-coded for the SPSS program without students' names. Each student was given a code number, so that individual participants could not be identified from the data. Only authorized researchers of the National Institute for Health and Welfare have access to the data. Access to the data is username and password protected. The student identification information is kept in a restricted access facility in a locked cabinet accessible only by authorized researchers. All results are reported so that identification of individual students is impossible.

6.5 Implications for future research

To achieve a deeper understanding of the effects of smoking prevention programmes, long-term studies with follow-ups are needed. Studies should provide longitudinal designs that evaluate the programmes' long-term outcomes and effects on smoking until the students are at least 18 years of age (Dobbins et al., 2008). Data should be reported in detail, including a detailed description of the intervention, randomization, follow-up period, subjects, data collection, attrition analysis, statistical analyses and adjustments as well as definition of measures and outcome variables (Skara et al., 2003). To enable valid interpretation of the effects of the prevention programmes, all results should be reported and published, not just significant ones. To facilitate comparison of the effectiveness of different prevention programmes, scientific journals should have common rules for required prevention programme criteria.

The relationship between parenting and adolescent smoking behaviour is likely to be bi-directional as parents and adolescents both react to and influence child and parent behaviour (Chassin et al., 2005). Further research is therefore needed on the bi-directional relationship between anti-smoking parental practices and adolescent smoking behaviour to achieve deeper understanding of this phenomenon.

Smoking initiation can be a sign of school-related problems in adolescence and may be manifested before deterioration of school achievement. Smoking initiation therefore requires more profound investigation and must be taken into account when planning future anti-smoking actions aimed at adolescents. Furthermore, in order to be more effective, studies to evaluate why students who do poorly at school smoke more often compared to others are needed. Future research needs to

put more effort into understanding mediating mechanisms between low school achievement and smoking behaviour. For instance, new questions regarding stigmatization and school grading systems need to be asked. Students are not necessarily being rewarded for academic success. Children for whom the teacher has high expectations may be unduly rewarded for success, while those for whom the teacher has low expectations may be negatively evaluated, even when they show academic success (Van Laar et al., 2001). In turn, this may influence adolescent smoking behavior.

The associations between smoking, school achievement and family factors are likely to form part of a multidimensional socioeconomic disadvantage which is not only a reality during childhood and adolescence, but may also shape the future of the child (Ferguson et al., 2007). More knowledge about the factors influencing adolescents who are particularly susceptible to smoking is therefore needed. Childhood socioeconomic circumstances may have an accumulative effect on child and adolescent smoking. Children who are exposed to a combination of risk factors may be at greater risk of starting smoking than those not exposed to as many risk factors. Nonetheless, only a small number of studies have focused on the contribution of accumulative effects of childhood socioeconomic circumstances on risk of smoking. Ferguson et al. (2007) suggested that parental education, family living standards and family income acted accumulatively to influence the likelihood that children from disadvantage families became smokers. A Finnish study showed that childhood financial problems, parental unemployment and divorce as well as alcohol and mental health problems had an accumulative effect on their children's later daily smoking (Kestilä et al., 2006). Jeffiris et al. (2004) found that socioeconomic circumstances (measured by occupational scale) influenced smoking accumulatively across the life course. However, a stronger effect was found for adulthood socioeconomic circumstances than for childhood socioeconomic circumstances. Similar evidence can be found when looking at childhood accumulative effects on poor school achievement. Children who had a combination of risk factors such as low parental educational and poverty, lived in single-parent households and deprived neighbourhoods were at greater risk of poor school grades than those who did not have all of these risk factors (Seifer et al., 1992; Whipple et al., 2010). Further studies of these phenomena are needed to improve our understanding of the risks factors and impacts of smoking in a fuller context.

Moreover, consistent evidence for genetic effects on many aspects of smoking behaviour and nicotine dependence can be found in twin, family and adoption studies (Kaprio, 2009). Genetic factors can impact smoking initiation, number of cigarettes smoked per day, and cessation (Broms et al., 2006). Interactions between environmental and genetic factors predicting smoking habits and nicotine dependence of adolescents have recently received increasing attention in the scientific literature. For instance, evidence shows that the influence of parental smoking (Keyes et al., 2008), parental monitoring (Dick et al., 2007) and peer smoking (Johnson et al., 2010) on adolescent smoking may be impact on genetic variation. Such evidence highlights the possibility that smoking prevention strategies focused upon social factors may have less influence on those at highest genetic risk

(Johnson et al., 2010). Better understanding of the genetic, social, environmental and individual determinants of adolescent smoking behaviour could contribute to improved smoking prevention actions. These determinants therefore merit further study (Hernandez et al., 2006).

6.6 Implications for future smoking prevention strategies

Based on earlier studies (Biglan et al., 2000; Vartiainen et al., 1998) and the results of the present study, it is recommended to use social influence approaches, including resistance skills training, and to include a community component in future smoking prevention programmes in schools (Cuijpers et al., 2002b; Muller-Riemenschneider et al., 2008). Smoking prevention using social influence approaches, such as resistance skill training, should be considered as part of the health curriculum in upper comprehensive schools in Finland. Feasibility can be improved by implementing these smoking prevention methods adequately in schools and conducting training for teachers and other participating personnel (Cuijpers, 2002a). Moreover, it is important to raise teachers' motivation and commitment to smoking prevention. Two possible reasons can be given as to why the ESFA programmes were effective at reducing smoking among adolescents in Portugal, Finland and Spain. Firstly, the teachers remained strongly committed for the whole duration of the programme. Secondly, the teacher training for the programme was very well elaborated in these countries compared to the other participating countries (De Vries et al., 2006b). In Finland, collaboration between the various participating bodies succeeded well. The City of Helsinki educational department and the principals of different schools supported the programme well, thus facilitating the implementation of the study (Vartiainen et al., 2007). Moreover, the skills training components of the training lessons were well elaborated in Finland, Spain and Portugal. Furthermore, integration of the programme activities was probably most successful in Finland, Spain and Portugal (De Vries et al., 2006b).

It could be argued that participation in the ESFA programme was a big investment for Finnish schools. The teachers participated in 2–3 training days per year. The estimated annual staff expenses, including teacher training, were about EUR 1,000 per school, plus material and operational costs of about EUR 1,500 per school, representing a total annual cost estimate of about EUR 2,500 per school. Although, these estimated costs may be high, it is possible that the trained teachers will benefit from the information and educational materials later, probably for the rest of their careers. Moreover, the ESFA programme in Finland was effective at preventing smoking onset among all students, including high-risk students. Eliminating tobacco use is the most cost-effective means of adult disease prevention (CDC, 2008).

The associations between adolescent smoking and school policy have been the focus of previous studies. For instance, the use of smoking bans for students and teachers has been shown to reduce the risk of adolescent smoking (Piontek et al., 2008). Poulsen et al. (2002) argue that students in a school where smoking restric-

tions were absent may perceive smoking as being acceptable, resulting in intentions to take up the habit. Moreover, teachers smoking during school hours have been found to be associated with adolescent smoking (Poulsen et al. 2002). In Finland, smoking in schools and school yards and the possession of tobacco products under the age of 18 are prohibited. However, these rules are not always followed and during breaks some students may smoke in the school yard or smoke near the school yard. Effective methods to supervise under aged students so that they cannot smoke during breaks should therefore be considered, and a strong message must be conveyed that smoking is not tolerated. In addition, it is also advisable to forbid school personnel from smoking during school hours.

In line with Tyas et al. (1998), the results of the present study indicate that a low level of school achievement is a strong predictor of smoking. Moreover, school-level factors have been suggested to influence students' school achievement. For instance, strong leadership and effective monitoring of student achievement (Marzano, 2000) as well as caring and supportive relationships in school (Akey, 2006; Baker, 1999; Skinner et al., 1993) may have a positive effect on student academic outcomes. It is therefore advisable to consider encouraging and motivating teachers and other school personnel to foster a school environment that supports and encourages children and adolescents towards achieving better success. Moreover, teachers should be aware that their subjective evaluations of their students' achievement may be influenced by the students' background characteristics, such that children from low SES families may be underestimated (Timperley et al., 2001). Previous studies have indicated that students who are underrated may lower their motivation to perform well at school (Derks et al., 2009; Van Laar et al., 2001) and identify themselves with alternative values (Crocker et al., 1989), such as smoking.

Prevention interventions and other public health strategies addressing adolescent smoking that involve parents should be improved by motivating and encouraging parents to be active and to intervene against their children's tobacco use (Chassin et al., 2002), even if they smoke themselves or their children have already become smokers. Parents ought to be trained to practice these anti-smoking policies consistently over the long term (Sargent et al., 2001). Prevention interventions should also aim to boost parental confidence in their ability to control their child's smoking behaviour (den Exter Blokland et al., 2006). Moreover, smoking parents should be motivated and assisted in quitting smoking, as this could lead to a sizable reduction in smoking uptake among adolescents (Farkas et al., 1999). These programmes might also help parents to discuss their own smoking cessation with their children in ways that support their children's non-smoking (Chassin et al., 2002).

Moreover, some evidence shows that cultural factors such as tobacco control policies have an impact on the reduction of adolescent smoking prevalence (Tauras et al., 2005; White et al., 2011). Finland has a long history of strict and extensive tobacco control policies which are considered to have influenced the decrease in smoking prevalence among adults and adolescents. The first Finnish Tobacco Control Act, passed in 1976, brought in a wide range of tobacco control measures, such as the prohibition of smoking in schools and the sale of tobacco to

persons below 16 years of age (Helakorpi et al., 2008; Puska et al., 1997) as well as a total ban on tobacco advertising, enforced in 1978 (Helakorpi et al., 2008; Puska et al., 1997). In 1994, the age limit on the sale of tobacco was raised to 18 years, the sale of smoke-free tobacco was prohibited and a total ban on smoking in school yards was introduced (Puska et al., 1997). In 2000 and 2009, smoking was restricted in bars and restaurants. The latest Tobacco Act came into force in 2010. The Act aims to end the consumption of tobacco products in Finland by the year 2040 (Finland's ASH, 2010). It also forbids people under 18 possess tobacco products and all facilities used by minors may not display tobacco products or their trademarks (Finland's ASH, 2010; Ministry of Social Affairs and Health, 2010). Besides smoking restrictions, health education including, anti-smoking promotion, has been part of the school curriculum since 2001.

Although tobacco control policy in Finland has moved forward a great deal in the past decades, further improvements are still needed. For instance, previous evidence shows that increased cigarette price is associated with lower adolescent smoking prevalence (Liang et al., 2002; White et al., 2011). Cigarette prices in Finland are somewhat lower than in other countries such as Norway, the United Kingdom, France, the Netherlands, Switzerland, Germany, Denmark and Belgium. The latest increase in tobacco taxation increased the price of a cigarette pack in Finland by around 0.30 to 0.40 Euros. Nevertheless, it is recommended to consider further increases in the price of cigarettes in Finland and, in particular, an increase in the minimum tax on rolling tobacco, as the price of rolling tobacco is considerably lower than the price of manufactured cigarettes. This action could reduce smoking among those with more limited financial resources, such as adolescents. Furthermore, previous evidence suggests that continuous passive smoking can affect children's health, learning abilities and likelihood of smoking (Charlton, 1989a; Charlton, 1996; Rainio et al., 2007). Hence, increased awareness of the risks to children of exposure to second-hand smoke should be promoted and the possibility of banning smoking in private places such as homes and cars when children are present should be considered.

7 Conclusion

1. The programme prevented the onset of weekly smoking among adolescents. The analysis included well-known high-risk factors such as poor school achievement and parental and best friend smoking, and the results indicate that intervention influenced all students, including high-risk students. The strongest determinant of progression of smoking behaviour among adolescents was poor school achievement. These results support the findings of earlier studies that social influence approaches, including a community component, may prevent adolescents smoking.
2. The relationship between smoking behaviour and school achievement is likely to be bi-directional, suggesting that deterioration in school achievement and the smoking uptake are both predictive of each other. Smoking initiation can be a sign of potential school-related problems in adolescence, which may be manifested before deterioration of school achievement, and needs to be taken into account when planning future anti-smoking action for adolescents.
3. At the beginning of the seventh grade, adolescents with poor school achievement had weaker self-efficacy to refuse smoking, more favourable attitudes towards smoking, stronger social influence from their peers as well as greater intention to smoke in the future than students with excellent school achievement. The follow-up analyses showed that for students with low grades, self-efficacy to refuse smoking became weaker during the follow-up compared to students with excellent grades. Lower achievers may be more vulnerable to smoking as they feel less capable of resisting various temptations to smoke.
4. Poor school achievement was associated with parental smoking and single parenting. A promising finding is that parents who smoked or were single parents tried to uphold anti-smoking practices. However, as their children became older these parents were not able to maintain these rules as effectively as other parents. Motivating parents to adopt and act out anti-smoking parental practices offers a prospective intervention opportunity. The only preventive anti-smoking practice implemented by parents was the enforcement of home smoking rules. It is suggested that a key preventive practice with regard to adolescent smoking would be to motivate smoking parents towards cessation and towards implementing smoking rules in their homes.

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APPENDIX A

School-based smoking prevention programmes published between January 2000 and December 2010. The search protocol included randomized controlled trials including a comparison group that received no smoking prevention intervention. The search strategy identified 153 studies. After removing studies that did not meet the criteria, 29 studies were perceived to be relevant. Methods and results are presented as in the original studies.

Reference, year and location	Participants	Study duration	Theory	Intervention/control	Intervention conducted by	Follow-up rate(s)	Follow-up group outcomes of smoking behaviour
Ausens et al., 2004, The Netherlands	Vocational school students. Mean age 13.1, n= 1547.	1997 to 1998	Computer tailoring	Two intervention groups: I= In-school (3 information lessons on smoking), O=Out of school (3 tailored letters with smoking prevention messages mailed home), C=control group: standard curriculum	Trained teachers	One year post-intervention follow-up: 75.4%	Smoking initiation among pre-test never smokers: I+O versus C: OR=1.85 (95% CI= 0.17- 4.83), O versus C: OR=0.42 (95% CI=0.18-0.96)
Aveyard et al., 2001, UK	13 to 14 year-old students, n=8063	Two years	Social competence model	Trans-theoretical model (TTM): 3 lessons and 3 lessons with interactive computer program. Control group, normal health education curriculum	Trained teachers	Two-year post-intervention follow-up: 85%	Intervention had no effect on regular smoking (OR=1.14, CI 95% 0.93-1.39)
Botvin et al., 2003, USA	Suburban elementary schools students in grades 3 to 6. N=1954, post-test n=1090	Three years	Social influence approaches and social competence model	Tobacco and alcohol prevention programme. Used Life Skills Training: 24 lessons, 8 lessons per year over a period of 3 years. Lessons included information and training in drug resistance skills, personal self-management, and general social skills for increasing overall competence and promoting characteristics associated with decreased risk of using drugs in the future. Control group: Standard curriculum	Trained teachers	Post-intervention: 56%	School-level analyses showed that mean smoking frequency was lower in intervention schools compared to control schools (p<0.013)
Botvin et al., 2001, USA	Economically disadvantaged, inner-city 7 th grade students, n=3621	15 months	Social influence approaches	Drug abuse preventive programme. Intervention: 15 lessons, life skills training. Control group: Normal health education curriculum	Trained teachers	One-year post-intervention follow-up: 69%	Intervention students reported lower smoking frequency (p<0.05) and smoking quantity compared to controls (p<0.001)
Brown et al., 2002, Canada	9 th grade students, n=3028	Two years	Social influence approaches	Intervention: Non-smoking activities to build commitment to non-smoking and to strength non-smoking as a school social norm. Teachers facilitate students, staff and community participants in planning and implementing prevention and cessation activities tailored to each intervention school. Control group: Standard curriculum	Trained teachers and student-leaders	Post-intervention: 95%	For grade 8 never-smokers, regular smoking rates were significantly lower for males from intervention schools compared to control schools, 9.8% vs. 16.2% (p=0.02), at the end of grade 10. There were no differences among females.
Chou et al., 2006, China	7 th grade students (mean age 12.5 years), n=2661	1998-1999, 12 months	Social influence approaches	The Wuhan Smoking Prevention Trial WSPT programme (modified version of Project SMART): 13 lessons. Control: normal health curriculum	Trained teachers	12-months post-baseline: I=90%, C=94%	Among boys who smoked at the baseline the programme reduced risk of being a recent smoker (OR= .45; 95% CI= .23- .88). Programme had no affect on smoking initiation.

Reference, year and location	Participants	Study duration	Theory	Intervention/control programme	Intervention conducted by	Follow-up rate(s)	Follow-up group outcomes of smoking behaviour
Crone et al., 2003, The Netherlands	Students with lower education. Mean age 13, n=2562	Not reported	Social competence model	I=Intervention: 3 lessons on knowledge, attitudes, and social influence, followed by a class agreement to not start smoking or to stop smoking for five months and a class-based competition. C=Control group: Standard curriculum	Trained teachers	Post-intervention: I=70%, C=65% . One year post-intervention: I=37%, C=36%	Smoking initiation: I=9.6%, C=14.2%, OR=0.61 (95% CI 0.41-0.90). One-year post intervention: not significant (numbers not reported)
Eisen et al., 2003, USA	Sixth grade students, n=7426	1998-2000, Two years	Social influence approaches	The Lions-Quest 'Skills for Adolescence' drug education programme. Intervention: 40 lessons of life skills training. Control group: Normal health education curriculum	Trained teachers	One-year post-intervention follow-up: 77%	Programme had no effect on smoking.
Elder et al., 2002, USA	Hispanic migrant students, n=660	1996 to 1999	Multi-modal programme and social influence approaches and social competence	Community-based tobacco and alcohol prevention programme. I=Intervention: 16 lessons, six lessons with parents, two booster phone calls, three news letters mailed home. C=Control group: First aid and home safety education programme	Trained group leaders	Two year follow-up: I=85%, C=78%.	No between-group differences in smoking were significant (at any point)
Elickson et al., 2003, USA	7 th to 8 th grade students, n=4276	Autumn 1997 to spring 1999	Multi-modal programme and social influence approaches	Project ALERT two intervention groups: A) 11 lessons in 7 th grade and 3 lessons in 8 th grade. Parental involvement included adolescents' interviews with parents about their experiences of peer pressure, parent/drug IQ test; B) same as A plus booster lessons in 9 th and 10 th grades. Control group: Standard curriculum	Trained teachers	Post-intervention 91%	Project ALERT curriculum curbed cigarette use initiation, current and regular cigarette use. Reduction ranged from 19% to 39%
Furr-Holden et al., 2004, USA	First graders, n=566	First graders followed to eighth grade	Multi-modal programme and social competence model	Drug prevention programme. Two intervention groups: classroom-centred (CC): number of lessons not reported. Family-school partnership intervention (FSP): Training teachers/school mental health professionals about parent/child communication, weekly home-school learning and communication activities, and nine workshops for parents during first grade autumn. Two booster workshops during following winter. Control group: Standard curriculum	Trained teachers, school psychologists and social workers.	7-year post-intervention follow-up: 84%	Intervention youths were less likely to use tobacco compared to control group. (CC group: RR=0.5, p=0.008, FST group: RR 0.6, p=0.042).
Griffin et al., 2003, USA	High-risk middle school students. 7 th to 8 th graders, n= 758.	One year	Social influence and social competence model	Alcohol, tobacco and other drug abuse prevention programme. I=Intervention: Life Skills Training. C=Control group: Normal health education curriculum	Trained teachers	Post-intervention: 62%	Smoking scores were lower for the intervention group compared to the control group p=0.006.
Hamilton et al., 2005, Australia	13 to 14 year olds, n=4636	March 1999 to Dec 2000	Social influence approaches and cessation support	Intervention group=8 lessons. Control group=Normal health curriculum	Trained teachers and school nurses	One-year post-intervention follow-up I=56%, C=55%	Intervention students were less likely to smoke regularly OR=0.51 (95% CI 0.36-0.71) or to have smoked within the previous 30 days OR=0.69 (95% CI 0.53-0.01).

Reference, year and location	Participants	Study duration	Theory	Intervention/control	Intervention conducted by	Follow-up rate(s)	Follow-up group outcomes of smoking behaviour
Johnson et al., 2005, USA	6 th grade students (number of students in schools were at least 25% Hispanic and/or Asian), n=3157	Two years	Social influence approaches with multicultural component	Two intervention groups: A) Project FLAVOR; 8 lessons, addressed values and situations from multiple cultures. B) Project CHIPS; 8 lessons, same theoretical content as A, but no references to specific cultural values or situations. C) Control group: Normal health education curriculum	Trained teachers	Post-intervention: A) 77%, B) 75%, C) 77%	Eighth grade ever smoking was lower among students in group A vs. group C (OR=0.77, 95% CI= 0.61-0.98), as well as 30 day smoking (OR=0.40, 95% CI= 0.18-0.90). There were no differences between group B vs. group C.
Josendal et al., 2005, Norway	Aged 12 to 15, n=4441.	1994 to 1997	Multi-modal programme and social influence approaches	BE smoke FREE: Three intervention groups: A=19 lessons, trained teachers, parental involvement; B=as for A but no teacher training; C=as for A but no parental involvement and D=control group: Standard curriculum	Trained and non-trained teachers	Post-intervention: A=88.8%, D=94.2%.	Weekly smoking: A, 19.6% and D 29.2% b=0.69 (95% CI 0.48-0.99) (other comparisons not reported)
Perry et al., 2009, India	6 th to 9 th graders, n=12484	2004 to 2006	Multi-model programme and social influence and social competence model	Project MYTRI: Intervention: 7 peer-led classroom lessons and 6 additional activities. Peer-led health activism outside of the class room. Parental involvement. Control group: Normal health education curriculum	Trained teachers, peer-leaders and field staff.	Post-intervention: 84%	Post-intervention: A significant between-group difference in the trajectories of cigarette smoking (p<0.05) and any tobacco use (p<0.04)
Peterson et al., 2000, USA	From grade 3 to 12, n=8388	1984 to 1997	Social influence approaches	Hutchinson Study of High School Smoking (HSPP): I=intervention: 65 sessions, C=Control group: no intervention	Trained teachers	Two year post-intervention follow-up: I=93.8%, C=93.7%	Daily smoking C=29.07, I=28.42 (95% CI=-2.8 to 3.8)
Resnicow et al., 2008, South Africa	Public school students, 8 th to 9 th graders, n=4684	Two years	Social influence approaches and social competence model	Two intervention groups: A) Life skills training; 16 lessons, B) Harm minimizing KEEP LEFT, 16 lessons (no social skills training), and C) Normal health education curriculum	Trained teachers	Post-intervention: 89%	30-day smoking from baseline to 2-year follow-up: A and B=3%, C =6%. Difference not significant
Schofield et al., 2003, Australia	Public secondary students, 7 th to 10 th grade	Nov 1995 to Nov 1997	Multi-model approaches and social influence approaches	Hunter Region Health Promoting Schools (HPS) Project. Intervention was based on community organization theory in which intervention schools were encouraged to adopt and own their HPS programme. Strategies included ensuring that a formal school curriculum addressed health risks associated with smoking, information leaflets, newsletters, smoke-free school policy, encouragement of non-smoking parents, peer influence programmes and incentive programmes. Most strategies were implemented by the majority of intervention schools. Control group: Standard curriculum	Project team, teachers	Post-intervention: I:84%, C=79%	HPS programme did not improve smoking behaviour over the 2 years. Equal increase of 10% in both groups.
Schulze et al., 2006, Germany	Public school students from 6 th to 8 th grade, n=1704	Oct 1998 to 2000	Social competence model	The intervention consists of information about the health effects of smoking, how to quit smoking, how to deal with peer pressure and the strategies of the tobacco industry and agreement not to smoke for a period of six months. Control group: Normal health education curriculum	Trained teachers	18-month post intervention follow-up: 42%	The programme did not prevent smoking initiation or lower relapse rates among ex-smokers.

Reference, year and location	Participants	Study duration	Theory	Intervention/control	Intervention conducted by	Follow-up rate(s)	Follow-up group outcomes of smoking behaviour
Seal et al., 2006, Bangkok	Students from grade 7 to 12, n=170,	Six years	Social influence approaches and social competence model	Drug prevention programme. Life Skills Training Intervention group: 10 lessons. Control group: Normal health education curriculum	Trained teachers	Not reported	Programme had no effect on student smoking reduction.
Simons-Morton et al., 2005, USA	Sixth to ninth graders, n=1484	Three years	Multi-modal programme, social influence approaches and social component model	Going Places programme. Intervention: 36 lessons plus parent education, school environment enhancement to increase academic engagement. Control group: Normal health education curriculum	Trained teachers	Not reported	Average smoking stage was lower for the intervention group compared to the control group.
Slater et al., 2006, USA	Students in middle or junior high schools, n=4216	1999 to 2003	Multi-modal programme and social influence approaches	Community-based media initiative on marijuana, alcohol and smoking. Four groups: Two groups with community media efforts (press releases, radio announcements etc.); A) In-school programme (20 lessons) and B) As for A plus media in school (posters, t-shirts, rulers etc.); Third group C) As for A but no community media efforts. D) Control group Normal health education curriculum	Trained teachers, trained project staff	Post-intervention: 68.6%	Growth trajectory results non-significant for smoking (p=.114)
Sloboda et al., 2009, USA	7 th to 11 th graders, n=17320	Three years	Social influence approaches and social competence model	School-based smoking, alcohol and marijuana prevention programme. Take Charge of your Life (TCYL): I=intervention: at the 7 th grade 10 lessons and 9 th grade 7 booster lessons. C=Control group: Normal health education curriculum	Trained Drug Abuse Resistance Education (D.A.R.E.) police officers	2-year post intervention follow-up: I=50.8% and C=56.9%	30-day smoking: I= 23.8% and C=19.7% (RR=1.21, 95% CI 1.05-1.37)
Spoth et al., 2008, USA	7 th grade students, n=1677	5 ½ years	Multi-modal programme, social influence approaches and social competence model	School and family based smoking, alcohol and marijuana prevention programme. Four treatment groups. A) Life Skill Training (LST): 15 lessons during the 7 th grade, five booster lessons during the 8 th grade. B) As for A, plus the Strengthening Families Programme (SFP): 7 evening sessions for families, including parent and youth skills-building curricula. C) As for B, plus six booster lessons during the 11 th grade. D) As for A plus six booster lessons during the 11 th grade. E) Control group: Normal health education curriculum	Trained teachers, facilitators	Six-month post-intervention follow-up: 74%	By the 12 th grade, smoking initiation was more common among students in the control group compared to the treatment groups (p<0.05). There were no differences in programme effectiveness between treatment groups.
Sussman et al., 2007, USA	Students varied from 13 to 19 years of age, n=1097	6 weeks	Social influence approaches	Project EX-4 prevention and cessation programme. Intervention: 8 lessons. Control: Normal health curriculum.	Project staff	One-year post-intervention follow-up: 64.7%	The programme reduced the prevalence of weekly and monthly smoking by 5.1% (p=0.003) and 6.9% (p=0.04), respectively
Sussman et al., 2003, USA	14 to 19 year olds, n=1037	Not reported, two-year follow-up between Oct 1997 and June 1998	Social competence model	Project Towards No Drug Abuse. Two intervention groups: A) Health educator-led programme: 12 sessions, B) Self-instruction programme: as for A, but by self-instruction. C) Control group: Normal health education curriculum	Trained staff health educators	Two-year post-intervention follow-up: 58%	Significant effects on smoking in the health educator-led programme compared to control group: OR=0.50 (95% CI 0.31-0.81), p=0.016. No effects on smoking in the self-instruction programme.

Reference, year and location	Participants	Study duration	Theory	Intervention/control	Intervention conducted by	Follow-up rate(s)	Follow-up group outcomes of smoking behaviour
Vigna-Taqlilanti et al., 2009, EU	N=6359	2004 to 2005	Multi-modal programme and social influence approaches	European Drug Abuse Prevention (EU-Dap) trial in seven EU countries. Intervention: 12 sessions: effects of smoking and drug use, group dynamic, problem solving, self-control, three seminars for parents, two students from each class conducted a peer-based intervention. Control group: Normal health curriculum	Trained teachers and peers	Not reported	Intervention male students were less likely to smoke daily OR=0.49 (95% CI 0.34-0.71) compared to the control group. No difference between girls.
Wen et al., 2010, China	7 th and 8 th grade students. N=2343	2004 to 2006	Multi-modal programme and social influence approaches	Intervention: Two different stages of intervention conducted during two years: A) First year: 1) Self-education materials, health curriculum including lectures; 2) Anti-smoking peer education and family information, parents were encouraged to create a smoke-free family; 3) School-wide smoking ban, non-smoking poster competition, anti-smoking information to school administrators, nurses and teachers, groceries were encouraged not to sell cigarettes to students, international anti-smoking events. B) Second year: 1) Peer education and 2) Population (media advocacy). Control group: Standard curriculum	Trained teachers and school nurses	After first programme year: 81% After second programme year: 72% (only baseline 7 th graders, n=859)	After the first programme year: Baseline treatment smokers' escalating to regular smokers (17.9% and C:18.3%, p=0.043) After second programme year: Baseline treatment smokers' escalating to regular smokers (1:22.6% and C:40%, p=1.199)