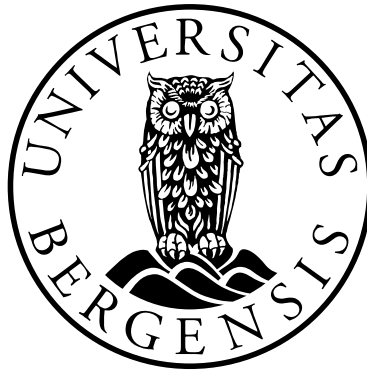


# **Development and evaluation of Be smokeFREE**

*A school-based smoking prevention program*

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## Scientific environment

This study was developed and evaluated by the Department of Health Promotion and Development (former Research Centre for Health Promotion , ‘HEMIL-senteret’), Faculty of Psychology, University of Bergen, in cooperation with the Norwegian Cancer Society.

During the statistical analyses of the first article included in this thesis, we collaborated with Institute of Education, University of London, a group developing statistical software for multilevel analyses (MLwiN) (professor Jon Rasbash<sup>1</sup>).

Before the project started, the Norwegian Cancer Society provided financial support for a visit of the author of this thesis to the Institute of Behavioral Science, University of Colorado (professor Richard Jessor).

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<sup>1</sup> Jon Rasbash, who recently became Professor of Computational Statistics and Director of the Centre for Multilevel Modelling at the University of Bristol, sadly passed away on 10 March, 2010, aged 49.

## Acknowledgements

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Professor Leif Edvard Aarø is the architect behind the project, he represents a remarkable source of knowledge and skills which made it possible to plan, perform and evaluate a project of this magnitude. The project led directly to a national implementation of the smoking prevention program in Norwegian secondary schools. In the time period from 1997-2011 more than 500 000 adolescents have been exposed to the program. It is possible that as much as 50 000 adolescents in this time period remained smoke free, thanks to this smoking prevention program. I am grateful and proud to have worked together with Leif Edvard Aarø during so many years. Leif is the most important success factor for the project itself, and I am convinced that he is the only person on the planet that could sustain a candidate like me. Without his patience, his positive mind, his wisdom and sense of humour, there would have been no articles and no thesis. I thank you Leif from the bottom of my heart!

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## Introduction

In the early 1990s, The Norwegian Cancer Society developed plans for a possible school-based smoking prevention program. A few external institutions were invited to evaluate the interventions, One of these institutions was the Research Centre for Health Promotion (HEMIL senteret), Faculty of Psychology, University of Bergen. Professors Jostein Riise and Leif Edvard Aarø at the HEMIL centre maintained that the intervention plans as well as the outline of evaluation design could be improved on some points. Their suggestions were well received by the Cancer Society, and the programme and evaluation plans were revised accordingly. The HEMIL centre was chosen as institution to be responsible for the evaluation of the programme.

The Norwegian Cancer Society organized the project, gave financial support both to the development and piloting of the intervention programme and the evaluation, and further assisted the process by ensuring national implementation after the program had come to an end.

This thesis is based on results from the evaluation project.

## Abstract

In 1988, approximately 7500 persons in Norway died from smoking-related diseases like heart failure and cancer (Engeland, 1997). Evidence from epidemiology strongly indicates that smoking is the main cause of a number of diseases, for instance lung- and airway diseases. During the second half of the 20<sup>th</sup> century, the health hazards from smoking were documented in a steadily increasing body of research (e.g. Royal College of Physicians, 1992).

Based on overwhelming facts, the Norwegian Cancer Society took an initiative to launch a tobacco prevention project in Norwegian secondary schools. The project was based on available knowledge, including relevant theory and methods. The intervention included three components: a classroom programme during secondary school, teacher courses, and parental involvement. Ninety nine Norwegian secondary schools were included in the project, and the schools were divided into four groups: Group A, control, performing traditional anti-tobacco education; Group B, intervention with all three intervention components; Group C, as B but without teacher courses; Group D, as B but without parental involvement.

Main results:

### Article 1

There were no significant differences in smoking habits among the four groups at baseline. The smoking habits in the group that was involved in the most comprehensive intervention (group B) changed more favourably than those of students in the comparison schools over the three follow-up data collections. At the third follow-up, the proportion of students smoking weekly or more in the comparison group was 29.2%, compared with 19.6% in the model intervention group. The proportions of smokers at the last data collection among students in the schools with less comprehensive interventions was lower than among students in the comparison schools, but higher than among students in schools with the most complete intervention. Smoking prevalence in these groups were, however, not significantly different from smoking prevalence in groups A and B. Multilevel

multiple logistic regression analyses, comparing changes in smoking habits between students in group B with those among students in the comparison schools (group A), confirmed the conclusion that the comprehensive intervention was the most effective. The findings from this first publication provide reasons for recommending the programme to be implemented for secondary schools all over Norway.

## Article 2

The dimensionality of smoking outcome expectancies was the same at both time points (baseline and last follow-up data collection), revealing three components ('Addictive', 'Not harmful' and 'Social'). After correction for attenuation, the Pearson's correlation between T1 and T2 (which in this article means the last data collection) was .41 for the total sumscore, indicating a low to moderate relative stability. When examining smoking expectancy sumscore means by smoking habits at T1 and T2, never smokers were markedly different from the smokers on both occasions. Never smokers scored low on "Social" and "Not harmful", and high on "Addictive". All associations were statistically significant ( $p < .001$ ). The 'Social' dimension was the strongest predictor of smoking behaviour both at T1 and T2. One of the outcome expectancy sumscores ('Addictive') at T1 predicted smoking habits at T2 after controlling for smoking habits at T1 ( $p < .01$ ). This predictor was significant also after entering outcome expectancy sumscores at T2 into the model ( $p < .05$ ). These findings illustrate the importance of emphasizing other outcomes than health related ones when designing intervention programmes for young people.

## Article 3

Measurement models were tested for self-efficacy and outcome expectancies modelled as latent variables. Acceptable fit was obtained without introducing any correlated error terms. A series of growth curve models were tested with frequency of smoking across measurement occasions modelled as a dependent latent variable. The intercept corresponds to the level of smoking at baseline while the slope is interpreted as change over time. The unit of change was set to one year. Self-efficacy

was defined as a latent variable with all items used as indicators. Outcome expectancy items are divided into three groups, each group being indicators of one latent variable. The three latent variables are “Smoking is social”, “Smoking is addictive” and “Smoking is harmful”.

Model 1 shows a significant difference in slope between intervention group and comparison group (coefficient =  $-.23$ ;  $p < .05$ ). Adding gender to the model reduces the coefficient marginally (Model 2). Adding self-efficacy and outcome expectancy sumscores measured at baseline (Models 3-5) increases the size of coefficient. With self-efficacy and outcome expectancies at baseline both included (Model 5), the coefficient is  $-.29$  ( $p < .01$ ). Adding first self-efficacy and then outcome expectancy sumscores at the last follow up data collection (Models 6-7) separately to the predictors, reduces the association between group (intervention versus comparison) and slope (change in smoking habits over time) to  $-.15$  and  $-.10$ . If both are simultaneously included (Model 8), the unstandardized coefficient goes down to  $-.13$  (not significant), indicating some mediation of programme effects. The most comprehensive model (Model 8) explains 76.4% of the variance in intercept and 94.1% of the variance in slope.

When testing all mediational paths from group (intervention versus control) to change in smoking over time (slope) combined (Sobel's approximate test), significance was not obtained ( $p = .39$ ). Estimate of total effect was  $-.125$ , while the estimate of all indirect effects combined was  $-.047$  (unstandardized coefficients). This test could not be done on all ten imputed data sets combined. The first imputed data set was chosen for this particular test.

This article provides no clear evidence that self-efficacy and outcome expectancies mediated the effects of the programme on smoking behaviour.

## List of publications

### Article 1:

Jøsendal O, Aarø LE, Torsheim T, Rasbash J. Evaluation of the school-based smoking-prevention program "BE smokeFREE". Scand J Psychol. 2005 Apr;46(2):189-99.

### Article 2:

Jøsendal, O, Aarø, LE. Adolescent smoking behavior and outcome expectancies. Scand J Psychol. 2012 Apr; 53 (2): 129 - 135. E pub Dec 11 DOI: 10.1111/j.1467-9450.2011.00927.x

### Article 3:

Jøsendal, O, Aarø, LE, Torsheim, T. (Submitted) Self-efficacy and outcome expectancies -mediators of effects of a smoking prevention programme?



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# 1. Development and evaluation of BE smokeFREE

## 1.1 Background

From the early 1970's and throughout the next 20 years, Norway experienced a decline in smoking prevalence among adolescents and young adults. However, around 1990 this decline levelled out (Lund, 1992). Lund pointed out that about 80% of Norwegian adult smokers started their smoking-career in adolescence, and that smoking prevalence among adults in Norway was one of the highest among countries in Western Europe. In Norway in the early 1990's about one in four persons in the age group 16 – 24 were daily smokers. In the age-group 16 – 19, approximately 20% were daily smokers, a proportion no better than 10 years earlier (Kraft & Svendsen, 1996). About one third of the adult population were daily smokers, despite the fact that tobacco legislation was comprehensive and firm, and prices of manufactured cigarettes were high. The tobacco legislation included ban of all advertising (direct and indirect) for tobacco products, labelling of tobacco packages with health warnings, selling of tobacco to persons under the age of 18 was prohibited, and vending machines for cigarettes were prohibited. Hand rolled cigarettes were, however, at this time point more than 40 per cent cheaper than manufactured cigarettes (Kraft & Svendsen, 1996).

During the period from 1985 to 1995, there was no reduction in the prevalence of regular smokers in the Norwegian adult population. However, our Nordic neighbour Sweden experienced a reduction in smoking prevalence in the same period from 35% to 25% (Peto et al., 1994). One possible explanation of this less favourable development in Norway was the lack of public education campaigns, and that funds raised for tobacco-related education and information were reduced by 90 % during the 1980s (Kraft & Svendsen, 1996). During the period 1981-1994, in Norway there

were no major public campaigns against smoking and no nation wide school based interventions were implemented.

In 1988, approximately 7500 persons in Norway died from smoking-related diseases like heart failure and cancer (Engeland, 1997). Evidence from epidemiology strongly indicated that smoking was the main cause of a number of diseases, for instance lung- and airway diseases. In 1988 1612 persons died from lung- and airway diseases, and approximately 90% of these persons were smokers. Further, an estimated 15% of all global cancer in 1985 was caused by smoking, and smoking was the main cause of cancer in lungs, larynx, oral cavity, pharynx, oesophagus, pancreas, kidney and urinary bladder (Parkin, 1994). Throughout this period, the health hazards from smoking were documented in a steadily increasing body of research (e.g. Royal College of Physicians, 1992; Peto et al., 1994)

Based on these overwhelming facts, the Norwegian Cancer Society took an initiative to launch a tobacco prevention project in Norwegian secondary schools. The project was based on the strategy document of the Norwegian Cancer Society, which stated:

*The Norwegian Cancer Society claims that a change in smoking habits is the strategical point in which the most positive influence as regards prevention of cancer and cancer mortality can be achieved. Therefore, it is important to cooperate in the field of smoking control, giving priority to certain groups. It is important to give priority to the work among those children and adolescents who so far have not started to smoke.*

## 1.2 Terminology

This thesis includes some central expressions or terms which are used as denoted below:

### ■ Adolescence

Denotes the age period between childhood and young adult. This age-period is often defined as the age from thirteen until nineteen. This definition finds support in the publication by Thomas and Perera (2007). Other definitions use slightly different age spans.

### ■ Health

Health is a general term, often defined as the mental and physical status of an individual. Health is not only absence of disease, but includes wellbeing (WHO 1946). Health has also been defined as one's ability to cope with the challenges of daily life and in this context it can be understood as a relational concept (Stige & Aarø, 2012).

### ■ Health Promotion

Health promotion is defined as activities aiming at improving the health of individuals, groups of individuals, or populations. According to the Ottawa charter<sup>2</sup> (WHO, 1986), health promotion is the process of enabling people to increase control over, and improve their health.

### ■ Smoking

Smoking is in the context of this thesis defined as the behaviour of smoking cigarettes containing nicotine.

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<sup>2</sup> <http://www.who.int/healthpromotion/conferences/previous/ottawa/en/>

## ■ Addiction

Addiction is often in international publications defined as 'a chronic, relapsing disorder in which compulsive drug-seeking and drug-taking behaviour persists despite serious negative consequences.' Continuous use induces adaptive changes in the central nervous system that leads to tolerance, physical dependence, sensitization, craving and relapse (Cami and Farre, NEJM 2003).

## ■ Health consequences

Health consequences are defined as positive or negative influences on mental or physical status of individuals, groups of individuals, or populations.

## **1.3 Adolescents and smoking**

Smoking in adolescence is found to be correlated with a number of factors. These factors can systematically be organized into three groups or levels: Intrapersonal, interpersonal and environmental. The contexts of people's health related behaviours have also been described as belonging to five domains: (i) personal factors, (ii) social environment, (iii) physical and organizational environment, (iv) the cultural context and (v) societal context (Aarø and Flisher, 2011). More widely used frameworks are Bronfenbrenner's ecological model (Bronfenbrenner, 1979) and levels of contexts as described in community psychology (Dalton et al., 2001), just to mention a few.

Below we will present examples of factors from the three groups of factors mentioned above (intrapersonal, interpersonal and environmental). Additional examples will follow in chapter 1.4 where selected theories and theoretical perspectives are presented.

### Intrapersonal factors

#### *Physiological effects*

The physiological effects of smoking tobacco are mainly determined by characteristics of the tobacco product and individual pattern of smoking (Royal College of Physicians, 1992). Level of nicotine exposure depends on frequency of smoking, type of tobacco (hand-rolled or manufactured cigarettes, pipe or cigars, as well as nicotine yield of the product) and the way the tobacco is smoked (extent of inhalation). Nicotine is a highly addictive substance, and even modest levels of cigarette smoking among adolescents may lead to addiction (Royal College of Physicians, 2000; Dybing & Sanner, 2002; Colby et al., 2000).

#### *Smoking outcome expectancies*

Adolescent smokers have more positive outcome expectations towards smoking, than adolescents at the same age who do not smoke. Smokers tend to believe that smoking mainly is a social activity, that it will support them in making friends, that smoke tastes well, that smoking is relatively harmless, and that it will be easy to stop smoking (Royal college of physicians, 1992, USDHHS 1994)

#### *Self efficacy*

Adolescent smokers are less convinced than non-smokers that it will be possible to sustain from smoking, when situations occur where smoking is a possible behaviour. Smokers are less convinced than non-smokers that it will be possible to refuse an offer to smoke, and they also expect to join in when groups of adolescents are smoking (Royal college of physicians, 1992; USDHHS, 1994)

### *Sensation-seeking*

Sensation-seeking is defined as 'The individual's need for varied, novel and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experience' (Zuckerman et al., 1980). Score on a scale measuring level of sensation-seeking is highly correlated with adolescent smoking behaviour (Pedersen et al., 1989; Kraft & Rise, 1994).

### *Problem behaviour*

Adolescent smokers are more often than non-smokers at the same age involved in various forms of problem behaviour. This includes school absenteeism, vagabonding, stealing, drinking alcohol, using illegal drugs, etc (Jessor & Jessor, 1977; Tyas, 1998).

### *Low academic achievement*

Adolescent smokers are more often than non-smokers at the same age performing moderate to low at school (Ahlgren et al., 1982; Nutbeam et al., 1988; Gerber et al., 1989). Eighty percent of relevant prospective longitudinal studies on smoking initiation show a correlation between moderate to low academic achievement and smoking (Conrad et al 1992). An international study, including a large sample of Norwegian adolescents, showed that the probability of being a smoker increased when the students reported low to moderate school results, high levels of school-alienation and no plan for further education (Nutbeam et al 1988).

### Interpersonal factors

#### *Smoking among significant others*

Sociological studies have shown that level of nicotine exposure alone cannot explain why some adolescents get addicted and others not. This research claims that smoking behaviour mainly is a social phenomenon (Sussman et al.,1995; Tyas, 1998).

Smoking habits among significant others are important determinants of individuals' smoking habits (Royal college of physicians, 1992). If the father and mother of a



young person are smokers, there is a strongly elevated risk that the person him- or herself will start to smoke (Aarø et al., 1981; Bricker et al., 2003). Furthermore, parental indifference, lack of supervision, and lack of knowledge about their children's friends increase the risk of becoming smokers (Tyas, 1998). However, even if parents themselves smoke, but do not allow their kids to smoke, fewer kids will become smokers (Aarø et al., 1981; Webster et al., 1994). Lowest proportion of smokers is still found in those families where none of the parents are smokers, and the kids are not allowed to smoke (Aarø et al., 1981; Eiser et al., 1989). Smoking habits among siblings (Bewley et al., 1976; Aarø et al., 1981; Murray et al., 1983) and peers (Bewley et al., 1976; Aarø et al., 1981; Ogawa et al., 1988; Tyas, 1998) are also important factors influencing the individuals smoking habits. The association between best friend's and own smoking habits is so strong that it has even been suggested that best friend's smoking can be used as a proxy for own smoking (Tjora et al., accepted for publication). Additionally, one should notice that socially isolated adolescents are more susceptible to take up smoking, than those with many friends (Ennet et al., 1993) and that smoking occurs relatively frequently when adolescents are alone, provided that they have established smoking as a regular behaviour (Sussman et al., 1993).

### Environmental factors

#### *Price*

The association between the price of cigarettes and consumption or between changes in price and change in consumption in a population or a sub-group of a population is notified as price-elasticity. If a ten percent increase in price is accompanied by a ten percent decrease in consumption in a specific population or population subgroup, the price elasticity is -1.0. In a meta-analysis of 86 studies, the mean price elasticity was found to be -0.48, meaning that a ten per cent increase in the price of cigarettes is accompanied by a 4.8 per cent reduction in consumption (Gallet & List, 2002). In an analysis covering 52 European countries Gallus and associates (2006) found that smoking consumption decreases 5-7% for a 10% increase in the real price of

cigarettes. The price elasticity on cigarettes is generally higher among adolescents than among adults. Estimates range from -0.9 to -1.5 (Ross & Chaloupka, 2003). In a study among young adults in Canada (Zhang et al., 2006) it was found that decreased cigarette price was associated with higher levels of smoking initiation.

Price is influenced by a number of factors, one of them directly related to smoking prevention: Taxes on cigarettes and other tobacco products (Liang, 2003).

Governments may use taxes on tobacco products to rise tobacco prices, and through this reduce the tobacco consumption of the population. A more philosophical and ethical question is whether or not this kind of state incomes directly should sponsor prevention programmes.

#### *Regulation of tobacco availability through legal acts*

Adolescents' access to tobacco products through retailers may be regulated by laws. If laws are made to restrict the availability to tobacco products, they will include prohibition of vendors from selling to under-age adolescents, establishment of minimum age-at-sale laws, ban on self-service displays, ban or strict limitations to the placement of cigarette vending machines to locations restricted to adults, ban on the sale of loose cigarettes, ban on distribution of free tobacco samples to minors, demand for licenses for retail vendors to be licensed to sell tobacco products, and revocation of the license for retailers who repeatedly violate the law (Woollery et al., 2000). Norway has implemented all of these law regulations, along with a very strict regulation of smoking in workplaces where environmental tobacco smoke (ETS) previously was a problem (ban on any smoking in public places) (Lund, 2005).

## 1.4 Theory

Previous studies in the area of smoking prevention have been based on several theories, mainly from the area of social psychology. As concluded in meta-analyses in the 1990's, some theories and models seemed to turn out as more effective than others as point of departure when planning new interventions (e.g. Bruvold, 1993; Rooney, 1996). The main directions pointed out by Bruvold, Rooney and others, are later confirmed by other authors in more recent publications (Thomas & Perera 2006; Botvin & Griffin 2007). A brief overview of the most important theories is presented in this chapter.

### *Social Cognitive Theory and the Reasoned Action Framework*

Albert Bandura's Social Cognitive Theory (Bandura, 1986) is one of the most influential theories in social psychology. In the introduction to his book from 1986, Bandura states that:

One of its organizing themes is the emphasis placed on reciprocal determinism. Social cognitive theory embraces an interactional model of causation in which environmental events, personal factors, and behavior all operate as interacting determinants of each other. Reciprocal causation provides people with opportunities to exercise some control over their destinies as well as sets limits of self-direction.

Person, behaviour and environment are connected interactively. Further, Bandura claims that behaviour is influenced by a number of factors, where two factors seem to be more important than other factors: self-efficacy and outcome expectancies. Self-efficacy is defined as the individuals own expectations of how successfully one will be able to perform a given behaviour. If an individual expects to be able to successfully cope with situations where smoking-pressure occurs, it is more likely that such success will take place when smoking pressure actually appears. According

to Bandura, the best way of increasing self-efficacy is by training in practical situations. Outcome expectancies are defined as the individual's own expectations of the outcomes of given behaviours. If such outcomes are negative, it is less likely that a certain behaviour will occur. Positive outcomes will increase the probability that the behaviour will occur. Behavioural outcomes can be physical, social or psychological. This means that health outcomes are not the only possible outcomes of importance for shaping health related behaviour such as smoking. Other outcomes, such as being popular among friends or feeling relaxed may equally or even more important. Interventions should aim at reducing the positive expectations of smoking, and shed more light on the negative consequences of smoking. It is important to keep in mind that smoking behaviour to a large extent is shaped by other outcome expectancies than those related to health. This is at least the case for the initiation of smoking. Health motives may play a more important role in smoking cessation.

Bandura also focuses on social diffusion and innovation (see paragraph below in this chapter on Everett Roger's approach to describing and analyzing diffusion of innovation processes). Social diffusion describes how ideas, habits or expressions spread in a population. Innovation describes how new ideas, habits or expressions spreads in a population. There are two main elements in the process of diffusion: First, individuals must acquire the new knowledge. Second, individuals must adapt the innovative element. According to Bandura, the first step is mainly influenced by model-learning, the second step by self-efficacy and outcome expectations (Bandura, 1986).

Related theoretical constructs can be found in Fishbein & Ajzen's theoretical frameworks and conceptual models, their Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), The Theory of Planned Behavior (Ajzen, 1991) and their more recent Reasoned Action Approach (Fishbein & Ajzen, 2010). Instead of Bandura's outcome expectancies they use the concept "behavioural beliefs", and they emphasize that in order to predict behaviour it is hardly sufficient to find out what outcomes are expected of a certain behaviour. It is also necessary to measure how important these outcomes are to the person him- or herself (evaluation of beliefs). Instead of the concept of "self-efficacy", Fishbein and Ajzen use the

concept “perceived behavioural control”. In the scientific literature there is a lot of discussion about the relationship between these two concepts (see Fishbein & Ajzen 2010, pp. 160-167). In the latest version of their model, they distinguish between perceived capacity to perform (ability to perform) a behaviour and autonomy (degree of control). Fishbein and Ajzen also regard subjective norms (injunctive norms – what other people expect from you, and descriptive norms – what other people actually do themselves) as important factors to take into account. Another important concept is attitudes, and they distinguish between instrumental attitudes (grounded on positive or negative behavioural beliefs) and experiential attitudes (positive and negative experiences associated with performing the behaviour). And it is also important to keep in mind that Fishbein and Ajzen see intentions as the most proximal predictor of behaviour, and as a mediator between attitudes, subjective norms, and perceived behavioural control on one side and behaviour on the other.

#### *Problem Behaviour Theory*

In their Theory of Problem Behaviour, Jessor and Jessor (1977) elaborate on the three main factors person, behaviour and environment. As for the environmental factor, Jessor and associates make it clear that they focus on how the individual experiences the environment. When it comes to the personal and the behavioural factors, Jessor et al distinguish between proximal and distal elements.

Personal factors are mainly cognitive, like values, expectations, beliefs, and attitudes. Elements which constitute the proximal part of the personal factor, are (related to smoking): The value of smoking, the tolerance of other smokers, perceived risk of smoking, belief in one's ability to refuse an offer to smoke, and so forth. Elements which constitute the distal part of the personal factor are: desire for academic achievement, religious focus, degree of independence, tolerance of unwanted behaviour, and so forth.

Environmental factors, as experienced by each individual, are according to Jessor and associates the most influential factor on behaviour. This is based on the assumption that each individual chooses to act according to his or her own perceptions and interpretations of the environment.

The proximal elements in the environmental system visualises if the individual is a part of a social environment where the behaviour takes place, and if the behaviour is accepted. Examples are peers' acceptance of the behaviour, peer pressure, parental acceptance or rejection of the behaviour, availability to cigarettes among peers, experienced punishment if the behaviour is detected, among others.

The distal elements in the environmental system are concentrated around the possible conflict between parental and peer attitudes and behaviour. Two factors are more important than others: Parental and peer compatibility, and parental and peer influence. Parental and peer compatibility denotes to which extent parents and peers are congruent in their view on the actual behaviour, for instance smoking. Parental and peer influence denotes which significant others that are most influential in the individual's decision making – parents or peers. High parental and peer compatibility and high parental influence strongly indicate a more conventional individual. This, in turn, makes it less likely that the individual will engage in problem behaviours.

The behavioural system is split into two parts: One part for conventional behaviour, and one part for problem behaviour. Conventional behaviour is normally accepted by the greater society (by adults), and this behaviour is wanted and expected, according to societal norms. Problem behaviour is normally not accepted by the greater society (by adults), the behaviour is considered to be unwanted and not suitable for adolescents. Examples of conventional behaviour are participation in religious organisations, participation in organized sport activities, attention to homework, and high academic achievements. On the opposite: No participation in religious organisations, no participation in organized sport activities, and low academic achievements are examples of conventional behaviour that indicate a high probability of engaging in problem behaviour.

Problem behaviour is defined as smoking, drinking alcohol, using drugs, stealing, fighting, and participation in high-risk behaviour. Examples of high-risk behaviours are driving motor-bikes without wearing helmet, mountain climbing, driving against red lights, driving over the speed-limits, and so forth. Engagement in one type of high-risk behaviour increases the probability of engaging also in other types of high-risk behaviours.

*Diffusion of Innovations Theory*

According to Rogers (1983) an innovation is an “idea, practice or object that is perceived as new by an individual or other unit of adoption”, and diffusion is defined as “the process by which an innovation is communicated through certain channels over time among the members of a social system.” The aim is usually to “maximize the exposure and reach of innovations, strategies, or programs (Oldenburg & Parcel, 2002).

Rogers (1983) examined diffusion of innovations processes empirically. The most important step in this process is to acquire a sufficient number of innovators, a small but critical mass which constitutes phase one. Once the innovators have adopted a new expression or behaviour, gradually a larger and larger part of the population will follow, in step two. The last part of the process involves those who are the slowest movers into new expression or behaviour. In the context of smoking, the first adolescents taking up the habit of smoking represent the innovators. Innovators can also play a positive role by being the ones who take a strong position against smoking. If such innovators set a positive example by being non-smokers and by advocating non-smoking, it increases the probability that more peers will remain smoke-free.

Related to the diffusion of innovation perspective is the “bandwagon effect” well known from research on voter’s behaviour (McAllister & Studlar, 1991). As more people come to hold a specific opinion, for instance to support a specific political candidate, and if this is made known to the public, the more other people will tend to adopt the same position. They literally “hop on the bandwagon”. In the field of marketing a number of persuasion techniques are based on the assumption that changes in consumers’ preferences, if made publicly known, may influence other consumers to buy a product. This is called “social validation” (Cialdini, 1993). In the field of health behaviour change this is an approach that has not received much attention. If properly implemented, however, communicating to target groups that there is a change towards more healthy behaviours in the population (or in relevant population segments) could be an element that might add to the effectiveness of

behaviour change programmes. This would be similar to a technique well known from drug education programmes for adolescents where the target groups' overestimation of the prevalence of drug use among peers is corrected (Pedersen 1993). There is, however, one main difference. Using a bandwagon approach means using changes taking place in the population in persuasive messages in order to motivate more people to change in the same direction.

### *The Theory of Psychological Reactance*

If individuals believe that other people are trying to limit their freedom to choose, it often leads to negative feelings or emotions and attempts to restore their freedom. This tendency is called psychological reactance (Brehm, 1966). Perceived loss of freedom may make individuals less motivated to perform the behaviour advocated by other people. In a recent study among 16-20 year olds in Norway it has been shown that smokers are generally more reactant than non-smokers, and that level of reactance among smokers is associated with negative attitudes towards strong smoking control measures (Wium et al., 2009). In the BE smokeFREE intervention, attempts were made to use trigger reactance against the tobacco industry. By emphasizing that tobacco is addictive and that the tobacco industry relies on their customers' addiction, with the associated loss of freedom, it was anticipated that students would develop reactance towards attempts to influence them to smoke.

### *Theories of relevance to Induced Compliance*

The technique of influencing people through involvement in attitude-discrepant behaviour is called induced compliance (Festinger & Carlsmith, 1959; Eagly & Chaiken, 1993). If students are involved in activities where they publicly advocate a smoke-free life and involve in a process where they develop and communicate arguments against smoking, it is expected that they will become more committed to remain smoke-free. There are two different theoretical frameworks that shed light on the processes of change taking place when an individual advocates a specific attitudinal position. When the behaviour is attitude discrepant, Festinger's Cognitive Dissonance Theory is particularly relevant (Festinger, 1957). According to Festinger we feel tension when our cognitions are psychologically inconsistent and such tension makes us strive to achieve consistency. Leading a person into a situation



where they argue against smoking will tend to influence their attitudes towards the position they are advocating. When strong attitudes towards the relevant behaviour have not yet been established, Bem's Self Perception Theory is also relevant (Bem, 1972). Bem assumes that we interpret our own behaviour the same way as we interpret others' behaviour. When we observe someone arguing against smoking, we tend to believe that this person actually have negative attitudes towards smoking. When we observe ourselves arguing against smoking, we make similar inferences.

### *Social Norms Theory*

As already mentioned, in Fishbein and Ajzen's Reasoned Action Framework subjective norms are seen as one of the three main predictors of behavioural intentions. There is, however, more to the concept of norms than each individual's perceptions. According to Cialdini (2012) the concept of norms has two meanings. It refers to what is typically done in a culture or subculture, and it refers to what is typically approved or disapproved. Both aspects tend to influence members of social systems or communities towards compliance. Norms develop and change in real life processes in groups and within social networks and communities.

As stated by Miller & Prentice (1996), our cultural beliefs about human motivation tend to underestimate the power of social motives to influence behaviour. The social psychologist Lee Ross presented an analysis of the tendency to overestimate the power of the person and to underestimate the importance of contextual factors in forming people's behaviour, and he suggested that this should be called "the fundamental attribution error" (Ross, 1977). As Nisbett and Ross have stated clearly in their textbook from 1991 (Ross & Nisbett, 1991), an important lesson learned from decades of research in social psychology is that social contexts powerfully influence people's behaviour.

Already in the 1940s Kurt Lewin concluded that individual behaviour can be changed more easily by working with the groups to which the individual belongs than by working with the individual alone (Lambert & Lambert, 1964). The social influence approach addresses factors and processes beyond those that are covered by social cognitive theory and social cognition models. Mobilizing support from parents

increases the chance that interventions in schools will succeed in having an impact on behaviour, and by systematically involving students in classroom and group activities, it is expected that peer group social norms relevant to smoking will change. These micro-level approaches to use social influence processes to change young people's behaviour must be seen in a larger context. As a result of health education activities targeting the adult population and use of restrictive measures and price policies, the prevalence of adult smokers may decrease and attitudes to smoking in the adult population become more negative. This leads to a different climate where smoking control programmes in school are supported by changes in norms in the general population.

### *Health Locus of Control*

Wallston et al. (1976), argue that individuals will be more likely to take responsibility for their health if they perceive that their behaviour will have an impact on their health. Wallston and associates developed scales for the measurement of what they called locus of control. They distinguished between three dimensions: inner control, chance control and other people control. While some people believe that their behaviours have a strong impact on their health (high internal control), other people tend to believe that their behaviour does not have a strong impact on their health. What happens to their health will happen anyway (high chance control). Some people also tend to believe that their health is in the hands of others such as doctors and health personnel (high on other people control). If we are able to make young people believe that their behaviour actually has consequences, that they can influence their own chances in life through their own behaviour, the more likely they are to take responsibility for their own actions, their own health behaviours. The concept of control is also related to the ideas governing health promotion. Health promotion is defined as the process of enabling people to win control over and improve health (Nutbeam, 1998). The process that takes place when trying to increase such control is called empowerment.

## 1.5 School-based smoking prevention

Evaluation of adolescent smoking prevention efforts began in the 1950's. Daniel Horn performed field-experiments where effects of different educational programs were compared (Horn, 1960). He came to the conclusion that some pedagogical approaches gave better results than other approaches. During the next half century a large number of studies on smoking prevention programmes targeting adolescents have been carried out. Probably, adolescent smoking prevention is the most carefully researched area within health promotion and health behaviour change.

Quite a few interventions have not shown any effect on smoking behaviour, (e.g. Bewley et al., 1976; Nutbeam et al., 1993; Peterson 2000). It must be stated explicitly that the largest and most rigorous study undertaken so far in this field, the Hutchinson Smoking Prevention Project, found no long-term effects of an intensive eight-year programme on smoking behaviour (Peterson 2000).

Some programmes have led to significantly less smoking (e.g. Aarø et al., 1983; Botvin et al., 1984; Perry et al., 1992). Meta-analyses comparing effects from different kinds of interventions (Tobler, 1986; Bruvold, 1993, Rooney 1996, Tobler 2000) indicate that broad-based interventions targeting environmental, behavioural and personal factors are most effective. While programmes based on the "information deficit" or "affective" models have proven ineffective, programmes utilizing elements from the "social influence model" have been more successful (USDHHS, 1994). It should be added, however that even broad programmes intervening on multiple levels sometimes fail in producing positive effects (de Vries et al 2003; de Vries et al 2006). During the last decades, new theories and models have been developed to further give support for developing more effective interventions (Royal college of physicians, 1992; USDHHS, 1994; Thomas & Perera, 2007; Botvin & Griffin, 2009).

The history of development of smoking prevention programmes can be described as a development through five stages (Thomas & Perera, 2007).

### Stage 1: The information deficit model

During the 1960s and early 1970s, anti-smokers, physicians and psychologists meant that the public had not become sufficiently aware of the health hazards of smoking. It was hypothesized that correction of this information deficit would lead directly to behaviour change. Information-giving curricula presented participants with information about smoking, including health risks of tobacco use, and the prevalence and incidence of smoking. It was assumed that information alone would lead to changes in behaviour. Evaluations of this kind of interventions showed no effects or only minimal effects on behaviour (Goodstadt, 1978; Thompson, 1978, Bangert-Drowns, 1988). Also more recent reviews of studies have come to the same conclusion (Peters et al., 2009).

### Stage 2: The affective education model

Affective education was based on Bandura's social learning theory (Bandura, 1977). One assumed that adolescents could learn drug use by modelling, imitation, and reinforcement. One also anticipated that the behaviour was influenced by the individuals' attitudes towards smoking, and skills to master either smoking or to resist smoking. The susceptibility to take up smoking was thought to be increased by poor personal and social skills and a poor personal self-concept (Botvin, 2000). The programmes made use of instruction, demonstration, rehearsal, feedback, reinforcement, and out-of-class practice. They taught or trained personal and social skills such as goal-setting, problem-solving, and decision making. Also, the programmes focussed on cognitive skills to resist external influences like media, to enhance self-esteem, to cope with stress, and to interact with others. In stage two there was an assumption that smoking was a part of a more general set of health-compromising behaviours. Several publications and reviews concluded that interventions based on the affective education model had almost no effect on behaviour (e.g. Hansen, 1988; Kellam, 1998; Storr, 2002,).

### Stage 3: Comprehensive interventions based on the social influence model

Throughout the 1980s, smoking was found to be strongly influenced by a number of social or environmental factors, besides personal and behavioural factors (Aarø et al., 1983; Evans, 1984). In stage 3, programmes initially were based on theories from social and behavioural psychology. Two theories initiated normative education methods and anti-tobacco resistance skills training, McGuire's persuasive communications theory (McGuire, 1968) and Evans's theory of psychological inoculation (Evans, 1976). Social factors received most attention as determinants of the onset of smoking. Interventions focused on the development of behavioural norms that favoured non-smoking and of skills to identify and resist social pressure to smoke. These include correcting adolescents' overestimates of the smoking rates of adults and adolescents, recognising high-risk situations, increasing awareness of media, peer, and family influences, teaching and practising refusal skills, and making public commitments not to smoke. Programmes in stage 3 often applied the techniques of generic competence enhancement to specific anti-tobacco, anti-alcohol, and anti-drug goals (Thomas & Perera, 2007). Several studies confirmed that interventions based on the Stage 3 model were relatively successful (e.g. Tobler, 1986; Botvin, 1984; Botvin, 1990).

#### Stage 4: Combination of social competence and social influence models

In stage 4 one started to combine methods by applying elements both from social competence and social influence approaches. Thomas and Perera, in their extensive meta-analysis based on the Cochrane criteria and methods, suggest that the intervention programme 'Be smokeFREE' (Josendal et al 1998, 2005) belongs to stage 4 (Thomas & Perera, 2007).

#### Stage 5: Multi-modal programmes

Stage 5 represents more advanced multi-modal programmes, where one combines the school-based programmes with initiatives in local communities and even national efforts. This includes programmes for parents, schools, local communities, as well as initiatives to change school policies about tobacco, or state policies about the taxation, sale, availability and use of tobacco (Thomas & Perera, 2007). Thomas and

Perera identified 16 trials for inclusion in their review and meta-analyses from the so-called stage 4. Depending on specific classification criteria, the 16 trials were grouped into three categories, where category one is the best. The criteria were:

- (1) minimal selection bias (no systematic differences in comparison groups, assessed by adequacy of randomization);
- (2) minimal performance bias (no problems with the implementation of the intervention);
- (3) minimal attrition bias (no systematic differences in withdrawals from groups);
- (4) minimal detection bias (no significant differences in outcome assessment);
- (5) a power calculation was performed and the desired sample sizes were achieved;
- (6) correct statistical analysis was performed, appropriate to the unit of allocation by randomization and the unit of assessment.

- Three trials from ‘stage 4’ met all criteria satisfactory, and were placed in category 1 (Spoth, 2001; Spoth, 2002; Sussman, 1995)
- Seven trials were placed in category 2, due to one or more problems in design or conduct that could threaten the validity of the conclusions (Botvin et al., 1990a; Botvin et al., 1990b; Botvin et al., 1999; Gersick, 1988; Josendal et al., 1998; Scheier, 2001; Sussman, 1993)
- Six trials were placed in category 3, due to serious problems in design or conduct that precluded drawing any conclusions (Botvin et al., 1980; Botvin et al., 1982; Botvin et al., 1983; Gilchrist, 1987; Hanewinkel, 1994; Schaps, 1986)

The overall conclusion from Thomas and Perera concerning interventions from ‘Stage 4’ is: *‘There were three category one RCTs of combined social influences and social competence interventions: one provided significant results and one only for instruction by health educators compared to self-instruction. There was a lack of high quality evidence about the effectiveness of combinations of social influences and social competence approaches.’*

This is a conclusion which has been met with critics from other authors (Botvin 2001, Sussman 2005), something which in turn makes it more exciting to elaborate on the project that constitutes the empirical basis of this thesis.

'BE smokeFREE' thus was placed in category 2, due to lack of publication of data describing criterion 2, performance. This will be addressed in the discussion section of this thesis.

## **1.6 "BE smokeFREE"**

'BE smokeFREE' was the name given to the Norwegian school-based smoking prevention programme which was piloted and evaluated during the three school-years 1994-95, 95-96 and 96-97. The programme was developed as a result of an initiative by the Norwegian Cancer Society, in the context of cancer prevention. As stated in the introduction, prevention of smoking among adolescents was seen as the most important point of action to prevent cancer.

During 1993, the Norwegian Cancer Society launched a project named 'Adolescent smoking habits', and invited the University of Bergen, Research Center for Health Promotion (presently the Department of Health Promotion and Development) to evaluate the project. The Norwegian Cancer Society decided a few months later to develop a school-based smoking prevention programme for secondary schools, and to sponsor a study aimed at evaluating this programme. Researchers at the Research Center for Health Promotion assisted in reviewing the substantial scientific literature in this intervention area, to ensure that the school-based adolescent smoking prevention programme would be based on the existing body of knowledge and best practice recommendations.

### **1.6.1 From theory to intervention**

'BE smokeFREE' was anchored to the theories presented in chapter 1.4. Each theory constituted the basis of elements or methods applied in the intervention.

Social cognitive theory (Bandura 1986) includes the main terms self-efficacy and outcome expectancies. In order to increase the students' self-efficacy in the BE smokeFREE intervention, they were trained in handling situations where smoking could be a possible choice. As for outcome expectancies, the intervention focussed on positive expectancies of the consequences of a smoke-free lifestyle. Much effort



was put into defining what personal goals or achievements each school student might have in mind, in situations when smoking became the chosen option. The goals and achievements were defined as relevant and acceptable, but through the intervention one tried to present other and maybe more adequate methods of reaching the goals or achievements. Students were encouraged to believe that they possessed the resources and skills to succeed in reaching their goals or achievements through other means than smoking.

Problem Behaviour Theory (Jessor and Jessor, 1977) gave inspiration to more discussions about possible behaviours adolescents could choose in order to reach certain goals or achievements. Further, 'BE smokeFREE' invited students to discuss the perspectives and attitudes of parents and peers, and possible compatibility between parents and peers. Parental involvement was a central part of Be smokeFREE, and methods of involvement were in part inspired by Problem Behaviour Theory. This theory also set the main frames for the structure of the questionnaire used in the evaluation, something which will be presented in detail in the Methods section.

Research based on the Diffusion of Innovations framework (Rogers 1983) has identified that one of the most important steps in establishing new behaviours in a population, is a sufficient number of innovators. Among young adolescents, those few who are the first ones to start smoking and to introduce smoking are innovators, although in a negative sense. Be smokeFREE made it clear that those who actually started to smoke significantly contributed to establish the new behaviour among adolescents in the communities to which they belonged, and that they had to be aware of their own role as innovators. It was also made explicit that individuals with formal or informal leader roles had to accept that their influence was important. Through the intervention it was an important goal to recruit formal and informal leaders to choose other behavioural options than smoking. Instead of being innovators paving the way for more smoking among peers, they were encouraged to be innovators in the process of establishing clear norms against smoking.

In the Theory of Psychological Reactance (Brehm 1966) it is pointed out that if individuals believe that other people are trying to limit their freedom to choose, it would lead to negative feelings or emotions and attempts to restore their freedom. One central element in 'BE smokeFREE' was to focus on addiction as loss of freedom. Also, students were thoroughly informed about the business strategies of the tobacco industry, and their dependence on new customers due to high death rates among established smokers. It was anticipated that students would develop reactance towards attempts to influence them to smoke.

Applying Induced Compliance techniques means to involve students in attitude-discrepant behaviour (Festinger & Carlsmith, 1959; Eagly & Chaiken, 1993). Students included in the Be smokeFREE project were involved in activities where they publicly advocated a smoke-free life. This was expected to increase the probability that they would be more committed to remaining smoke-free. Students with positive attitudes towards smoking were expected to become less positive, and perhaps negative towards smoking. Students with no strong attitudes towards smoking were expected to develop negative attitudes towards smoking.

Social norms have a strong impact on behaviours such as smoking. As mentioned above, Kurt Lewin came to the conclusion that individual behaviour can be changed more easily by working with the groups to which the individual belongs than by working with the individual alone (Lewin, 1951; Lambert & Lambert, 1964). Hence, Be smokeFREE approached classes as group structures to establish non-smoking as a social norm. Additionally, parents and families were involved in order to provide social support for non-smoking and thereby strengthen this norm.

Internal Health Locus of Control has also been suggested as an important factor to take into account when designing health behaviour change interventions. Wallston et al. (1976) maintained that individuals who believe that they are able to influence their own health, more often than others actually are able to take action and succeed in taking care of their own health. Through BE smokeFREE, students were encouraged to believe in their own responsibility and their own possibilities, concerning their health situation. This is closely related to Bandura's idea of strengthening agency or self efficacy (Bandura, 1986), and it also relates to the idea

of empowerment (Minkler, Wallerstein & Wilson, 2008). While Health Locus of Control theory emphasizes the perceived control over health, self efficacy focuses on control over behaviour itself, and empowerment is defined as a process of social action where people can gain mastery over their lives.

### **1.6.2 Experiences and recommendations from interventions before 1995**

BE smokeFREE was in part developed on the basis of theory, as shown in chapter 1.6.1. In addition, the intervention built on experiences and recommendations from previous efforts in the field of school-based adolescent smoking prevention programmes.

Sussman et al (1995) compared different methods of intervention to prevent adolescent smoking. They made three main conclusions:

1. If interventions are school-based, most adolescents will be exposed to the intervention. This contrasts other arenas, where only sub-populations are present at the same time, and scattered in time.
2. Schools are mandated through law to educate students in questions of health and health promotion. This is an internal incentive in schools to perform activities like smoking prevention programmes.
3. Education is face-to-face, which facilitates two-way dialogue and to adjust the pedagogical approach to reactions both from the class and from individual students.

Glynn (1989) published a summary from a panel of experts of adolescent smoking prevention. The panel reached consensus of eight essential structural elements of successful smoking-prevention programmes in schools:

1. Classroom sessions should be delivered at least five times per year in two of the three years from sixth to eight grades.
2. The programme should emphasize (i) social factors that influence the onset of smoking, (ii) short-term consequences of smoking, and (iii) refusal skills.
3. The programme should be incorporated into the existing school curriculum.
4. The programme should be introduced during the transition from elementary school to junior high or middle school.
5. Students should be involved in the presentation and delivery of the programme.
6. Parental involvement should be encouraged.
7. Teachers should be adequately trained.
8. The programme should be socially and culturally acceptable to the local community.

As will be shown in the Methods section, Be smokeFREE was designed to meet all recommendations mentioned above.

## 2. METHODS

### The intervention - BE smokeFREE

BE smokeFREE was a school-based smoking prevention programme which was administered in a sample of Norwegian secondary schools during the school-years 1994-95, 95-96 and 96-97. Prior to implementation in the intervention, elements developed for the classroom intervention were piloted in two school-classes belonging to the same cohort, these classes and schools were not included in the main project. After piloting, programme elements were adjusted according to recommendations from the students, provided that the remarks were seen as sufficiently important and if they were consistent with the theoretical framework and pedagogical principles guiding the intervention development.

The teacher training component and the parental support component were systematically varied (included or not included) in order to examine their possible contribution to the effect of the programme. It is claimed that both these components are necessary ingredients of effective school-based smoking behaviour interventions (Glynn, 1989). The Norwegian Cancer Society was also particularly interested in the effects of these two components. A systematic variation was achieved by establishing three intervention-groups: One school-group where all components were put into work, one school-group containing all intervention components except teacher training, and one school-group containing all intervention components except parental involvement. The design also included a comparison group where no specific intervention was administered (business as usual).

The classroom programme consisted of eight lessons in grade 7, five lessons in grade 8 and six lessons in grade 9. All activities were administered by the schools' own teachers in the normal classroom context. The teacher training component consisted of a two-day course, where main elements of the program, its goals and

methods were presented. Teachers were given detailed manuals in order to secure program fidelity. The teacher courses did not represent any costs to the schools, but schools had to give the teachers the opportunity to attend the courses during work hours with no reduction in salary. The schools were not compensated financially for this.

In schools where parent involvement was part of the intervention, parents were involved in three different ways:

- Two brochures were brought home by the students, the first one giving information about the project, the second giving advice about how to communicate with teenage children, and about how to say no to tobacco
- Teachers involved parents in discussions at appropriate occasions
- No-smoking contracts were signed by students and parents.

Every school-hour contained elements of non-traditional classroom activities such as the use of video, games, and group work. Activities were designed to ensure that all students would participate actively. During the first year of intervention, the classroom-programme focussed on the following themes: personal freedom, freedom to choose, freedom from addiction, to make own decisions, training social skills to resist smoking-pressure, and short-term consequences of smoking.

During the second year of intervention, the classroom-programme concentrated on the following themes: Adjusting the tendency of over-estimating the number of smokers, learn that modern trends points in a smoke-free direction, learning more about addiction and health consequences of smoking, training in handling temptations, learning more about the cynical tobacco industry, getting insight in methods and strategy of media and professional agitators.

During the third year of intervention, a different educational strategy was chosen. Teachers and students indicated to the programme administrators that there was a need for change, which led to an adjustment to the intervention plans. Due to motivational and developmental factors among teachers and students, the last year of intervention was planned as a project in itself, where the students in grade 9 (last

year in secondary school) should plan, perform and evaluate an intervention to prevent smoking among the youngest students in secondary school (grade 7). The intervention cohort could choose between 9 different action-groups, where they should work together in the planning, performing and evaluation of their own campaign. The action-groups were labelled *the scientists*, *the contact-makers*, *the information-department*, *the PR department*, *the health care unit*, *the actors*, *the pedagogical department*, *the artists*, and *the stuntmen*. The classroom programme concentrated on the following themes: Increasing knowledge about ways to promote behavioural change, learning to promote behavioural change among others, gaining more knowledge about attitudes, norms and behaviours among 7th graders, getting involved in one group of action, perform the chosen action, and evaluate the campaign.

Table 1 gives some examples of the path between theory and intervention activity in the classroom:

**Table 1: From theory to student activities - some examples**

<b>Theory</b>	<b>Concepts or elements from theory</b>	<b>Method</b>	<b>Intervention activity</b>
Social Cognitive Theory & The Reasoned Action Framework	Self-efficacy, Perceived behavioural control  Outcome expectancies, Behavioural beliefs	Increase self-efficacy to resist smoking in situations where smoking is a possible alternative  Focus on positive outcome expectancies from being smoke-free	Role-play situations where peer-pressure to smoke is present, and other actions than smoking can be introduced  Classroom discussions, acceptance of the goals and achievements smoking could contribute to, but where other actions than smoking could bring the same benefits
Diffusion of Innovations Theory	Role of innovators	Try to identify or establish innovators that can promote a smoke-free lifestyle	Peer-led classroom sessions where innovators actively promote a smoke-free lifestyle
Psychological Reactance Theory	Reactance	Point out that smoking is addictive, that the tobacco-industry relies on the customers' addiction, and the cynical marketing of tobacco products by the tobacco industry	Classroom presentations  Movie about the tobacco industry  Classroom discussion aiming at producing reactance against tobacco advertising and marketing
Cognitive Dissonance Theory & Self Perception Theory	Cognitive dissonance,  Self perception	Induced compliance techniques - lead students into situations where they argue in favour of a smoke-free lifestyle (Role-playing)	Writing essay arguing why one should not smoke  Older students educating younger students of the benefits of a smoke-free lifestyle
Social Norms Theory & The Reasoned Action Framework	Injunctive norms  Descriptive norms  Social support	Small group processes  Correcting false norms	Establish the class as a smoke-free group  Involve parents and family to support non-smoking  Inform about the low proportion of smokers among peers of same age



## 2.1 Sample

When the project started, sample size calculations were carried out with no access to power calculators which allowed control for cluster effects. The sample size was therefore based on calculations with no such control, but with a reasonable increase in sample size in order to compensate for the loss of precision due to the clustering of cases (students within schools). The present calculations are done with the cluster sample size calculator from the Health Services Research Unit, University of Aberdeen (<https://www.abdn.ac.uk/hsru/>) which is based on formulas provided by Kish (1965) and Donner, Birkett & Buck (1981). All calculations are based on comparisons of the most complete intervention (Group B) with the comparison group (Group A). Provided that we expect the proportion of smokers among school students to be 30% in the comparison group and 20% in the most complete intervention group at the last follow up (not taking smoking habits at baseline into account), and provided that we set the significance level to 5%, the statistical power to .80 and do not take into account the clustering of cases, the sample size in each of the groups needs to be 586. If the intraclass correlation is set to .04 and the cluster size is assumed to be 50 (50 students per school), the required number of clusters is 36 in each group. If we optimistically assume that the proportion of students who smoke in the intervention schools at the last follow up data collection is 15%, and assume that the intraclass correlation is .04, the required number of clusters is 16 in each group. An intervention effect reducing the proportion of smokers by one third was more realistic than a reduction by half, and an intraclass correlation of .04 may be in the lower range of estimates when using data collected in Norwegian schools in the 1990's. In retrospect it is therefore obvious that the desired number of clusters in each group is closer to 36 than to 16.

With an average of two classes and 47 students per secondary school in Norway, it was decided to allocate about 25 schools to the comparison group as well as each of the three intervention groups. In order to obtain a sufficiently large sample, each of the four school-groups consisted of every 44th Norwegian secondary school. For the whole project, every 11<sup>th</sup> Norwegian secondary school had to be included. Schools

were sampled from a list of all secondary schools in Norway, sorted by ascending postal code number.

Schools were allocated to groups (one comparison group and three intervention groups) as follows: First, a random number between 1 and 44 was chosen. Starting with that number we then selected every 44<sup>th</sup> school to constitute the comparison group. Then the three next schools on the list (matched by total number of students at the school, +/- 10%) following on the same list, after each control school, were allocated to the three intervention groups. Through this sampling procedure we obtained clusters of schools, each cluster containing four schools. Schools in each cluster were systematically allocated to school-group A, control (school 1), school-group B, full intervention (school 2), school-group C, full intervention except teacher-courses, (school 3) and school-group D, full intervention except parental involvement (school 4). The procedure ensured four randomly and sequentially selected groups of schools, matched on size and geography. The procedure applied is described as a first category sampling method, with minimal risk of bias (Thomas & Perera, 2007).

School boards, principals, and teachers were informed about the project. After agreeing to participate, schools were told whether they had been allocated to a comparison or intervention group. After invitations and acceptances from the schools, the sample included in the study consisted of 99 schools, with 195 classes in 7th grade with a total of 4,441 students. Mean age at baseline in November 1994 was 13.8 years, all subjects born in 1981.

Written consents from students and parents were obtained from 95 % (4215 ss). Non-participants consisted of students whose parents did not allow them to participate (n=74; 1,5 %) and non-responders (n=152; 3,5 %). In order to follow each person longitudinally, unique code numbers were allocated to each individual student. The sample consisted of 50.6 % males and 49.4 % females.

Not all groups are included in all analyses presented in this thesis. In the first paper, which describes intervention effects, all four groups are included. The second paper is about prospective associations between smoking habits and outcome

expectancies. The analyses for this paper were carried out on students in comparison schools only. The third paper is about possible mediators of programme effects. Identifying mediators of intervention effects requires rather strong effects. Only students in the control condition (group A, n = 1088) and students from the school-group receiving the most comprehensive intervention (group B, n=1126) are therefore included in the analyses presented in paper 3. The intervention effects were less strong in the other intervention groups (Jøsendal, 1998; Jøsendal, 2005).

Attrition was also lower in groups A and B than in the remaining two groups. More than 90 % of the students in the comparison group (A) and the group with the most complete intervention (B) took part in the full experiment. Analyses of attrition throughout the project period showed that the odds of non-participation was 1.6 in the intervention group compared to the control-group, and the odds of non-participation was 1.7 among smokers compared to non-smokers. Analysis of attrition by an interaction variable consisting of group and smoking status showed no significance. This means that the tendency for smokers to drop out of the study was not significantly different for the two groups. In Chapter 2.5 we have described different kinds of missing processes, Missing Completely at Random (MCAR), Missing at Random (MAR) and Not Missing at Random (NMAR). Under the assumption that the missing processes in the present study are Missing at Random, our conclusion regarding programme effects are based on adequate statistical analyses. The estimates from a multilevel logistic model in paper 1, and the multiple imputation procedure used in paper 3 are unbiased with respect to missing when the missing mechanism is MAR.

Additionally, a survey was performed one year after the intervention had come to an end. This survey demonstrated that attrition in the control group included a larger proportion smokers than the intervention group (data not shown). Hence, attrition does not explain the results obtained on smoking behaviour.

## 2.2 Experimental design

Evaluation of BE smokeFREE followed a classical experimental design (figure 1). Schools were allocated into four comparable groups. Group A served as the control-group. In group B, the most extensive intervention were carried out, including a classroom program, involvement of parents and a teacher training component. In group C the intervention was identical to the B program, but teacher training was not included. The intervention in group D was also identical to the B program, but parents were not involved at any stage. The baseline survey took place in November 1994, the first follow-up in May 1995, the second follow-up in May 1996, and the third (last) follow-up in May 1997.

Questionnaires being used in the surveys include scales and questions selected from previous studies, with documented reliability and validity. Experimental design is showed in table 2

Table 2, experimental design

School-year	1994 - 1995		1995 - 1996		1996 - 1997	
<b>School-group</b>						
<b>A</b>						
Control	B	S1	S2	S3		
<b>B</b>						
Classroom programme, teacher courses, involvement of parents	B	X 1	S1 X2	S2 X3	S3	
<b>C</b>						
As B, but no teacher courses	B	X 1	S1 X2	S2 X3	S3	
<b>D</b>						
As B, but no involvement of parents	B	X 1	S1 X2	S2 X3	S3	

B, baseline survey

S1 – S3, follow up survey 1 – 3

X1 – X3, interventions in years 1 – 3

## 2.3 Methods in the evaluation of "BE smokeFREE"

### 2.3.1 Quantitative evaluation.

Quantitative evaluation was made possible through extensive surveying of the comparison group as well as the intervention groups. The design of the study included sequential sampling of clusters of students (schools) to each of the experimental conditions, monitoring of interventions, baseline survey, and follow-up surveys each year after intervention. The number of cases and clusters were sufficient to detect medium strong effects of the full programme intervention. Standard survey instruments were applied for quantitative data collections.

#### *Measures*

Smoking behaviour constitutes the dependent variable. The students were asked one question regarding *frequency* of smoking, with four possible response categories: Every-day smoker, every-week smoker, smoking less than once a week, no smoking at all. Additionally, weekly and daily smokers were asked how many cigarettes they smoked per week.

Outcome expectancies were measured by a combination of two scales. Ellickson and Hays (1992) used a scale to measure outcome expectancies in 698 junior high school-students, with alpha values ranging from 0.69 to 0.82. Wilhelmsen and associates used a similar scale to measure alcohol outcome expectancies among 915 seventh grade students, having an alpha value of 0.73 (Wilhelmsen et al., 1994). The scale consisted of 9 items. Examples of statements are: "It is not harmful for kids of my age to smoke a little every week"; "If I am smoking a few cigarettes in the weekends, I might get addicted"; "It is easier to be together with people when you smoke"; "Smokers really enjoy their cigarettes". Students were given four response categories: Totally agree, somewhat agree, somewhat disagree, and totally disagree. If the item stated positive outcome expectancies towards smoking, totally disagree was coded 0, somewhat disagree = 1, somewhat disagree = 2, and totally disagree = 3. If the item stated negative outcome expectancies towards smoking, coding was reversed. In some initial statistical analyses, simple additive sumscores for subscales

or for all items combined were used. Our data revealed an alpha value of 0.72 for the total outcome expectancy scale. When data were analyzed by structural equation modelling techniques, the items were defined as categorical indicators, and measurement models for all subscales combined were tested.

The sensation seeking scale is the same as Kraft and Rise (1994) used to survey a sample of Norwegian adolescents aged 17-19, examining the relationship between sensation seeking and smoking, alcohol consumption and sexual behaviour. This 18-item version of the sensation seeking scale has also been used by Pedersen and coworkers in 1988 on a sample of 13-19 year old school students, examining the relationship between sensation seeking and drug use (Pedersen, Clausen & Lavik, 1988). Each item consists of pairs with one "high-sensation statement" and one "low sensation statement". The students had to select one item from each pair. Scores were added and divided by number of non-missing items to form a sumscore describing the extent of sensation seeking. The scale range was 0 - 1, where 1 means maximum sensation seeking. Examples of items: "I often wish I could be a mountain climber", vs "I can't understand people who risk their necks climbing mountains". "I prefer the surface of the water to the depths", vs "I would like to go scuba diving". Internal consistencies measured by Cronbach's alpha were measured for males and females separately, being 0.66 and 0.70 (Kraft & Rise. 1994). In our sample, consisting of students aged 13, the sensation seeking scale has an alpha value of 0.62. (Results not included in articles included in this thesis).

Antisocial behaviour was measured by the same scale as Wichstrøm has used in surveying more than 12 000 Norwegian adolescents aged 13 to 19 (Wichstrøm, 1992). This scale is a combination of Olweus' (1991) scale measuring antisocial behaviour and Windle's (1990) scale measuring antisocial behaviour in a longitudinal study of predictors of substance abuse. The response categories were coded as follows: never done = 0, done once = 1, done 2-5 times = 2, done 6-10 times = 3, done 10-50 times = 4, done more than 50 times = 5. Scores for all 22 items were added and divided by number of non-missing items (sumscore range 0-5). In

the introduction to this question, students were asked if they during the last 12 months had behaved like described. Examples were: - "stolen money or valuables from someone in your family?", - "been into shoplifting?", - "been driving a car or motorbike without a driving license?"

Internal consistency shown by Cronbach's alpha was in the range 0.71 to 0.76. (Wichstrøm, 1992) In our sample the antisocial behaviour scale has an alpha value of 0.89.

Students were asked two questions on *parental smoking*, one question regarding mother and one question regarding father. "Does your father/mother smoke", with two response categories (yes and no). A sumscore was constructed from these two items and divided by the number of non-missing items (range 0-1). Sumscore 0 indicated no parental smoking, 0,5 indicated that one of two parents smoked, and sumscore 1 indicated that both parents smoked (or a smoking single parent). These questions have been used and proven useful in a number of previous studies of smoking behaviour among adolescents in Norway (Aarø et al., 1981).

## 2.4 Qualitative evaluation

Ådnanes (1996) carried out a qualitative evaluation study with a focus on some of the core elements of the intervention. She followed three school-classes through all five intervention sessions in the second year of intervention. Thereafter about one third of the students in these classes were interviewed for about half an hour each. The interviews were structured, by an interview guide. Main focus areas during the interviews were:

- Assessment of the intervention methods, programme contents etc
- Assessment of the students' own attitudes towards smoking, and possible reasons for these attitudes
- Assessment of the influence of significant others' on the students' own level of consciousness on smoking issues, and relevance of the intervention



- Assessment of class and classroom environment, in a smoke-free direction

The report presented the following main conclusions:

- The students knew fairly much about health-hazards of smoking, it seemed to be a well justified and important decision not to put much efforts in focussing on health-hazards in the programme
- The students responded very favourable to the tobacco-industry issues, and on learning more about advertising, PR and so forth
- The programme focussed on self-efficacy. However, only few students reported significant smoking-pressure. Contrary, their own search for excitement and their own curiosity brought them closer to situations where smoking became an option. This is consistent with conclusions by Kraft (1999) and should be taken into account when new versions of the intervention programme are developed.
- Programme elements where untraditional educational methods were put into work (role-play, games, video etc) were popular
- The students pointed out that the most significant contribution to promoting a smoke-free lifestyle, was a series of *new* arguments in favour of a non-smoking behaviour, like for instance the cynical tobacco-industry, as well as a correction of the most common misunderstandings (i.e. correcting the perception that a high proportion of adolescents are smokers)

## 2.5 Procedures

School boards, principals, and teachers were informed about the project. After agreeing to participate, schools were told whether they had been allocated to a comparison or intervention group.

In the intervention schools, teachers were trained in two-day courses before the programme started at each school. The teacher courses focussed on the aims of the programme, background, theoretical basic, and methods applied in the different classroom settings.

Parents were involved through two brochures which were brought home by the students, the first one giving information about the project, the second giving advice about how to communicate with teenagers, and about how to help them say no to tobacco. Teachers also provided information about the project and involved parents in discussions about the project at appropriate occasions such as meeting with parents at schools. Such meetings could involve parents of individual students or parents of all students belonging to a particular class. Finally, no-smoking contracts were signed by students and parents.

All schools received identical questionnaires at baseline. At first follow-up survey, the control-groups only received the part of the questionnaire that did not focus on the intervention programme. School-group B (full intervention) received a full questionnaire at all three follow-up surveys. School-group C (Full intervention except teacher courses) received a full questionnaire at all three surveys, while school-group D (Full intervention except parental involvement) received a full questionnaire except items concerning parental involvement.

Administering of questionnaires took place at school, and all students were able to fill in the questionnaire during one normal school-hour (45 minutes). Envelopes marked with each student's-name contained a questionnaire with corresponding code-number, and an empty unmarked envelope for return of completed

questionnaires. Administration and organization of the data collection in class were taken care of by teachers.

## 2.6 Statistics

Data from the surveys conducted in this research project have a hierarchical structure. There are repeated measurements of smoking status (Level 1), on individuals (Level 2), within school classes (Level 3), and within schools (Level 4). Ordinary statistical analyses are inadequate for data with this structure, because the assumption of independence among cases does not hold. This is primarily due to two reasons. First, responses of two individuals from the same class or from the same school are likely to be more similar than the responses from two individuals picked at random from the population, due to possible school- and class-level effects present in the data. Second, there may be strong correlations between occasions within individuals. The data contain measurements of individuals who always smoke and individuals who never smoke; that is, there are serial correlations present in the data. If these class- and school-level random effects and serial correlations that exist in the data and are ignored, the confidence intervals estimated for the effects of the intervention will be incorrect.

Taking cluster effects into account and simultaneous analysis of data at different levels (such as students within school classes) is possible by using appropriate software. In the current studies, repeated clustered data were analysed with two different approaches: multilevel modelling (Goldstein, 2003) and complex design-based data analysis (Chambers & Skinner, 2003). The two approaches differ in the way cluster information is used. In multilevel modelling, the cluster variation is an integral part of the model, and viewed a relevant population parameter. In complex data analysis, the clustered variation is regarded as a nuisance factor that needs to be corrected for in estimation. These approaches are both valid in the current situation, but represent slightly different foci. Whereas the multilevel model provides subject-

specific estimates, the estimates from the complex survey-based methods are population-averaged effects.

The longitudinal aspects of the models were analysed differently across studies.

In article 1 the longitudinal aspects were incorporated through a multivariate model, with time 2, 3 and 4 as dependent variables. In article 2, a regression ANCOVA approach was used with time 4 as dependent variable for the effects, controlling for time 1 status. Lastly, in paper 3, latent growth curve models were used, incorporating information from all time points as dependent variables.

Due to attrition and item missing, the statistical analyses in all papers were based on incomplete data. According to the taxonomy of Little and Rubin (2002), it is essential to take into account the missing mechanism of data modelling, as the missing mechanism might potentially have impact on the accuracy of the estimates. Three situations can be distinguished: data missing completely at random (MCAR), data missing at random (MAR), and data not missing at random (NMAR). When missing data is MCAR, neither observed or unobserved information account for the missing mechanism. When missing data is MAR, observed information, but not unobserved information can account for missing. When missing data is NMAR, unobserved information account for the missing, i.e. the study does not have the information that account for the missing data. The analysis of attrition revealed that attrition differed across groups. It is thus unlikely that the current data follows a MCAR assumption. The attrition increased across measurements. If observed variables account for missing data, the mechanism is MAR. Importantly the current papers include baseline status, group membership and a range of demographic and age as predictors. Thus important predictors of attrition are included in the models. Since the dependent variable smoking shows a strong consistency, it is likely that data follows a missing at random mechanism.

The estimates from a multilevel logistic model in paper 1, and the multiple imputation procedure used in paper 3 are unbiased with respect to missing when the missing mechanism is MAR. Notably, a listwise deletion procedure would require even stronger assumptions MCAR. Multilevel modelling or statistical analyses with control for cluster effects are techniques that allow us to include these effects in our

model or to take them into account when estimating confidence intervals or carrying out significance testing (Goldstein, 1995). Moreover, if one makes analyses of hierarchical data, such techniques have become the standard and required scientific tools (Thomas & Perera, 2007).

### Article 1

Data analyses were performed on SPSS version 10, Stata version 7, MLwiN (Rasbash et al., 2000). Cross tabulations with adjustment for the design effect were used to examine differences among groups in smoking behaviour at baseline as well as for each of the three post-tests. Multilevel, multiple logistic regression analyses were used to examine the odds of smoking among students in the model intervention (group B) compared with students in the comparison group (A), adjusting for gender and smoking habits at baseline. To overcome problems of dependency within and between measurement occasions, an unrestricted multivariate multilevel logistic regression analysis was conducted. In this model, measures of smoking status at time 1, 2 and 3 were simultaneously entered as three dependent variables, with intervention mode as the independent variable and gender and smoking status at baseline as control covariates. For each of the three measurement occasions a binomial variation was assumed at the individual level, with normal distributed variation of residuals at the classroom level. Since the sample only included a subsample of classes in each school, random effects were modelled at the classroom level, but not at the school level. Dependency between measurement occasions were modelled as covariance between measurement occasions.

### Article 2

Data were analysed by the statistical program SPSS version 15.0, STATA version 9.2, and Mplus version 5.1. Statistical analyses included percentage distributions in order to examine properties of single items and principal components analyses (Varimax rotation and Kaiser's normalization) for examining the dimensionality of outcome expectancies (at time 1 and time 2). We also report Cronbach's alpha, correlations, and means as well as standard deviations of outcome expectancy sumscores. Multiple logistic regression analyses (with binary as well as ordinal

dependent variables) were used in order to predict smoking in 1997 (T2) from gender, smoking habits in 1994 (T1) and outcome expectancies (1994 and 1997).

### Article 3

Data were analysed using SPSS version 15.0 to examine percentage distributions for the items of the self efficacy and outcome expectancy scales, descriptive statistics for sumscores, to estimate intercorrelations among sumscores, and in order to calculate Cronbach's alpha. SPSS version 17.0.2 was used for producing multiple files with imputation of missing values on covariates (self efficacy and outcome expectancy items). Before imputation, cases with missing on all four smoking variables and those with missing on all outcome expectancy and self efficacy items were deleted.

To model the mediation of intervention effects, latent growth curve analysis with control for the cluster effect (schools) was applied. Frequency of smoking at each data collection occasion was defined as ordered categorical, and the intercept (level of smoking at baseline) as well as slope (increase in smoking over time) were used as outcome variables in a series of blockwise analyses with group (intervention versus comparison), gender, outcome expectancies (baseline and last follow up) and self efficacy (baseline and last follow up) as predictors. The three dimensions of outcome expectancies and the single self efficacy dimension were all modelled as latent variables, and each indicator was defined as ordered categorical. The WLSMV estimator in Mplus was used (Flora and Curran, 2004). Ten data files with multiple imputation on missing values were used for the analyses. The growth curve models were tested out with Mplus version 5.2 (Muthén and Muthén, 2007).

### 3. RESULTS

#### Article 1

There were no significant differences in smoking habits among the four groups at baseline. The smoking habits in the group that was involved in the most comprehensive intervention (group B) changed more favourably than those of students in the comparison schools over the three follow-up data collections. At the third follow-up, the proportion of students smoking weekly or more in the comparison group was 29.2%, compared with 19.6% in the model intervention group. Proportions of smokers at the last data collection among students in the schools with less comprehensive interventions were lower than among students in the comparison schools, but higher than among students in schools with the most complete intervention (no teacher in-service courses in group C, and no involvement of parents in group D). Smoking prevalences in these groups were, however, not significantly different from smoking prevalences in groups A and B. Multilevel multiple logistic regression analyses, comparing changes in smoking habits between students in group B with those among students in the comparison schools (group A), confirmed the conclusion that the comprehensive intervention was the most effective.

#### Article 2

The dimensionality of smoking outcome expectancies was the same at both time points (baseline and last follow-up data collection), revealing three components ('Addicted', 'Not harmful' and 'Social'). After correction for attenuation, the Pearson's correlation between T1 – T2 (which in this article means the last data collection) was .41 for the total sumscore, indicating a low to moderate relative stability. When examining smoking expectancy sumscore means by smoking habits at T1 and T2, never smokers were markedly different from the smokers on both occasions. Never smokers scored low on "Social" and "Not harmful", and high on

“Addictive”. All associations were statistically significant ( $p < .001$ ). The ‘Social’ dimension was the strongest predictor of smoking behaviour both at T1 and T2. One of the outcome expectancy sumscores (‘Addictive’) at T1 predicted smoking habits at T2 after controlling for smoking habits at T1 ( $p < .01$ ). This predictor was significant also after entering outcome expectancy sumscores at T2 into the model ( $p < .05$ ).

### Article 3

Measurement models were tested out for self efficacy and outcome expectancies modelled as latent variables. Acceptable fit was obtained without introducing any correlated error terms. A series of growth curve models were tested with frequency of smoking across measurement occasions modelled as a dependent latent variable. The intercept corresponds to the level of smoking at baseline while the slope is interpreted as change over time. The unit of change was set to one year. Self efficacy was defined as a latent variable with all items used as indicators. Outcome expectancy items are divided into three groups, each group being indicators of one latent variable. The three latent variables are “Smoking is social”, “Smoking is addictive” and “Smoking is harmful”.

Model 1 shows a significant difference in slope between intervention group and comparison group (coefficient =  $-.23$ ;  $p < .05$ ). Adding gender to the model reduces the coefficient marginally (Model 2). Adding self efficacy and outcome expectancy sumscores measured at baseline (Models 3-5) increases the size of coefficient. With self efficacy and outcome expectancies at baseline both included (Model 5), the coefficient is  $-.29$  ( $p < .01$ ). Adding first self efficacy and then outcome expectancy sumscores at the last follow up data collection (Models 6-7) separately to the predictors, reduces the association between group (intervention versus comparison) and slope (change in smoking habits over time) to  $-.15$  and  $-.10$ . If both are simultaneously included (Model 8), the unstandardized coefficient goes down to  $-.13$  (not significant), indicating some mediation of programme effects. The most comprehensive model (Model 8) explains 76.4% of the variance in intercept and 94.1% of the variance in slope.



When testing all meditational paths from group (intervention versus control) to change in smoking over time (slope) combined (Sobel's approximate test), significance was not obtained ( $p = .39$ ). Estimate of total effect was  $-.125$ , while the estimate of all indirect effects combined was  $-.047$  (unstandardized coefficients). This test could not be done on all ten imputed data sets combined. The first imputed data set was chosen for this particular test.

## **4. DISCUSSION**

This thesis is based on a project developed and carried out in the middle of the 1990's. The theoretical and empirical basis of the project was based on the best available knowledge at that time, with substantial influence from publications between 1980 and 1992. The interventions and data collections were conducted from 1994 to 1997, with a follow-up period until the year 2000. Publications from the project have been produced until 2010. This has not only given the opportunity to cover a substantial historical period of time, but has also given the opportunity to analyze and discuss the findings in light of new publications and modern analytic tools.

The discussion chapter will focus on the following topics:

- Theoretical basis
- Program content
- Program fidelity
- Interpretation of results
- Limitations
- Implications for future research

### **4.1 Theoretical basis**

The activities and components included in the programme were selected and designed based on a number of theoretical insights, see chapter 1.4. This includes attempts to take into account factors such as locus of control and processes such as psychological reactance, cognitive dissonance and self-perception and to influence factors such as self-efficacy, outcome expectancies, and social norms, the latter ones known to be important mediators in processes of behaviour change (Conner & Norman, 1996; Rutter & Quine, 2002). Furthermore, the intervention was based on educational principles such as emphasising short-term positive consequences of behaviour (Maibach & Cotton, 1995), involving the students actively (Cooper &

Scher, 1994), and mobilising support from parents (Perry, 1999), principles which have proven effective in previous interventions, and which also find considerable support in theory and theoretical models. In the time period from 1994, when the project was launched, until 2010, a high number of new publications have appeared, addressing adolescent school-based smoking prevention. Quite a few publications focus on new models for intervention and intervention development. It is, however, more difficult to find substantial new theories which would have contributed towards significant improvements of the BE smokeFREE intervention.

## **4.2 Program content**

There are five main arenas for adolescent smoking prevention: family, school, leisure/local community, mass media, and governmental regulation. The project evaluated in this study mainly concentrates on one arena for prevention, school, although with some emphasis on parents. Despite mainly taking place on one arena only, the effect of the smoking-prevention programme was substantial. Some factors seem to have contributed significantly to the positive outcome of the project

In the most comprehensive intervention, teachers were trained at two-day courses each year, parents were involved and encouraged to communicate their support of the programme goals to their offspring, and the programme was administered under conditions typical of most classrooms. When the intervention was planned, it was considered important to adjust it to everyday life at schools. Elements suggested to be part of the classroom programme were examined and considered with regards to possible cognitive and behavioural effects, as well as to implementation criteria such as simplicity, well-known pedagogical methods, and demands for low-cost audio-visual equipment.

Several elements of the intervention programme, such as classroom sessions, videos, role-plays and so forth, focussed specifically on influencing smoking

outcome expectations, and strengthening self-efficacy to resist smoking. Health outcomes were highlighted. Behavioural outcomes were also covered, such as social outcomes, for example friendship and recognition by peers. Activities were systematically connected to why adolescents start to smoke and what adolescents want to achieve by smoking, but attempts were made to show how to achieve these goals using other means than smoking. Other lessons focussed on how to resist smoking pressure and to avoid smoking in situations where cigarettes are available. The subject of how the tobacco industry specifically puts efforts into making adolescents to start smoking was very engaging to the students (Ådnanes, 1996), and students learned how to detect hidden or forbidden marketing efforts from the tobacco industry.

The design of the classroom programme was based on careful examination of previous successful interventions, discussions of programme elements with selected experts, adjustment to Norwegian conditions, collaboration with teachers, parents and students, and pretesting of the programme at two secondary schools. As stated by Müller-Riemenschneider and coworkers (Müller-Riemenschneider et al., 2008), the social and cultural dimension of programmes aiming at behaviour change among adolescents must be given particular attention. In their review of smoking prevention programmes, the multi-modal programmes analyzed reported significant stronger effects on smoking behaviour than the school-based programs. Iceland is a Nordic country, which faced the same challenges in the 1990's, as Norway. Through a broad multi-modal programme lasting for at least 10 years, they succeeded in reducing every-day smoking among 10<sup>th</sup> graders from 23% in 1998 to 12% in 2006 (Sigfusdottir et al., 2008). Program content in 'BE smokeFREE' seems to be satisfactory as a more narrowly implemented school-based project, but according to recent publications, the program should ideally have been implemented as one part of a multi-modal programme, similar to the Iceland model mentioned above. Core elements in the 'Icelandic model' are analyses of national and local data, mobilizing discussions in local communities, local actions on various fields, and integrative reflection by all participants.

### 4.3 Programme fidelity

The annual questionnaire supplied to the students in the evaluation of the intervention, included detailed questions on participation of every lesson. In addition to a monitoring of participation, students were questioned on a number of topics addressing the content of the lessons, methods used in the lessons, and the students' opinion on the overall quality of the lesson.

Every teacher responsible for the programme also filled in a questionnaire after each lesson, to evaluate the quality of each lesson. Data from this part of the evaluation project were reported to the Norwegian Cancer Society shortly after each data collection. Both program quality and program fidelity were found to be most satisfactory. More than 90% of the programme was implemented in the intervention group, measured by extensive surveying among students and teachers (data not shown).

Both the group where teachers did not attend courses and the group where parents were not involved (groups C and D) ended up with prevalence of smokers and consumption of cigarettes which were in an intermediate position between the comparison students and the model intervention students. This is consistent with our second main hypothesis. These findings indicate that some core elements of more comprehensive intervention programmes may play a key role, and that removing such elements may reduce the impact of the programme.

When teachers were attending courses, we expected that their understanding of both theory, model of intervention, goals of the programme, and so forth, would become satisfactory. Teachers were also given summaries of relevant experiences from other programmes. We also expected that the teachers attending courses would be more comfortable and skilled when administering the programme in class. By attending preparatory training it was also expected that teachers would become more enthusiastic and more motivated to administer the intervention as intended.

Parental involvement makes it more likely that parents actually will communicate support for the goals of the programme. Our findings support this assumption, as

results from the intervention group where parents were not involved, were less convincing than in the model intervention. This corresponds well to findings from a previous school-based smoking intervention in Norway (Aarø et al., 1983).

Differences in recruitment of smokers across the three years between groups C and D on one hand and groups A (comparison) and B (optimal intervention) were, however, not statistically significant, so no firm conclusions can be drawn on this point.

#### **4.4 Interpretation of results**

Results from this intervention study must be interpreted in light of the methods applied. In experimental studies, an important principle is random allocation of units (individual students, school classes, schools) to the various experimental conditions. In our project, schools were selected sequentially from a list of all schools in Norway with students in the relevant grade. The procedure applied is described in detail in the Methods chapter. The procedure ensured four sequentially selected groups of schools, matched on size and geography. If we assume that sequential sampling of this kind produces samples which for all practical purposes can be regarded as probability samples, no randomization should be necessary. When testing baseline differences across all four groups, no significance was found. Post hoc comparisons of smoking habits and important predictors across the two most important groups (groups A and B) revealed only one significant difference, namely a significant difference in self efficacy. The difference in terms of explained variance was, however, as small as 0.3 per cent, and such a difference may have occurred by chance.

One important advantage of random allocation to groups is to avoid self selection of schools to the various conditions. This is for instance strongly emphasized by Rubin (1974; 1991). With the procedure applied in our study, no self selection took place. Although schools were not always happy about being put in the comparison conditions, no schools were allowed to change condition after their group membership had been decided.

Our selection procedure may be seen as selecting clusters of schools. Each cluster consisted of four schools, each belonging to one of the four experimental conditions. One might argue that after selecting the four schools in each cluster, a random allocation of the four school-groups should have been carried out. In our opinion, the systematic allocation based on a list organizing the schools by ascending postal numbers ensures comparability of groups sufficiently well. This is supported by Thomas and Perera, as they state that the risk of a randomization bias in our study is minimal (Thomas & Perera, 2007).

Being a student in the school-group where the model intervention took place, was significantly associated with a decreased risk of becoming a smoker during the years of the interventions. Out of three students, who would otherwise have started smoking, only two became smokers. This supports assumptions from reviews and meta-analyses, indicating that interventions built on a combination of the social competence and the social influence models (Stage 4 interventions) tend to be effective (USDHHS, 1994). However, interventions based on a sound theoretical framework and adequate investment of resources for planning, have sometimes proved ineffective (Nutbeam et al., 1993; Peterson et al., 2000). Especially, the disappointing results from the Hutchinson Smoking Prevention Project (HSPP) led to serious concern about the usefulness of school-based smoking prevention programs. Despite some disappointing results, the results of the present study as well as other studies (Botvin et al., 1990; Perry et al., 1992, Sigfusdottir et al 2008) demonstrate that well-planned interventions may make a difference. A study from Finland was even able to demonstrate effects of an intervention targeting young people after 15 years (Vartiainen et al., 1998). In a ten-year follow-up of the "Know Your Body" programme which was implemented in schools in Oslo, Norway, the proportion of weekly smokers among males who did not smoke at baseline was 30% lower in intervention schools than in control schools (Klepp, Tell & Vellar, 1993).

In our project, results from the last year of the intervention were not as convincing as the first two years. One possible explanation is that after two years of intervention, the number of potential starters was higher in the intervention group than in the comparison group. However, there are reasons to believe that intervention

activities during the third year may have been too demanding for some students, particularly for those students at risk of becoming smokers. Previous studies have shown that students who report that they are performing below average at school are at a higher risk of becoming a smoker (Evans, 1984). The final year of intervention in the 'BE smokeFREE' project was less structured than previous years. Students had to make individual choices on activities on a number of occasions. Some students, and particularly students performing below average at school, may have experienced a discrepancy between program demands and individual resources. Based on these findings, the evaluation project recommended a major revision of the intervention year three before nationwide implementation.

The BE smokeFREE interventions were carried out among students in one grade-cohort only. This means that both older students and younger students at the same schools received traditional anti-tobacco education only, and that a number of teachers and parents connected to the intervention schools were not part of a common project with common goals. Recent publications strongly support the assumption that the effect of programmes such as BE smokeFREE would have been significantly better if all cohorts at the intervention schools would have participated simultaneously (Müller-Riemenschneider et al., 2008; Sigfusdottir et al., 2008). In the preparation period of the 'Be smokeFREE' project, a total inclusion of all classes in the intervention schools was discussed, but it fell due to budgetary constraints.

### *Statistical considerations*

As discussed by Susser and Susser (Susser and Susser, 1996 I; Susser and Susser, 1996 II), the improvement of analytic tools, as well as a rapidly increasing knowledge about causing agents and outcomes, called the field of prevention to move beyond the 'black box paradigm'. In prevention projects this methodological progress includes efforts to shed light on the processes between program input, and behavioural change. In the perspective of statistical analysis of intervention efforts (independent variables, X's) and outcome effects on behaviour (dependent variables, Y's), one approach to throwing light on the processes taking place within black boxes seems to be examination of possible mediating factors. That is: The efforts in



prevention programmes, like classroom curricula and activities, are expected to influence one or more mediating variables, like smoking outcome expectancies, self-efficacy, and others. Significant changes in these mediating variables are in turn hypothesized to generate behavioural change. This very interesting development in statistical analysis of data in psychology is described by MacKinnon and coworkers (MacKinnon, 2008). From 2000 until 2006, nearly 300 publications from psychology contained the word 'Mediation' in the title, and by far the largest number (98) from the field of social psychology.

Article 2 in this thesis addresses in particular one possible mediating or moderating variable, smoking outcome expectancies. Previous studies indicate that outcome expectancies can develop via observational learning, prior to direct experience with the substance (Christiansen et.al., 1989). Recent studies also present strong evidence that children's smoking outcome expectancies are developing from a very low age (Copeland et al., 2007).

Analyses from the baseline study revealed three factors or dimensions of smoking outcome expectancies, and were given the labels 'Not harmful', 'Addicted' and 'Social'. Our findings indicate that the dimensionality of our scale for measuring smoking outcome expectancies is consistent over time, even in a sample of adolescents. The pattern of component loadings is fairly simple and clear, with high loadings for each variable on one component only. These loadings range from 0.70 to 0.87, indicating a rather well defined dimensional structure.

The strongest predictor of concurrent smoking in our survey is the social dimension, both at the baseline and final survey. At the baseline survey, sumscore mean on this dimension is 1.39 among never smokers, 2.52 among seldom smokers, and 2.83 among weekly and daily smokers combined. Since the standard deviation on the 'social' sumscore is 0.65, the difference between the never smokers and the weekly/daily smokers combined corresponds to an effect size as large as 2.2.

The test-retest correlations of smoking outcome expectancies between T1 and T2 (in this context T2 means the last data collection) are rather low, and could be explained by a general low stability of smoking outcome expectancies as adolescents mature, and by the long period of time between T1 and T2 . A time period of 30

months in an adolescents' life normally covers significant parts of the maturing process. Such instability or low test-retest correlations might also be found where the test in itself has low reliability. However, the relatively high Cronbach's Alpha coefficients indicate that instability in adolescents' outcome expectancies have contributed considerably to the low test-retest correlations.

Our study followed individuals longitudinally throughout the project period. Furthermore, when performing statistical analyses, the clustered allocation to treatment conditions was taken into account whenever relevant. Applying multilevel modelling gave the opportunity to analyse the effects of a group-based intervention, contingent on individual baseline status. Through this, it was demonstrated that the observed intervention effects were valid for both smokers and non-smokers. Also, as pointed out in methodological studies (Moerbeek et al., 2003), the effect estimates obtained under multilevel procedures are more conservative than the ones obtained under individual and aggregate level studies. In our data, school-level effects were modest and therefore not included in the multilevel statistical analysis. Class level effects were present, however, and had to be taken into account. A review of the smoking prevention literature showed that such statistical considerations should be routine in reports where the sample has a hierarchical structure (Rooney et al., 2003; Thomas and Perera, 2007). A detailed discussion on the method applied in our project, multilevel repeated measures binary response models is given by Yang et al. (2000). In article 3, the effects of the interventions were again confirmed in a latent growth curve analysis with control for school.

We have shown in this project that being a student in intervention schools was significantly associated with less increase in smoking from baseline to the last follow up data collections, and that self efficacy and outcome expectancy at the last follow up data collection partly explained the association. This indicates partial mediation. Since Sobel's approximate test of mediation did not show significance in an overall test of the various possible paths from intervention to effects on smoking behaviour, no firm conclusion on this point is possible. Apart from the focus of this study on mediation of programme effects, our results lend considerable support to the idea that smoking is associated with self efficacy and outcome expectancies cross-sectionally as well as prospectively.

There are publications where mediation has been reported on a number of variables, for instance knowledge of immediate consequences of smoking, peer normative expectations, adult normative expectations (Botvin et al., 1992), self efficacy (Orlando et al., 2005), and behavioural skills (Bühler et al., 2007). Consistent with these studies, the pattern of associations between group (intervention – comparison) and change in smoking habits (slope) in our study indicates that programme effects at least partially are mediated by self efficacy and outcome expectancies. However, the overall test of mediation on our data proved not to be significant, providing limited support for the idea of mediation. Still, if applying similar tests and same statistical tools as those applied by other authors (Botvin et al., 1992; Orlando et al., 2005; Bühler et al., 2007) mediation would have been confirmed also in our study.

#### *Attrition*

In panel studies, such as the one presented here, attrition is usually a major problem. In the BE smokeFREE study, both in the comparison group and in the model intervention group, attrition rates were acceptable. Attrition in the optimal intervention group was 11.2 % accumulated across four different time points, and in the comparison group the corresponding figure was as low as 5.8 %. As expected, smokers were more likely to drop out than non-smokers, therefore the survey carried out one year after the completion of the last data collection, mentioned in the 'Methods' section, was conducted. Results from this survey showed that more smokers had left the comparison group than the model intervention group, strongly indicating that attrition does not explain the observed differences in behavioural outcomes. And as pointed out above, if attrition took place at random (MAR), the statistical analyses used in articles 1 and 3 are unbiased with respect to missing. In both analyses differences in changes in smoking habits over time between the optimal intervention condition and the comparison condition turned out to be significant.

### *Internal validity*

As stated by Botvin et al. (1990), substance users tend to have lower participation rates in prevention projects than non-users. This is a threat to the internal validity of evaluation studies. We support the suggestion made by Botvin and associates that more aggressive follow-up techniques should be implemented, to include even school dropouts, as well as broadening the sources of data. This might include interviews with peers and coaches.

## **4.5 Limitations of the study**

The contribution of each mediator, hypothesized process, or programme component, beyond the factors covered by the design itself (in our case: teacher training and parental involvement), can not easily be identified. Such decomposition of programme effects may be questionable from a theoretical point of view. Effects of smoking control interventions in schools or elsewhere can probably not be regarded as a simple sum of the contributions of each programme component or element. However, this problem of inability to link effects to specific programme components must be recognized. Evidence regarding the usefulness of single programme elements must to a large extent come from other branches of behavioural research like for instance experimental social psychology.

Our study was performed in one cohort, leaving at least 2/3 of the school population, as well as a majority of teachers, unattended to the project. In light of recent reviews, the effect of the classroom programme might be underestimated. If the programme would have been part of a multi-modal programme, stronger effects might have been achieved (Müller-Riemenschneider et al., 2008; Botvin et al., 2009).

Our study would have benefited from data on smoking outcome expectations from the two data collections in the time period between first and last survey. This would have given more detailed indications of how smoking outcome expectations change over time, and it would have been possible to distinguish more clearly between

instability caused by less than perfect reliability of scales and instability in adolescents "real" scores on outcome expectancies.

The modest test-retest correlations of smoking outcome expectations may indicate need for further refinement of the test instrument. This can also be seen in the context of tracking. Studying tracking means to examine changes in scores over time in groups defined by their initial score on a scale. Baranowski and coworkers (Baranowski et al., 1997) claim that success of interventions among adolescents to a large extent depends on a high degree of tracking in the behaviour to be influenced. An even more reliable measurement instrument would be a significant contribution to further studies of prevention efforts involving systematic efforts to influence smoking outcome expectations. Adding items to each sub-scale is one obvious strategy to improving reliability.

Alternative mediators might be operating in the BE smokeFREE intervention, and other explanations of the results are possible. When a school is involved in a smoking control intervention, this may influence attitudes among teachers and lead to norms which contribute to less smoking among the students. There is also a possibility that the processes of mediation are more complex than the simple one-stage mediation which was built into the statistical analyses carried out in this study. There could be multi-step mediation processes (intervention delivery – changes in attitudes among teachers – changes in rules and restrictions – changes in social norms as regards smoking among students - less smoking) and there might be processes of reciprocal causation. Such complex processes may be better described with other research designs, quantitative or qualitative.

The statistical power of the study was not sufficient to allow for meaningful testing of differences in change of smoking habits between all possible pairs of groups. If we assume a 5% significance level, a power of .80, a cluster size of 50, an intraclass correlation of .04, 30% smokers in the comparison group at post-test and 25% smokers in the groups where teachers were not trained or parents were not involved, the number of schools in each group would need to be as high as 150. Based on the same set of premises, but comparing with 20% smokers in the most complete intervention group (group B), the number of clusters in each group would have to be

as high as 130. These sample sizes would raise the costs of the study to unreasonable high levels. All we can do is therefore to observe that, consistent with our expectations, the less complete interventions ended up with results that are less strong than in the most complete intervention group, and stronger than in the comparison group. These power calculations demonstrate one of the problems involved in randomized community studies with several intervention conditions. In order to experimentally test out single elements of interventions, the sample sizes need to be very large and the costs correspondingly high.

#### **4.6 Implications for future intervention research**

There seem to be differences of opinions in the research literature with regard to the effectiveness and efficiency of school-based smoking prevention programmes. Thomas and Perera (2007) acknowledge short term effects, but do not come to any firm conclusions as regards longer term effects. Botvin and Griffin (2009) are somewhat more optimistic. Our study indicates that a carefully planned and adequately resourced intervention programme under the right circumstances actually does produce substantial effects over a period of three years. Thomas and Perera placed our study in the second-best category, due to inadequate reporting of performance (implementation fidelity). In fact, a very thorough implementation study was performed, but only reported internally in the project, as an important part of the process evaluation. Such data obviously should have been published.

Norway is a rather small country, and conditions are favourable for school-based tobacco interventions. Teachers are familiar with educational approaches that include active involvement of students and parents, and there is a system of regular communication and meetings between teachers and parents. And during the 1990, when the first BE smokeFREE intervention was tested out, headmasters and teachers were ready and willing to invest time and resources in school-based smoking control programmes. But also the larger societal context was favourable. A nation-wide tobacco control programme had been ongoing since the early 1970s. During the 1970s this programme included health education approaches such as mass media campaigns. Taxation on tobacco products contributed to high prices on cigarettes.

All forms of tobacco advertising were prohibited, and so was sale of tobacco to persons under 18 years of age. A comprehensive tobacco and health legislation was introduced as early as in 1975, and was improved and strengthened on several occasions. This means that the BE smokeFREE intervention was carried out in a context of a comprehensive smoking control programme where educational approaches were combined with restrictive measures.

According to a report by Aarø and associates (2009), however, the Norwegian Smoking Control Programme had suffered from lack of funding during the 1980's. During a relatively long period of time, no nation-wide mass media campaigns had been carried out, and studies had reported a levelling of in the reduction of daily smoking that had taken place previously (Kraft & Svendsen, 1996). This levelling off had also taken place among adolescents (Aarø et al., 2009). It is possible that the context of a rather inactive smoking control programme was particularly favourable for the evaluation of BE smokeFREE. The general climate of opinions was in favour of strengthening intervention efforts among school students, but the programme did not have to compete with a high number of ongoing health education efforts. It may also be easier to demonstrate effects of programmes in periods of time when there is no ongoing reduction in smoking. The lesson learned for future evaluations of school-based interventions may therefore be that it is easier to obtain effects in the context of comprehensive, nation-wide smoking control programmes, particularly if there is no downward trend in the prevalence of smokers.

It seems important to search for relevant mediators and moderators. In our study a few such factors were covered, for instance outcome expectancies (possible mediating factor) and smoking behaviours of significant others (possible moderating factor). Future evaluation studies in this field should pay more attention to such measurements and analyses, and hopefully add substantially to the theoretical and practical guidance to behavioural change. In order to examine processes of mediation and in order to identify moderators of programme effects, however, larger samples may be needed. This is important to take into account when estimating minimum sizes of samples.

Outcome expectancies seem to predict future health behaviour, even expectancies among adolescents too young to have much experience with the behaviour itself. More studies should also be done to unravel the role of outcome expectations in shaping future health behaviours among adolescents. Studies with prospective panel designs as well as intervention studies may contribute to expanding our insights into this particular field of health behaviour research. It is important to keep in mind that outcome expectancies related to health are not necessarily the most important predictors of health behaviours. In our study the 'Social' dimension was the strongest concurrent predictor of smoking, and 'Addiction' was the strongest prospective predictor of smoking behaviour. In future studies a broader range of outcome expectancies may deserve attention.

There have been examples of projects where the behavioural effects of the intervention appeared to be contrary to what was intended (Ellickson & Bell, 1990; deVries et al., 2006). If prevention efforts are put into action in populations where the unwanted behaviour still is almost not occurring, such effects are possible. In such cases, the efforts must be highly effective, and with a guarantee that adverse effects will not occur. Materials and learning experiences should concentrate on improving students' insights and understanding of positive outcomes of remaining non-smokers and providing alternative solutions to positive outcomes that are believed to follow from smoking.

From a theoretical point of view, smoking is just one out of a number of individual behaviours that can be targeted by interventions aimed at behavioural change. Such programmes can be relevant in fields such as alcohol and drug use, physical activity and healthy eating.

Based on findings in our project as well as other publications on this issue, it seems reasonable to suggest that coming studies should focus even more on program elements that facilitate mediation of desired effects, under what circumstances these elements work most effectively, among which subgroups various program activities are most effective, and at what developmental stage the target population are most receptive to the different program elements.



In the USA, funding of prevention programmes escalated throughout the 1990's. However, in Oregon, Pizacani and coworkers evaluated a recent steep defunding of a tobacco control program (Pizacani et al, 2008). In 2003, a 70% reduction of the Oregon Tobacco Prevention and Education program took place. The school-program was totally defunded. Previous gains were quickly lost, and growth in smoking uptake did not differ between defunded districts as compared to districts which never had been funded. This clearly demonstrates that the battle against smoking must be a continuously ongoing activity on all arenas of importance. Future studies should indeed closely monitor adverse effects of reduction of prevention programmes in communities, regions or states.

In a publication from 2003, Liang and coworkers addressed policies and economics concerning adolescent smoking. They made a statement about future research, which in my opinion might be broadened to all arenas of smoking prevention, and will be the final statement of this thesis (Liang et al, Addiction, 2003; 98 (suppl) p 105):

*More research is needed to address issues such as: (1) the effects of gender, age, race and socio-economic status on the relationship between tobacco control policies and youth smoking; (2) better measurement of the outcome variables to account for the multi-dimensional nature of dependence; and (3) the effects of excise taxes and other tobacco control policies with regard to a host of dimensions of smoking such as initiation, cessation, and more generally the trajectories of tobacco use that would include patterns of progression, maintenance, regression, cessation, and relapse. More frequently collected longitudinal data than those currently available are needed to address the above issues. Understanding smoking behavior cannot be achieved without incorporating familial and other social contexts.*

## **4.7 Epilogue: Nationwide implementation of BE smokeFREE**

After the completion of the evaluation study and after a number of preliminary reports to the Norwegian Cancer Society, it was decided that the programme deserved to be made available to all secondary schools in Norway. A secretariat for updating and dissemination of the programme was established in the Norwegian Directorate of Health. Budgets large enough for nation-wide distribution were made available. A nation-wide system for teacher training was established, and after some time (during the school year 2006-2007) 64% of all secondary schools in Norway used the programme. Each year about 550 teachers participated in teacher the training programme.

A new evaluation was carried out by the Norwegian Institute for Alcohol and Drug Research, and they found that results were even better in the nation-wide distribution, compared to the project (Lund et al 2002). Among schools performing other tobacco-prevention programmes or no anti-tobacco education, approximately 30% were smokers by the end of secondary schools. Among schools performing 'BE smokeFREE' approximately 20% were smokers.

A study of the implementation of BE smokeFREE in schools was carried out in 2005 (Hetland & Aarø, 2005). It turned out that not all schools carried out the full programme. The rest of the schools left out parts of the programme. This was reflected in the number of school periods allocated to the programme within one school year. One out of three teachers reported that they had used less than four school sessions. This is well below the number of sessions recommended. When elements of the programme are left out, the impact on the smoking habits of the students is likely to be reduced.

Nation- wide implementation of the BE smokeFREE programme was accompanied by a strong reduction in the prevalence of smokers among students in secondary schools in Norway. During the period 2000-2005 the proportion of daily smokers in secondary schools (all three grades combined) was ten per cent. In 2005 the

proportion was down to five per cent (Aarø, Lindbak, Øverland & Hetland, 2009). A similar reduction in smoking took place also among young adults and among the adult population as a whole (Aarø, Lund, Vedøy & Øverland, 2009). It is impossible to estimate to what extent the reduction in smoking which took place among students in secondary schools can be attributed to the BE smokeFREE programme. We may hypothesize, however, that the reduction in the prevalence of smokers among Norwegians which took place after year 2000 was related to the strengthening of the national smoking control programme which started towards the end of the 1990's.

A revision of the programme was done by the Norwegian Directorate of Health in 2006. The name of the programme is now BE FREE. The purpose of the revision was to make the programme easier to use by teachers. The three teacher manuals which were used in the original version of the programme have been reduced to one. The teacher training programme has been discontinued, and replaced by a training module on the BE FREE homepage. The intervention approaches used in BE FREE are recommended also in other fields of school based health education. During the revision in 2006 it was also seen as important to relate the programme more strongly to the Norwegian school reform of 2006 (Kunnskapsløftet) and to the national curriculum for secondary schools. In spite of the strong reduction of smoking which has taken place among school students in Norway after year 2000, in the school year 2010-2011 more than half of all secondary schools in Norway implement the BE FREE programme.

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## 6.0 APPENDIX, PAPERS

Article 1:

Jøsendal O, Aarø LE, Torsheim T, Rasbash J. Evaluation of the school-based smoking-prevention program "BE smokeFREE".  
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Evaluation of the school-based smoking-prevention programme 'BE smokeFREE'

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## *Objectives*

This article examines the impact of the school-based smoking-prevention programme 'BE smokeFREE' on adolescent smoking.

## *Methods*

A national representative sample of 99 schools (195 classes, 4,441 students) was used when the intervention started in November 1994. Schools were allocated to one of four groups: a comparison group (A) and three intervention groups (B, C, and D). Group B received the most comprehensive intervention. A baseline (autumn 1994) and three follow-up data collections (1995, 1996, and 1997) were conducted.

## *Results*

There were no significant differences in smoking habits among the four groups at baseline. The smoking habits in the group that was involved in the most comprehensive intervention (group B) changed more favourably than those of students in the comparison schools over the three follow-up data collections. At the third follow-up, the proportion of students smoking weekly or more in the comparison group was 29.2%, compared with 19.6% in the model intervention group. The two less comprehensive interventions (no teacher in-service courses in group C, and no involvement of parents in group D) appeared to be less effective than the model intervention. Multilevel multiple logistic regression analyses, comparing changes in smoking habits between students in group B with those among students in the comparison schools, confirm the conclusion that the comprehensive intervention was the most effective.

## *Conclusion*

This school-based intervention, based on a social influence approach, proved to be effective at reducing smoking rates among participants.

*Key words:* Adolescents, school, smoking, intervention, prevention, evaluation, multilevel statistical analysis

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## Introduction

Since the 1970s there has been a trend towards lower proportions of smokers among adults in the Nordic countries. While figures for all age groups combined indicate that the decrease has been particularly strong for men, analyses of changes within specific age groups reveal that the decrease has been substantial also among young and middle-aged women. The changes taking place among adolescents have, however, been less consistent across time and across countries. In Norway the decline in smoking prevalence among adolescents and young adults levelled out during the 1990s, and some studies among adolescents even showed an increase in the proportion of smokers (Braverman et al., 2001). Throughout this period, the health hazards from smoking have been documented in a steadily increasing body of research (Royal College of Physicians, 1992; Peto et al., 1994; Engeland, 1997).

Sussman et al. (1995) have discussed various forms of smoking-prevention interventions, and maintained that adolescent school-based smoking prevention tends to be more effective than other options for several reasons: because most young people are likely to be exposed to such programming if instituted during school hours, because schools are typically mandated by law to provide health education, and because they allow for face-to-face learning and optimal evaluation of programmes.

A large number of school-based smoking-prevention projects have been evaluated. Some evaluations have shown no significant effect on smoking behaviour (Bewley et al., 1976; Nutbeam et al., 1993; Peterson et al., 2000), while other studies have demonstrated convincing effects (Tell et al., 1984; Botvin et al., 1990; Perry et al., 1992). During the 1980s and 1990s, new theories and models have been developed to support the design of more effective interventions (U.S. Department of Health and Human Services, 1994).

Meta-analyses of parts of the substantial amount of literature in this area allow for comparison of the effects of different kinds of interventions (Tobler, 1986; Bruvold, 1993). Based on these reviews as well as further examination of previous research, and based on information from surveys of the target population, the Norwegian Cancer Society during the 1990s developed a school-based smoking prevention programme entitled "BE smokeFREE". The programme was classroom-based and comprised teacher training as well as involvement of parents. The current article briefly describes the programme and presents some core results regarding the effect of the intervention on students' smoking habits. Our two main hypotheses were:

- This new smoking prevention programme, when implemented in secondary school, was expected to be more effective in preventing adolescents from smoking than the relevant educational activities that normally take place.
- Less positive effects were expected from programmes that either (i) did not include teacher training or (ii) did not include parental involvement.

In 1993, the Norwegian Cancer Society started developing the school-based smoking-prevention programme BE smokeFREE for adolescents in secondary school. Two previous Norwegian intervention studies provided important background information for the intervention described here. During the 1970s the Norwegian Council on Tobacco and Health developed a brief school-based intervention to prevent smoking among sixth to ninth graders (aged 12 – 15 years). This intervention was administered to students at schools in a rural district of central southern Norway in 1978. Those students who had experienced the most extensive intervention showed a short-term reduction in cigarette consumption of 21%. An improved version of the same intervention was carried out in a more urbanized neighbouring district in 1979. It was estimated that the intervention resulted in an eight-percentage-point reduction in the prevalence of smokers in the intervention area for both boys and girls 12 months after the intervention took place (Aarø et al., 1983).

As part of an international study on adolescent health promotion, the ‘Know Your Body Programme’, six primary and secondary schools in Oslo participated in The Oslo Youth Study (Defriese et al., 1990). The intervention in this study targeted three behaviours known to be related to the risk of coronary heart disease: eating habits, physical activity, and tobacco smoking. The smoking-prevention part of the programme consisted of 10 lessons given over the course of two school years. Two years after the intervention had finished, the recruitment of smokers in the intervention group was 40% lower than the recruitment rate in the control group (Tell et al., 1984).

In the period 1980–94, there were no evaluations of large-scale school-based interventions for the prevention of smoking in Norway. However, a substantial number of school-based interventions have been conducted and evaluated in other countries. In the report ‘Preventing Tobacco Use Among Young People’ (U.S. Department of Health and Human Services, 1994), three models corresponding to three stages in the historical development of school-based smoking interventions are described.

#### Stage 1: the information deficit model

During the 1960s and early 1970s, anti-smoking lobby groups as well as physicians and psychologists accepted that the public had not become sufficiently aware of the health hazards of smoking. It was hypothesized that correction of this information deficit would lead directly to behaviour change. Evaluations of this kind of interventions showed no effects or only minimal effects on behaviour (Goodstadt, 1978; Thompson, 1978).

#### Stage 2: the affective education model

In this stage, there was an assumption that smoking is part of a more general set of health-compromising behaviours. Interventions sought to increase adolescents’ perceptions of self-worth and to establish a personal health-related value system that would support their decision to remain smoke-



free. Several reviews concluded that interventions based on the affective education model had almost no effect on behaviour (e.g. Hansen et al., 1988).

### Stage 3: comprehensive interventions based on the social influence model

Throughout the 1980s, smoking was found to be strongly influenced by a number of social factors, in addition to personal and behavioural factors (Aarø et al., 1983; Evans, 1984). From the beginning of Stage 3, programmes were based on theories from social and behavioural psychology. Social factors received most attention as determinants of the onset of smoking. Interventions focused on the development of behavioural norms that favoured non-smoking and of skills to identify and resist social pressure to smoke. Several studies confirmed that interventions based on the Stage 3 model were relatively successful (Tobler, 1986).

In 1988, a panel of experts reached consensus regarding essential structural elements of successful smoking-prevention programmes in schools. The following eight features were considered necessary and sufficient (Glynn, 1989):

- Classroom sessions should be delivered at least five times per year in two of the three years from sixth to eight grades.
- The programme should emphasize (i) social factors that influence the onset of smoking, (ii) short-term consequences of smoking, and (iii) refusal skills.
- The programme should be incorporated into the existing school curriculum.
- The programme should be introduced during the transition from elementary school to junior high or middle school.
- Students should be involved in the presentation and delivery of the programme.
- Parental involvement should be encouraged.
- Teachers should be adequately trained.
- The programme should be socially and culturally acceptable to the local community.

The 'BE smokeFree' programme was designed in order to meet all these criteria.

### Theoretical anchoring

The BE smokeFREE intervention is primarily based on insights from social psychology and from previous smoking-prevention research that showed the strengths of the social influence model. The intervention strongly focuses on the opportunities of individual students to choose. This study argues,

in line with Wallston et al. (1976), that individuals will be more likely to take responsibility for their health if they perceive that their behaviour will have an impact on their health. Thus, increasing the internal health locus of control was one of the aims of the intervention.

According to Bandura's Social Cognitive Theory, self-efficacy and outcome expectancies are major predictors of behaviour. Increasing students' self-efficacy to cope with situations where they might be under pressure to smoke was an important intervention goal. Another important aim was to increase their positive expectancies of the consequences of a smoke-free lifestyle (Bandura, 1986). Students were consistently encouraged to believe that they could improve their own health through being smoke-free, and that they possessed the resources and skills to succeed in this effort.

Adolescents make assumptions about the possible gains and losses inherent in smoking, and are more likely to be influenced by short-term positive gains than long-term negative consequences (U.S. Department of Health and Human Services, 1994). Thus, students were given a detailed description of the immediate negative consequences of consuming cigarettes, such as physiological, dermatological, dental, economic, and social consequences. Short-term positive consequences of not smoking were also emphasised.

If individuals believe that other people are trying to limit their freedom to choose, it often leads to negative feelings or emotions and attempts to restore their freedom. This tendency is called psychological reactance (Brehm, 1966). Perceived loss of freedom may make individuals less motivated to perform the behaviour advocated by other people. By emphasizing that tobacco is addictive and that the tobacco industry relies on their customers' addiction, with the associated loss of freedom, it was anticipated that students would develop reactance towards attempts to influence them to smoke.

It has previously been shown that behaviour is more strongly influenced by projects where students are involved in activities rather than being passive information receivers (U.S. Department of Health and Human Services, 1994). The technique of influencing people through involvement in attitude-discrepant behaviour is called "induced compliance" (Festinger & Carlsmith, 1959; Eagly & Chaiken, 1993). If students are involved in activities where they publicly advocate a smoke-free life, it is expected that they will become more committed to remaining smoke-free. Students in the intervention condition were given opportunities to express the advantages of being smoke-free through a variety of activities such as singing, writing, and making T-shirts, and through developing interventions targeting younger students.

The social influence approach, however, goes beyond the scope of the personal factors and processes addressed above. By mobilizing support from parents and by involving students in classroom and group activities, it is expected that social norms relevant to smoking will change. The societal and individual norms are expected to increasingly favour non-smoking. Kurt Lewin concluded that individual behaviour can be changed more easily by working with the groups to which the individual

belongs than by working with the individual alone (Lambert & Lambert, 1964). As this conclusion is undoubtedly still valid, it guided the approaches chosen in the BE smokeFREE intervention.

The Norwegian Cancer Society has built the intervention on well-established theories, experiences, and recommendations from scientifically evaluated projects. Experiences from interventions and evaluation studies in the U.S. were examined, and necessary adaptations to Norwegian conditions were made.

As mentioned above, a number of research-based and carefully designed interventions have failed showing any impact on smoking habits of school students. A recent example is the Hutchinson Smoking Prevention Project (Peterson et al., 2000). The purpose of evaluation studies such as the present one is therefore primarily to demonstrate that the actual intervention is sufficiently powerful to have an impact on the smoking habits of the adolescents involved. In order to achieve this, multi-component interventions are needed, and several hypothesized mediating factors and personal as well as interpersonal processes (such as those described above) may operate simultaneously. Such multi-faceted interventions are rather different from theoretically driven research on behaviour change, where the purpose often is to examine the impact of single factors or test out highly specific hypotheses (Burgoon, Hunsaker & Dawson, 1994).

In the present study, however, two intervention components were systematically varied in order to examine their contribution to the success of the programme; the teacher training component and the parental support component. It is generally assumed that both these components are necessary ingredients of effective school-based smoking behaviour interventions (Glynn, 1989). Teacher training is important in order to motivate teachers for actually administering the whole programme according to the manuals and guidelines provided, and also in order to train teachers in approaches which are specifically important when influencing students' behaviour and not only their recall and comprehension.

As shown in a number of previous studies, smoking habits of adolescents are strongly influenced by the behaviour and the attitudes of their parents (Aarø et al., 1981; Bricker et al., 2003), and it has been demonstrated that triggering parental support for programmes administered by schools significantly adds to the effectiveness of such programmes (Aarø et al., 1983). The intervention would, however, have been more cost-effective if the same impact could have been obtained without training teachers or involving parents. These two components were therefore specifically addressed by the present evaluation study.

## Methods

Sample and experimental design

A national representative sample of 99 schools participated, containing 195 classes with 4,441 students in Grade 7 (students aged 13 years). Schools were allocated to four groups, one comparison group and three intervention groups, with approximately the same number of schools and students in each group. Samples were large enough to obtain a statistical power of 0.80 with a small effect size (ES) and an  $\alpha$  of 0.05 with maximally 8 independent variables operating simultaneously in a Multiple R significance test, leading to a recommendation of  $N=757$  or more in each group (Lwanga & Lemeshow, 1991). Given that schools were units of assignment (allocation of clusters to experimental condition) and that there will inevitably be attrition, we decided to include between 1,000 and 1,100 students in each group. The approximations made were adequate for data with a hierarchical (students within classes within schools within experimental condition) structure. With an average of two classes and 47 students per secondary school in Norway, it was necessary to allocate 25 schools to the comparison group as well as to each of the three intervention groups.

Schools were sampled from a list of all secondary schools in Norway. The schools were sorted by ascending postal code number. In order to obtain a sufficiently large sample, every 11<sup>th</sup> school had to be included in the study. Schools were allocated to groups (one comparison group and three intervention groups) as follows: First, a random number between 1 and 44 was chosen. Starting with that number we then selected every 44<sup>th</sup> school to constitute the comparison group. Then the three next schools on the list (of approximately the same size, +/- 10%) following after each control school were allocated to intervention groups A, B, and C respectively.

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Insert Figure 1 about here  
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This study is based on data obtained from the baseline survey conducted in November 1994 and follow-up surveys conducted in May 1995, April 1996, and April 1997.

Written consent was obtained from 95% of students and parents (4 223 subjects). Individual students were given code numbers so that they could be anonymously tracked over time. School boards, principals, and teachers were informed about the project. After agreeing to participate, schools were told whether they had been allocated to a comparison or intervention group. All surveys took place in a classroom setting, administered by classroom teachers within a 45-minute period. After completion, all questionnaires were placed in envelopes that were sealed to ensure confidentiality and mailed to evaluators.

### The Intervention

The intervention methods chosen were similar to those recommended in the report 'Preventing Tobacco Use Among Young People' (U.S. Department of Health and Human Services, 1994). In order to allow for effective dissemination of the programme to schools throughout the country after the completion of the evaluation study, it was decided that the intervention was to be administered by teachers and other staff of each school only. Using external personnel to administer the interventions would have made a nation-wide dissemination of the programme much more difficult.

The programme was tested out among students who were in Grade 7 in 1994 (mean age at baseline slightly lower than 13 years). The programme was administered among this cohort throughout secondary school, that means for three years (in grades 7, 8 and 9). The intervention was completed spring 1997, shortly before the third follow-up data collection took place.

In Grades 7 to 9, the numbers of school hours allocated for the intervention were eight, five, and six, respectively. Every school hour contained elements of non-traditional classroom activities such as the use of video, games, and group work. Activities were designed to ensure that all students would participate actively.

During Grade 8, teachers and students indicated to the programme administrators that the main messages and educational approaches that had been chosen when planning the intervention had been sufficiently emphasized, and requested a change. Adjustments were subsequently made to the intervention plans. Instead of receiving additional educational activities, Grade 9 students developed, carried out, and evaluated their own campaign to promote a smoke-free lifestyle among Grade 7 students at their own school. Students were recruited to different working groups, which each held a particular role within the campaign at their own school.

### Measures

A more thorough description of scales and questionnaire items is given elsewhere (Jøsendal, Aarø & Bergh, 1998). The students were asked one question regarding frequency of smoking, with four possible response alternatives: daily smoker, weekly smoker, smoking less than once a week, or not smoking at all. This ordered categorical dependent variable was dichotomized, to be used as the criterion variable in logistic regression analyses; non-smokers and those who smoked less often than weekly were given a value of 0, while those who smoked daily or weekly were given a value of 1. Students were also asked about the number of cigarettes they smoked per week. Data on students' experimentation with or use of cannabis were collected by a question on the frequency of such use (ever, once, or more than once). All non-users were coded 0, and all others 1, to form the dichotomous dependent variable in a logistic regression analysis.

## Data analyses

Data analyses were performed on SPSS version 10, Stata version 7, and MLwiN (Rasbash et al., 2000). Cross tabulations with adjustment for the design effect were used to examine differences among groups in smoking behaviour at baseline as well as for each of the three post-tests.

Our data have a hierarchical structure. We have repeated measurements of smoking status (Level 1), on individuals (Level 2), within school classes (Level 3), and within schools (Level 4). Ordinary multiple logistic regression analysis is inadequate for data with this structure because the assumption of independent binomial variation at each measurement occasion does not hold, which is primarily due to two reasons. First, responses of two individuals from the same class or from the same school are likely to be more similar than the responses from two individuals picked at random from the population, due to possible school- and class-level effects present in the data. Second, there may be strong correlations between occasions within individuals. The data contain measurements of individuals who always smoke and individuals who never smoke; that is, there are serial correlations present in the data. If these class- and school-level random effects and serial correlations exist in the data and are ignored, the confidence intervals estimated for the effects of the intervention will be incorrect. Multilevel modelling is a technique that allows us to include these effects in our model (Goldstein, 1995). Multilevel, multiple logistic regression analyses were used to examine the odds of smoking among students in the model intervention (group B) compared with students in the comparison group (A), adjusting for gender and smoking habits at baseline.

To overcome problems of dependency within and between measurement occasions, an unrestricted multivariate multilevel logistic regression analysis was conducted. In this model, measures of smoking status at time 1, 2 and 3 were simultaneously entered as three dependent variables, with intervention mode as the independent variable and gender and smoking status at baseline as control covariates. For each of the three measurement occasions a binomial variation was assumed at the individual level, with normal distributed variation of residuals at the classroom level. Since the sample only included a sub-sample of classes in each school, random effects were modelled at the classroom level, but not at the school level. Dependency between measurement occasions were modelled as covariance between measurement occasions.

## Results

### *Smoking habits by experimental condition – bivariate analyses*

Table 1 shows the proportions of daily smokers, weekly smokers, those who smoked less often than weekly, and non-smokers, by experimental condition. The differences across groups were not statistically significant at baseline. On all three follow-up occasions, the differences were significant.

This was the case not only when testing among all experimental conditions, but also when testing model intervention schools (group B) specifically against comparison schools (A). All significance tests are shown in Table 1. The tests used in these analyses are adjusted for the design effect, i.e., the increases in standard errors resulting from allocating schools instead of individual students to the various experimental conditions. The proportion of smokers, irrespective of how smokers are defined (daily, daily or weekly, daily or weekly or less often) was higher among students in the comparison schools than in the model intervention schools on all three follow-up occasions. In the two other intervention groups, where either teacher training (group C) or the involvement of parents (group D) were not part of the intervention, the proportion of smokers on all follow-up occasions was higher than that in the model intervention, but lower than that in the comparison schools. After the third intervention year, the proportion of weekly smokers among students in the model intervention schools was 19.6%, compared with 29.2% of students in the comparison schools.

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Insert Tables 1 & 2 and Figure 2 about here

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The mean numbers of cigarettes smoked per week by students under the experimental condition are shown in Table 2 and Figure 2. The results are consistent with the results of the analyses above. For all follow-up occasions, the highest mean rate of smoking was found among students in the comparison schools and the lowest among students in the model intervention schools. Again, the students in the other two conditions were in an intermediate position. These differences were not tested for significance, since there is no test in the available software that can handle such strongly skewed variables while simultaneously adjusting for the design effect.

### Attrition

Attrition in the intervention group was 11.2 % accumulated across four different time points, and in the comparison group the corresponding figure was 5.8 %. Analyses of attrition showed that smokers were more likely to drop out than non-smokers. This tendency was slightly stronger in the comparison group than the intervention group. Due to this, a separate survey of approximately 100 students who dropped out of the project was conducted approximately three years after the intervention had been finished (data not shown). Results from this survey showed that more smokers had left the comparison group than the model intervention group

*Smoking habits by experimental condition, multilevel multiple logistic regression analysis*

Table 3 shows the odds-ratio of being a smoker (smoking daily or weekly) after intervention years 1, 2, and 3 by experimental condition (model intervention vs. comparison), adjusted for gender and baseline smoking (main effects). Since the model controls for baseline smoking status, the odds ratio can be interpreted as the odds ratio of becoming a smoker. An odds ratio of 1.0, would mean that there are equal odds of becoming a smoker in the comparison group and the model intervention group.

It can be seen from the table that the odds ratio of becoming a smoker during the intervention period, was statistically lower in the intervention group, indicated by statistically significant Wald's test for daily smoking (Wald's 9.81, df = 3, p = 0.020) , weekly smoking (Wald's 15.65, df=3, p = 0.0001), and for any smoking (Wald's 16.54, df = 3, p = 0001). The relative difference between intervention group and the comparison group was comparatively more pronounced in the early stages (year 1) of the intervention, than in the later stages (year 3).

Owing to the fact that the overall base rate of smoking changed substantially during the period, comparisons of odds ratios across the intervention period can be potentially misleading. To translate the present estimates into absolute probabilities of smoking we converted predicted log odds of smoking to predicted probabilities of smoking, contingent on baseline smoking status. As shown in table 4, for a student that was non-smoking at baseline, the absolute rate differences of smoking between the intervention group and the comparison group increased across the intervention period.

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Insert Table 4 about here  
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Cannabis experimentation / use

The odds-ratio of cannabis use was 0.51 in the model intervention, with the control group as reference (95% CI 0.19 – 0.85, p< 0.01).



## Discussion

Being a student in the model intervention condition, which included the educational programme BE smokeFREE, in-service courses for teachers, and parental involvement, was significantly associated with a decreased risk of becoming a smoker during the years of the interventions. Consistent with this, the mean consumption of cigarettes among students in the model intervention group was considerably lower than in the comparison group. These results support assumptions shown in meta-analyses, indicating that interventions built on the social influence model (Stage 3 interventions) tend to be effective (U.S. Department of Health and Human Services, 1994). However, even interventions that are apparently based on a sound theoretical framework and adequate investment of resources for planning have sometimes proved ineffective (Nutbeam et al., 1993; Peterson et al., 2000). Despite some disappointing results, the results of the present study as well as other studies (Botvin et al., 1990; Perry et al., 1992) demonstrate that well-planned interventions may make a difference. A study from Finland was even able to demonstrate effects of an intervention targeting young people after 15 years (Vartiainen et al., 1998).

Results from the last year of the intervention were not as convincing as the previous two years (Table 2). It might be argued that after two years of intervention, the number of potential starters was higher in the intervention group than in the comparison group. However, there are reasons to believe that participation in the intervention activities during the third year may have been too demanding for some students, particularly for those students at risk of becoming smokers. We know from previous studies that students who report that they are performing below average at school are at a higher risk of becoming a smoker (Evans, 1984). The last year of intervention in the 'BE smokeFREE' project was less structured than previous years. Students were allowed to make individual choices on activities on a number of occasions. Students performing below average at school probably found that the methods used in intervention year three were insufficiently structured and perhaps also too difficult and demanding. A major revision of the intervention year three was therefore needed before nationwide implementation started.

The BE smokeFREE interventions were carried out among students in one grade-cohort only. This means that both older students and younger students at the same schools received traditional anti-tobacco education only. We may hypothesize that the intervention on smoking behaviour would have been even more effective if all grades in the intervention schools had received the intervention. Due to budgetary constraints, however, this could not occur.

### Possible explanations to why 'BE smokeFREE' made a difference

There are five main arenas for adolescent smoking prevention: family, school, leisure/local community, mass media, and governmental regulation. The project evaluated in this study mainly concentrates on one arena for prevention, school, although with some emphasis on parents. Despite mainly taking place on one arena only, the effect of the smoking-prevention programme was substantial. A number of factors may have contributed to the positive outcome of the project, some of which are likely to be more important than others.

Firstly, the activities and components included in the programme were selected and designed based on a number of theoretical insights which are described in the introduction of this article. This includes attempts to influence factors such as locus of control, self-efficacy, outcome expectancies, and social norms, all of them known to be important mediators in the process of behaviour change (Conner & Norman, 1996; Rutter & Quine, 2002). Furthermore, the intervention was based on educational principles such as emphasising short-term positive consequences of behaviour (Maibach & Cotton, 1995), involving the students actively (Cooper & Scher, 1994), and mobilising support from parents (Perry, 1999), principles which have proven effective in previous interventions, and which also find considerable support in theory and theoretical models. As is the case with most large-scale community-based intervention studies, the contribution of each mediator, hypothesized process, or programme component, beyond the factors covered by the design itself (in our case: teacher training and parental involvement), can not easily be identified. Such decomposition of programme effects may even turn out to be questionable from a theoretical point of view.

Secondly, the design of the classroom programme was based not only on careful examination of previous successful interventions but also on discussions of programme elements with selected experts, careful adjustment to Norwegian conditions, collaboration with teachers, parents and students, and pretesting of the programme at two secondary schools. In addition, in the model intervention teachers were trained at two-day courses each year, and parents were involved and encouraged to communicate their support of the programme goals to their offspring.

Thirdly, this programme was administered under conditions typical of most classrooms. When the intervention was planned, it was considered important to adjust it to everyday life at schools. With this in mind, elements suggested to be part of the classroom programme were evaluated in relation to possible cognitive and behavioural effects, as well as to implementation criteria such as simplicity, well-known pedagogical methods, and demands for low-cost audio-visual equipment only.

### Removing teacher training and parental involvement

In the present study, student in two of the school groups showed less convincing results than those in schools where the most extensive intervention took place. Both the group where teachers did not

attend courses and the group where parents were not involved ended up with prevalence of smokers and consumption of cigarettes which were in an intermediate position between the comparison students and the model intervention students. This is consistent with our second main hypothesis. These findings indicate that some core elements of more comprehensive intervention programmes may play a key role, and that removing such elements may substantially reduce the impact of the programme.

When teachers are attending courses, one might expect that they develop a deeper understanding of the programme. They are exposed to relevant experiences from other programmes, they participate in discussions on the theoretical background of the programme, and they may develop a clearer understanding of the rationale underlying various programme components. Furthermore, one might expect that the teachers attending courses are feeling more comfortable and skilled when administering the programme in class. Participating in preparatory training may also lead to more enthusiasm and a stronger motivation for administering the programme according to the instructions provided.

Parental involvement makes it more likely that parents actually will communicate support for the goals of the programme. Our findings support this assumption, as results from the intervention group where parents were not involved, were less convincing than in the model intervention.

#### Influence on cannabis experimentation

It has been shown previously that adolescent smoking predicts experimentation with cannabis (Lai et al., 2000). In our study, the frequency of cannabis experimentation was approximately 50% lower among students in model intervention schools compared with students in comparison schools. A similar difference was not observed for alcohol. This difference in impact on the consumption of the two kinds of addictive substances might be explained by the way in which the substances are used. As both tobacco and cannabis are normally smoked and inhaled, the impact of a campaign targeting smoking may more easily be generalized to a behaviour which is more similar as regards the actual use of the substance.

#### Multilevel statistical analysis

The present analysis was subject-based, but took into account the clustered randomization of treatment. The multilevel modelling was carried out in order to analyse the effects of a group-based intervention, contingent on individual baseline status. In that way we were able to demonstrate that the observed intervention effects were valid for both smokers and non-smokers, which would have

been more cumbersome if the analysis had been based on aggregate class-level data. Also, as suggested by recent methodological studies (Moerbeek, van Breukelen, & Berger, 2003), the effect estimates obtained under multilevel procedures are more conservative than the ones obtained under individual and aggregate level studies.

Estimating class- and school-level random effects is also important from a substantive perspective. In our data, school-level effects were negligible and therefore unreported. However, class level effects were present, and had to be taken into account in our testing of significance. A review of the smoking prevention literature showed that such statistical considerations should be routine in reports where the sample has a hierarchical structure (Rooney et.al. 2003). For a more detailed discussion on multilevel repeated measures binary response models, see Yang et al. (2000).

### Attrition

In panel studies, such as the one presented here, attrition is usually a major problem. In the BE smokeFREE study, both in the comparison group and in the model intervention group, attrition rates were acceptable. Attrition in the intervention group was 11.2 % accumulated across four different time points, and in the comparison group the corresponding figure was as low as 5.8 %. As expected, smokers were more likely to drop out than non-smokers, therefore the survey mentioned in the 'Methods' section was conducted. Results from this survey showed that more smokers had left the comparison group than the model intervention group, strongly indicating that attrition does not explain the observed differences in behaviour.

### Internal validity

As stated by Botvin et al. (1990), substance users tend to have lower participation rates in prevention projects than non-users. This is a threat to the internal validity of evaluation studies. We support the suggestion made by Botvin and associates that more aggressive follow-up techniques should be implemented, to include even school dropouts, as well as broadening the sources of data collection. This might include interviews with peers and coaches.

### Nationwide implementation

The positive results obtained inspired a nationwide implementation that was launched in late 1997. More than 40% of the national cohort of students (25,000 students) who started secondary school in Norway in August 1997 participated. In all schools which were involved in the programme, every new class starting at secondary school were given the opportunity to participate. This means that by the school year 1999/2000, schools that joined in 1997 and were still participating in the programme, comprised a student body who had all been exposed to and involved in the BE smokeFREE

programme. By autumn 2002, more than 60% of Norwegian secondary schools were involved in the programme, and 110,000 students had participated.

#### Implications for future intervention research

There are considerable differences of opinion in the research literature as regards the effectiveness and efficiency of school-based smoking prevention programmes. This is the case even for the third generation (social influence) programmes. The present study indicates that a carefully planned and adequately resourced intervention programme under the right circumstances actually does produce substantial effects. And we have to keep in mind that the students in the model intervention were not compared with students who received no intervention. The comparison group consisted of students who were exposed to "business as usual" education on smoking and health. Attempts were made to measure the number of school hours of smoking and health education that was delivered in comparison schools. It turned out that the mean number of school hours allocated to such education in the comparison group was about half of the corresponding figure for the model intervention schools.

The circumstances in Norway may be rather favourable for school-based tobacco interventions. Norwegian teachers are at least to some extent familiar with educational approaches that include active involvement of students. There is a system of regular communication and meetings between teachers and parents. In Norway all forms of tobacco advertising is prohibited, and so is sale of tobacco to persons under 18 years of age. A comprehensive tobacco and health legislation was introduced as early as in 1975, and has been improved and strengthened on several occasions. From June 2004 there will be a total ban on smoking in restaurants and cafeterias. The attitudes of parents and adults in Norway are discouraging smoking among early adolescents. If a similar intervention is administered in a less favourable context, we have no guarantee that the impact will be as strong as indicated by the present evaluation. Other circumstances may require different approaches.

The present study was primarily designed for the purpose of showing that the programme had an impact on smoking habits, and that two components (parental involvement and teacher training) contributed to the effects of the programme. Most evaluation studies in the field of school-based smoking intervention only compare one intervention group with one comparison group. Adding two more conditions and utilising a two-factorial design like the present one, has to some extent made this study a more interesting one. Adding two groups, however, also made the evaluation study more challenging. The number of students to be included had to be doubled in order to ensure sufficient statistical power. Furthermore it turned out that attrition among students in the two extra intervention conditions was considerably higher than among students in the model intervention and the comparison schools. To some extent this reduces the usefulness of the two extra groups of schools. The higher attrition rates, however, also provide additional evidence regarding the problems with

administering interventions in schools when teachers are not adequately trained or when parents are not involved.

A different approach to identifying processes and factors contributing to successful interventions is to search for important mediators and moderators. In order to cover the whole range of potentially important mediating and moderating factors, the questionnaires easily become too comprehensive to be adequately administered by teachers within one school session. In the present study a few such factors were covered, for instance outcome expectancies (possible mediating factor) and smoking behaviours of significant others (possible moderating factor). Analyses of possible mediators and moderators will be presented in future publications from this research project. We would like to recommend that future evaluation studies in this field pay more attention to such measurements and analyses. This will add substantially to the theoretical and practical contributions of such research.

#### Acknowledgements

The BE smokeFREE intervention was designed and developed by the Norwegian Cancer Society, which also funded this evaluation study. We are grateful for a most fruitful and productive collaboration with the Information Department of the Norwegian Cancer Society. We also extend our gratitude to Professor Richard Jessor and colleagues at the Institute of Behavioural Science, University of Colorado, Boulder, for their support during the planning of this project.

## Evaluation of 'BE smokeFREE'

Table 1: Smoking habits at baseline and at each of the three post-intervention data collections (percentage distributions), by experimental condition. Significance is tested with Pearson's  $\chi^2$ , corrected for the design effect. The correction implies that the  $\chi^2$ -value is converted to an F-value with the number of degrees of freedom that may deviate from integer values.

	Comparison Schools	Model intervention	Model interventio minus teacher Courses	Model intervention minus parent. involvement
	A	B	C	D
-----				
1994 (8 <sup>th</sup> grade - baseline)				
daily smokers	2.2	1.1	2.1	3.2
weekly smokers	0.8	1.6	1.7	1.8
less than weekly	4.2	4.1	4.5	5.2
non-smokers	92.8	93.2	91.6	89.9
-----				
sum	100.0	100.0	99.9	100.0
N	1092	1125	933	1005
-----				
1995 (8 <sup>th</sup> grade)				
daily smokers	5.9	1.8	5.5	6.3
weekly smokers	3.1	1.5	1.1	2.6
less than weekly	5.6	4.9	6.0	6.9
non-smokers	85.4	91.8	87.5	84.3
-----				
sum	100.0	100.0	100.1	100.1
N	1063	1029	750	859
-----				

1996 (9 <sup>th</sup> grade)				
daily smokers	12.3	6.9	10.4	12.3
weekly smokers	9.3	5.9	8.2	6.8
less than weekly	9.2	5.8	4.6	6.6
non-smokers	69.3	81.4	76.8	74.3
-----				
sum	100.1	100.0	100.0	100.0
N	1059	1035	733	888
-----				
1997 (10 <sup>th</sup> grade)				
daily smokers	23.0	15.5	17.7	21.1
weekly smokers	6.2	4.1	5.9	5.4
less than weekly	12.4	12.0	8.1	10.8
non-smokers	58.3	68.5	68.3	62.7
-----				
sum	99.9	100.1	100.0	100.0
N	1029	977	615	724
-----				

Testing among all four groups:

$F_{(8,18; 801.57)} (1994) = 1.12$ ; not significant

$F_{(9,74; 886.65)} (1995) = 2.84$ ;  $p < .01$

$F_{(7,87; 739.55)} (1996) = 3.98$ ;  $p < .001$

$F_{(6,00; 485.98)} (1997) = 2.46$ ;  $p < .05$

Testing between comparison group and model intervention only:

$F_{(2,24; 112.11)} (1994) = 1.56$ ; not significant

$F_{(2,61; 125.49)} (1995) = 5.66$ ;  $p < .01$

$F_{(2,34; 114.46)} (1996) = 7.19$ ;  $p < .001$

$F_{(2,39; 112.42)} (1997) = 4.05$ ;  $p < .05$



Table 2: Mean number of cigarettes smoked per week at the baseline and at each of the three post-intervention data collections by experimental condition

	Comparison Schools	Model intervention	Model intervention Minus teacher courses	Model intervention minus parental involvement
	A	B	C	D
-----				
1994 (Baseline)				
mean	0.71	0.57	1.07	1.22
N	1081	1121	918	997
1995				
mean	2.92	0.91	2.23	2.77
N	1054	1002	728	843
1996				
mean	7.09	3.20	5.19	5.66
N	985	954	676	868
1997				
mean	17.79	10.91	12.82	14.28
N	891	839	545	611
-----				

**Table 3:** Odds-ratio of being a smoker (smoking less than weekly or not at all) in intervention years 1, 2, and 3, by experimental condition (model intervention vs. comparison). Multivariate, multilevel logistic regression analysis, adjusted for gender and baseline smoking (main effects).

Outcome	b	SE	Exp (b)	95%CI	Wald	df	p
Daily smoking					9.81	3	0.020
Year 1	-1.17	0.40	0.31	(0.14, 0.69)	8.38	1	0.004
Year 2	-0.56	0.27	0.57	(0.34, 0.97)	4.29	1	0.038
Year 3	-0.38	0.18	0.69	(0.48, 0.99)	4.15	1	0.042
Weekly smoking					15.65	3	0.001
Year 1	-1.15	0.31	0.32	(0.17, 0.59)	13.49	1	0.000
Year 2	-0.64	0.20	0.53	(0.36, 0.77)	10.58	1	0.001
Year 3	-0.43	0.17	0.65	(0.46, 0.91)	6.22	1	0.013
Any smoking					16.54	3	0.001
Year 1	-0.75	0.25	0.47	(0.29, 0.77)	8.86	1	0.003
Year 2	-0.68	0.17	0.51	(0.36, 0.71)	15.72	1	0.000
Year 3	-0.31	0.15	0.74	(0.55, 0.98)	4.30	1	0.038

Table 4

Predicted probability of being a smoker by smoking status at baseline and treatment condition

Smoking status at baseline	Predicted probability of daily smoking		
	Year 1	Year 2	Year 3
Non-smoking	.	.	.
Intervention Group	0.01	0.05	0.13
Comparison group	0.03	0.08	0.18
Smoking	.	.	.
Intervention Group	0.42	0.65	0.67
Comparison group	0.70	0.76	0.75

Figure 1: Be smokeFREE – experimental design

School years:	1994/95		1995/1996			1996/97	
<hr/>							
<b>school group:</b>							
A (comparison)	S1	S2		S3		S4	
B (classroom curriculum, teacher-course, parental involvement)	S1	x1	S2	x2	S3	x3	S4
C (as for B, but no teacher in-service course)	S1	x1	S2	x2	S3	x3	S4
D (as for B, but no parental involvement)	S1	x1	S2		x2	S3	x3 S4
<hr/>							
Baseline survey, Nov 1994	=	S1		1. follow-up, May 1995	=	S2	
2. follow-up, April 1996	=	S3		3. follow-up, May 1997	=	S4	
Intervention Grade 7	=	x1		Intervention Grade 8	=	x2	
Intervention Grade 9	=	x3					

Cigarettes per week

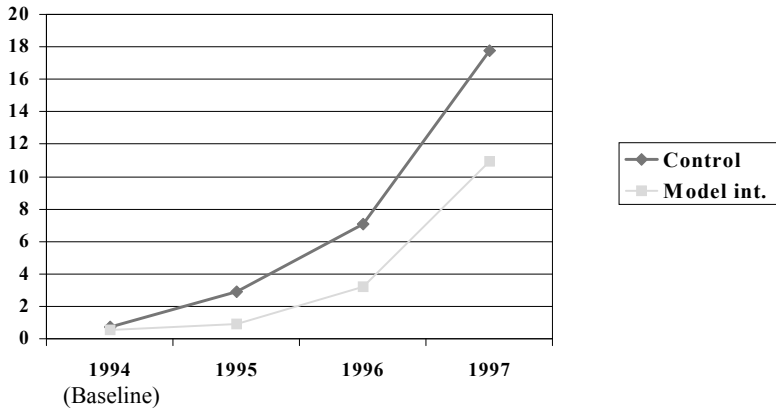


Fig. 2: Cigarette consumption (mean number of cigarettes per week) by experimental condition and year

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### **Adolescent smoking behavior and outcome expectancies**

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### Abstract

Adolescent smoking behaviour is assumed to be associated with smoking outcome expectancies. Results in this paper are based on data from the control-group of two data collections among Norwegian secondary school students taken approximately 30 months apart ( T1 and T2). The dimensionality of smoking outcome expectancies was the same at both time points, revealing three components ('Addictive', 'Not harmful' and 'Social'). After correction for attenuation, the Pearson's correlation between T1 – T2 was .41 for the total sumscore, indicating low to moderate relative stability. When examining smoking expectancy sumscore means by smoking habits at T1 and T2, never smokers were different from smokers on both occasions. Never smokers scored low on "Social" and "Not harmful", and high on "Addictive". All associations were statistically significant ( $p < .001$ ). The 'Social' dimension was the strongest predictor of smoking behaviour at T1 and T2. One of the outcome expectancy sumscores ('Addictive') at T1 predicted smoking habits at T2 after controlling for smoking habits at T1 ( $p < .01$ ). This predictor was significant also after entering outcome expectancy sumscores at T2 into the model ( $p < .05$ ). These results indicate that outcome expectations other than the health-related ones should be paid attention to when planning new prevention programmes.

### Introduction

A well accepted and relatively effective method to prevent smoking is adolescent smoking prevention targeting the major psychosocial factors contributing to the recruitment of smokers (Peto, Lopes, Boreham, Thun & Heath, 1994; Thomas & Perera 2006; Botvin & Griffin 2007). Some theories from social psychology seem to have been more influential than other theories in highlighting important psychosocial factors related to smoking, for example Problem Behaviour Theory (Jessor & Jessor, 1977), Social Cognitive Theory (Bandura, 1986), and the Theory of Planned Behavior (Ajzen 1988). These theories are somewhat different regarding concepts, inclusion of factors, and interrelations among factors, but they all include a construct describing individual expectancy, like 'perceived function (Jessor & Jessor, 1977), 'outcome expectancies (Bandura, 1986), and 'behavioral beliefs' (Ajzen, 1988). In the context of smoking behavior, these expectancy constructs reflect the individual's beliefs or expectancies of possible consequences or outcomes of their own smoking.

Outcome expectancies have been described in relation to adolescent drug use in a number of earlier studies (e.g. Botvin, Dusenbury, Baker, James Ortiz, Botvin & Kerner, 1992; Wahl, Turner, Mermelstein & Flay, 2005; Wium & Aarø, 2010). It has been shown that positive outcome expectancies towards smoking, smokeless tobacco or alcohol are significantly related to more frequent use of the drug. Gender differences like buzz (boys) and weight-control (girls) are shown to be important elements in smoking outcome expectancies (Vidrine, Anderson, Pollak & Wetter, 2006). Also, Urban has shown that outcome expectancies mediate the relationship between sensation seeking and smoking (Urban, 2010).

Positive outcome expectancies of alcohol use are stronger predictors of such behavior than is the case with negative outcome expectancies (Dalton, Sargent, Beach, Bernhardt & Stevens, 2003).

Interventions taking place in school are well established as an important category of interventions in adolescent smoking prevention. From a health promotion perspective, school-based intervention is one of the most carefully studied and evaluated intervention approaches. This allows new programs and studies to build on experiences and recommendations from meta-analyses and state-of-the-art reports (e.g. Bruvold 1993; USDHHS, 1994; Thomas & Perera, 2007; Peters, Kok, Ten Dam, Bujis & Paulussen, 2009). Based on a substantial amount of literature and empirical evidence, suggestions have been made to describe essential elements of school-based programs (Glynn, 1989; Peters, Kok, Ten Dam, Bujis & Paulussen, 2009), and attempts have been made to determine the effectiveness of school-based programmes in comparison with out of school programmes (Sussman, Dent, Burton, Stacy & Flay, 1995). Well-planned and carefully implemented interventions at school have on a number of occasions resulted in significant reductions in recruitment of smokers, Thomas and Perera 2006.

Some of the studies on school-based smoking prevention present long-term outcomes. As can be expected, effects tend to decay over time (Perry, Kelder, Murray & Klepp, 1992; Klepp, Tell & Vellar, 1993; Botvin, Baker, Dusenbury, Botvin & Diaz, 1995; Rooney & Murray, 2003). As early as 1994 this led to a request for ongoing interventions throughout a major part of childhood and adolescence (Peto, Lopes, Boreham, Thun & Heath, 1994). In addition it seems reasonable to suggest that the effects of interventions can be improved if we learn more about processes between intervention efforts and behaviour outcomes. As described above, smoking outcome expectancies are important predictors of smoking behaviour and possibly important mediators of intervention effects.

In the research project which provided the data for the present paper, smoking outcome expectancies were measured at two time points, at the baseline data collection (time 1) and after approximately 2.5 years (third follow up data collection; here: T2). The design of the study allows for examining not only the dimensionality of outcome expectancies and its association with smoking behaviour for the same individuals at two different ages, but also to examine stability, change and longitudinal prediction. The present article addresses the following topics:

- Range of and difference between smoking outcome expectancies at time 1 and time 2
- Change and relative stability of smoking outcome expectancies
- Cross-sectional associations between smoking outcome expectancies and smoking behaviour at time 1 and time 2
- Prediction of smoking behaviour at time 2 from outcome expectancies at time 1.

## Method

A more detailed description of methods is given elsewhere (Jøsendal, Aarø, Torsheim & Rasbash 2005). Only aspects particularly relevant to the present paper are provided here.

### Experimental design

The main objective of the project was to evaluate effects of a smoking prevention curriculum named "BE smokeFREE". To evaluate this, we followed a classic experimental design, with one intervention group and one control group. However, data in this publication comes from the control-group only.

### Sample

A sample of schools was drawn sequentially from a list (ordered by ascending by zip-code) of all schools in Norway with students in the relevant grade (grade 7). To obtain a satisfactory number of students and schools, we had to include every 44.th Norwegian secondary school. We started out with an arbitrary number between 1 and 44, and then included every 44.th school on the list based on zip-code. The original sample in the comparison group included 26 schools with a total of 1105 students. Mean age at the baseline survey, which took place in November 1994, was 13.4 years. Mean age at last survey was 15.9 years.

Written consents were obtained from 98.5 % (1088) students ( parents and students), where 50.5 % were males and 49.5 % females. Non-participants consisted of subjects whose parents refused to approve of their children's participation (n=3) and non-responders (n=14).

### Procedures

A baseline survey which included items on outcome expectancies took place in November 1994 (T1). Two follow-up surveys in 1995 and 1996 did not include items on smoking outcome expectancies. The fourth data collection, which took place in April 1997 (T2) included items on smoking outcome expectancies.

The data collections were conducted in normal classroom settings and administered by teachers within one class session (45 min.). Students delivered the questionnaires in sealed envelopes to ensure confidentiality. Every student was assigned an individual number, and only the project leader had access to the list containing names and numbers.

### Measures

Students were asked one question concerning smoking-behaviour, with four possible response alternatives: every-day smoker, every-week smoker, smoking less than once a week, no smoking at all, and received coding 0, 1, 2 and 3 respectively.

Smoking outcome-expectancies were measured by a scale consisting of nine items at time 1 and eight items at time 2. All items are listed in Table 1. Students could choose between four response categories: 'totally agree', 'somewhat agree', 'somewhat disagree', and 'totally disagree'. Sumscores (mean score across items with valid answers) were constructed for subscales as well as for all items combined (range 1-4). The smoking outcome expectancies scale used in this project was based on previous experiences and publications (Ellickson & Hays, 1992; Wilhelmsen, Laberg & Klepp, 1994).

### Statistics

Data were analysed by the statistical program SPSS versions 15.0 and 19.0 and STATA version 9.2. Statistical analyses included percentage distributions in order to examine properties of single items and factor analyses (oblique rotation of factors and Kaiser's normalization) for examining the dimensionality of outcome expectancies (at time 1 and time 2). We also report Cronbach's alpha, correlations, and means as well as standard deviations of outcome expectancy sumscores. Multiple ordinal logistic regression analyses were used in order to predict smoking in 1997 (T2) from gender, smoking habits in 1994 (T1) and outcome expectancies (1994 and 1997). All significance tests and confidence intervals were done with control for cluster effects.

### Results

#### *Percentage distributions*

Percentage distributions of smoking outcome expectancy items for both data collections are shown in Table 1. At time 1, six items are left skewed (harmfulness of smoking, social outcome expectancies and taste of cigarettes), while three items are skewed to the right (addictiveness and enjoying cigarettes). The informants tend to disagree with statements denying the harmfulness of smoking, they tend to agree that they may get addicted to tobacco and that smoking is a behaviour that contributes favourably to socialization. There is a similar deviation among items at time 2, but the students agree less than at time 1 that smoking is addictive. Deviation of items in different directions tends to influence patterns of intercorrelations, and therefore also has an impact on analyses of dimensionality.

#### *Dimensionality of smoking outcome expectancies*

Factor analysis (principal axis factoring) of smoking outcome expectancy a T1 and T2 revealed three components (Table 2). One component included items one and two. These were both related to harmfulness of smoking (sumscore named 'not harmful'). The second component included items three and four, and related to how quickly it is possible to get addicted to tobacco (sumscore named 'addicted'). The third component included items six to nine. Three items were related to social gains from smoking, while one item was related to how well cigarettes taste (sumscore named 'social'). If there had been more than one item on taste of cigarettes, it is likely that they may have formed a fourth factor. The relatively low component loading of this item on the 'social' component at T2 indicates that the taste of cigarettes was less closely related to the social aspects of smoking when the students were older.

As item 5, 'smokers really enjoy their cigarette' did not obtain high loading on any of the three components at T1, it was not included in the questionnaire used at T2.

Since variations in skewness among variables in factor analyses and principle components analyses may influence the results, a separate analysis was carried out in Mplus with polychoric correlations (table not shown). The dimensions revealed were identical to those already identified and presented.

Based on the results of the component analysis, one simple sumscore was produced for each component and each data collection occasion (T<sub>1</sub> and T<sub>2</sub>). Further, sumscores which included all 8 items were constructed. It turned out that the intercorrelations among the sumscores at T1 were rather low to moderate, ranging from .14 (sumscore 2 and 3) via .15 (sumscore 1 and 2) to .35 (sumscore 1 and 3) (tables not shown). The corresponding correlations at T2 were 0.20, .22 and .37. The correlations between the specific sumscores and the total sumscore were high for sumscore 1 (.83 at T1 and .86 at T2), more modest for sumscore 3 (.66 in both years) and mixed for sumscore 2 (.12 at T1 and .59 at T2). All correlations were significant at the .01 level of significance.

#### *Relative stability of smoking outcome expectancies*

Data on smoking outcome expectancies were collected on two occasions, 1994 (T1) and 1997 (T2). As shown in table 4, Pearson's correlations for each sumscore across data collection occasions are rather low (from .17 to .24), indicating low stability between time points. The T<sub>1</sub>-T<sub>2</sub> correlation for the sumscore based on all items was 0.24. After correction for attenuation, the correlations were somewhat higher, .23 to .33 for the individual sumscores and .33 for the total sumscore.

#### *Cross-sectional associations between smoking outcome expectancies and smoking behaviour*

Table 5 shows smoking expectancy sumscore means by smoking habits at T1 and T2. On both occasions, the never smokers were markedly different from the smokers. Never smokers scored low on "Social" and "Not harmful", and high on "Addictive". All associations were statistically significant ( $p < .001$ ). For those who reported that they had never tried smoking the results were similar to the non-smokers, but marginally more extreme.

#### *Longitudinal prediction of smoking*

Table 6 (upper part) shows smoking habits at T2 by smoking habits at T1 and smoking outcome expectancies at T1. Only one of the outcome expectancy sumscores obtained significance, namely "Addictive" ( $p < .01$ ). This predictor proved to be significant also after entering outcome expectancy sumscores at T2 into the model ( $p < .05$ ). All three sumscores from T2 were significant. "Social" and "Addictive" proved to be more strongly associated with smoking at T2 than was the case with "Not harmful".

## Discussion

Previous studies have strongly indicated that outcome expectancies can develop via observational learning, prior to direct experience with the substance (e.g. Christiansen, Roehling, Smith & Goldman, 1989). Recent studies also present strong evidence that children's smoking outcome expectancies are developing from a very low age (Wang, Henley & Donovan, 2007). Our sample consisted of in-school adolescents with a mean age of approximately 13.5 years, at baseline.

In our analyses from the baseline study, we revealed three factors or dimensions of smoking outcome expectancies. They were labelled 'Not harmful', 'Addicted' and 'Social'. 'Not harmful' represents the students' perception of how little harmful it might be to smoke. 'Addicted' reflects the students' perception of the addictive properties of smoking. 'Social' denotes positive expected social consequences of smoking.

By analyzing data from the last follow-up survey, we were able to reproduce the three components of smoking outcome expectancies, as demonstrated in analyses from the baseline study. That is, our findings indicate that the dimensionality of our scale for measuring smoking outcome expectancies is consistent over time, even in a sample of adolescents. This finding finds some support from the study by Copeland and colleagues (Copeland, Diefendorff, Kendzor et.al., 2007). However, the stability over age demonstrated by Copeland et.al. is indicated by a single survey covering different age-groups, not by a prospective longitudinal design as in our study. The pattern of component loadings is clear, with high loadings for each variable on one component only. These loadings range from 0.70 to 0.87, indicating a rather well defined dimensional structure.

Albert Bandura distinguishes between three dimensions of outcome expectancies: 'Physical', 'Social' and 'Self-evaluative' (Bandura, 1986). The three components revealed in our study correspond well to these three dimensions. Our dimension 'Social' directly associates with the social dimension outlined by Bandura. From our data, the dimension 'Not harmful' associates with the physical dimension. If we hypothesise that addiction to substances is regarded as inconsistent with own values and standards, 'Addicted' may reflect the self-evaluative dimension. The correspondence with Bandura's three domains of outcome expectancies lends credibility to the structure of our scale.

The analysis of smoking habits at T2 by smoking habits at T1 and smoking outcome expectancies at T1 showed that the only sumscore that remained statistically significant was 'Addicted'. The term reflects the students' perception of the addictive power of smoking tobacco. Even children at the age of nine to ten years seem to be influenced by the perception of the addictive properties of smoking (Copeland, Diefendorff, Kendzor et.al., 2007). Wang and co-workers present results which suggest that children's concept of smoking addiction may influence attitudes towards experimenting with smoking (Wang, Henley & Donovan, 2004).

Wahl and coworkers (Wahl, Turner, Mermelstein & Flay, 2005) revealed four factors in their study, factors named 'taste', 'weight control', 'boredom relief' and 'negative affect management'. It seems that these factors may also be included in the dimensionality picture denoted by Bandura, but not as clearly as the factors emerging from our data. Wahl and co-workers in a prospective panel study also showed that smoke free students with high smoking outcome expectancies at baseline had significantly higher probability of becoming smokers at follow-up.

In their study of smoking outcome expectancies in children, Copeland and coworkers (Copeland, Diefendorff, Kendzor et.al., 2007) demonstrated that a 3- factor solution was most appropriate for the data set. The three



factors revealed were 'Positive reinforcement', 'Negative consequences', and 'Weight control'. 'Positive reinforcement' indicated that there were social structures supporting smoking (as parental or peer smoking), 'Negative consequences' indicated that there were health hazards following smoking, and 'Weight control' reflected the children's perception of outlook, weight and food intake among smokers contrasted to non-smokers.

All dimensions presented in our study, as well as dimensions referred from other studies (e.g. Wahl, Turner, Mermelstein & Flay, 2005) have proven to be significant predictors of smoking, some of them also in cross-sectional analyses. In our study, the 'addictive' dimension from the baseline study proved to be a significant predictor of smoking at the last follow-up study.

The strongest predictor of concurrent smoking in our survey is the social dimension. At the baseline survey, the sumscore mean on this dimension is 1.39 among never smokers, 2.52 among seldom smokers, and 2.83 among weekly and daily smokers combined. Since the standard deviation on the 'social' sumscore is 0.65, the difference between the never smokers and the weekly/daily smokers combined corresponds to an effect size as large as 2.2. At the final follow-up survey a similar pattern is shown. The social dimension or component is based on four items among which three clearly reflect social aspects of smoking; it is easier to be together with smokers, it is more fun to join smokers, and smoking might reduce loneliness.

The strong and repeated indications of the importance of social dimension in smoking outcome expectations deserve attention when planning prevention programmes. One should also work with structures outside the school environment, to further strengthen the positive impact of social factors which influence the reduction in smoking behaviour among adolescents.

The test-retest correlations of smoking outcome expectancies between T1 and T2 are rather low (table 3b). This might be explained by a general low stability of smoking outcome expectancies as adolescents mature. The long period of time between T1 and T2 (approximately 30 months) may contribute to reducing the correlations. A time period of 30 months in an adolescent's life normally covers significant parts of the maturing process, where important socialization processes take place. One might also find such instability or low test-retest correlations where the test in itself has low reliability. The relatively high Cronbach's Alpha coefficients indicate that instability in adolescents' outcome expectancies have contributed considerably to the low test-retest correlations.

Of particular importance among the findings of the present study are the results presented in table 5, showing that one of the smoking outcome expectancies sumscores (addictive) at baseline significantly predicts daily smoking at the last follow-up survey. This association remains significant, even when we control for baseline smoking and smoking outcome expectancies at last follow-up survey. From a practical point of view, this probably has some important implications for prevention programmes and research related to such programmes. Knowing that outcome expectancies predict future health behaviour, one should design programmes specifically aimed at influencing outcome expectancies before young people develop the behaviour in question. Furthermore, more efforts should be made to shed light on the role of outcome expectations in shaping future health behaviours among adolescents. Studies with prospective panel designs as well as intervention studies may contribute well to expanding our insights into this particular field of health behaviour research.

### Limitations of study

We acknowledge that our study would have benefited from data on smoking outcome expectations from the two data collections in the time period between first and last survey. This would have given more detailed indications of how smoking outcome expectations change over time, and it would have been possible to distinguish more clearly between instability caused by less than perfect reliability of scales and instability in adolescents "real" scores on outcome expectancies.

The modest test-retest stability of smoking outcome expectations may indicate the need for further refinement of the test instrument. A better (more reliable) measurement instrument with more items on each component would improve the quality of the scales. This can also be seen in the context of tracking. Studying tracking means to examine changes in scores over time in groups defined by their initial score on a scale. Baranowski and coworkers (Baranowski, Cullen & Basen-Enquist, 1997) claim that success of interventions among adolescents to a large extent depends on a high degree of tracking in the behaviour to be influenced. An even more reliable measurement instrument would be a significant contribution to further studies on prevention efforts involving systematic efforts to influence smoking outcome expectations.

Data collections were made during the 1990's. One might argue that relevance of data is limited in 2011. However, the scales used have shown remarkable consistency over the time period they have been used, and the expectancy construct has not been subject to main revisions or rejected in the same time period.

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**Table 1:** Percentage distributions of outcome expectancy items at T1 (1994) and T2 (1997).

	Totally agree %	Somewhat agree %	Somewhat disagree %	Totally disagree %	Total %	n
1 It is not harmful for kids of my age to smoke a little every week	9.7	7.0	12.9	70.5	100.0	1088
2 It is not harmful to smoke, if you quit after a few years	4.0	12.7	25.6	57.7	100.0	1080
3 If I am smoking a few cigarettes in the weekends, I might get addicted to tobacco	45.0	35.1	12.3	7.6	100.0	1072
4 Children and adolescents might get addicted to tobacco after only having tried to smoke a few cigarettes	40.5	30.7	15.4	13.4	100.0	1071
5 Smokers really enjoy their cigarettes	49.3	35.0	10.7	4.9	100.0	1056
6 It is easier to be together with other people when you smoke	11.6	11.5	15.3	61.7	100.0	1012
7 It is ok to smoke, since you can stay together with others having fun	2.2	5.5	9.9	82.5	100.0	1061
8 Many different types of cigarettes taste well	5.2	8.3	10.4	76.1	100.0	949
9 You don't feel that lonely, if you smoke	6.1	11.3	17.2	65.4	100.0	1003
1 It is not harmful for kids of my age to smoke a little every week	9.9	13.6	21.6	54.9	100.0	1031
2 It is not harmful to smoke, if you quit after a few years	4.4	16.3	27.2	52.1	100.0	1026
3 If I am smoking a few cigarettes in the weekends, I might get addicted to tobacco	26.4	31.9	20.9	20.8	100.0	1024
4 Children and adolescents might get addicted to tobacco after only having tried to smoke a few cigarettes	19.7	23.4	22.1	34.8	100.0	1023
5 Smokers really enjoy their cigarettes			Item omitted 1997			
6 It is easier to be together with other people when you smoke	10.9	22.8	15.6	50.7	100.0	1015
7 It is ok to smoke, since you can stay together with others having fun	6.6	11.3	18.2	63.9	100.0	1020
8 Many different types of cigarettes taste well	28.1	16.1	11.2	44.6	100.0	980
9 You don't feel that lonely, if you smoke	10.7	21.8	16.9	50.6	100.0	1011

**Table 2:** Principal components analysis of outcome expectancy at T1 and T2. Varimax rotation with Kaiser normalization. Pairwise deletion of missing cases.

	T1 (n = 901-1077)			T2 (n = 975-1026)		
	Component 1	Component 2	Component 3	Component 1	Component 2	Component 3
Statement number	'Social'	'Addicted'	'Not harmful'	'Social'	'Addicted'	'Not harmful'
	Loading	Loading	Loading	Loading	Loading	Loading
1	.11	-.12	<b>.81</b>	.14	-.14	<b>.84</b>
2	.19	-.09	<b>.76</b>	.21	-.03	<b>.84</b>
3	-.14	<b>.86</b>	-.03	-.04	<b>.85</b>	-.11
4	-.02	<b>.87</b>	-.06	-.10	<b>.87</b>	-.04
5	.07	.19	.26		Omitted at T2	
6	<b>.71</b>	.04	.10	<b>.83</b>	-.01	.08
7	<b>.77</b>	-.07	.24	<b>.82</b>	-.01	.16
8	<b>.71</b>	-.22	.13	<b>.58</b>	-.35	.25
9	<b>.74</b>	.02	.07	<b>.81</b>	-.10	.14

Table 3. Outcome expectancy sumscores for T1 (1994) and T2 (1997).

Significances and confidence intervals controlled for cluster effect.

	Number of items	Alpha		T1-T2 correlation	Sign . p<	T1-T2 correlation attenuation corrected	Mean T1	Mean T2	Mean of difference score	99% CI of change score	n
		T1	T2								
Social	4	.71	.78	.24	.001	.32	1.49	1.91	0.42	0.27 - 0.56	86 4
Addictive	2	.71	.69	.26	.001	.37	3.07	2.46	-0.61	-0.78 - -0.44	89 4
Not harmful	2	.52	.67	.18	.001	.31	1.59	1.73	0.14	0.01 - 0.28	90 3
Total	8	.70	.76	.30	.001	.41	1.63	2.02	0.39	0.27 - 0.51	90 0

## Evaluation of 'BE smokeFREE'

Table 4 Smoking expectancy sumscore means ('social', 'addicted', 'not harmful' and total sumscore) by smoking habits at T1 and T2.

		<b>T1 (1994)</b>							
		Sumscore 1		Sumscore 2		Sumscore3		Sumscore total	
		'Social'		'Addictive'		'Not harmful'			
Smoking		Mean	n	Mean	n	Mean	n	Mean	n
Never		1.39	968	3.13	994	1.54	1003	1.56	1001
Seldom		2.52	45	2.56	44	2.11	45	2.37	44
Weekly or daily		2.83	32	2.58	33	2.36	33	2.61	33
Wald F		54.753		19.370		14.887		56.875	
d.f		2; 25		2; 25		2; 25		2; 25	
P<		.001		.001		.001		.001	
Ever tried		1.82	346	2.83	350	1.83	351	1.91	350
Never tried		1.33	701	3.20	722	1.48	731	1.49	729
Wald F		88.286		55.604		28.103		123.732	
d.f.		1; 26		1; 26		1; 26		1; 26	
P<		.001		.001		.001		.001	
		<b>T2 (1997)</b>							
Never		1.49	563	2.72	572	1.54	575	1.70	574
Seldom		2.29	119	2.00	119	2.06	119	2.41	119
Weekly		2.65	59	1.86	59	1.94	58	2.61	58
Daily		2.63	199	2.19	199	2.08	199	2.53	199
Wald F		258.726		44.666		27.435		399.580	
d.f.		3; 22		3; 22		3; 22		3; 22	
P<		.001		.001		.001		.001	
Ever tried		2.21	612	2.21	613	1.89	613	2.27	612
Never tried		1.35	335	2.91	343	1.47	345	1.57	345
Wald F		328.575		92.735		54.780		581.280	

d.f.	1; 24	1; 24	1; 24	1; 24
P<	.001	.001	.001	.001

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**Table 5:** Smoking habits at T2 (1997) by smoking habits at T1 (1994), smoking outcome expectancies (total) at T1, and smoking outcome expectancies at T2. Multiple ordinal logistic regression analyses.

Dependent variable: Non-smoker = 0; Smokes seldom = 1; Weekly = 2; Daily = 3

Predictors		N	Odds ratio	t	d.f.	Sign. p<	Wald's test	d.f.	Sign. p<
Gender	Girl	449	1.00						
	Boy	402	0.77	2.083	24	.05			
-----									
Smoking habits 1994	Non-smoker	795	1.00						
	Seldom	35	4.78	3.922	24	.001	12.167	2; 23	.001
	Daily or weekly	21	5.04	4.399	24	.001			
-----									
Outcome expectancy sumscores 1994	Social		1.17	1.163	24	n.s.			
	Addictive		0.78	2.838	24	.01			
	Not harmful		1.11	1.176	24	n.s.			

Nagelkerke's pseudo R<sup>2</sup> = .089

Predictors		N	Odds ratio	t	d.f.	Sign. p<	Wald's test	d.f.	Sign. p<
Gender	Girl	441	1.00						
	Boy	389	0.82				2.687	2; 23	n.s.
-----									
Smoking habits 1994	Non-smoker	774	1.00						
	Seldom	35	7.43	5.845	24	.001	26.348	2; 23	.001
	Daily or weekly	21	9.40	5.351	24	.001			
-----									
Outcome expectancy sumscores 1994	Social		0.84	0.968	24	n.s.			
	Addictive		0.84	2.292	24	.05			
	Not harmful		0.96	0.573	24	n.s.			
-----									
Outcome expectancy sumscores 1997	Social		4.50	15.371	24	.001			
	Addictive		0.70	3.892	24	.001			
	Not harmful		1.37	-2.089	24	.05			

Nagelkerke's pseudo R<sup>2</sup> = .428

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Article 3:

Jøsendal, O, Aarø, LE, Torsheim, T. (Submitted) Self-efficacy and outcome expectancies -mediators of effects of a smoking prevention programme?

**Self-efficacy and outcome expectancies -  
mediators of effects of a smoking prevention programme?**

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**Key words: Self-efficacy, Outcome expectancies, mediator, smoking**

## Abstract

This study examines self efficacy and outcome expectancies as possible mediators of effects of a school-based intervention programme (BE smokeFREE) among students in secondary schools in Norway. There were one baseline and three follow-up questionnaire data collections (after 6, 18 and 30 months). Smoking habits and self efficacy were measured in all data collections, outcome expectancies at baseline and the last follow up only. A series of growth curve models were tested with frequency of smoking across measurement occasions modelled as a dependent latent variable. The first model with only group (intervention versus comparison) as predictor, showed a significant difference in slope between intervention group and comparison group (coefficient =  $-.23$ ;  $p < .05$ ). Adding gender, self efficacy and outcome expectancy measured at baseline as predictors strengthened the association ( $-.29$ ;  $p < .01$ ). Adding self efficacy and outcome expectancy at last follow up data collection reduced the association ( $-.13$ ; not significant), indicating at least some degree of mediation. Sobel's test of all mediational paths combined, however, showed no significance. The most comprehensive model (Model 8) explained 76.4% of the variance in intercept and 94.1% of the variance in slope. There seems to be an interplay between cognitive variables and smoking over time during adolescence, but in this study there is no conclusive evidence that the cognitive factors examined mediate intervention outcomes.

## Introduction

A number of mortal and chronic diseases such as cancer, lung diseases and cardiovascular diseases have been shown to be related to smoking (Royal college of Physicians, 1992; Peto et al., 1994; Engeland, 1997; Jha et al., 2006). Search for effective strategies to reduce the consumption of cigarettes continues, and one well accepted and widely used strategy is school-based adolescent smoking prevention programmes. These programmes normally target the major psychosocial factors contributing to the recruitment of smokers (Botvin et al., 1992; Thomas and Perera, 2006). A number of such factors have been identified, and some theories from social psychology seem to have been more influential than other theories, for instance Problem Behaviour Theory (Jessor and Jessor, 1977), Social Cognitive Theory (Bandura, 1986), and the Reasoned Action Approach (Ajzen et al., 2005; Fishbein and Ajzen, 2010). These theories are somewhat different regarding inclusion of variables, but they all include a construct describing individual expectancy. The constructs 'perceived function' (Jessor and Jessor, 1977), 'outcome expectancies' (Bandura, 1986), and 'behavioural beliefs' (Ajzen et al., 2005) all point at the individual's expectations of consequences of a specific behaviour. With regard to adolescent smoking, the expectancy constructs refer to the individual's beliefs or expectations of the positive and negative (as perceived by the person him- or herself) outcomes of smoking.

Outcome expectancies have been described in relation to adolescent drug use in earlier studies, e.g. (Jessor and Jessor, 1977; Botvin et al., 1990; Ellickson and Hays 1992; Wilhelmsen et al., 1994; Heinz et al., 2010). It has been shown that positive outcome expectancies towards smoking or alcohol are significantly related to more frequent use.

Bandura emphasizes that behaviour in part is regulated by personal mastery expectations, or self-efficacy (Bandura, 1986). This construct reflects the individual's judgement of what he or she in fact will be able to do. According to Bandura, self-efficacy is developed through experience, vicarious learning, verbal persuasion and physiological information, and the cognitive integration of information from the different sources mentioned. Self-efficacy among adolescents, in relation to smoking, can be explained as the individual's perceived capability to organize and execute courses of action to avoid smoking. High self-efficacy is a significant predictor of a non-smoking status (Aussems et al., 2009). Additionally, smoking prevention programmes concentrating on enhancing adolescents' self-efficacy to refuse smoking seems to be successful (Lotrean et al., 2010).

A Cochrane review of studies maintained that there is no strong evidence of long-term effects of school-based programs aiming at preventing the uptake of smoking (Thomas and Perera, 2006). However, some programmes were shown to be more effective and efficient than other programmes. It is therefore crucial to identify aspects of interventions that can explain such differences. Searching for possible mediators of effects is one approach which may contribute to our understanding of programme effects.

It seems reasonable to suggest that the effect of interventions can be improved by studying processes between intervention efforts and behaviour change. We have not found many examples of conclusive evidence about

moderators and mediators and processes leading from intervention efforts, to behavioural change. There obviously have to be some mechanisms through which input of various kinds result in behaviour change. These mechanisms may be moderating or mediating the connection between input and output, or between the independent and dependent variables in conceptual models on which interventions are based.

Baron and Kenny (Baron and Kenny, 1986) argue that moderators are variables that affect the strength of a relation between independent variables and dependent variables, or the direction of the same relationship. Mediators are considered to be variables that account for the relation between independent and dependent variables. Baron and Kenny state that there are three conditions which must be met, in order for a variable to qualify as a mediator (p.1176): (a) variation in levels of the independent variable must significantly account for variations in the presumed mediator. (b) variation in the mediator variable must significantly account for variation in the dependent variable. (c) a previously significant relationship between the independent and the dependent variable is no longer significant, when controlled for the association between mediator and dependent variable, with the strongest demonstration of mediation occurring when relationship between dependent and independent variables becomes zero. In more recent publications MacKinnon and others have pointed out that mediation effects can be present even in situations where there is no significant zero-order association between independent and dependent variables (MacKinnon, 2008).

Botvin and coworkers (Botvin et al., 1992) analyzed the impact of hypothesized mediating variables in a school-based smoking-prevention intervention. Significant associations with intervention effects were found for a number of variables, such as knowledge of smoking prevalence, knowledge of immediate consequences of smoking, peer normative expectations and adult normative expectations. All variables analyzed met the criteria of being mediators.

Based on structural equation modelling of data from the school-based drug prevention programme ALERT (Orlando et al., 2005) showed that self efficacy was a mediator of programme effects.

In the present study, we examine the role of self efficacy and outcome expectancies as possible mediators of effects of a school-based intervention programme tested out in a large scale field experiment among students in secondary schools in Norway. Changes in smoking habits among students in one group of intervention schools are compared to students in comparison schools. Our hypothesis was that the effects on smoking behaviour of the programme would, at least partly, be mediated by smoking outcome expectancies and perceived self-efficacy. It was also of particular interest to apply new statistical software on former data collections.

## Method

Experimental design.

The main objective of the study was to examine effects of a smoking prevention programme named "BE smokeFREE". The smoking prevention programme was developed specifically for Norwegian adolescents in secondary school. The development of the programme was based on an examination of relevant theory, conceptual models and previous empirical studies. The programme was assumed to influence smoking



behaviour through several psychosocial processes, with outcome expectancies and self efficacy serving as important mediators (Bandura, 1986; Botvin et al., 1992). Evaluation of the programme was based on an experimental design with one comparison group and three intervention groups. In the comparison group (school-group A), students received traditional anti-tobacco education (business as usual). In the first intervention group (school-group B), all students were presented to the full anti-smoking curriculum "BE smokeFREE", teachers were trained, and parents were systematically involved. Two other intervention groups were established, but they are not included in the present article. A more detailed description of the three intervention groups and the intervention is given elsewhere (Jøsendal et al., 2005).

### Sample

Unit of assignment was school. Schools were selected from a numbered list containing all Norwegian secondary schools in order of ascending zip-code. Every 44.th school was selected, and a total of 25 schools were included. The starting number was arbitrarily chosen among the first 44 schools on the list. This constituted the group of control schools. Thereafter, another three samples (one sample for each of the interventions) were sequentially selected by a similar procedure, matching the group of control schools on size. After invitations and acceptances from the schools, the sample included in the study consisted of 99 schools, with 195 classes in 7th grade with a total of 4,441 students. Mean age at baseline in November 1994 was 13.8 years.

Consents (written) from students and parents were obtained from 95 % (4215 subjects), where 50.6 % were males and 49.4 % females. Non-participants consisted of students whose parents refused to approve of their children's participation (n=74; 1.5%) and non-responders (n=152; 3.5 %).

Identifying mediators of intervention effects requires rather strong intervention effects. Only students in the control condition (group A, n = 1088) and students from the school-group receiving the most comprehensive intervention (group B, n=1126) are therefore included in the analyses presented here. The intervention effects were less strong in the other intervention groups (Jøsendal et al.,1998; Jøsendal et al., 2005). More than 90 % of the students in the control-group (A) and the intervention-group (B) took part in the full experiment (1080 from the control group, and 1006 from the intervention group). Analyses of attrition throughout the project period showed that the odds of non-participation was 1,6 in the intervention group compared to the control-group, and the odds of non-participation was 1,7 among smokers compared to non-smokers. Analysis of attrition by an interaction variable consisting of group and smoking status was not significant.

### Procedures.

The baseline survey took place in November 1994, the first follow-up survey in May 1995, the second follow-up survey in April 1996, and the third (final) follow-up survey in April 1997. Surveys were conducted in normal classroom settings, administered by teachers within one class session (45 min.). The programme was implemented solely by teachers.

## Measures

Students were asked one question concerning frequency of smoking, with four possible response alternatives: Every-day smoker, every-week smoker, smoking less than once a week, not smoking at all (coded as 0, 1, 2, and 3 respectively). When, in connection with some of the statistical analyses, dichotomizing the smoking variable at baseline (due to low proportions of smokers), no-smokers were coded 0 and all smoking categories 1.

Self-efficacy was measured through an 8-item scale, where the students could choose between six response categories ranging from 'totally agree' to 'totally disagree' for each item. Scores for the 8 items were added and divided by number of non-missing items (sumscore mean, range 0-5). Examples of items/statements are: «If my friends smoke, it will be difficult for me to stay smoke-free», and «If someone offers me a cigarette, I find it hard to refuse». Scales were systematically recoded to ensure that high scores meant high levels of self efficacy.

Smoking outcome-expectancies were measured through 9 items. Examples of statements are: "It is not harmful for kids of my age to smoke a little every week"; "If I smoke a few cigarettes in the weekends, I might get addicted". Students could choose between four response categories: Totally agree, somewhat agree, somewhat disagree, and totally disagree (scores 0-3). In a previous publication from this project we have shown that the outcome expectancy scale contains three dimensions: (i) smoking is not harmful to health, (ii) smoking is social, and (iii) smoking is addictive. Three separate sumscores (mean score of non-missing items) were constructed. When more than half of the items within a sumscore were coded as missing, the sumscore itself was also coded as missing.

## Data analysis

Data were analysed using SPSS version 15.0 to examine percentage distributions for the items of the self efficacy and outcome expectancy scales, descriptive statistics for sumscores, to estimate intercorrelations among sumscores, and in order to calculate Cronbach's alpha. SPSS version 17.0.2 was used for producing multiple files with imputation of missing values on covariates (self efficacy and outcome expectancy items). Before imputation, cases with missing on all four smoking variables and those with missing on all outcome expectancy and self efficacy items were deleted.

To model the mediation of intervention effects, latent growth curve analysis with control for the cluster effect (schools) was applied. Frequency of smoking at each data collection occasion was defined as ordered categorical, and the intercept (level of smoking at baseline) as well as slope (increase in smoking over time) were used as outcome variables in a series of blockwise analyses with group (intervention versus comparison), gender, outcome expectancies (baseline and last follow up) and self efficacy (baseline and last follow up) as predictors. The three dimensions of outcome expectancies and the single self efficacy dimension were all modelled as latent variables, and each indicator was defined as ordered categorical. The robust weighted least square estimator (WLSMV) estimator in Mplus was used (Flora and Curran, 2004). Ten data files with multiple imputation on missing values were used for the analyses. The growth curve models were tested out with Mplus version 5.2.

## Results

Measurement models were tested out for all latent variables. Acceptable fit was obtained without introducing any correlated error terms. For self efficacy at baseline the fit indices were as follows: CFI=.948; RMSEA=.080; WRMR=1.918. For outcome expectancies at baseline the fit indices for all three dimensions combined were: CFI=.984; RMSEA=.047; WRMR=1.297.

Table 1 shows descriptive statistics, Cronbach alpha values and intercorrelations for the four self efficacy sumscores (one for each data collection occasion). With a 1-6 scale range, mean scores were generally high (4.77 – 5.03). Standard deviations still indicate adequate variation (.87 – 1.04). The alpha coefficients, ranging from .69 to .78 indicate satisfactory levels of internal consistency. For all data collection occasions the alpha value increase slightly (typically by .02) if the second item is removed from the scale. This may be attributed to the hypothetical nature of the second statement (“If I wanted to stop smoking ...”). The statement was included when we calculated sumscores.

The correlations across two consecutive data collections increase with age from .46 to .59. Since the interval between the two first data collections was shorter (6 months) than between the later ones (12 months), the correlation would probably have been lower if the time interval was longer. It is also worth noticing that the longer intervals between data collections, the lower are the correlations. The lowest correlation is found between baseline and the third follow-up data collection ( $r=.29$ ). The correlations shown are not corrected for attenuation.

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Insert table 1 about here

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Table 2 shows descriptive statistics, Cronbach alpha values and intercorrelations for the self efficacy sumscores. Scores were close to the lowest scale value (reflecting disagreement) for the “Social” and “Not harmful” sumscores and close to the ceiling (indicating agreement) for “Addictive”. Standard deviations are large enough to allow for use of these variables in regression of structural equation modelling. Self efficacy was measured only at baseline and the last data collection. The test-retest correlations (no correction for attenuation) were all rather low (.17 - .22), but statistically significant ( $p<.001$ ). As expected, on both measurement occasions there were positive associations between “Not harmful” and “Social”, and these two were negatively associated with “Addictive”. Alpha values ranged from barely adequate (.53) to high (.77) and were higher at the last data collection (than at baseline).

A series of analyses were carried out in order to examine changes in self efficacy and outcome expectancy sumscores from baseline to the last follow up data collection (tables not shown). Intervention schools scored slightly higher than comparison schools on self efficacy at baseline ( $p < .05$ ). This difference remained stable across all four data collections. There were no significant differences in any of the outcome expectancy sumscores at baseline. At last follow up, students in the comparison schools scored higher on “Smoking not harmful” (Cohen’s  $d = .12$ ;  $p < .05$ ) and on “Smoking is social” (Cohen’s  $d = .16$ ;  $p < .05$ ).

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Insert table 2 about here  
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Table 3 presents a series of growth curve models (unstandardized coefficients) with frequency of smoking across measurement occasions modelled as dependent latent variables. The intercept corresponds to the level of smoking at baseline while the slope is interpreted as change over time. The unit of change is one year. Self efficacy is defined as a latent variable with all items used as indicators. Outcome expectancy items are divided into three groups, each group being indicators of one latent variable. The three latent variables are “Smoking is social”, “Smoking is addictive” and “Smoking is harmful”. Model 1 shows a significant difference in slope between intervention group and comparison group (coefficient =  $-.23$ ;  $p < .05$ ). Adding gender to the model reduces the coefficient marginally (Model 2). Adding self efficacy and outcome expectancy sumscores measured at baseline (Models 3-5) increases the coefficient. With self efficacy and outcome expectancies at baseline both included (Model 5), the coefficient is  $-.29$  ( $p < .01$ ). Adding first self efficacy and then outcome expectancy sumscores at the last follow up data collection (Models 6-7) separately to the predictors, reduces the association between group (intervention versus comparison) and slope (change in smoking habits over time) to  $-.15$  and  $-.10$ . If both are simultaneously included (Model 8), the unstandardized coefficient goes down to  $-.13$  (not significant), indicating some mediation of programme effects. The most comprehensive model (Model 8) explains 76.4% of the variance in intercept and 94.1% of the variance in slope.

When testing all mediational paths from group (intervention versus control) to change in smoking over time (slope) combined (Sobel’s approximate test), significance was not obtained ( $p = .39$ ). Estimate of total effect was  $-.125$ , while the estimate of all indirect effects combined was  $-.047$  (unstandardized coefficients). This test could not be done on all ten imputed data sets combined. The first imputed data set was chosen for this particular test.

High scores on self efficacy and the “Addictive” component of outcome expectancies are significantly associated with less smoking at baseline (intercept). High scores on “Social” are associated with more smoking at baseline (Model 5). Furthermore, high scores on “Addictive” at baseline are associated with a lower slope, which means less increase in smoking over the 2.5 years from baseline to the third follow-up data collection for those who regarded smoking as addictive at baseline.

Self efficacy at last follow up and the conviction that smoking is addictive is significantly associated with reduced increase in smoking over data collection (slope). High scores on "Smoking is social" at the last data collection are associated with a steeper increase in smoking.

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Insert table 3 about here  
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Relevant indices indicated adequate to good fit across all model tested (CFI = .920 - .993; RMSEA = .039 - .069; WRMR = .735 – 2.349).

Percentage distributions of self efficacy items at baseline are shown in Appendix (A1). Percentage distributions of outcome expectancy items at baseline are shown in Appendix (A2).

#### Discussion.

The pattern of associations shown in Table 3, where correlations close to the diagonal are higher than correlations further away from the diagonal, was expected. The longer the time interval between data collections, the lower is the relative stability of variables such as attitudes and self efficacy. The increase in correlations (given that intervals are constant) as the adolescents grow older may reflect consolidation of person factors (Lytle et al., 1996). Other possible explanations are more reliable reports as the students grow older, or more experience with answering questionnaires. The observed pattern adds to our confidence in the quality of the data from this study.

The alpha values shown in Tables 3 and 4 vary from rather low to high. Use of SEM analyses with self efficacy and outcome expectancy modelled as latent variables will compensate for less than optimal levels of internal consistency of scales. The rather low correlations of individual sumscores between baseline and last data collection (ranging from .17 to .29) indicate not only less than perfect reliability of scales, but also considerable instability of such cognitions over time during early adolescence.

As discussed by Susser and Susser (Susser and Susser, 1996 I; Susser and Susser, 1996 II), the improvement of analytic tools, as well as a rapidly increasing knowledge about causing agents and outcomes, called the field of prevention to move beyond the 'black box paradigm'. In prevention projects this methodological progress includes efforts to shed light on the processes between program input, and behaviour change.

'BE smokeFREE' is specifically targeted at possible mediating variables. The two most important possible mediating variables in this intervention were hypothesized to be smoking outcome expectancies and self-efficacy to resist pressure to smoke. In this study, we have shown that being a student in intervention schools

was significantly associated with less increase in smoking from baseline to the last follow up data collection, and that self efficacy and outcome expectancy at the last follow up data collection (when added to a model with control for gender, self efficacy at baseline and outcome expectancies at baseline) explained more than half of the association. This indicates partial mediation. Since Sobel's test of mediation did not show significance in an overall test of the various possible paths from intervention to effects on smoking behaviour, no firm conclusion on this point is possible. Apart from the focus of this study on mediation of programme effects, our results lend considerable support to the idea that smoking is associated with self efficacy and outcome expectancies cross-sectionally as well as prospectively.

In our opinion, there were good reasons to expect that our analyses would confirm the hypothesized mediating role of self-efficacy and outcome expectancies. Several elements of the intervention programme focussed specifically on influencing smoking outcome expectations, and strengthening self-efficacy to resist smoking. As in most school-based smoking control interventions, health outcomes were documented. Behavioural outcomes beyond these were also extensively covered, such as social outcomes (friendship, recognition by peers). Discussions and tasks were systematically connected to why adolescents start to smoke, the project focussed on what adolescents want to achieve by smoking, but tried to show how to achieve these goals using other means than smoking. Some lessons focussed on how to resist smoking pressure and to avoid smoking in situations where cigarettes are available. These programme activities included practical exercises and homework. Also, one clarified that the tobacco industry specifically wants adolescents to start smoking, and students learned how to detect hidden or forbidden marketing efforts from the tobacco industry.

Low attrition and substantial intervention effect on the main outcome variable (in our case frequency of smoking) are critical to a successful documentation of mediating processes. In the present study attrition turned out to be moderate, and differences in attrition between the intervention and comparison groups used in the present analyses are not likely to account for much (if any) of the documented differences in smoking after three years of intervention. The intervention seems to have produced relatively strong effects when compared with previous studies of school-based smoking control interventions.

One can not rule out the possibility that there are alternative mediators operating in the 'BE smokeFREE' intervention. Influences on smoking behaviour among students could for instance evolve from different development of smoking norms among teachers and other staff at school. A more focussed and negative norm among teachers at the intervention schools could, at least partly, explain the different uptake of smoking among the students. Furthermore, it must be kept in mind that there may be more than one step in the causal chain leading to programme outcomes. Exposure to the programme and student involvement may be important predictors of changes in self efficacy and outcome expectancies. It should also be kept in mind that there may be more complex processes of reciprocal influences taking place. Changes in self efficacy and outcome expectancy could at least to some extent reflect instead of lead to changes in smoking habits. The conceptual model applied in this case is, after all, just one out of a number of different models which may explain the observed patterns of associations.

Botvin and coworkers (Botvin et al., 1992) found significant associations between intervention effects and

variables such as knowledge of immediate consequences of smoking, peer normative expectations and adult normative expectations. All variables analyzed met the criteria of being mediators at the time of publication (Orlando et al., 2005). They found that self efficacy functioned as a mediating variable in their intervention programme. In a life skills programme among German adolescents (Bühler et al., 2007), behavioural skills appeared to mediate the effect of the program on all outcome variables, including smoking. Consistent with these studies, the pattern of associations between group (intervention – comparison) and change in smoking habits (slope) indicates that at least part of the programme effects are mediated by self efficacy and outcome expectancies in our study. Since the overall test of mediation proved not to be significant, our study only provides limited support for the idea of mediation.

If further research provides more evidence that effects of smoking intervention programmes in schools are mediated by smoking outcome expectancies and self-efficacy to resist smoking onset, such programmes can be developed and designed with more accuracy. Materials and learning experiences should be planned with the specific aims of improving students' insights and understanding of positive outcomes of remaining non-smokers and providing alternative solutions to positive outcomes that are believed to follow from smoking. Equally important is the development of learning activities which may contribute to increasing students' perceived ability to cope with situations where they may be under influence to start smoking.

Based on findings in our project as well as other publications on this issue, it seems reasonable to suggest that coming studies should focus even more on what kind of program elements that facilitate mediation of desired effects, under what circumstances these elements work most effectively, among which subgroups of students various programme activities are most effective, and at what developmental stage students are most receptive to the different program elements.

Table 1: Self efficacy sumscores – descriptives, intercorrelations and Cronbach's alpha (sumscore range: 1-6)

	1	2	3	4				
	Pearson's r correlations				Mean	SD	Alpha	n
1. Self efficacy baseline	1.00				4.94	.86	.69	2186
2. Self efficacy at FU1	.46*	1.00			5.03	.87	.76	2108
3. Self efficacy at FU2	.37*	.49*	1.00		4.94	.96	.78	2113
4. Self efficacy at FU3	.29*	.37*	.59*	1.00	4.77	1.04	.78	1992

\* -  $P < .001$



Table 2: Outcome expectancy sumscores – descriptives, intercorrelations and Cronbach's alpha (sumscore range: 1-4)

	1	2	3	4	5	6	Mean	SD	Alpha	n	
	Pearson's r correlations										
Baseline											
1. Social	.100						1.48	0.66	0.72	2198	
2. Addictive	-.15*	1.00					3.07	0.88	0.69	2203	
3. Not harmful	.34*	-.16*	1.00				1.60	0.76	0.53	2217	
Last follow up											
4. Social	.22*			1.00			1.86	0.83	0.77	2001	
5. Addictive		.21*		-.24*	1.00		2.51	0.96	0.70	2010	
6. Not harmful			.17*	.37*	-.19*	1.00	1.71	0.81	0.66	2016	

\* - P < .001

Table 3. Smoking habits at baseline (intercept) and changes in smoking behaviour from baseline to third follow up data collection (slope) by selected predictors – growth curve analyses with control for cluster (school) effect. Table shows unstandardized regression coefficients.

Model number	1		2		3		4		5		6		7		8	
	Int.	Sl.	Int.	Sl.	Int.	Sl.	Int.	Sl.	Int.	Sl.	Int.	Sl.	Int.	Sl.	Int.	Sl.
Intercepts of intercept and slope	.00	.31	.00	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.27
Group (control = 0; interv. = 1)	-.17	-.23*	-.19	-.26*	-.17	-.27*	-.17	-.29*	-.17	-.20	-.15+	-.22	-.10	-.21	-.13+	
Gender (0 = male; 1 = female)	-.07	.12+	-.07	.13	-.07	.14+	-.07	.14+	-.07	-.06	.11+	-.06	.10+	-.06	.10+	
Self efficacy at BL				.01					-.28**	-.06	.43***	-.30**	.08	-.40***	.35***	
Smoking is social (OE) at BL									1.29***	.00	1.24***	1.16***	-.40***	1.06***	-.20*	
Smoking is addictive (OE) at BL									-.16***	-.13*	-.16***	-.17***	.00	-.16***	-.02	
Smoking not harmful (OE) at BL									-.07	-.13	-.07	-.08	-.09	-.07	-.05	
Self efficacy at FU3																
Smoking is social (OE) at FU3																
Smoking is addictive (OE) at FU3																
Smoking not harmful (OE) at FU3																
N	2394	2281	2281	2281	2281	2281	2281	2281	2281	2281	2281	2281	2281	2281	2281	2281
CFI	.993	.991	.991	.930	.967	.967	.933	.925	.925	.926	.926	.926	.926	.926	.926	.920

## Evaluation of 'BE smokeFREE'

RMSEA	.039	.042	.069	.051	.064	.064	.061	.064
WRMR	.735	.842	2.037	1.525	2.061	2.330	2.121	2.349

BL—Baseline FU3—Third follow-up data collection

+ p<.10; \* p<.05; \*\* p<.01; \*\*\* p<.001

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## Evaluation of 'BE smokeFREE'

A1: Self efficacy items at baseline - students from schools with the most comprehensive intervention programme and students from comparison schools only.

	Totally disagree	Somewhat disagree	Disagree a little	Agree a little	Somewhat agree	Totally agree	Total	
	%	%	%	%	%	%	%	n
If my friends smoke, it will be difficult for me not to smoke	34.5	15.6	8.2	18.5	14.6	8.7	100.0	2171
If I wanted to stop smoking, I am sure I would have made it	7.6	10.1	15.9	18.8	22.1	25.4	100.0	2139
When somebody offers me a cigarette, I always find a good reason to abstain	8.6	2.4	3.6	5.5	10.4	69.5	100.0	2124
If somebody offers me a cigarette, I feel it is difficult to refuse	73.9	8.5	3.8	5.2	3.6	5.1	100.0	2149
It is easy for me to remain a non-smoker	7.9	3.0	6.2	7.2	17.3	58.4	100.0	2105
If my friends offer me a cigarette, I would not dare to refuse	78.3	7.6	4.9	3.7	1.4	4.2	100.0	2143
If someone teases me for not smoking with them, I am self-confident and able to come up with a good answer	6.8	2.1	3.6	7.8	14.7	64.9	100.0	2143
I feel it is easy to explain to others that I don't want to smoke	5.9	1.9	3.9	7.2	13.7	67.3	100.0	2167

A2: Outcome expectancy items at baseline - students from schools with the most comprehensive intervention programme and students from comparison schools only.

	Totally disagree	Somewhat disagree	Somewhat agree	Totally agree	Total	
	%	%	%	%	%	n
It is not harmful for kids of my age to smoke a little every week	68.3	14.6	7.4	9.6	100.0	2208
It is not harmful to smoke, if you quit after a few years	57.6	26.7	12.0	3.8	100.0	2202
If I am smoking a few cigarettes in the weekends, I might get addicted to tobacco	8.6	12.6	33.7	45.1	100.0	2188
Children and adolescents might get addicted to tobacco after only having tried to smoke a few cigarettes	13.8	15.3	29.6	41.3	100.0	2185
It is easier to be together with other people when you smoke	62.6	14.5	12.2	10.7	100.0	2073
It is ok to smoke, since you can stay together with others having fun	82.2	10.0	5.6	2.2	100.0	2154
Many different types of cigarettes taste well	77.2	9.9	7.6	5.3	100.0	1956
You don't feel that lonely, if you smoke	67.5	15.8	10.9	5.9	100.0	2037



**Doctoral Theses at The Faculty of Psychology,**  
**University of Bergen**

<b>1980</b>	Allen, H.M., Dr. philos.	Parent-offspring interactions in willow grouse ( <i>Lagopus L. Lagopus</i> ).
<b>1981</b>	Myhrer, T., Dr. philos.	Behavioral Studies after selective disruption of hippocampal inputs in albino rats.
<b>1982</b>	Svebak, S., Dr. philos.	The significance of motivation for task-induced tonic physiological changes.
<b>1983</b>	Myhre, G., Dr. philos.	The Biopsychology of behavior in captive Willow ptarmigan.
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	Havik, O.E., Dr. philos.	After the myocardial infarction: A medical and psychological study with special emphasis on perceived illness.
<b>1989</b>	Bråten, S., Dr. philos.	Menneskedyaden. En teoretisk tese om sinnets dialogiske natur med informasjons- og utviklingspsykologiske implikasjoner sammenholdt med utvalgte spedbarnsstudier.
	Wold, B., Dr. psychol.	Lifestyles and physical activity. A theoretical and empirical analysis of socialization among children and adolescents.
<b>1990</b>	Flaten, M.A., Dr. psychol.	The role of habituation and learning in reflex modification.
<b>1991</b>	Alsaker, F.D., Dr. philos.	Global negative self-evaluations in early adolescence.
	Kraft, P., Dr. philos.	AIDS prevention in Norway. Empirical studies on diffusion of knowledge, public opinion, and sexual behaviour.
	Endresen, I.M., Dr. philos.	Psychoimmunological stress markers in working life.
	Faleide, A.O., Dr. philos.	Asthma and allergy in childhood. Psychosocial and psychotherapeutic problems.
<b>1992</b>	Dalen, K., Dr. philos.	Hemispheric asymmetry and the Dual-Task Paradigm: An experimental approach.
	Bø, I.B., Dr. philos.	Ungdoms sosiale økologi. En undersøkelse av 14-16 åringers sosiale nettverk.
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	Aas, H.N., Dr. psychol.	Alcohol expectancies and socialization: Adolescents learning to drink.
	Bjørkly, S., Dr. psychol.	Diagnosis and prediction of intra-institutional aggressive behaviour in psychotic patients
<b>1996</b>	Anderssen, N., Dr. psychol.	Physical activity of young people in a health perspective: Stability, change and social influences.
	Sandal, Gro Mjeldheim, Dr. psychol.	Coping in extreme environments: The role of personality.
	Strumse, Einar, Dr. philos.	The psychology of aesthetics: explaining visual preferences for agrarian landscapes in Western Norway.
	Hestad, Knut, Dr. philos.	Neuropsychological deficits in HIV-1 infection.
	Lugoe, L.Wycliffe, Dr. philos.	Prediction of Tanzanian students' HIV risk and preventive behaviours
	Sandvik, B. Gunnhild, Dr. philos.	Fra distriktsjordmor til institusjonsjordmor. Fremveksten av en profesjon og en profesjonsutdanning
	Lie, Gro Therese, Dr. psychol.	The disease that dares not speak its name: Studies on factors of importance for coping with HIV/AIDS in Northern Tanzania
	Øygaard, Lisbet, Dr. philos.	Health behaviors among young adults. A psychological and sociological approach
	Stormark, Kjell Morten, Dr. psychol.	Emotional modulation of selective attention: Experimental and clinical evidence.

- Einarsen, Ståle, Dr. psychol. Bullying and harassment at work: epidemiological and psychosocial aspects.
- 1997**
- Knivsberg, Ann-Mari, Dr. philos. Behavioural abnormalities and childhood psychopathology: Urinary peptide patterns as a potential tool in diagnosis and remediation.
- Eide, Arne H., Dr. philos. Adolescent drug use in Zimbabwe. Cultural orientation in a global-local perspective and use of psychoactive substances among secondary school students.
- Sørensen, Marit, Dr. philos. The psychology of initiating and maintaining exercise and diet behaviour.
- Skjæveland, Oddvar, Dr. psychol. Relationships between spatial-physical neighborhood attributes and social relations among neighbors.
- Zewdie, Tekla, Dr. philos. Mother-child relational patterns in Ethiopia. Issues of developmental theories and intervention programs.
- Wilhelmsen, Britt Unni, Dr. philos. Development and evaluation of two educational programmes designed to prevent alcohol use among adolescents.
- Manger, Terje, Dr. philos. Gender differences in mathematical achievement among Norwegian elementary school students.
- 1998**
- V Lindstrøm, Torill Christine, Dr. philos. «Good Grief»: Adapting to Bereavement.
- Skogstad, Anders, Dr. philos. Effects of leadership behaviour on job satisfaction, health and efficiency.
- Haldorsen, Ellen M. Håland, Dr. psychol. Return to work in low back pain patients.
- Besemer, Susan P., Dr. philos. Creative Product Analysis: The Search for a Valid Model for Understanding Creativity in Products.
- H Winje, Dagfinn, Dr. psychol. Psychological adjustment after severe trauma. A longitudinal study of adults' and children's posttraumatic reactions and coping after the bus accident in Måbødalen, Norway 1988.
- Vosburg, Suzanne K., Dr. philos. The effects of mood on creative problem solving.
- Eriksen, Hege R., Dr. philos. Stress and coping: Does it really matter for subjective health complaints?
- Jakobsen, Reidar, Dr. psychol. Empiriske studier av kunnskap og holdninger om hiv/aids og den normative seksuelle utvikling i ungdomsårene.
- 1999**
- V Mikkelsen, Aslaug, Dr. philos. Effects of learning opportunities and learning climate on occupational health.
- Samdal, Oddrun, Dr. philos. The school environment as a risk or resource for students' health-related behaviours and subjective well-being.
- Friestad, Christine, Dr. philos. Social psychological approaches to smoking.

	Ekeland, Tor-Johan, Dr. philos.	Meining som medisin. Ein analyse av placebofenomenet og implikasjoner for terapi og terapeutiske teoriar.
H	Saban, Sara, Dr. psychol.	Brain Asymmetry and Attention: Classical Conditioning Experiments.
	Carlsten, Carl Thomas, Dr. philos.	God lesing – God læring. En aksjonsrettet studie av undervisning i fagtekstlesing.
	Dundas, Ingrid, Dr. psychol.	Functional and dysfunctional closeness. Family interaction and children's adjustment.
	Engen, Liv, Dr. philos.	Kartlegging av leseferdighet på småskoletrinnet og vurdering av faktorer som kan være av betydning for optimal leseutvikling.
<b>2000</b>		
V	Hovland, Ole Johan, Dr. philos.	Transforming a self-preserving "alarm" reaction into a self-defeating emotional response: Toward an integrative approach to anxiety as a human phenomenon.
	Lillejord, Sølvi, Dr. philos.	Handlingsrasjonalitet og spesialundervisning. En analyse av aktørperspektiver.
	Sandell, Ove, Dr. philos.	Den varme kunnskapen.
	Oftedal, Marit Petersen, Dr. philos.	Diagnostisering av ordavkodingsvansker: En prosessanalytisk tilnæringsmåte.
H	Sandbak, Tone, Dr. psychol.	Alcohol consumption and preference in the rat: The significance of individual differences and relationships to stress pathology
	Eid, Jarle, Dr. psychol.	Early predictors of PTSD symptom reporting; The significance of contextual and individual factors.
<b>2001</b>		
V	Skinstad, Anne Helene, Dr. philos.	Substance dependence and borderline personality disorders.
	Binder, Per-Einar, Dr. psychol.	Individet og den meningsbærende andre. En teoretisk undersøkelse av de mellommenneskelige forutsetningene for psykisk liv og utvikling med utgangspunkt i Donald Winnicotts teori.
	Roald, Ingvild K., Dr. philos.	Building of concepts. A study of Physics concepts of Norwegian deaf students.
H	Fekadu, Zelalem W., Dr. philos.	Predicting contraceptive use and intention among a sample of adolescent girls. An application of the theory of planned behaviour in Ethiopian context.
	Melesse, Fantu, Dr. philos.	The more intelligent and sensitive child (MISC) mediational intervention in an Ethiopian context: An evaluation study.
	Råheim, Målfrid, Dr. philos.	Kvinnens kroppserfaring og livssammenheng. En fenomenologisk – hermeneutisk studie av friske kvinner og kvinner med kroniske muskelsmerter.
	Engelsen, Birthe Kari, Dr. psychol.	Measurement of the eating problem construct.

	Lau, Bjørn, Dr. philos.	Weight and eating concerns in adolescence.
<b>2002</b>		
V	Ihlebak, Camilla, Dr. philos.	Epidemiological studies of subjective health complaints.
	Rosén, Gunnar O. R., Dr. philos.	The phantom limb experience. Models for understanding and treatment of pain with hypnosis.
	Høines, Marit Johnsen, Dr. philos.	Fleksible språkrom. Matematikklæring som tekstutvikling.
	Anthun, Roald Andor, Dr. philos.	School psychology service quality. Consumer appraisal, quality dimensions, and collaborative improvement potential
	Pallesen, Ståle, Dr. psychol.	Insomnia in the elderly. Epidemiology, psychological characteristics and treatment.
	Midthassel, Unni Vere, Dr. philos.	Teacher involvement in school development activity. A study of teachers in Norwegian compulsory schools
	Kallestad, Jan Helge, Dr. philos.	Teachers, schools and implementation of the Olweus Bullying Prevention Program.
H	Ofte, Sonja Helgesen, Dr. psychol.	Right-left discrimination in adults and children.
	Netland, Marit, Dr. psychol.	Exposure to political violence. The need to estimate our estimations.
	Diseth, Åge, Dr. psychol.	Approaches to learning: Validity and prediction of academic performance.
	Bjuland, Raymond, Dr. philos.	Problem solving in geometry. Reasoning processes of student teachers working in small groups: A dialogical approach.
<b>2003</b>		
V	Arefjord, Kjersti, Dr. psychol.	After the myocardial infarction – the wives' view. Short- and long-term adjustment in wives of myocardial infarction patients.
	Ingjaldsson, Jón Þorvaldur, Dr. psychol.	Unconscious Processes and Vagal Activity in Alcohol Dependency.
	Holden, Børge, Dr. philos.	Følger av atferdsanalytiske forklaringer for atferdsanalysens tilnærming til utforming av behandling.
	Holsen, Ingrid, Dr. philos.	Depressed mood from adolescence to 'emerging adulthood'. Course and longitudinal influences of body image and parent-adolescent relationship.
	Hammar, Åsa Karin, Dr. psychol.	Major depression and cognitive dysfunction- An experimental study of the cognitive effort hypothesis.
	Sprugevica, Ieva, Dr. philos.	The impact of enabling skills on early reading acquisition.
	Gabrielsen, Egil, Dr. philos.	LESE FOR LIVET. Lesekompetansen i den norske voksenbefolkningen sett i lys av visjonen om en enhetsskole.
H	Hansen, Anita Lill, Dr. psychol.	The influence of heart rate variability in the regulation of attentional and memory processes.

	Dyregrov, Kari, Dr. philos.	The loss of child by suicide, SIDS, and accidents: Consequences, needs and provisions of help.
<b>2004</b>		
V	Torsheim, Torbjørn, Dr. psychol.	Student role strain and subjective health complaints: Individual, contextual, and longitudinal perspectives.
	Haugland, Bente Storm Mowatt Dr. psychol.	Parental alcohol abuse. Family functioning and child adjustment.
	Milde, Anne Marita, Dr. psychol.	Ulcerative colitis and the role of stress. Animal studies of psychobiological factors in relationship to experimentally induced colitis.
	Stornes, Tor, Dr. philos.	Socio-moral behaviour in sport. An investigation of perceptions of sportspersonship in handball related to important factors of socio-moral influence.
	Mæhle, Magne, Dr. philos.	Re-inventing the child in family therapy: An investigation of the relevance and applicability of theory and research in child development for family therapy involving children.
	Kobbeltvedt, Therese, Dr. psychol.	Risk and feelings: A field approach.
<b>2004</b>	Thomsen, Tormod, Dr. psychol.	Localization of attention in the brain.
H	Løberg, Else-Marie, Dr. psychol.	Functional laterality and attention modulation in schizophrenia: Effects of clinical variables.
	Kyrkjebø, Jane Mikkelsen, Dr. philos.	Learning to improve: Integrating continuous quality improvement learning into nursing education.
	Laumann, Karin, Dr. psychol.	Restorative and stress-reducing effects of natural environments: Experiential, behavioural and cardiovascular indices.
	Holgersen, Helge, PhD	Mellom oss - Essay i relasjonell psykoanalyse.
<b>2005</b>		
V	Hetland, Hilde, Dr. psychol.	Leading to the extraordinary? Antecedents and outcomes of transformational leadership.
	Iversen, Anette Christine, Dr. philos.	Social differences in health behaviour: the motivational role of perceived control and coping.
<b>2005</b>	Mathisen, Gro Ellen, PhD	Climates for creativity and innovation: Definitions, measurement, predictors and consequences.
H	Sævi, Tone, Dr. philos.	Seeing disability pedagogically – The lived experience of disability in the pedagogical encounter.
	Wium, Nora, PhD	Intrapersonal factors, family and school norms: combined and interactive influence on adolescent smoking behaviour.
	Kanagaratnam, Pushpa, PhD	Subjective and objective correlates of Posttraumatic Stress in immigrants/refugees exposed to political violence.

	Larsen, Torill M. B. , PhD	Evaluating principals` and teachers` implementation of Second Step. A case study of four Norwegian primary schools.
	Bancila, Delia, PhD	Psychosocial stress and distress among Romanian adolescents and adults.
<b>2006</b>		
V	Hillestad, Torgeir Martin, Dr. philos.	Normalitet og avvik. Forutsetninger for et objektivt psykopatologisk avviksbegrep. En psykologisk, sosial, erkjennelsesteoretisk og teoriehistorisk framstilling.
	Nordanger, Dag Øystein, Dr. psychol.	Psychosocial discourses and responses to political violence in post-war Tigray, Ethiopia.
	Rimol, Lars Morten, PhD	Behavioral and fMRI studies of auditory laterality and speech sound processing.
	Krumsvik, Rune Johan, Dr. philos.	ICT in the school. ICT-initiated school development in lower secondary school.
	Norman, Elisabeth, Dr. psychol.	Gut feelings and unconscious thought: An exploration of fringe consciousness in implicit cognition.
	Israel, K Pravin, Dr. psychol.	Parent involvement in the mental health care of children and adolescents. Emperical studies from clinical care setting.
	Glasø, Lars, PhD	Affects and emotional regulation in leader-subordinate relationships.
	Knutsen, Ketil, Dr. philos.	HISTORIER UNGDOM LEVER – En studie av hvordan ungdommer bruker historie for å gjøre livet meningsfullt.
	Matthiesen, Stig Berge, PhD	Bullying at work. Antecedents and outcomes.
<b>2006</b>		
H	Gramstad, Arne, PhD	Neuropsychological assessment of cognitive and emotional functioning in patients with epilepsy.
	Bendixen, Mons, PhD	Antisocial behaviour in early adolescence: Methodological and substantive issues.
	Mrumbi, Khalifa Maulid, PhD	Parental illness and loss to HIV/AIDS as experienced by AIDS orphans aged between 12-17 years from Temeke District, Dar es Salaam, Tanzania: A study of the children's psychosocial health and coping responses.
	Hetland, Jørn, Dr. psychol.	The nature of subjective health complaints in adolescence: Dimensionality, stability, and psychosocial predictors
	Kakoko, Deodatus Conatus Vitalis, PhD	Voluntary HIV counselling and testing service uptake among primary school teachers in Mwanza, Tanzania: assessment of socio-demographic, psychosocial and socio-cognitive aspects
	Mykletun, Arnstein, Dr. psychol.	Mortality and work-related disability as long-term consequences of anxiety and depression: Historical cohort designs based on the HUNT-2 study
	Sivertsen, Børge, PhD	Insomnia in older adults. Consequences, assessment and treatment.



**2007**

V

- Singhammer, John, Dr. philos. Social conditions from before birth to early adulthood – the influence on health and health behaviour
- Janvin, Carmen Ani Cristea, PhD Cognitive impairment in patients with Parkinson's disease: profiles and implications for prognosis
- Braarud, Hanne Cecilie, Dr.psychol. Infant regulation of distress: A longitudinal study of transactions between mothers and infants
- Tveito, Torill Helene, PhD Sick Leave and Subjective Health Complaints
- Magnussen, Liv Heide, PhD Returning disability pensioners with back pain to work
- Thuen, Elin Marie, Dr.philos. Learning environment, students' coping styles and emotional and behavioural problems. A study of Norwegian secondary school students.
- Solberg, Ole Asbjørn, PhD Peacekeeping warriors – A longitudinal study of Norwegian peacekeepers in Kosovo

**2007**

H

- Søreide, Gunn Elisabeth, Dr.philos. Narrative construction of teacher identity
- Svensen, Erling, PhD WORK & HEALTH. Cognitive Activation Theory of Stress applied in an organisational setting.
- Øverland, Simon Nygaard, PhD Mental health and impairment in disability benefits. Studies applying linkages between health surveys and administrative registries.
- Eichele, Tom, PhD Electrophysiological and Hemodynamic Correlates of Expectancy in Target Processing
- Børhaug, Kjetil, Dr.philos. Oppseding til demokrati. Ein studie av politisk oppseding i norsk skule.
- Eikeland, Thorleif, Dr.philos. Om å vokse opp på barnehjem og på sykehus. En undersøkelse av barnehjemsbarns opplevelser på barnehjem sammenholdt med sanatoriebarns beskrivelse av langvarige sykehusopphold – og et forsøk på forklaring.
- Wadel, Carl Cato, Dr.philos. Medarbeidersamhandling og medarbeiderledelse i en lagbasert organisasjon
- Vinje, Hege Forbech, PhD Thriving despite adversity: Job engagement and self-care among community nurses
- Noort, Maurits van den, PhD Working memory capacity and foreign language acquisition

**2008**

V

- Breivik, Kyrre, Dr.psychol. The Adjustment of Children and Adolescents in Different Post-Divorce Family Structures. A Norwegian Study of Risks and Mechanisms.
- Johnsen, Grethe E., PhD Memory impairment in patients with posttraumatic stress disorder
- Sætrevik, Bjørn, PhD Cognitive Control in Auditory Processing

	Carvalhosa, Susana Fonseca, PhD	Prevention of bullying in schools: an ecological model
<b>2008</b>		
<b>H</b>	Brønneck, Kolbjørn Selvåg	Attentional dysfunction in dementia associated with Parkinson's disease.
	Posserud, Maj-Britt Rocio	Epidemiology of autism spectrum disorders
	Haug, Ellen	Multilevel correlates of physical activity in the school setting
	Skjerve, Arvid	Assessing mild dementia – a study of brief cognitive tests.
	Kjønniksen, Lise	The association between adolescent experiences in physical activity and leisure time physical activity in adulthood: a ten year longitudinal study
	Gundersen, Hilde	The effects of alcohol and expectancy on brain function
	Omvik, Siri	Insomnia – a night and day problem
<b>2009</b>		
<b>V</b>	Molde, Helge	Pathological gambling: prevalence, mechanisms and treatment outcome.
	Foss, Else	Den omsorgsfulle væremåte. En studie av voksnes væremåte i forhold til barn i barnehagen.
	Westrheim, Kariane	Education in a Political Context: A study of Knowledge Processes and Learning Sites in the PKK.
	Wehling, Eike	Cognitive and olfactory changes in aging
	Wangberg, Silje C.	Internet based interventions to support health behaviours: The role of self-efficacy.
	Nielsen, Morten B.	Methodological issues in research on workplace bullying. Operationalisations, measurements and samples.
	Sandu, Anca Larisa	MRI measures of brain volume and cortical complexity in clinical groups and during development.
	Guribye, Eugene	Refugees and mental health interventions
	Sørensen, Lin	Emotional problems in inattentive children – effects on cognitive control functions.
	Tjomsland, Hege E.	Health promotion with teachers. Evaluation of the Norwegian Network of Health Promoting Schools: Quantitative and qualitative analyses of predisposing, reinforcing and enabling conditions related to teacher participation and program sustainability.
	Helleve, Ingrid	Productive interactions in ICT supported communities of learners
<b>2009</b>		
<b>H</b>	Skorpen, Aina Øye, Christine	Dagliglivet i en psykiatrisk institusjon: En analyse av miljøterapeutiske praksiser
	Andreassen, Cecilie Schou	WORKAHOLISM – Antecedents and Outcomes

	Stang, Ingun	Being in the same boat: An empowerment intervention in breast cancer self-help groups
	Sequeira, Sarah Dorothee Dos Santos	The effects of background noise on asymmetrical speech perception
	Kleiven, Jo, dr.philos.	The Lillehammer scales: Measuring common motives for vacation and leisure behavior
	Jónsdóttir, Guðrún	Dubito ergo sum? Ni jenter møter naturfaglig kunnskap.
	Hove, Oddbjørn	Mental health disorders in adults with intellectual disabilities - Methods of assessment and prevalence of mental health disorders and problem behaviour
	Wageningen, Heidi Karin van	The role of glutamate on brain function
	Bjørkvik, Jofrid	God nok? Selvaktelse og interpersonlig fungering hos pasienter innen psykisk helsevern: Forholdet til diagnoser, symptomer og behandlingsutbytte
	Andersson, Martin	A study of attention control in children and elderly using a forced-attention dichotic listening paradigm
	Almås, Aslaug Grov	Teachers in the Digital Network Society: Visions and Realities. A study of teachers' experiences with the use of ICT in teaching and learning.
	Ulvik, Marit	Lærerutdanning som danning? Tre stemmer i diskusjonen
<b>2010</b>		
<b>V</b>	Skår, Randi	Læringsprosesser i sykepleieres profesjonsutøvelse. En studie av sykepleieres læringserfaringer.
	Roald, Knut	Kvalitetsvurdering som organisasjonslæring mellom skole og skoleeigar
	Lunde, Linn-Heidi	Chronic pain in older adults. Consequences, assessment and treatment.
	Danielsen, Anne Grete	Perceived psychosocial support, students' self-reported academic initiative and perceived life satisfaction
	Hysing, Mari	Mental health in children with chronic illness
	Olsen, Olav Kjellevoid	Are good leaders moral leaders? The relationship between effective military operational leadership and morals
	Riese, Hanne	Friendship and learning. Entrepreneurship education through mini-enterprises.
	Holthe, Asle	Evaluating the implementation of the Norwegian guidelines for healthy school meals: A case study involving three secondary schools
<b>H</b>	Hauge, Lars Johan	Environmental antecedents of workplace bullying: A multi-design approach
	Bjørkelo, Brita	Whistleblowing at work: Antecedents and consequences

Reme, Silje Endresen	Common Complaints – Common Cure? Psychiatric comorbidity and predictors of treatment outcome in low back pain and irritable bowel syndrome
Helland, Wenche Andersen	Communication difficulties in children identified with psychiatric problems
Beneventi, Harald	Neuronal correlates of working memory in dyslexia
Thygesen, Elin	Subjective health and coping in care-dependent old persons living at home
Aanes, Mette Marthinussen	Poor social relationships as a threat to belongingness needs. Interpersonal stress and subjective health complaints: Mediating and moderating factors.
Anker, Morten Gustav	Client directed outcome informed couple therapy
Bull, Torill	Combining employment and child care: The subjective well-being of single women in Scandinavia and in Southern Europe
Viig, Nina Grieg	Tilrettelegging for læreres deltakelse i helsefremmende arbeid. En kvalitativ og kvantitativ analyse av sammenhengen mellom organisatoriske forhold og læreres deltakelse i utvikling og implementering av Europeisk Nettverk av Helsefremmende Skoler i Norge
Wolff, Katharina	To know or not to know? Attitudes towards receiving genetic information among patients and the general public.
Ogden, Terje, dr.philos.	Familiebasert behandling av alvorlige atferdsproblemer blant barn og ungdom. Evaluering og implementering av evidensbaserte behandlingsprogrammer i Norge.
Solberg, Mona Elin	Self-reported bullying and victimisation at school: Prevalence, overlap and psychosocial adjustment.
<b>2011</b>	
<b>V</b>	
Bye, Hege Høivik	Self-presentation in job interviews. Individual and cultural differences in applicant self-presentation during job interviews and hiring managers' evaluation
Notelaers, Guy	Workplace bullying. A risk control perspective.
Moltu, Christian	Being a therapist in difficult therapeutic impasses. A hermeneutic phenomenological analysis of skilled psychotherapists' experiences, needs, and strategies in difficult therapies ending well.
Myrseth, Helga	Pathological Gambling - Treatment and Personality Factors
Schanche, Elisabeth	From self-criticism to self-compassion. An empirical investigation of hypothesized change processes in the Affect Phobia Treatment Model of short-term dynamic psychotherapy for patients with Cluster C personality disorders.
Våpenstad, Eystein Victor, dr.philos.	Det tempererte nærvær. En teoretisk undersøkelse av psykoterautens subjektivitet i psykoanalyse og psykoanalytisk psykoterapi.

	Haukebø, Kristin	Cognitive, behavioral and neural correlates of dental and intra-oral injection phobia. Results from one treatment and one fMRI study of randomized, controlled design.
	Harris, Anette	Adaptation and health in extreme and isolated environments. From 78°N to 75°S.
	Bjørknes, Ragnhild	Parent Management Training-Oregon Model: intervention effects on maternal practice and child behavior in ethnic minority families
	Mamen, Asgeir	Aspects of using physical training in patients with substance dependence and additional mental distress
	Espevik, Roar	Expert teams: Do shared mental models of team members make a difference
	Haara, Frode Olav	Unveiling teachers' reasons for choosing practical activities in mathematics teaching
<b>2011</b>		
<b>H</b>	Hauge, Hans Abraham	How can employee empowerment be made conducive to both employee health and organisation performance? An empirical investigation of a tailor-made approach to organisation learning in a municipal public service organisation.
	Melkevik, Ole Rogstad	Screen-based sedentary behaviours: pastimes for the poor, inactive and overweight? A cross-national survey of children and adolescents in 39 countries.
	Vøllestad, Jon	Mindfulness-based treatment for anxiety disorders. A quantitative review of the evidence, results from a randomized controlled trial, and a qualitative exploration of patient experiences.
	Tolo, Astrid	Hvordan blir lærerkompetanse konstruert? En kvalitativ studie av PPU-studenters kunnskapsutvikling.
	Saus, Evelyn-Rose	Training effectiveness: Situation awareness training in simulators
	Nordgreen, Tine	Internet-based self-help for social anxiety disorder and panic disorder. Factors associated with effect and use of self-help.
	Munkvold, Linda Helen	Oppositional Defiant Disorder: Informant discrepancies, gender differences, co-occurring mental health problems and neurocognitive function.
	Christiansen, Øivin	Når barn plasseres utenfor hjemmet: beslutninger, forløp og relasjoner. Under barnevernets (ved)tak.
	Brunborg, Geir Scott	Conditionability and Reinforcement Sensitivity in Gambling Behaviour
	Hystad, Sigurd William	Measuring Psychological Resiliency: Validation of an Adapted Norwegian Hardiness Scale
<b>2012</b>		
<b>V</b>	Roness, Dag	Hvorfor bli lærer? Motivasjon for utdanning og utøving.
	Fjermestad, Krister Westlye	The therapeutic alliance in cognitive behavioural therapy for youth anxiety disorders

	Jenssen, Eirik Sørnes	Tilpasset opplæring i norsk skole: politikeres, skolelederes og læreres handlingsvalg
	Johansen, Venke Frederike	Når det intime blir offentlig. Om kvinners åpenhet om brystkreft og om markedsføring av brystkreftsaken.
	Herheim, Rune	Pupils collaborating in pairs at a computer in mathematics learning: investigating verbal communication patterns and qualities
	Vie, Tina Løkke	Cognitive appraisal, emotions and subjective health complaints among victims of workplace bullying: A stress-theoretical approach
	Jones, Lise Øen	Effects of reading skills, spelling skills and accompanying efficacy beliefs on participation in education. A study in Norwegian prisons.
<b>2012</b>		
<b>H</b>	Danielsen, Yngvild Sørebo	Childhood obesity – characteristics and treatment. Psychological perspectives.