Promoting smoking cessation among parents

Integrating treatment and prevention of nicotine addiction?

Kathrin Schuck

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Sometimes you're ahead, sometimes you're behind.
The race is long and, in the end, it's only with yourself.

- Baz Luhrmann

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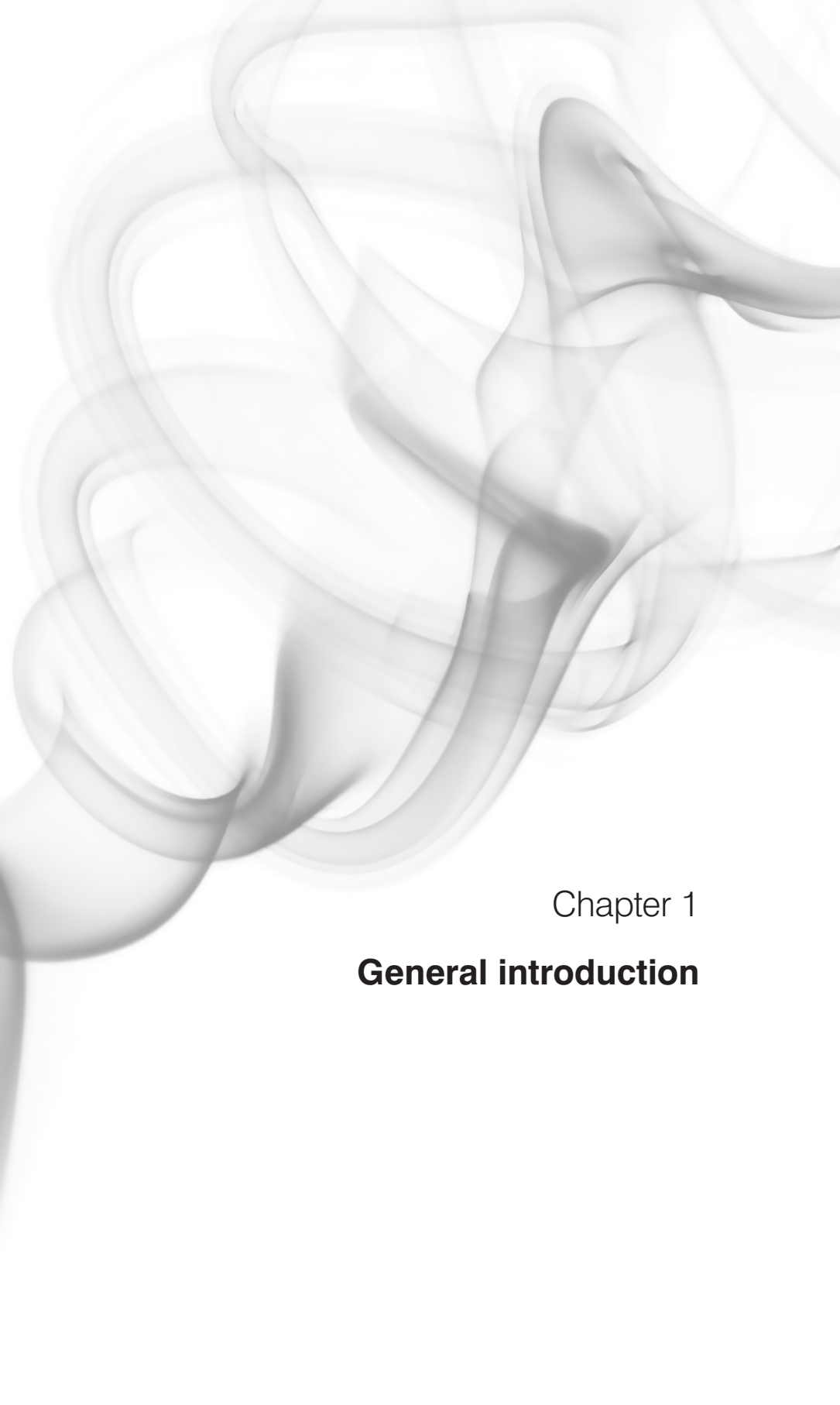

Chapter 1

General introduction

Tobacco smoking: The scope of the problem

Tobacco smoking is the leading preventable cause of death and a leading preventable cause of disease and disability. Smoking causes a wide variety of cancer types and is responsible for an estimated 22% of cancer deaths per year (Stivoro, 2012; WHO, 2005). Additionally, smoking causes a variety of other serious illnesses such as heart disease, stroke, and numerous lung diseases. On average, smokers die 13 to 14 years earlier than non-smokers. Up to half of current smokers will eventually die of a tobacco-related disease. It is estimated that tobacco smoking costs more than $193 billion each year due to lost productivity and health care expenditures and kills more than 5 million people every year (U.S. Department of Health and Human Services, 2012; WHO, 2013).

In the Netherlands, the prevalence of smoking is high. In 2012, 26% of the population 16 years or older smoked (Stivoro, 2012). Among those, 80% reported that they want to quit smoking. Nearly two-third of Dutch smokers have attempted to quit smoking in the past and nearly one-third have attempted to quit smoking in the past year (Stivoro, 2012). In addition to the high prevalence of smoking among the adult population, the prevalence of youth smoking is high. In 2012, 18% of the population between 10 and 19 years old had smoked tobacco in the past four weeks (Stivoro, 2012). Once smoking is initiated, nicotine addiction may develop quickly. The first symptoms of nicotine addiction can appear within weeks of the uptake of occasional smoking (DiFranza et al., 2000). Due to the highly addictive properties of nicotine and the adverse health outcomes associated with tobacco use, uptake of and experimentation with smoking are hazardous behaviours, and prevention of smoking onset is a major focus in tobacco control efforts.

In addition to the active use of tobacco, exposure to passive smoke or environmental tobacco smoke (ETS) among non-smokers remains a public health problem. ETS is the combination of smoke that is emitted by burning tobacco and smoke that is exhaled by the smoker. It contains hundreds of chemicals known to be toxic or carcinogenic (cancer causing) and concentrations of many toxic and cancer-causing chemicals are higher in ETS than in the smoke inhaled by smokers. In North America, 43% of non-smokers have detectable levels of cotinine (i.e., a biomarker indicative of exposure to ETS) and almost 60% of children aged 3-11 years are exposed to ETS (U.S. Department of Health and Human Services, 2006). Exposure to ETS has been associated with a variety of adverse health outcomes in non-smokers including lung cancer, heart disease, and respiratory infections (U.S. Department of Health and Human Services, 2006).

To reduce smoking-related morbidity and mortality, tobacco control efforts need to focus on both the treatment of nicotine addiction among smokers and the prevention of nicotine addiction among youth. Both will be addressed in this thesis.

Smoking parents: A high priority population

Prevalence and prospects

Smoking parents constitute a substantial subgroup of adult smokers. Twenty percent of parents are self-reported smokers (Winickoff et al., 2006). Worldwide, over 40% of children have at least one smoking parent (The GTSS Collaborative Group, 2006;

WHO, 2013). National surveys conducted in the United Kingdom and the Netherlands indicate that approximately one third of children live with at least one parent who smokes (King et al., 2009; Otten, Engels, & van den Eijnden, 2005).

Smoking parents may be particularly motivated to quit smoking. Nearly two-thirds of adult smokers express concern for modelling smoking to children (Hitchman, Fong, Zanna, Hyland, & Bansal-Travers, 2011). In a telephone survey, 64% of parent smokers indicated that they would accept telephone cessation support if recommended (Winickoff et al., 2006). Parents of children with smoking-related illnesses display a particularly high motivation to quit (Halterman, Borrelli, Conn, Tremblay, & Blaakman, 2010; Winickoff, McMillen, et al., 2003). Addressing smokers in their role as parents may increase their motivation to quit smoking and their willingness to make use of available cessation support. Previous studies have shown that offering cessation support to smoking parents in settings such as paediatric clinics, birth clinics, and physicians' offices can engage a high proportion of parents. Throughout this thesis, we focus on this high priority population among adult smokers - smoking parents.

Effects of parental smoking on children

Tobacco smoking is detrimental, not only to the parent, but also to the child who is often exposed to ETS. Worldwide, almost 50% of children regularly breathe air polluted by tobacco smoke (WHO, 2013). Among children, parents and caretakers are the main sources of exposure to ETS (Holliday, Moore, & Moore, 2009). Findings from the Global Youth Tobacco Survey indicated that a large proportion of students in every World Health Organization (WHO) region are exposed to ETS at home (43.9%) (The GTSS Collaborative Group, 2006). The majority of parents in smoking households report using harm reduction strategies to protect their children from exposure to ETS (e.g., ventilating the room after smoking, only smoking in specific rooms, not smoking in the vicinity of children). However, only a minority of parents report using comprehensive measures such as implementation of a complete smoking ban in the house (Spencer, Blackburn, Bonas, Coe, & Dolan, 2005). Exposure to ETS is associated with numerous adverse health outcomes in children, including higher rates of childhood asthma, respiratory infections, serious bacterial infections such as meningitis, sudden infant death syndrome, behavioural problems, neuro-cognitive decrements, respiratory-related emergency department visits, and hospitalizations of children (DiFranza, Aligne, & Weitzman, 2004; Priest et al., 2010). In general, ETS exposure has been shown to increase health service use and costs (Lam, Leung, & Ho, 2001).

In addition to the physical and psychological adversities associated with ETS, a recent meta-analytic review concluded that parental smoking is a strong determinant of the risk of smoking uptake in adolescents. Results showed that the risk of smoking uptake in adolescents was nearly threefold when both parents smoked (Leonardi-Bee, Jere, & Britton, 2011). Also, a growing body of research has shown that parental smoking and exposure to ETS constitute a risk factor for higher rates of smoking and progression into nicotine dependence once smoking has been initiated (Bernat, Erickson, Widome, Perry, & Forster, 2008; Hu, Davies, & Kandel, 2006; Kardia, Pomerleau, Rozek, & Marks, 2003; Lieb, Schreier, Pfister, & Wittchen, 2003; Widome, 2008).

In this thesis, we examined the effects of parental smoking behaviour on child smoking behaviour. Specifically, we examined whether parents and children reciprocally influence each other's smoking behaviour within the family system (*Chapter 5*).

Explaining the effects of parental smoking on children

Although a large number of studies have demonstrated an increased risk for smoking initiation and progression to regular smoking among adolescents with at least one smoking parent (for reviews, see Avenevoli & Merikangas, 2003; Leonardi-Bee et al., 2011), the mechanisms underlying this association are not well elucidated. Genetic heritability (e.g., shared genetic make-up), social-cognitive processes (e.g., social modelling, cognitive processes, accessibility of cigarettes), and physiological processes (e.g., sensitization to nicotine induced by pharmacological exposure to environmental tobacco smoke) are considered potential mechanisms in the association between parental smoking and smoking behaviour of children.

Genetic heritability

Regarding genetic heritability, twin studies have shown that genetic factors play a substantial role in the aetiology of cigarette smoking. Twin studies have demonstrated genetic influences on multiple phenotypes of smoking (i.e., observable behaviours, characteristics, or traits), including smoking initiation, smoking continuation, amount of cigarettes smoked, severity of nicotine dependence, smoking cessation, and responses to smoking cessation treatment (Al Koudsi & Tyndale, 2005; Carmelli, Swan, Robinette, & Fabsitz, 1992; Li, 2003; Sullivan & Kendler, 1999). Research estimates the variance in different nicotine dependence phenotypes explained by genetic factors in the range of 50-70% (Li, 2003; True, 1997). To date, the evidence for a contribution of specific candidate genes (i.e., pre-specified genes of interest) to smoking behaviour remains modest, although the identification of and distinction between more refined phenotypes may increase the genetic signal in candidate gene studies (Munafo, Clark, Johnstone, Murphy, & Walton, 2004).

Despite the lack of evidence for a contribution of specific candidate genes, it is likely that genetic risk involves a complex interaction between multiple genes in different biologic pathways including genes involved in general processes related to dependence (e.g., genes within the opioid or dopaminergic system related to reward) and genes involved in specific processes related to dependence (e.g., genes encoding nicotinic acetylcholine receptors and nicotine-metabolizing enzymes (Al Koudsi & Tyndale, 2005). In addition, considering interaction effects between genetic risk and personality (e.g., novelty seeking, impulsivity) or environmental characteristics (e.g., exposure to smoking, poor family environment) is important in explaining smoking behaviour. Several studies have shown that the genetic effects on smoking behaviour may be enhanced or attenuated by personality factors and environmental influences (Kleinjan, DiFranza, Engels, submitted; Laucht, Becker, El-Faddagh, Hohm, & Schmidt, 2005; Nilsson, Oreland, Kronstrand, & Leppert, 2009).

Social-cognitive processes

In addition to genetic factors, social-cognitive processes may also explain the association between parental and child smoking. According to Social Learning Theory (SLT;

Bandura, 1977), children learn within a social context through observing others' behaviours, attitudes, and outcomes of behaviour. Several processes may be relevant in explaining the effects of parental smoking, including processes related to the formation of cognitions, self-efficacy, normative perceptions, social reinforcement, and parenting.

Regarding smoking-related cognitions, smokers have been shown to hold strong beliefs (e.g., positive outcome expectations of smoking such as stress relief) as well as cognitive distortions (e.g., attentional bias, optimistic bias/risk denial) (Arnett, 2000; Chapman, 1993; Halpern-Felsher, 2004; Peretti-Watel et al., 2007). Smokers may communicate these beliefs, consciously or unconsciously, to their social environment. It is possible that children who are regularly exposed to smokers may adopt similar cognitions through observations and social learning. In addition, observing role models buy and use tobacco may affect self-efficacy (i.e., perceived ability to use tobacco or refrain from tobacco use) by providing children with the necessary knowledge and skills to obtain and use cigarettes on one hand ('use self-efficacy') and by conveying beliefs about one's ability to control the use of tobacco on the other hand ('refusal self-efficacy). Normative perceptions may also play a role in children of smoking parents. Because of regular exposure to environmental smoking, children may perceive smoking as a normative behaviour.

In addition, favourable cognitions, perceptions, and behaviour may be less forcefully discouraged or even reinforced by parents who smoke. Previous research has shown that smoking and non-smoking parents differ in the extent to which they apply anti-smoking socialization practices (i.e., parenting practices that aim to keep children away from smoking). Parental anti-smoking socialization practices (e.g. rule setting, parental monitoring, establishing a non-smoking agreement, warnings about the negative consequences of smoking) have been associated with more negative attitudes towards smoking, higher self-efficacy to refrain from smoking, lower intentions to initiate smoking, and less smoking behaviour among adolescents (Engels & Willemsen, 2004; Harakeh, Scholte, de Vries, & Engels, 2005).

Empirical evidence supports the effects of parental smoking on smoking-related social-cognitive processes in children. During 'pretend play', kindergarten children of smoking parents were more likely to 'buy' and 'smoke' cigarettes than were children of non-smoking parents (Dalton et al., 2005; de Leeuw, Engels, & Scholte, 2010). Among pre-adolescents and adolescents, parental and environmental smoking has been associated with more positive and tolerant attitudes towards smoking (Andrews, Hampson, Greenwald, Gordon, & Widdop, 2010; Brook, Mendelberg, Galili, Priel, & Bujanover, 1999; Lorenzo-Blanco, Bares, & Delva, 2012; Porcellato, Dugdill, Springett, & Sanderson, 1999), more normative perceptions of smoking (Otten et al., 2009), more perceived benefits of smoking (Prokhorov, 1995), and a higher willingness to initiate smoking (Mak, 2012; Waa, 2011). Although longitudinal studies are needed to establish a temporal order and causal relation, a large body of cross-sectional studies suggests that children of smoking parents differ in smoking-related social-cognitive processes from children of non-smoking parents.

In turn, social-cognitive processes seem important in the development of smoking behaviour. According to the Theory of Planned Behaviour (TPB; Ajzen, 1998), behaviour (including smoking behaviour) is determined by an individual's reasoned intentions,

which are determined by three cognitive factors, respectively cost and benefit evaluations, perceived social norms, and perceived ease or difficulty to perform a behaviour. Considerable empirical evidence supports these assertions. Longitudinal research showed that smoking-related perceptions (i.e., social images and subjective norms) of elementary schoolchildren predicted children's intention and willingness to smoke which, in turn, predicted adolescent smoking behaviour at five-year follow-up (Andrews et al., 2010; Hampson, 2007). Similarly, children of smoking parents have been shown to overestimate the prevalence of smoking, which significantly mediated the effect of parental smoking on regular smoking in children at follow-up (Otten, Engels, & Prinstein, 2009). Several studies have shown that smoking-related cognitions (e.g., attitudes towards smoking, normative beliefs about smoking, risk and benefit perceptions, tobacco refusal self-efficacy, lack of a firm commitment to refrain from smoking) are predictive of smoking intentions and smoking behaviour in the future (Bidstrup et al., 2009; Carvajal, Wiatrek, Evans, Knee, & Nash, 2000; Gerrard, Gibbons, Benthin, & Hessling, 1996; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Song et al., 2009).

In this thesis, we examined the effects of parental smoking on smoking-related cognitions, which are assumed to precede vulnerability to smoking, among never-smoking children (*Chapter 2*).

Physiological processes

Finally, research suggests that physiological processes may constitute a mechanism of action in the association between parental smoking and child smoking. It has been proposed that pharmacological exposure to the psychoactive properties of nicotine may lead to an increased risk of smoking initiation and nicotine dependence, hypothetically through nicotine-induced neuro-psychological adaptations in the brain (Anthonisen & Murray, 2005; Okoli, Kelly, & Hahn, 2007). From a biological perspective, exposure to ETS may induce neuro-psychological changes in the brain similar to those in active smokers. Previous studies have demonstrated that non-smokers who are exposed to high levels of ETS may absorb amounts of nicotine comparable to light or non-daily smoking (Al-Delaimy, Fraser, & Woodward, 2001; Dimich-Ward, Gee, Brauer, & Leung, 1997). In line with this finding, pharmacological exposure to ETS smoke has recently been shown to be capable of producing nicotine dependence in rats (Small, 2010; Yamada, 2010). As a result, nicotine-induced neuro-psychological adaptations may occur and altered psycho-behavioural responses to nicotine may develop, which resemble those seen in active smokers (e.g., tolerance to aversive effects, sensitization to rewarding effects, withdrawal symptoms).

Research has only started to examine the psycho-behavioural effects of ETS exposure. Okoli, Rayens, and Hahn (2007) evaluated the effects of ETS exposure in non-smoking bar and restaurant workers. In their study, hair nicotine levels predicted the report of four or more subjective symptoms adapted from the *DSM-IV* nicotine withdrawal symptoms. Similarly, Belanger and colleagues (2008) reported that 5% of never-smoking 10-12 year-old children reported self-perceived nicotine dependence symptoms (e.g., feeling mentally addicted to nicotine). Exposure to ETS in a car was associated with an increased probability to report these symptoms. Recently, Racicot, McGrath, and O'Loughlin (2011) found that the number of smokers in the child's social

environment predicted perceived nicotine dependence in never-smoking 11-15 year-old students.

Taken together, these findings indicate a gradient between exposure to ETS and self-reported psycho-behavioural responses in non-smokers and non-smoking youth. However, it is unclear whether these responses are indeed the result of nicotine absorbed from ETS. Research is only beginning to examine the effects of ETS smoke in the human brain (for example Brody, 2011). To date, no evidence exists for neural adaptations induced by exposure to ETS (Yamada, 2010). Yet, the report of altered responses (i.e., self-perceived dependence symptoms) has been associated with an increased susceptibility to smoking and an increased risk of smoking initiation (O'Loughlin, Karp, Koulis, Paradis, & DiFranza, 2009; Okoli, Richardson, Ratner, & Johnson, 2009). These findings suggest that psycho-behavioural responses – if induced by exposure to nicotine - may constitute a putative mechanism in the association between parental smoking and risk of smoking in children.

In this thesis, we examined the effects of parental smoking behaviour on smoking-related responses, which are assumed to increase the risk of subsequent smoking initiation and progression to dependence among youth. Specifically, we describe the effects of parental smoking on psycho-behavioural responses to ETS among children and responses to the first active dose of nicotine among adolescents (*Chapter 3-4*).

Promoting parental cessation: Integrating treatment and prevention?

To reverse the tobacco epidemic, WHO identified the need to enhance cessation rates among smokers and decrease smoking initiation rates among youth. In addition to the treatment and prevention of nicotine addiction, WHO identified reducing exposure to parental smoking as a key element of action to encourage health and development among children (WHO, 1999).

Research demonstrates that the promotion of smoking cessation among parents can have important health benefits for both parents and children. Parents who quit smoking will not only improve their own health, but will also reduce the risk of physical illness (Halterman et al., 2004), smoking initiation (den Exter Blokland, Engels, Hale, Meeus, & Willemsen, 2004; Otten, Engels, van de Ven, & Bricker, 2007), and regular smoking (Bricker et al., 2003; Chassin, Presson, Rose, Sherman, & Prost, 2002) in their children. Parental cessation will also increase the likelihood of smoking cessation among children once smoking has been initiated (Bricker, Rajan, Andersen, & Peterson, 2005).

The mechanisms that putatively mediate the effects of parental smoking cessation on children are assumed to be similar to those that mediate the effects of parental smoking (genetic heritability, socio-cognitive processes, physiological processes). Previous studies examining mediation effects of parental smoking cessation on children identified smoking-related cognitions and anti-smoking socialization as significant mechanism of action. Chassin and colleagues (2002) reported that parental smoking cessation was associated with more anti-smoking socialization, which was a partial mediator in the relation between parental and adolescent smoking. Wyszynski, Bricker, and Comstock (2011) reported that parental smoking cessation was related to less favourable smoking-related cognitions, which, in turn, reduced the risk of child smoking. Negative attitudes toward smoking and tobacco refusal self-efficacy together

significantly mediated the prospective relationship between parental smoking cessation and regular smoking in children.

In summary, considerable evidence suggests that the risk of smoking initiation, which is associated with parental smoking, may be attenuated by parental smoking cessation. Thus, promoting smoking cessation among parents may prevent the uptake of smoking, experimenting with smoking, and subsequent development of regular smoking and dependence in youth. Connecting smoking parents to evidence-based cessation support has the potential to integrate both treatment of nicotine addiction in smokers and prevention of nicotine addiction in youth.

To date, we are not aware of any studies that have examined the potential preventive effects that smoking cessation treatments for parents may have among children. In this thesis, we report the effects of an evidence-based smoking cessation treatment (i.e., telephone-based cessation support compared to self-help material) and subsequent parental smoking cessation on smoking-related cognitions and smoking behaviour in children of smoking parents (*Chapter 11*).

Evidence-based interventions for smoking cessation

Brief overview of evidence-based interventions

In a meta-analytic review, a range of psychological interventions demonstrated effectiveness in increasing smoking cessation rates, including brief advice from a physician, structured interventions from nurses, individual counselling, group counselling, generic and personalized self-help materials, nicotine replacement therapy, and smoking cessation medication (Lancaster, Stead, Silagy, & Sowden, 2000). In the population of smoking parents, numerous studies have described interventions to increase parental smoking cessation and decrease exposure of children to ETS (for reviews, see Priest, 2010; Rosen, Noach, Winickoff, & Hovell, 2012). A systematic review of interventions targeting smoking parents in hospitals, paediatric settings, baby clinics, and family homes concluded their overall effectiveness in increasing parental smoking cessation (Rosen et al., 2012). Similarly, a systematic review identified numerous studies that show that interventions targeting smoking families and carers can reduce ETS exposure among children (Priest, 2010).

Reach of available interventions: Need for proactive approaches

Although effective treatments are available, smoking cessation support is underutilized in Europe and North America. In the United States, only 37% of smokers who have tried to quit smoking report that they had ever read written material on smoking cessation, 12% had called a quitline, and 9% had attended individual counselling (Hughes, Marcy, & Naud, 2009). Shiffman and colleagues (2008) reported similar rates on the use of cessation treatments. In the Netherlands, one third of quitters report that they received assistance in quitting (NIPO, 2008) and less than 1% of smokers contact the national quitline (Willemsen, Segaar, & van Schayck, 2013). Access barriers often include treatment costs, low interest in traditional treatments, and lack of knowledge regarding the availability of cessation support (Bricker, Wyszynski, Comstock, & Heffner, 2013; Husten, 2010).

Research suggests that the use of cessation support can be increased substantially by using different strategies aiming to increase awareness of cessation support among the smoking population: for example, the use of mass media, printing quitline phone numbers on cigarette packages, and systematic integration of cessation support into the health care system (Borland & Segan, 2006). In addition, proactive recruitment approaches have been recommended to increase the proportion of smokers who make use of quitline services.

Proactive outreach is the systematic targeting of all individuals in a defined population of smokers and the attempt to engage smokers with varying levels of motivation. Previous studies have used different approaches to connect smokers to cessation support (e.g., direct mailings, health care provider outreach, telephone recruitment, or media advertisements). Studies offering cessation support through mailings have yielded response rates between 2-11% in smokers identified from general practice and health care provider records (Gilbert, Nazareth, & Sutton, 2007; McClure, Richards, Westbrook, Pabiniak, & Ludman, 2007; McDonald, 1999). Recruitment rates tend to be higher for interpersonal recruitment (e.g., in-person or telephone recruitment), with recruitment rates ranging between 44-65% (Boyle et al., 2007; Peterson et al., 2009; Tzelepis et al., 2009). While interpersonal recruitment may constitute an efficient way to recruit smokers into clinical trials, this approach is less feasible for implementation into the health care system, where few resources for recruitment are available.

To date, efforts to engage smoking parents have almost exclusively focused on clinical settings (Roseby et al., 2003; Winickoff et al., 2010; Winickoff, Hillis, Palfrey, Perrin, & Rigotti, 2003; Winickoff, McMillen, et al., 2003). While these efforts are valuable, proactive outreach of health care practices and hospitals may not extend to the general population of smoking parents. Public schools are a highly promising but understudied venue for reaching parents who smoke. Promoting cessation support through schools has the potential to reach a major proportion of smoking parents, thus yielding high potential public health impact. Also, it is possible that schools may constitute a 'teachable setting', that is, smokers may be more likely to make use of cessation support when reminded of their role as parents.

To date, no study has evaluated the use of primary schools as a venue to promote smoking cessation among parents. In this thesis, we evaluated the efficacy of a population-based strategy to connect smoking parents to cessation support. Specifically, we examined the reach of a school-based recruitment approach and acceptability of cessation support (quitline counselling vs. self-help material) among smoking parents (*Chapter 7*).

Quitline counselling versus self-help: Two interventions with high potential reach

In this thesis, we examined the effects of two evidence-based interventions to increase smoking cessation rates, which are both characterized by high potential population-level reach. Specifically, we evaluated the effectiveness of tailored quitline counselling in comparison to a self-help brochure, which was chosen as an active control treatment.

Quitline counselling

Quitlines are telephone-based smoking cessation services that assist smokers in quitting smoking. The primary aim of quitlines is to support quit attempts among

smokers seeking cessation support. Counsellors aim to provide information, increase the smoker's motivation to quit and confidence in being able to quit, and provide knowledge and skills that increase the chance of successful smoking cessation. Counselling is usually based on the principles of addiction theories, cognitive behavioural therapy (CBT), and motivational interviewing (MI; Miller & Rollnick, 2002). Use of nicotine replacement therapy (NRT) or smoking cessation medication (bupropion, varenicline) is usually recommended as adjunct treatment for dependent smokers.

Quitlines may function as a central contact point for smokers seeking cessation support and may help direct smokers to the most appropriate assistance by offering a range of services such as brief advice, information about cessation support and pharmacotherapy, counselling, self-help materials, and referral to other services (e.g., group courses). Quitlines provide a quick and easy service for smokers to use, require no travel and are readily available in rural and urban areas. In proactive telephone counselling, calls are initiated by the counsellor, thereby decreasing reliance on the smoker to take the initiative. Telephone counselling for smoking cessation is convenient and has the potential to reach a broad population. Currently, smokers in almost all Western European countries and in the United States, Canada, Australia, and New Zealand have access to telephone counselling services through national quitlines. In many countries, quitline services are available for free or costs are reimbursed by health insurance companies.

A systematic review demonstrated the effectiveness of telephone counselling in increasing smoking cessation rates (Stead, Perera, & Lancaster, 2006). The authors concluded that there is evidence for a dose-response relation. While one or two brief calls are less likely to provide a measurable benefit, three or more calls increase the chances of quitting compared to minimal interventions such as brief advice, standard self-help materials, or compared to pharmacotherapy alone. Data from the European Smoking Cessation Helplines Evaluation study (ESCHER), which assessed cessation rates after quitline use in several European countries, showed point prevalent abstinence rates between 12% and 28% and prolonged abstinence rates between 4% and 15% at one-year follow-up (Willemsen, Meer, & Bot, 2008). In smokers who actively sought quitline support, satisfaction with telephone counselling was usually quite high. Across European quitlines, 83% of callers said that the service they received from the quitline met their expectations, and, across countries, average caller satisfaction ratings ranged between 6.9 and 8.3 on a 10-point scale (Willemsen et al., 2008). Accumulating evidence indicates that quitline support is a cost-effective public health intervention (Cromwell, Bartosch, Fiore, Hasselblad, & Baker, 1997; Kahende, Loomis, Adhikari, & Marshall, 2009; Tomson, Helgason, & Gilljam, 2004). Among European quitlines, the costs per quitter were generally quite low. Overall, the costs per quitter were 51 Euro and ranged between 8 and 217 Euro across European countries (Willemsen et al., 2008).

Quitline counselling is highly suitable for tailoring. The goal of tailoring is to adapt an intervention to make it most suitable for a target population. The contents of counselling can be adapted to specific needs and supplementary materials can be easily added to provide population-specific information. Previous research has shown that tailored materials and advice are more effective and more appealing to target

populations (Dijkstra, De Vries, & Roijackers, 1999; Lancaster & Stead, 2005; Orleans et al., 1998). To increase use of available cessation support, it is important to offer a range of interventions that appeal to different individual needs and preferences. Parents who smoke seem to experience unique quitting motives (e.g., wanting to quit for the health of the child) and, possibly, barriers to quitting (Halterman et al., 2010; Hitchman et al., 2011; Winickoff, Hillis, et al., 2003). Tailoring available interventions to address the specific needs of smoking parents can potentially increase reach as well as effectiveness of available smoking cessation interventions.

In summary, a large body of research shows that telephone counselling provided by quitlines is well evaluated by smokers, effective in increasing smoking cessation rates, probably cost-effective, and suitable to address different populations (e.g., smoking parents). As quitline counselling is available to nearly all smokers in Western Europe, it has the potential to have a high public health impact.

Self-help materials

Printed self-help materials include brochures, workbooks, or handouts that provide information and advice on how to quit smoking. Printed self-help materials often include didactic information on nicotine addiction, the health benefits associated with quitting smoking, and tips and advice on how to initiate and maintain abstinence based on principles from CBT. In addition, information on the use of NRT or a pharmacological treatment is frequently provided. Advantages of self-help materials include easy access and high convenience, high acceptability among smokers, and low costs compared to individual counselling.

Self-help materials have demonstrated efficacy in increasing smoking cessation rates. In a meta-analytic review, it was concluded that standard self-help materials have a small benefit compared to no intervention (Lancaster & Stead, 2005). Therefore, self-help materials are a cost-effective method to support otherwise unaided quit attempts, they can be disseminated easily, and they have the potential to help a large proportion of smokers.

In this thesis, we examined the effects of two evidence-based interventions, both characterized by high potential population-level reach, to increase smoking cessation rates among parents. Specifically, we evaluated the effectiveness of tailored quitline counselling in comparison to an active control treatment (i.e., self-help materials) to increase parental smoking cessation rates. The effects (primary and secondary outcomes) of quitline counselling compared to self-help materials are reported in *Chapter 8*.

Moderators and mediators of smoking cessation interventions

To match clients to the optimal treatment, a better understanding of moderators and mediators of treatment outcome is needed. General predictors of treatment outcome (regardless of treatment provided) provide prognostic information by clarifying which subgroups of clients will respond more or less favourably to treatment in general. Moderators of treatment outcome (i.e., treatment-specific predictors of outcome)

provide prescriptive information about optimal treatment selection by identifying subgroups of clients who are likely to benefit more from one treatment than from another (Wolitzky-Taylor, Arch, Rosenfield, & Craske, 2012). Mediators of treatment outcome (i.e., underlying processes responsible for treatment-induced change) provide information about how treatments operate to produce an effect. The identification of treatment moderators and mediators can provide clinical practitioners and investigators with important information to find the most appropriate treatment for a client, clarify the best choice of inclusion and exclusion criteria to maximize statistical power in future clinical trials, and identify the active and redundant elements within treatments to increase the effectiveness and cost-effectiveness of evidence-based smoking cessation interventions (Kraemer, Wilson, Fairburn, & Agras, 2002; Wolitzky-Taylor et al., 2012).

Randomized controlled trials (RCTs) provide an excellent opportunity to identify moderators and mediators of treatment outcome. Although various treatments have demonstrated effectiveness, a comprehensive understanding of how and under which circumstances smoking cessation treatments work is lacking. It has been recommended that RCTs should routinely include the analysis and report of moderators and mediators of evidence-based treatments (Kraemer et al., 2002). In this thesis, we identified moderators of treatment outcome and mediators underlying treatment effectiveness among smoking parents who received cessation support (quitline counselling vs. self-help material) (*Chapter 8* and *9*).

Methodology

Different study designs and statistical techniques have been employed to collect and analyze the data underlying this thesis. Below, the employed methodology is briefly described.

Survey research

In survey research, questionnaires are administered to study behaviours, thoughts, opinions, feelings, or characteristics of a sample of individuals from a given population. A survey consists of a number of predetermined questions that the respondent answers, usually in a set format. When surveys are administered to a representative sample, inferences about the larger population of interest can be made (i.e., generalizing findings from the sample to the population). Common methods of survey administration include online surveys, mailed surveys, in-home surveys, and school-based surveys (among students). All of these methods were used in this thesis. Surveys may be administered either at one point in time (cross-sectional survey research) or at multiple points in time (longitudinal survey research). In this thesis, both designs were included.

Randomized controlled trial

A randomized controlled trial (RCT) is a specific type of scientific experiment that is used to test the efficacy or effectiveness of one or more interventions (often in comparison to a control intervention) within a certain population. RCTs are considered the gold standard of clinical trials. A key feature of RCTs is that study participants are

randomly allocated to intervention conditions, thereby ensuring an equal distribution of known and unknown participant characteristics that may be related to treatment outcome. After randomization, all study participants are followed in exactly the same way, and the only difference between conditions pertains to the intervention received (or characteristics intrinsic to the intervention received). In this thesis, a RCT was conducted. The protocol of the RCT is registered with the Netherlands Trial Register (NTR2707). The results of the RCT are reported in accordance with the Consolidated Standards of Reporting Trials statement (CONSORT), which is an evidence-based, minimum set of recommendations to facilitate the complete and transparent reporting of findings from RCTs and aid their critical appraisal and interpretation.

Structural Equation Modelling

Structural Equation Modelling (SEM) is a combination of different statistical techniques. A major advantage of SEM is that multiple equations can be estimated simultaneously, rather than in a series of separate regression analyses (Joreskog, 1996; Kline et al., 2005; Muthen & Muthen, 2007). An advantage of the single estimation is that it yields a global likelihood for the model and includes a range of tests and indices to determine goodness of model fit. Additionally, it is possible to examine indirect effects (statistical mediation) as well as bidirectional and reciprocal associations between variables across time ('cross-lag' effects).

Research questions and study characteristics

This thesis addresses the following research questions (in order of appearance):

Part 1 – Effects of environmental smoking on youth

- What are the effects of smoking parents, siblings, and peers on smoking-related cognitions and susceptibility to smoking among never-smoking children? – *Chapter 2*
- What are the effects of smoking parents, siblings, and peers on psycho-behavioural responses to ETS among never-smoking children? – *Chapter 3*
- What are the effects of smoking parents, siblings, and peers on initial responses to the first active dose of nicotine among adolescents who recently initiated smoking? – *Chapter 4*
- Do family members (reciprocally) influence each other's smoking behaviour? – *Chapter 5*

Part 2 – A smoking cessation intervention for parents: Results of a randomized controlled trial

- What is the reach of school-based promotion of cessation support and how acceptable is cessation support (tailored quitline support and self-help materials) among smoking parents recruited through their children's primary schools? – *Chapter 7*
- What are the effects of tailored quitline counselling compared to self-help materials among smoking parents? – *Chapter 8*
- What are general predictors and treatment-specific predictors of tailored quitline support and self-help materials among smoking parents? – *Chapter 9*

- What are the psychological mechanisms underlying the effectiveness of tailored quitline support among smoking parents? – *Chapter 10*
- What are the effects of recruiting parents into quitline cessation support and parental smoking cessation on children? – *Chapter 11*

Characteristics of the studies included in this thesis are presented in Table 1.

Table 1 Characteristics of the studies included in this thesis

Chapter	Sample	Setting	Design	Method
2, 3	780 never-smoking children	School-based	Cross-sectional	Survey
4	178 adolescents who recently initiated smoking	School-based	Cross-sectional	Survey
5	412 families (2 parents and 2 adolescents)	Family-based	Longitudinal	Survey
6-11	512 parent-child dyads (smoking parent)	Family-based	2-arm randomized controlled trial with 3 assessments	Survey

Overview of this thesis

Part 1 – Effects of environmental smoking on youth

In *Part 1* of this thesis, the objective was to examine the effects of environmental and parental smoking on children and adolescents. *Chapter 2* reports the effects of environmental smoking on smoking-related cognitions and susceptibility to smoking among never-smoking elementary schoolchildren. *Chapter 3* examines the effects of environmental smoking on psycho-behavioural symptoms in response to ETS among never-smoking elementary schoolchildren. *Chapter 4* reports the effects of environmental smoking on initial responses to the first active dose of nicotine among adolescents who recently initiated smoking. *Chapter 5* describes how family members (i.e., parents and their adolescent children) may influences each other's smoking behaviour in the context of the family system.

Part 2 – A smoking cessation intervention for parents: Results of a randomized controlled trial

In *Part 2* of this thesis, the objective was to examine the feasibility of a population-based strategy to connect smoking parents to cessation support through their childrens' primary schools and to examine the effects of smoking cessation support among parents and their children. *Chapter 6* describes the study protocol of the randomized

controlled trial to examine the effects of tailored quitline counselling and self-help materials among smoking parents. *Chapter 7* examines the reach and acceptability of the school-based recruitment approach used to recruit smoking parents into cessation support. *Chapter 8* reports the results of a randomized controlled trial that examined the effectiveness of tailored quitline counselling compared to self-help materials in increasing smoking cessation rates among parents. *Chapter 9* identifies general predictors of treatment outcome and treatment-specific predictors of treatment outcome (moderators) that help identify which subgroups of clients are particularly likely to benefit from smoking cessation treatment. *Chapter 10* examines mediators of the effectiveness of smoking cessation treatment to gain insight into the mechanism underlying treatment. *Chapter 11* reports the effects of telephone-based cessation counselling for smoking parents and parental smoking cessation on smoking-related cognitions and smoking behaviour among their children. A summary and general discussion of the main findings from this thesis are presented in *Chapter 12*. In addition to the limitations of this thesis, implications of the findings are discussed in this chapter, including practical implications and implications for future research.

Part 1

Effects of environmental smoking on youth

Chapter 2

The role of environmental smoking in smoking-related cognitions and susceptibility to smoking in never-smoking 9-12 year-old children

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Abstract

Environmental smoking has numerous adverse effects on child health, and children are frequently exposed to environmental smoking. In the present study, we investigated the role of environmental smoking (parental smoking, sibling smoking, peer smoking) in smoking-related cognitions (pros of smoking, perceived safety of casual smoking, cue-triggered wanting to smoke) and susceptibility to smoking among 9-12 year old never-smoking children (N=778). We collected cross-sectional survey data from children attending 15 Dutch primary schools. Using structural equation modelling, we assessed direct as well as indirect relationships among study variables. The results showed that children who were exposed to more smoking parents, siblings, and peers perceived more pros of smoking. Additionally, parental smoking was associated with higher perceived safety of casual smoking and more cue-triggered wanting to smoke. In turn, perceiving a higher safety of casual smoking and more cue-triggered wanting to smoke were associated with a higher susceptibility to smoking in children. No direct effects of environmental smoking on children's susceptibility to smoking were found. However, parental smoking was associated with children's susceptibility to smoking through children's perceived safety of casual smoking and cue-triggered wanting to smoke. The present study indicates that pre-adolescents may already display favourable smoking-related cognitions and that these cognitions may be an early indicator of a child's vulnerability to smoking. Environmental smoking, particularly parental smoking, is associated with more favourable smoking-related cognitions in never-smoking children. In the intergenerational transmission of smoking from parents to children, children's risk perceptions of smoking and the experience of cue-triggered wanting to smoke may constitute mechanisms of action, which need to be investigated in longitudinal research.

Introduction

Environmental smoking has various adverse effects on child health, such as childhood asthma, respiratory tract infections, decreased lung growth, behavioural problems, or neurocognitive decrements (Cook & Strachan, 1999; DiFranza, Aligne, & Weitzman, 2004). In North America and Europe, children are frequently exposed to environmental smoking. At least one third of children live in a household with a smoker (King et al., 2009; Schuster, Franke, & Pham, 2002), and approximately two-thirds of children are exposed to smoking in their social environment (USDHHS, 2006). In addition to the numerous detrimental effects on child health, environmental smoking increases the child's risk for smoking initiation in the future (Becklake, Ghezzo, & Ernst, 2005; Bernat, Erickson, Widome, Perry, & Forster, 2008; Leonardi-Bee, Jere, & Britton, 2011).

To prevent youth smoking, it is essential to understand factors that promote vulnerability to smoking among children and adolescents. Research indicates that the development of a cognitive susceptibility and intentions to smoke precede actual smoking initiation among youth. Several studies suggest that children may display susceptible cognitions already at a very young age. In a longitudinal study, smoking-related perceptions (i.e., social images about what smokers are like and subjective norms about smoking) of children in the elementary years have been shown to predict children's intention and willingness to smoke which, in turn, predicted adolescent smoking behaviour at five-year follow-up (Andrews, Hampson, Barckley, Gerrard, & Gibbons, 2008; Hampson, Andrews, & Barckley, 2007). Among children and adolescents, an increasing number of studies shows that smoking-related cognitions (e.g., attitudes towards smoking, normative beliefs about smoking, risk and benefit perceptions, tobacco refusal self-efficacy) are predictive of smoking intentions and smoking behaviour (Andrews, Hampson, & Barckley, 2008; Bidstrup et al., 2009; Carvajal, Wiatrek, Evans, Knee, & Nash, 2000; Gerrard, Gibbons, Bethin, & Hessling, 1996, Otten, Engels, & Prinstein, 2009; Song et al., 2007). However, relatively little is known about the development of smoking-related cognitions. Previous studies have focused mainly on adolescents to determine who is at risk for smoking initiation. Consequently, childhood factors that may predispose youth for smoking are largely unrecognized.

Several studies have linked smoking in the social environment to more favourable smoking-related cognitions in youth. For pre-adolescents, parental smoking has been found to be associated with more tolerant and more positive attitudes towards smoking (Brook, Mendelberg, Galili, Priel, & Bujanover, 1999; Porcellato, Dugdill, Springett, & Sanderson, 1999). Similarly, pre-adolescents with smoking family members displayed more favourable implicit attitudes towards smoking compared to pre-adolescents with non-smoking family members (Andrews, Hampson, Greenwald, Gordon, & Widdop, 2010). Parental smoking and peer smoking were associated with more normative perceptions of smoking in early adolescence (Otten et al., 2009). Finally, adolescents exposed to smokers in their social environment perceived more benefits of smoking compared to adolescents not exposed to environmental smoking (Prokhorov et al., 1995). Taken together, previous studies demonstrate that environmental smoking affects global smoking-related cognitions, such as attitudes towards smoking and normative perceptions in youth. However, little is known about more specific cognitions,

particularly in children. Smokers may hold very specific beliefs about smoking, and smokers may communicate these beliefs, to their social environment consciously or unconsciously. According to social learning theory (Bandura, 1977), children learn within a social context through observing others' behaviour, attitudes, and outcomes of behaviour. Adult and adolescent smokers have been shown to hold strong beliefs as well as cognitive distortions regarding smoking. For example, smokers usually belief that smoking has various instrumental benefits, such as stress relief, concentration enhancement, or appetite control (Chapman, Wong, & Smith, 1993; Halpern-Felsher, Biehl, Kropp, & Rubinstein, 2004). In addition, in comparison to non-smokers, smokers display an optimistic bias; they tend to underestimate the risks of smoking in general and the personal risks of smoking in particular (Arnett, 2000). Similarly, risk denial has been found to be quite widespread among smokers (Peretti-Watel et al., 2007). Smokers also display associations between smoking-related cues and urges to smoke (Carter & Tiffany, 1999), which can be explained by classical conditioning through repeated pairing across time. For example, seeing others smoke can elicit the desire to smoke and smoking behaviour in smokers. Much less is known about similar beliefs and associations among children. Possibly, children who are exposed to smokers in their social environment may adopt beliefs and associations from their social environment through observations and social learning.

The present study investigated three types of susceptible cognitions in children, the perceived pros of smoking, the perceived safety of casual smoking, and the experience of cue-triggered wanting to smoke. Pros of smoking and safety of casual smoking assess risk and benefit perceptions. Cue-triggered wanting to smoke assesses the desire or temptation to smoke in response to smoking-related cues. In a recent study, a substantial percentage of never-smoking children reported cue-triggered wanting to smoke, which was associated with the number of smokers in the child's social environment (Schuck, Kleinjan, Otten, Engels, & DiFranza, 2012). Previous studies suggest that these three types of cognitions reflect an increased vulnerability to smoking among youth (Carvajal et al., 2000, Schuck et al., 2012; Song et al., 2007).

It is assumed that a susceptibility to smoking precedes intentions to smoke and smoking initiation. Research has shown that susceptibility to smoking among never-smokers (i.e., the lack of a firm commitment to refrain from smoking) strongly predicted smoking experimentation at four-year follow-up (Pierce, Choi, Gilpin, Farkas, & Merrit, 1996). In pre-adolescents, intentions to smoke are seldom reported. Therefore, susceptibility to smoking, as measured by the lack of a resolute intention to refrain from smoking, may constitute a relevant outcome, particularly in younger age groups.

To summarize, the present study investigated the role of environmental smoking (parental smoking, sibling smoking, peer smoking) in smoking-related cognitions (pros of smoking, perceived safety of casual smoking, cue-triggered wanting to smoke) and susceptibility to smoking among 9-12 year old never-smoking children. We hypothesized that environmental smoking is associated with susceptible cognitions in children. In particular, we expected smoking of parents to be most influential, as parental influences are thought to be more important in elementary years while peer influences become increasingly important during adolescent years (Vitaro, Wanner, Brendgen, Gosselin, & Gendreau, 2004). Moreover, we hypothesized that susceptible cognitions in children are associated with an increased susceptibility to smoking, and

that environmental smoking affects children's susceptibility through susceptible cognitions.

Methods

Participants and procedure

We used cross-sectional survey data collected in 15 Dutch primary schools. Primary schools were selected randomly from a larger pool of schools located in urban areas in the East of the Netherlands. Participating schools agreed to distribute short questionnaires during school hours to all students in Dutch grades 6-8 (US grades 4-6). Study participants were 880 children aged between 9 and 12 years. Parents received written information about the school's participation in the study as well as information about the procedure and aim of the study. All parents were informed that participation in the study was voluntary, and they received a form with a return envelop, which they were asked to return if they wished to withdraw their child from study participation ('passive consent'). Parents of three students withdrew their child from study participation. Data collection took place between March and September 2010. Questionnaires were filled in anonymously with an instructed teacher present in the classroom. Children were informed that participation was voluntary. For the present study, we selected all children who reported that they had never smoked, not even a single puff (N = 778).

Measures

Parental smoking. Parental smoking was assessed with two questions "Does your mother/father smoke?" Response options were: 1 (my mother/father has never smoked), 2 (my mother/father quit smoking), 3 (my mother/father smokes), 4 (I don't have a mother/father), and 5 (I do not know). Scores for mothers and fathers were dichotomized (0 = not currently smoking, 1 = currently smoking) and summed, to indicate the number of smoking parents.

Sibling smoking. To assess sibling smoking, children were asked to report the names of all siblings and for each sibling indicate whether he/she smokes. Response options were: 0 (no, he/she doesn't smoke) and 1 (yes, he/she smokes). Scores of all siblings were summed, to indicate the number of smoking siblings.

Peer smoking. To assess the number of smoking peers, children were asked to report the number of friends who smoke. Response options were: 0 (nobody), 1 (1 friend), 2 (2 friends), 3 (3 friends), 4 (4 friends), and 5 (5 or more friends).

Perceived pros of smoking. To assess perceived pros of smoking, children were asked to indicate the degree to which they agree with ten statements. Response options ranged from 1 (totally disagree) to 4 (totally agree). Example items are: "Smoking helps cope with stress" and "Smoking helps relax". The measure has been validated previously in adolescents (Dijkstra & De Vries, 2000). A mean score was calculated. Internal consistency was good (Cronbach's alpha = .85).

Perceived safety of casual smoking. To assess perceived safety of casual smoking, children were asked to indicate the degree to which they agree with three statements on a scale ranging from 1 (totally disagree) to 4 (totally agree). The following

items were used: "There is no harm in smoking a cigarette once in a while", "It is safe to smoke for only one or two years", and "If you only smoke once in a while you won't become addicted" (see Siegel, Alvaro, & Burgoon, 2003). A mean score was calculated. Internal consistency was acceptable (Cronbach's alpha = .63).

Cue-triggered wanting to smoke. To assess cue-triggered wanting to smoke, we used the cue-induced craving subscale of the Autonomy Over Smoking Scale (AUTOS; DiFranza, Wellman, Ursprung, & Sabiston, 2009). Examples of the four items are: "When I see other people smoking, I want a cigarette" and "When I smell cigarette smoke, I want a cigarette" Children were asked to select the response that best describes them. Response options ranged from 1 to 5 (never, sometimes, regularly, often, very often). Because the distribution was skewed towards lower response categories, answers were recoded into 0 (never) or 1 (sometimes, regularly, often, very often). A sum score of items endorsed was calculated ranging from 0 to 4. In smokers, both the number of symptoms endorsed in the AUTOS and symptom intensity have been shown to correlate with cigarette consumption and other measures of tobacco use (DiFranza et al., 2009).

Susceptibility to smoking. To assess susceptibility to smoking, children were asked to select the statement that best describes them. Response options were: 1 (I know for sure that I will never start smoking), 2 (I think that I will never start smoking), 3 (I think I will try smoking in the future), 4 (I think I will try smoking within five years), 5 (I think I will try smoking within one year), 6 (I think I will try smoking within six months), 7 (I think I will try smoking within one month), and 8 (I have already tried smoking). Due to a preponderance of scores at the scale minimum, the scores were dichotomized into 0 (I know for sure that I will never start smoking) and 1 (any other response), thereby indicating (the lack of) a resolute intention to refrain from smoking (Pierce et al., 1996).

Strategy for analyses

A path model was estimated in Mplus 5 (Muthén & Muthén, 2007) to evaluate the effects of environmental smoking (parental smoking, sibling smoking, peer smoking) on children's susceptibility to smoking via children's smoking-related cognitions (perceived pros of smoking, perceived safety of smoking, cue-triggered wanting to smoke). The chi-square value, degrees of freedom, and the *p*-value of the model were evaluated. Direct associations between variables were assessed based on standardized path coefficients and *p*-values. Indirect effects (i.e., mediation) were tested using a bootstrap method in Mplus (Shrout & Bolger, 2002).

Of the 778 never-smoking children, 36 children (4.6%) had missing responses on the outcome variable (susceptibility to smoking) and were not included in the analyses. Missing values on predictor variables were substituted in Mplus using full information maximum likelihood (FIML) estimation.

To examine gender differences in individual model paths, we compared the relative model fit between a model in which all parameters were allowed to vary freely across groups and a model in which the individual parameters were held equal across groups (i.e., nested model comparison). All parameters were tested separately (i.e., one parameter was freed at a time). A chi-square difference test was used to test relative model fit (Satorra & Bentler, 2001).

Results

Descriptive analyses

Descriptive statistics are provided for the sample of 742 never-smoking children. Univariate correlations between study variables are displayed in Table 1. The mean age of the sample was 10.7 (*SD*=1.0) and 50.9% of the sample were girls. Overall, 167 children (22.5%) reported that one parent currently smokes, and 77 (10.4%) reported that both parents currently smoke. Forty-two children (5.7%) reported current smoking among at least one sibling, and 52 (7.0%) reported current smoking among at least one peer. Of the 742 never-smoking children, 305 children (41.3%) agreed with at least one item on the 'pros of smoking' scale, 255 (35.6%) agreed with at least one item on the 'perceived safety of casual smoking' scale, and 61 (8.4%) reported at least one item on cue-triggered wanting to smoke. Regarding intentions to smoke, 403 children (54.3%) reported 'I know for sure that I will never start smoking (i.e., a resolute intention to refrain from smoking in the future). A total of 301 children (40.6%) reported 'I think that I will never start smoking' and 38 children (5.1%) reported 'I think I will try smoking in the future' (i.e., lack of a resolute intention to refrain from smoking in the future).

Table 1 Pearson correlations between study variables

Variables	1	2	3	4	5	6	7
1 Age	-						
2 Parental smoking	.05	-					
3 Sibling smoking	-.01	.03	-				
4 Peer smoking	.03	.12	.01	-			
5 Pros of smoking	.13***	.15***	.10**	.13***	-		
6 Safety of smoking	-.04	.12***	.03	-.01	.29***	-	
7 Wanting to smoke	-.02	.10**	.05	.06	.29***	.23***	-
8 Susceptibility	.02	.11**	.06	.09*	.15***	.22***	.20***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Direct and indirect associations between study variables

We used structural equation modelling (path analysis) to evaluate direct and indirect associations between study variables (Figure 1). The model included direct effects between age, gender, parental smoking, sibling smoking, and peer smoking on one hand and susceptibility to smoking on the other hand as well as indirect effects between these variables through children's smoking related cognitions (perceived pros of smoking, the perceived safety of casual smoking, cue-triggered wanting to smoke).

The model was fully saturated. Age was positively associated with perceived pros of smoking in children (beta=.12, SE=.02, *p*=.01). Boys perceived more pros of smoking (beta=.12, SE=.03, *p*=.001), perceived a higher safety of casual smoking (beta=.14, SE=.07, *p*<.001), and reported more symptoms of cue-triggered wanting to

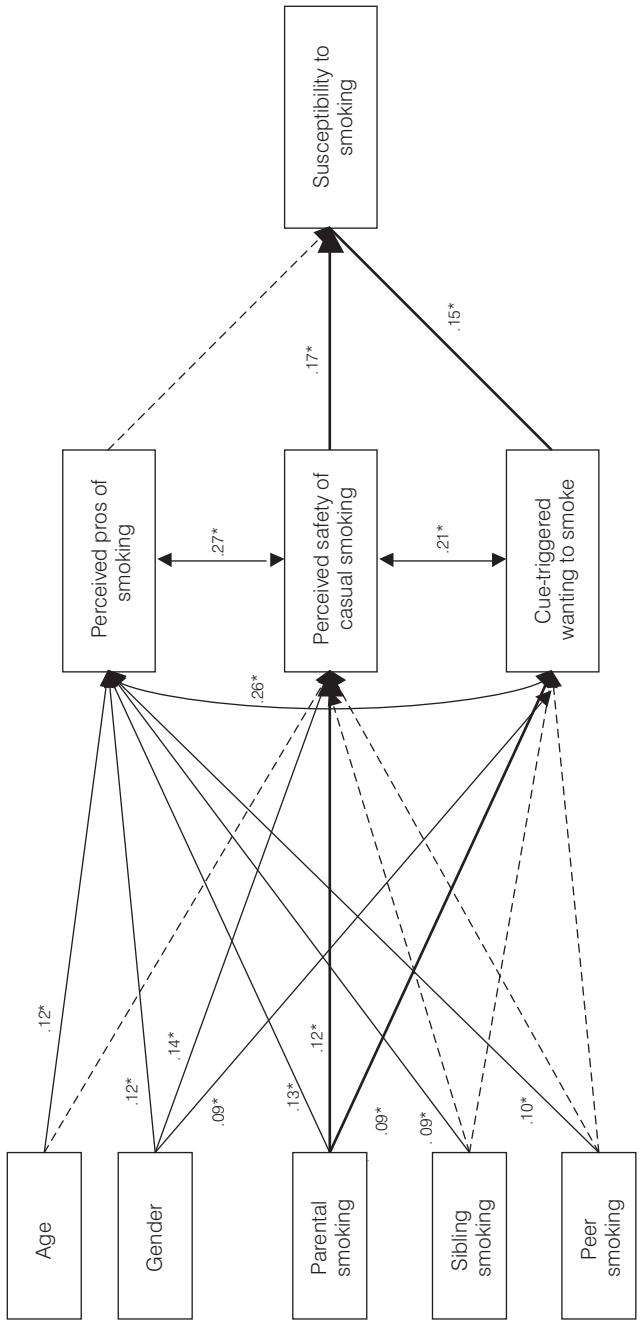

Figure 1 Standardized path coefficients of the structural equation model testing direct and indirect associations between parental smoking, sibling smoking, peer smoking, pros of smoking, perceived safety of casual smoking, cue-triggered wanting, and susceptibility to smoking

Note. * p < .05. Only significant correlation coefficients are displayed.
Solid lines indicate significant paths. Bold lines indicate significant indirect effects.

smoke (beta=.09, SE=.03, p=.02) compared to girls. Parental smoking, sibling smoking, and peer smoking were positively associated with perceived pros of smoking in children (beta=.13, SE=.03, p=.001; beta=.09, SE=.05, p=.03; and beta=.10, SE=.03, p=.02, respectively). Additionally, parental smoking was positively associated with perceived safety of casual smoking (beta=.12, SE=.05 p<.001) and reported symptoms of cue-triggered wanting to smoke (beta=.09, SE=.03, p=.04). In turn, perceiving a higher safety of casual smoking (beta=.17, SE=.02, p<.001) and reporting more symptoms of cue-triggered wanting to smoke (beta=.15, SE=.04, p<.001) was associated with a higher susceptibility to smoking in children. Perceiving more pros of smoking was unrelated to susceptibility to smoking in children (beta=.03, SE=.04, p=.45). The effect of parental smoking on children's susceptibility to smoking was statistically mediated by children's perceived safety of casual smoking (indirect effect=.02, SE=.01, p=.01) and children's report of cue-triggered wanting to smoke (indirect effect=.01, SE=.01, p=.05). No significant direct effects of parental smoking, sibling smoking, or peer smoking on children's susceptibility to smoking were found.

Gender differences across model parameters

In two instances, imposing the restriction of equal path loadings across boys and girls resulted in a statistically significant nested model comparison, indicating a decrease in model fit in the constrained model compared to the unconstrained model. First, constraining the association between peer smoking and the perceived pros of smoking to be equal across boys and girls yielded a significant nested model comparison ($\Delta\chi^2$ (1) = 3.90, p = .05), indicating a difference in the relative strength of this association between boys and girls (girls: beta=-.02, p=.73; boys: beta=.16, p=.01). Second, constraining the association between the perceived pros of smoking and the perceived safety of smoking to be equal across boys and girls yielded a significant nested model comparison ($\Delta\chi^2$ (1) = 5.76, p = .02), indicating a difference in the relative strength of this association between boys and girls (girls: beta=.22, p<.001; boys: beta=.31, p<.001). For all other paths, imposing the restriction of equal path coefficients across boys and girls did not result in a statistically significant nested model comparison, indicating no reliable differences between boys and girls in the magnitude of these path coefficients.

Discussion

The present study investigated the role of environmental smoking in smoking-related cognitions and susceptibility to smoking among 9-12 years-old never-smoking children. In the present sample, the prevalence of parental smoking was quite high (33%), which is consistent with findings in other Dutch samples (Otten, Engels, & van den Eijnden, 2005). The results showed a positive graded association between the numbers of smokers among parents, siblings, and peers and the perceived pros of smoking in children (i.e., children with more smoking parents, siblings, and peers perceived more pros of smoking). Separate analyses for boys and girls revealed that the association between peer smoking and the perceived pros of smoking was significant only for boys. Otherwise, only few gender differences were found, indicating that the results of

the present study are generalizable to both boys and girls. In addition, children of smoking parents perceived casual smoking to be safer, and they reported more wanting to smoke in response to smoking-related cues compared to children of non-smoking parents. Sibling smoking and peer smoking were unrelated to the perceived safety of casual smoking and cue-triggered wanting to smoke in children. Previously, several studies have suggested that environmental smoking is related to susceptible cognitions in youth (Andrews et al., 2010; Brook et al., 1999; Otten et al., 2009; Porcellato et al., 1999; Prokhorov et al., 1995). However, most studies have examined general cognitions, such as attitudes and normative perceptions, and only few studies have compared the effect of smoking behaviour of parents, siblings, and peers on children's cognitions directly. As expected, parental smoking seems to influence children's cognitions the most, as it is associated with a wider variety of cognitions compared to sibling smoking and peer smoking. Children in elementary years are likely to spend a lot of time with their parents. Moreover, parental smoking behaviour is probably more established and more overt compared to sibling and peer smoking.

Interestingly, children of smoking parents already display rather specific smoking-related cognitions. They perceive more benefits of smoking, less risks of smoking, and report a stronger desire or temptation to smoke in response to smoking-related cues. According to social learning theory (Bandura, 1986), children learn from their social context through observations and imitation. Smokers may communicate their beliefs and associations regarding smoking to their social environment consciously or unconsciously. Children who are exposed to smokers in their social environment may adopt these cognitions either because they are overtly displayed or because of children's observations and inferences of behaviour. Particularly, children may easily adopt benefit perceptions, as smokers often emphasize the instrumental benefits of smoking while children can observe the immediate effects of smoking directly (e.g., stress relief). Parental smoking also seems to affect children's risk perceptions of smoking. Smokers generally display an optimistic bias (i.e., they tend to underestimate the risks of smoking in general and the risks of smoking for themselves in particular). It has been suggested that optimistic biases develop in response to threatening information and serve to preserve psychological well-being. Possibly, perceiving smoking to be less harmful may serve a similar function in children of smoking parents (i.e., decreasing worries about the parent/smoker). Alternatively, pre-adolescents may view their parents as role models and health experts, and they may assume that smoking may not be as harmful, otherwise, their parents would not engage in it. Finally, parental smoking was associated with more cue-triggered wanting to smoke in children. However, while 'wanting' may reflect urges to smoke in smokers, it may reflect a desire or temptation to smoke in never-smoking children (Schuck et al., 2012). In smokers, cigarette craving and smoking behaviour can be elicited by smoking-related cues (e.g., seeing somebody smoke, smelling cigarette smoke, sight of ashtray). Theoretically, children may form similar associations following observations of repeated pairing of smoking cues and smoking behaviour in their environment. In a recent study among kindergarten children, children of smoking parents were more likely to pretend to smoke a cigarette when they were asked to pretend to be grown-ups having dinner than were children of non-smoking parents (de Leeuw, Engels, & Scholte, 2010).

Interestingly, the present findings suggest that children may not only form associations between smoking cues and smoking behaviour, but may also experience a desire to smoke in response to these cues.

In the present study, the perception of (casual) smoking as less harmful and the experience of more cue-triggered wanting to smoke were associated with an increased susceptibility to smoking in never-smoking children. Previously, several studies have suggested that favourable smoking-related cognitions (e.g., attitudes towards smoking, normative beliefs about smoking, risk and benefit perceptions, tobacco refusal self-efficacy) predict smoking intentions, smoking initiation, and smoking behaviour among youth (Andrews et al., 2008; Bidstrup et al., 2009; Carvajal et al., 2000; Gerrard et al., 1996; Otten et al., 2009; Song et al., 2007). The present study suggests that in pre-adolescents, risk perceptions and cue-triggered desire or temptation to smoke are more important determinants of children's susceptibility than are benefit perceptions. Contrary to our expectations, the perceived pros of smoking were unrelated to susceptibility to smoking in pre-adolescents. Possibly, the perceived benefits of smoking are more important in adolescent rather than elementary years. Alternatively, the lack of resolute intention to refrain from smoking may have different determinants than smoking initiation or smoking behaviour. Possibly, the lack of a resolute intention to refrain from smoking is better explained by motivation (being less motivated to refrain from smoking if smoking is perceived as harmless) and inhibitory abilities (resisting the desire or temptations to smoke in situations where smoking-related cues are present) rather than cognitive elaboration (being tempted to smoke because smoking is perceived to have instrumental benefits). This explanation supports the idea that smoking initiation is a spontaneous and situated behaviour rather than planned behaviour.

The present study suggests that smoking-related cognitions may mediate the association between parental smoking and children's susceptibility to smoking (i.e., parental smoking affects children's susceptibility through children's cognitions). Parental smoking was associated with children's cognitions, which were, in turn, associated with child susceptibility. Statistically, the effect of parental smoking on children's susceptibility was fully mediated by these cognitions. However, it should be noted that due to the cross-sectional design of the present study, only statistical mediation could be inferred. To conclude that smoking-related cognitions constitute a mechanism of action in the association between parental smoking and child susceptibility to smoking a longitudinal design is required to establish a temporal order between study variables (Embry & Biglan, 2008). Temporal precedence needs to be addressed in future research.

Several limitations should be acknowledged in interpreting the results of the present study. First, smoking in the social environment was self-reported by children and has not been validated against other measures. However, previous research suggests that pre-adolescents are reliable reporters of smoking in their social environment (Barnett, O'Loughlin, Paradis, & Renauld, 1997). Moreover, the cross-sectional design of the study does not allow for making interferences regarding temporal precedence or causality between study variables. While it is intuitive to assume that environmental smoking affects children's cognitions rather than vice versa, it is also possible that children who display susceptible cognitions or a cognitive vulnerability to

smoking are more likely to notice and report smoking behaviour in their social environment. Similarly, it cannot be concluded from the present study that smoking-related cognitions precede susceptibility to smoking in children. Possibly, smoking-related cognitions and susceptibility to smoking may simply reflect a common underlying construct (cognitive vulnerability to smoking). Moreover, it should be noted that the number of smokers in the environment may have a different effect on children than the amount of exposure to environmental smoking. While children may be generally aware that a parent is a smoker, the number of cigarettes that parents smoke in the presence of the child may vary. Future studies should distinguish between these measures to increase the understanding of the effects of environmental smoking on children. Finally, children's cognitions measured in the present study are of course not comprehensive and may even be as diverse as are cognitions of smokers. Future studies may further examine different types of smoking-related cognitions in pre-adolescents. Different methodologies, for example indirect tasks (e.g., computer tasks measuring reaction times to specific stimuli) or eye-tracking technology, may add to a more comprehensive understanding of cognitions, cognitive distortions, and cognitive biases in children.

In summary, the present study investigated the role of environmental smoking in smoking-related cognitions and susceptibility to smoking among 9-12 years-old never-smoking children. A substantial percentage of never-smoking children displayed susceptible smoking-related cognitions. Findings showed a positive association between the number of smokers in the child's social environment, particularly parent smokers, and smoking-related cognitions in children. In turn, smoking-related cognitions (i.e., perceived safety of casual smoking and cue-triggered desire to smoke) were associated with children's susceptibility to smoking. Whether susceptible cognitions constitute a mechanism of action in the intergenerational transmission of smoking from parents to children needs to be investigated in longitudinal research. Practical implications of this study include enhanced attention to preadolescence in smoking prevention. Knowledge regarding predisposing factors in childhood may help in the early identification of vulnerable groups and selective prevention of youth smoking.

Chapter 3

Responses to environmental smoking in never-smoking children: Can symptoms of nicotine addiction develop in response to environmental tobacco smoke exposure?

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Abstract

A recent line of studies has brought attention to the question whether repeated exposure to environmental tobacco smoke (ETS) is capable of producing psycho-physiological effects in non-smokers and whether symptoms of nicotine dependence can develop in the absence of active smoking. Children seem to be particularly vulnerable to the effects of ETS. We examined the occurrence of psycho-behavioural symptoms, designed to assess nicotine addiction and nicotine withdrawal, in a sample of 778 never-smoking children aged 9-12 years using cross-sectional survey data collected in 15 Dutch primary schools. In the present study, 6% of never-smoking children reported symptoms of craving, 8% reported cue-triggered wanting to smoke, and 20% reported subjective symptoms in response to ETS exposure. In never-smoking children, a higher number of smokers in the child's social environment was associated with more symptoms of cue-triggered wanting to smoke and more subjective symptoms in response to ETS. Never-smoking children and children who had initiated smoking were equally likely to report subjective symptoms in response to ETS exposure. Environmental smoking is associated with self-reported psycho-behavioural symptoms in never-smoking children. Future research needs to investigate whether symptoms in children exposed to ETS are physiologically-based or whether they reflect other characteristics which predispose youth for smoking initiation in the future.

Introduction

A substantial body of evidence indicates that novice smokers may experience symptoms of nicotine dependence (e.g., craving and withdrawal symptoms, tolerance to nicotine, loss of autonomy over smoking, unsuccessful attempts at quitting) very soon after smoking initiation and at very low exposures to smoking (DiFranza et al., 2002; DiFranza et al., 2007; DiFranza et al., 2000; Kandel, Hu, Grieisler, Schaffran, 2009). Previous studies have demonstrated that non-smokers who are exposed to high levels of environmental tobacco smoke (ETS) may absorb amounts of nicotine comparable to light or non-daily smoking (Al-Delaimy, Fraser, & Woodward, 2001; Dimich-Ward, Gee, Brauer, & Leung, 1997). In recent years, a new line of research is beginning to investigate whether the psychoactive properties of nicotine absorbed from ETS are capable of producing psycho-physiological effects in non-smokers. Hypothetically, the absorption of nicotine from prolonged and repeated ETS exposure may engender symptoms of nicotine dependence in the absence of active smoking. In line with this, pharmacological exposure to ETS smoke has recently been shown to produce nicotine dependence in rats (Small et al., 2010; Yamada et al., 2010). Up to this point, however, research on nicotine dependence symptoms in non-smokers poses significant challenges, as no validated measures to assess nicotine dependence and nicotine withdrawal exist for never-smokers.

Children seem to be particularly vulnerable to the effects of ETS. Compared to adults, children display higher relative cotinine and nicotine levels during and after exposure to ETS (Willers, Skarping, Dalene, & Skerfving, 1995; Yamada et al., 2010), indicating that they absorb higher doses of nicotine at the same amount of ETS exposure. In North America and Europe, children are frequently exposed to ETS. At least one third of children live in a household with smokers (King, Martynenko, Bergman, Liu, Winickoff, & Weitzman, 2009; Schuster, Franke, & Pham, 2002), and approximately two-thirds of children are exposed to smoking in their social environment (USDHHS, 2006). Parents, siblings, and peers are the most significant sources of children's exposure to environmental smoking. Parental and sibling smoking, exposure to smoking in a car, and a pharmacological measure of ETS exposure (i.e., salivary cotinine levels) have been shown to predict smoking uptake in adolescence (Becklake et al., 2005; Glover et al., 2011; Leonardi-Bee et al., 2011).

While epidemiological studies have demonstrated for decades that ETS exposure is associated with numerous adverse health outcomes, for example cardiovascular and respiratory illnesses, attention-deficit/hyperactivity disorder, and behaviour problems (Pitsavos et al., 2002; Sturm, Yeatts, & Loomis, 2004, USDHHS, 2006), research is only starting to examine the psycho-behavioural effects of ETS exposure. Okoli, Rayens, and Hahn (2007) evaluated the effects of ETS exposure in non-smoking bar and restaurant workers. In this study, hair nicotine levels predicted the report of four or more subjective symptoms adapted from *DSM-IV* nicotine withdrawal symptoms. Similarly, Bélanger et al. (2008) reported that 5% of never-smoking 10-12 year-old children reported self-perceived nicotine dependence symptoms. Exposure to ETS in a car was associated with an increased probability to report these symptoms. Recently, Racicot, McGrath, and O'Loughlin (2011) found that the number of smokers in the child's social environment, but not a pharmacological measure of salivary cotinine, predicted perceived nicotine dependence in never-smoking 11-15 year-old students. The authors note power limitations due to very low cotinine levels in students. Taken

together, these findings indicate a gradient between exposure to environmental smoke and self-reported psycho-behavioural responses in non-smokers and non-smoking youth. Yet, the nature of these responses in non-smokers remains unclear.

It has been proposed that pharmacological exposure to the psychoactive properties of nicotine may lead to neuronal adaptations in the brain and nicotine-induced sensitization of neuronal pathways (Anthonisen & Murray, 2005; Okoli, Kelly, & Hahn, 2007). As a result, altered psycho-behavioural responses may develop at exposure to nicotine, or symptoms of withdrawal may occur when the effects of nicotine wear off. Furthermore, it has been hypothesized that nicotine-induced sensitization may produce tolerance to nicotine's aversive effects or increase sensitivity to nicotine's reinforcing effects at the uptake of smoking in later life (Okoli et al., 2007). While exposure to ETS may engender serum cotinine concentrations similar to levels in light smokers, it should be acknowledged that the effects of nicotine on the brain may be much more pronounced in active smokers than non-smokers exposed to ETS smoke. Currently, research is beginning to examine effects of ETS smoke in the human brain (for example, Brody et al., 2011). Yet, neuronal adaptations or sensitization induced by ETS exposure are not yet supported by empirical data (Yamada et al. 2010).

While the nature of self-perceived nicotine dependence symptoms in never-smokers is not yet established, there is evidence suggesting that the report of these symptoms may constitute a relevant early predictor of smoking initiation. Okoli, Richardson, Ratner, and Johnson (2009) reported that, in never-smoking children, self-perceived mental addiction to tobacco was associated with an increased susceptibility to initiate smoking. Measures of perceived addiction to tobacco may constitute a promising way of assessing vulnerability to smoking among youth (Okoli et al., 2009).

The present study aimed to examine the extent to which self-reported psycho-behavioural symptoms, designed to assess nicotine addiction and nicotine withdrawal in smokers, are reported by never-smoking 9-12 year-old children and whether these symptoms are associated with smoking in the social environment. First, we sought to evaluate whether previous findings of Okoli et al. (2007), whereby ETS exposure predicted the report of subjective symptoms in non-smoking adults, extend to never-smoking children. Additionally, we sought to further understand the nature of self-perceived nicotine dependence in never-smoking children. Using two scales which are well validated in smokers (Wheeler, Fletcher, Wellman, & DiFranza, 2004; DiFranza et al., 2009), we evaluated whether ETS exposure predicts hallmark symptoms of nicotine dependence (i.e., craving and cue-triggered wanting to smoke). Finally, we compared internal consistency of the employed scales between never-smoking children and children who have initiated smoking and determined whether measures of nicotine addiction and nicotine withdrawal constitute reliable measures in never-smokers.

Methods

Participants and procedure

Study participants were 880 children aged between 9 and 12 years who were recruited from 15 primary schools in the Netherlands. Participating schools agreed to distribute short questionnaires during school hours to all students in Dutch grades 6-8 (US

grades 4-6). Parents received written information about the school's participation in the study as well as information about the procedure and aim of the study. All parents were informed that participation in the study was voluntary and received a form to withdraw their child from study participation and a return envelope ('passive consent'). Three children were excluded by their parents from study participation. Data collection took place between March and September 2010. Children were informed that participation was voluntary. Questionnaires were filled in anonymously with an instructed teacher present. The study was approved by the ethics committee of the Radboud University Nijmegen.

Measures

Smoking status. Smoking status was assessed using the item: "Have you ever smoked, even if only a single puff?" Children reporting that they had never smoked, not even a single puff, were considered never-smokers (n = 778; 88.4%). Children reporting that they had smoked were considered initiators (n = 66; 7.5%). A total of 36 children (4.1%) did not respond to this item and were not included in further analyses.

Number of smokers in the social environment. To calculate the number of smokers in the child's social environment, smoking behaviour was assessed among parents, siblings, and peers. Parental smoking was measured using the question "Does your mother/father smoke?" Response options were: 1 (my mother/father has never smoked), 2 (my mother/father quit smoking), 3 (my mother/father smokes), 4 (I don't have a mother/father), 5 (I don't know). To measure sibling smoking, children were asked to report the names of all siblings and to indicate for each sibling whether he/she smokes. Response options were: 0 (no, he/she doesn't smoke) and 1 (yes, he/she smokes). To measure number of smoking peers, children were asked to report the number of friends who smoke. Response options were: 0 (nobody), 1 (1 friend), 2 (2 friends), 3 (3 friends), 4 (4 friends), 5 (5 or more friends). The number of smokers in the child's social environment was calculated by summing the number of current smokers among parents, siblings, and peers (range 0-11 smokers) (see Racicot et al., 2011).

Subjective symptoms in response to ETS exposure. Subjective symptoms in response to exposure to ETS were adapted from symptoms of nicotine withdrawal based on the fourth edition of the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-IV; American Psychiatric Association, 2000). Children were asked the following: "After you have been in a smoky environment, have you ever experienced the following: feeling sad, trouble sleeping, feeling irritable, feeling anxious, trouble concentrating, feeling restless, feeling angry or frustrated?" Answer options were no (0) or yes (1). The number of items endorsed was summed to create a subjective symptom score (range 0 to 7; see Okoli et al., 2007).

Craving. To assess craving, we used four items from the Hooked On Nicotine Checklist (HONC; DiFranza et al., 2000). Example items are: "Have you ever felt like you really needed a cigarette?" and "Did you ever feel a strong need or urge to smoke?" Children were asked to indicate the response which described them best. Response options ranged from 1 to 4 (never, rarely, sometimes, often). Answers were recoded into 0 (never) or 1 (rarely, sometimes, often). The number of items endorsed was summed to create a craving score (range 0 to 4). In smokers, the number of HONC items endorsed has been shown to correlate with cigarette consumption (Wheeler et al, 2004).

Cue-triggered wanting to smoke. To assess cue-triggered wanting to smoke, we used the cue-induced craving subscale of the Autonomy Over Smoking Scale (AUTOS; DiFranza, Wellman, Ursprung, & Sabiston, 2009). Example items are: "When I see other people smoking, I want a cigarette" and "When I smell cigarette smoke, I want a cigarette" Children were asked to indicate the response which describes them best. Response options ranged from 1 to 5 (never, sometimes, regularly, often, very often). Answers were recoded into 0 (never) or 1 (sometimes, regularly, often, very often). A sum score of items endorsed was calculated ranging from 0 to 4. In smokers, both the number of symptoms endorsed in the AUTOS and symptom intensity have been shown to correlate with cigarette consumption and other measures of tobacco use (DiFranza et al., 2009).

Intention to refrain from smoking in the future. To assess intention to refrain from smoking in the future, children were asked to indicate the response which describes them best. Response options were: 1 (I know for sure that I will never start smoking), 2 (I think that I will never start smoking), 3 (I think I will try smoking in the future), 4 (I think I will try smoking within five years), 5 (I think I will try smoking within one year), 6 (I think I will try smoking within six months), 7 (I think I will try smoking within one month), and 8 (I have already tried smoking). Scores were dichotomized into 0 (I know for sure that I will never start smoking) and 1 (any other response), thereby indicating (the lack of) a resolute intention to refrain from smoking (Pierce et al., 1996; Schuck, Otten, Engels, & Kleinjan, 2012).

Strategy for analyses

Descriptive statistics were used to describe the sample. Comparisons between groups were based on chi-square analyses for categorical variables and independent sample t-tests for continuous variables. Frequency distributions of individual symptoms and symptom scores were compared for never-smoking children and children who had initiated smoking. Also, we compared the internal consistency (Cronbach's alpha) of the symptom scales for never-smokers and initiators. Furthermore, never smoking children who had and had not reported symptoms were compared on several characteristics. Finally, we used structural equation modeling (Mplus 5, Muthén & Muthén, 2007) to evaluate the association between the number of smokers in the social environment and symptom scores in never-smoking children. Model fit was evaluated by way of the: (a) root-mean square error of approximation (RMSEA), (b) comparative fit index (CFI), and (c) Tucker-Lewis index (TLI). Preferably, RMSEA values should be ≤ .05 and CFI and TLI values should > .90 (Bentler & Bonett, 1980). Associations between variables are evaluated based on standardized path coefficients (Beta's) and *p*-values ($p < .05$).

Of the 880 children, 42 children (4.8%) did not respond to one or more of the key outcome variables. If children did not respond to a specific item, we assigned a null value[1] (see Bélanger et al., 2008). Missing values for predictor variables were substituted in Mplus by full information maximum likelihood (FIML) estimation.

1 In addition to the analyses with imputed missing values, we repeated all analyses after excluding cases with missing outcome variables. Across both analyses, there were no differences in the significance of parameters.

Results

Descriptive analyses

Of 880 children, a total of 778 (88.4%) reported that they had never smoked, not even a single puff, and were considered never-smokers. A total of 66 children (7.5%) reported that hey had tried smoking and were considered initiators. For initiators, mean age of first puff was 9.9 years (SD=1.8). Among the 66 initiators, 46 children (69.7%) reported no current smoking, and 10 (15.2%) reported current infrequent smoking. None of the children reported daily smoking, though 10 children (15.1%) did not respond to this question.

The mean age of the sample (including never-smokers and initiators) was 10.7 (SD=1.0) and 49.6% of the sample were girls. A total of 202 children (23.9%) reported that one parent currently smokes, and 94 children (11.1%) reported that both parents currently smoke. Fifty-four children (6.4%) reported current smoking among at least one sibling, and 77 (9.1%) reported current smoking among at least one peer. A total of 357 children (41.2%) reported current smoking in their social environment (i.e., parental, sibling, or peer smoking), and 253 (30.0%) reported daily or almost daily exposure to smoke in their homes from a household member. The prevalence rate of smoking among parents and children in the present sample was similar to corresponding prevalence rates in other national samples and population surveys (Otten, Engels, van den Eijnden, 2005; Ringlever, Otten, van Schayck, & Engels, 2012; Stivoro, 2011).

Distribution of symptom scores

Table 1 displays the assessed symptoms and the prevalence of each item among never-smokers and initiators. In response to exposure to ETS, never-smoking children most frequently reported trouble concentrating (10.0%), feeling irritable (9.4%), and feeling restless (7.2%). Among the items measuring craving and cue-triggered wanting to smoke, a strong need or urge to smoke (4.2%) and wanting to smoke when seeing other people smoking (5.3%) were most frequently reported by never-smokers.

In addition, internal consistency of the symptom scales was evaluated for never-smokers and initiators. Internal reliability for subjective symptoms was good for initiators as well as never-smokers (=.82 and .79). Internal reliability for craving and cue-triggered wanting to smoke was excellent for initiators (= .89 and .91), but much lower in never-smokers (= .59 and .43).

Table 2 displays the distribution of the symptom scores for never-smokers and initiators. A total of 20% of never-smoking children reported at least one subjective symptom in response to ETS exposure. Respectively, 6% and 8% of never-smoking children reported at least one item of craving and cue-triggered wanting to smoke. Between never-smokers and initiators there was no significant difference in the likelihood to report at least one subjective symptom in response to ETS exposure (χ^2 =.22, p=.37). However, the experience of at least one item of craving (χ^2 =123.70, p<.001) and cue-triggered wanting to smoke (χ^2 =75.82, p<.001) was significantly more likely among initiators than never-smokers.

Characteristics related to symptoms in never-smokers

Table 3 displays the association between symptoms and sample characteristics in never-smokers. Never-smoking children experiencing at least one symptom of craving

Table 1 Overview of items used to assess psycho-behavioural symptoms and endorsement frequencies among never-smokers and initiators

	Never-smokers (n = 778)	Initiators (n = 66)
Subjective symptoms in response to ETS exposure		
Feeling sad	1.8%	4.5%
Trouble sleeping	6.4%	7.6%
Feeling irritable	9.4%	6.1%
Feeling anxious	3.5%	3.0%
Trouble concentrating	10.0%	16.7%
Feeling restless	7.2%	9.1%
Feeling angry or frustrated	5.5%	7.6%
Craving		
Have you ever felt like you really needed a cigarette?	1.4%	16.7%
Did you ever feel a strong need or urge to smoke?	4.2%	42.4%
Have you ever had cravings to smoke?	3.5%	30.3%
Have you ever felt you were addicted to tobacco?	0.0%	9.1%
Cue-triggered wanting to smoke		
When I see other people smoking, I want a cigarette	5.3%	33.3%
When I feel stressed, I want a cigarette	2.8%	21.2%
After eating, I want a cigarette	0.4%	12.1%
When I smell cigarette smoke, I want a cigarette	1.7%	28.8%

were more likely to be boys (χ^2 =8.04, p=.01), more likely to have a smoking sibling (χ^2 =5.00, p=.04), and were more likely to lack a resolute intention to refrain from smoking in the future (χ^2 =22.73, p<.001). Never-smoking children experiencing at least one item of cue-triggered wanting to smoke were more likely to have at least one smoking parent (χ^2 =3.43, p=.05), one smoking sibling (χ^2 =9.91, p=.01), and one smoking peer (χ^2 =3.94, p=.05). Also, they were more likely to be exposed to smoke in their home from a household member (χ^2 =4.36, p=.03) and were more likely to lack a resolute intention to refrain from smoking in the future (χ^2 =29.17, p<.001). The report of subjective symptoms in response to ETS exposure did not differ by sample characteristics.

Prediction of symptom scores by the number of smokers in the social environment in never-smokers

We used structural equation modeling to evaluate the association between the number of smokers in the social environment and symptom scores in never-smoking children

Table 2 Distribution of symptoms among never-smokers and initiators

		Never-smokers (n = 778)	Initiators (n = 66)
		n %	*n* %
Subjective symptoms in response to ETS exposure	None	620 (80%)	51 (77%)
	1	78 (10%)	6 (9%)
	2	39 (5%)	3 (5%)
	3 or more	41 (5%)	6 (9%)
Craving *	None	732 (94%)	35 (53%)
	1	25 (3%)	10 (15%)
	2 or more	21 (3%)	21 (32%)
Cue-triggered wanting *	None	716 (92%)	38 (58%)
	1	48 (6%)	11 (17%)
	2 or more	14 (2%)	17 (25%)

* denotes significant difference ($p < .05$) in chi-square distribution of dichotomized symptom score (no symptom versus at least one symptom) among never-smokers and initiators.

(Figure 1). The model was fully saturated (CFI=1.00, TLI=1.00, and RMSEA=.00). Standardized path coefficients and their p-values are displayed in Figure 1. Controlling for children's age and gender, the number of smokers in children's social environment was significantly associated with the subjective symptom score (Beta=.08; p=.02) as well as the cue-triggered wanting score (Beta=.10; p=.01). The number of smokers in the social environment was unrelated to the craving score.

Table 3 Associations between symptoms and sample characteristics in never-smoking children (n = 778)

Characteristics		Total sample	Subjective symptoms		Craving		Cue-triggered wanting	
			None	≥ 1	None	≥ 1	None	≥ 1
		n %	*n* %	*n* %	*n* %	*n* %	*n* %	*n* %
Gender [b] (n = 777)	Female	383 (49%)	311 (79%)	83 (21%)	**380 (96%)**	**14 (4%)**	369 (94%)	25 (6%)
	Male	394 (51%)	308 (80%)	75 (20%)	**351 (92%)**	**32 (8%)**	346 (90%)	37 (10%)
Parent(s) smoke [c] (n = 777)	No	521 (67%)	418 (80%)	103 (20%)	492 (94%)	29 (6%)	**486 (93%)**	**35 (7%)**
	Yes	256 (33%)	201 (79%)	55 (21%)	239 (93%)	17 (7%)	**229 (80%)**	**27 (20%)**
Sibling(s) smoke [b, c] (n = 778)	No	734 (94%)	586 (80%)	148 (20%)	**694 (95%)**	**40 (5%)**	**681 (93%)**	**53 (7%)**
	Yes	44 (6%)	34 (77%)	10 (33%)	**38 (86%)**	**6 (14%)**	**35 (80%)**	**9 (20%)**
Peer(s) smoke [c] (n = 769)	No	712 (93%)	572 (80%)	140 (20%)	675 (95%)	37 (5%)	**663 (93%)**	**49 (7%)**
	Yes	57 (7%)	42 (74%)	15 (26%)	52 (91%)	5 (9%)	**49 (86%)**	**8 (14%)**
Household-member(s) smoke [c] (n = 772)	No	557 (72%)	439 (79%)	118 (21%)	525 (94%)	32 (6%)	**520 (93%)**	**37 (7%)**
	Yes	215 (28%)	178 (83%)	37 (17%)	202 (94%)	13 (6%)	**191 (89%)**	**24 (11%)**
Resolute intention to refrain from smoking [b, c] (n = 742)	No	339 (47%)	266 (79%)	73 (21%)	**303 (89%)**	**36 (11%)**	**291 (86%)**	**48 (14%)**
	Yes	403 (54%)	325 (81%)	78 (19%)	**394 (98%)**	**9 (2%)**	**390 (97%)**	**13 (3%)**
Age (n = 760)		M SD	M SD	M SD	M SD	M SD	M SD	M SD
		10.7 1.0	10.7 1.0	10.7 1.0	10.7 1.0	10.7 1.1	10.7 1.0	10.5 1.1

Note: Comparisons between groups are based on chi-square tests for categorical variables and independent sample t-test for continuous variables.
[a, b, c] denote significant differences at the level of $p < .05$ (bold font) in chi-square distribution of subjective symptoms, craving, and cue-triggered wanting, respectively.

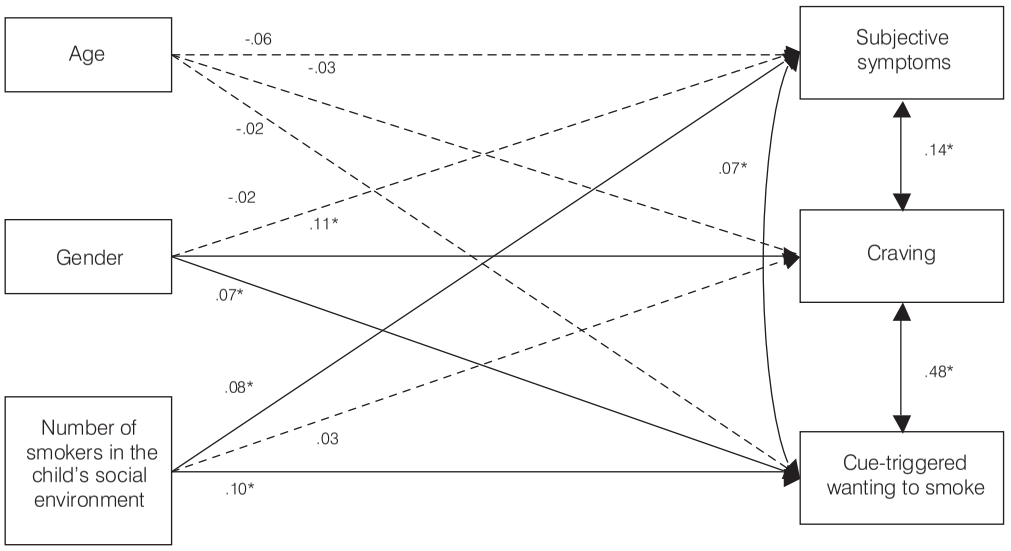

Figure 1 Standardized path coefficients of the structural equation model testing association between number of smokers in the child's social environment and symptom scores in never-smoking children (n = 778)

Note. * indicates significant path coefficients at the level of $p < .05$ (solid line).

Discussion

The present study evaluated responses to environmental smoking in 9-12 year-old children. Out of 778 never-smoking children, 20% reported at least one subjective symptom in response to ETS exposure. Similarly, previous research shows that up to 40% of non-smoking hospitality workers reported subjective symptoms in response to ETS exposure, and these symptoms were associated with ETS exposure as measured by hair nicotine concentrations (Okoli et al., 2007). Furthermore, in the present study, 6% and 8% of never-smoking children reported the experience of at least one symptom of craving or cue-triggered wanting to smoke, respectively. Similarly, Bélanger et al. (2008) found that 5% of 10-12 year-old never-smoking children report symptoms that would suggest nicotine dependence if reported by an active smoker. Together, these studies suggest that never-smoking youth experience craving or wanting to smoke, but the implications of such reports may be different for smokers and never-smokers. Our data suggest that such reports in never-smokers reflect a vulnerability to smoking: both the experience of craving and cue-triggered wanting to smoke were associated with the lack of a resolute intention to refrain from smoking in the future. These findings support previous research indicating that self-perceived nicotine dependence in never-smokers may reflect an increased susceptibility to smoking initiation in the future (Okoli et al., 2009).

Furthermore, in the present study, the number of smokers in the child's social environment predicted the number of subjective symptoms following ETS exposure as well as the number of symptoms of cue-triggered wanting to smoke among never-smoking children. Similar findings among never-smoking 11-15 year old students have been reported (Racicot et al., 2011). Taken together, these findings clearly indicate a graded association between smoking in the social environment and self-reported psycho-behavioural symptoms in never-smoking children and adolescents. It has been hypothesized that physiological exposure to ETS and nicotine-induced sensitization may produce these symptoms in never-smokers. However, social context characteristics (e.g., imitation of smoking role models, familial attitudes, social norms) may also contribute to the report of psycho-behavioural symptoms in never-smoking children. Possibly, a social desirability bias may also play a role in the report of psycho-behavioural symptoms. Children may have knowledge of the adverse effects of ETS and report symptoms accordingly.

The present study additionally compared psycho-behavioural symptoms between never-smoking children and children who had initiated smoking. Never-smoking children and initiators were equally likely to report subjective symptoms in response to ETS exposure. Previously, among adults, no significant differences were found between smokers and non-smokers in the number of subjective symptoms reported in response to ETS exposure (Okoli et al. 2007). Apparently, both smokers and non-smokers tend to report symptoms of negative affect, trouble sleeping, or trouble concentrating following exposure to ETS. On the contrary, children who have initiated smoking differ remarkably from never-smoking children in craving and cue-triggered wanting to smoke. Almost half of the children who had initiated smoking reported the experience of craving or cue-triggered wanting to smoke, even though two-thirds of initiators reported no current smoking. Compared to never-smokers, initiators were eight times more likely to report craving and five times more likely to report cue-triggered wanting to smoke. This finding is consistent with a growing body of research showing that novice smokers may experience symptoms of nicotine dependence (e.g., craving and withdrawal symptoms, tolerance to nicotine, loss of autonomy over smoking, unsuccessful attempts at quitting) early following smoking initiation and at very low exposures to smoking (DiFranza et al., 2007).

The present study extends previous work by distinguishing between different types of responses to smoking in the social environment. Subjective symptoms seem to reflect a more general response to ETS exposure, with a higher number of smokers in the social environment associated with a higher number of reported symptoms in never-smokers. Correspondingly, subjective symptoms were reported in equal measure by initiators as well as never-smoking children. On the contrary, craving was reported significantly more often by initiators than never-smokers, and the number of smokers in the social environment did not predict craving in never-smokers, suggesting that active nicotine uptake is required for the development of craving in youth. Possibly, the development of cigarette craving may require attributions about the cause of craving and the means to alleviate it. Finally, cue-triggered wanting to smoke was associated with both active smoking as well as environmental smoking. Cue-triggered wanting to smoke describes the conditioned association between smoking-related cues and the experience of urges to smoke. In classical conditioning, smoking-related cues (e.g., seeing somebody smoke, ashtrays, lighters) become associated with smoking behaviour after repeated pairing and can eventually elicit conditioned states of craving in smokers. Much less is known about comparable associations in non-smokers. Recent studies have found that non-smoking children with smoking family members displayed more favorable implicit attitudes as well as attentional biases in response to smoking-related cues compared to children without smoking family members (Andrews, Hampson, Greenwald, Gordon, & Widdop, 2010; Forestell, Dickter, Wright, & Young, 2011; Lochbuehler, Otten, Voogd, & Engels, in press). In the present study, never-smoking children who were exposed to a high number of smokers in the social environment reported more symptoms of cue-triggered wanting to smoke. However, it should be noted that cue-triggered wanting to smoke may be interpreted differently by never-smoking children and initiators. While 'wanting' may reflect a desire or a temptation to smoke in never-smokers, it may reflect physiologically-based urges to smoke in initiators.

Considering the differences between smokers and non-smokers in internal reliability of the scales measuring craving and cue-triggered wanting, it seems likely that the scales reflect different underlying constructs in smokers and non-smokers. In never-smoking children, the internal reliability of both scales was rather low, indicating that craving and cue-triggered wanting may not reflect a single underlying construct in non-smokers. It should be noted that content and convergent validity of the scales used to assess craving and cue-triggered wanting have only been established in smokers and that both scales are not validated in non-smokers. Our results should be interpreted with that in mind.

Several limitations should be acknowledged in interpreting the results of the present study. First of all, smoking in the social environment was self-reported by children and not validated with biochemical assessments. However, previous research

showed that children are reliable reporters of the smoking behaviour in their social environment (Harakeh, Engels, de Vries, & Scholte, 2006). Furthermore, due to the cross-sectional nature of the study, it is possible that confounded variables may account for the relation between environmental smoking and psycho-behavioural symptoms in children. Particularly, subjective symptoms (e.g., trouble concentrating, feeling restless, feeling irritated) may be explained by confounders of environmental smoking such as behavioural problems or mental health problems in children which are associated with lower socio-economic status. Also, the present study does not establish a temporal precedence or causal relation between study variables. Moreover, the present study assessed only a limited number of subjective symptoms in children. Exposure to ETS is known to produce physical symptoms (e.g., respiratory tract irritations) and may engender other symptoms not assessed in the present study. Finally, it should be acknowledged that the number of smokers in children's social environment may be different from children's exposure to ETS which may, in turn, be different from the uptake of nicotine in the child's body. Ideally, measurements should distinguish between these constructs to clarify the mechanisms of action through which environmental smoking produces symptoms in children.

The present study suggests several recommendations for future research. To understand the nature of the reported symptoms, future research needs to clarify how craving and cue-triggered wanting are understood and interpreted by never-smokers. Qualitative data gathered in focus groups may help to differentiate being curious about smoking and being tempted to smoke from a physiologically-based wanting, needing, or craving a cigarette. Furthermore, future research needs to clarify the nature of subjective symptoms in response to ETS exposure. Subjective symptoms may reflect negative attitudes towards ETS smoke (e.g., annoyance), physical effects of ETS exposure (e.g., toxic exposure, irritation, inflammation), neurophysiologic adaptations following nicotine absorption, or nicotine withdrawal. For a comprehensive understanding of the reported symptoms, more information is needed, particularly regarding the frequency and intensity of physiological exposure, the latency to symptoms after abstinence from ETS, and the consistency of symptoms across time. Whether symptoms among never-smokers are physiologically-based or whether they reflect other characteristics which predispose youth for smoking initiation in the future will need to be clarified in subsequent studies.

In conclusion, a substantial number of never-smoking children report the experience of craving, cue-triggered wanting to smoke, and subjective symptoms in response to ETS exposure. The number of smokers in the child's social environment predicted the report of subjective symptoms and symptoms of cue-triggered wanting. Future research needs to clarify the nature of these symptoms and to further examine associates and consequences of these symptoms in never-smoking children.

Chapter 4

Initial responses to the first dose of nicotine in novel smokers: The role of exposure to environmental smoking and genetic predisposition

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Abstract

Objective: Sensitivity to nicotine constitutes an early predictor of the risk of nicotine dependence among youth. Environmental smoking, candidate gene polymorphisms (OPRM1 A118G, DRD2 TaqIA, DRD4 bp VNTR), and gene-environment interactions were examined as potential predictors. Design: We used cross-sectional survey data and saliva samples of 1,399 Dutch students. Analyses were conducted among ever-inhalers (N=171, mean age=13.9 years). Main Outcome Measures: The outcome measures were adolescents' self-reported responses to initial smoking. Results: Exposure to peer smoking was positively associated with liking and pleasant sensations. Exposure to maternal smoking was negatively associated with unpleasant sensations. Adolescents carrying the G-variant of the OPRM1 polymorphism reported more liking and adolescents homozygous for the C-variant of the DRD2 polymorphism reported less unpleasant sensations. No effect of the DRD4 polymorphism was found and there was no evidence for gene-environment interaction. Conclusions: Although preliminary, these findings suggest that exposure to environmental smoking and polymorphisms in the OPRM1 and DRD2 gene may affect initial sensitivity to nicotine, an early phenotype of the risk of dependence. In the future, collaborative efforts to combine data from multiple studies in meta-analyses are needed to improve accuracy of estimated effects in genetic studies.

Introduction

A growing body of research indicates that sensitivity to the first dose of nicotine (i.e., experience of rewarding or aversive sensations) constitutes an early predictor of the vulnerability to develop nicotine dependence among adolescents (DiFranza et al., 2007; DiFranza et al., 2004; Kandel, Hu, Griesler, & Schaffran, 2007; Sartor et al., 2010). According to the sensitivity model (Pomerleau, 1995), drug-naive individuals who display a high initiate sensitivity to nicotine may rapidly develop tolerance to the aversive effects of nicotine, while remaining sensitive to the rewarding effects. In contrast, individuals who are less sensitive to the effects of nicotine may experience limited reinforcement from nicotine despite continued use and may therefore never progress beyond minimal or intermittent smoking. Animal research provides support for the sensitivity model (Marks, Stitzel, & Collins, 1989; Schechter, Meehan, & Schechter, 1995).

To date, few studies have prospectively examined whether initial sensitivity to nicotine predicts a greater risk of dependence in humans. Kandel et al. (2007) reported that pleasant responses to initial smoking predicted occurrence of the first dependence symptom among novel smokers as well as development of the full *DSM-IV* nicotine dependence syndrome. DiFranza, Savageau, Rigotti, et al. (2004) found that individuals who experienced relaxation, dizziness, and nausea when first inhaling were more likely to subsequently develop symptoms of nicotine dependence. Similar findings have been observed in cross-sectional research (Chen et al., 2003; Hu, Davies, & Kandel, 2006; O'Connor et al., 2005; Wang, Fitzhugh, Trucks, Cowdery, & Perko, 1995).

Although several studies support the assertion that higher sensitivity to nicotine predicts greater risk of dependence, there is also evidence suggesting that the experience of certain sensations (i.e., irritations, nausea) may protect against it (Chen et al., 2003; DiFranza, Savageau, Rigotti, et al., 2004). More specifically, pleasant responses to initial smoking have been generally found to predict continued tobacco use and subsequent symptoms of nicotine dependence (DiFranza et al., 2007; DiFranza, Savageau, Rigotti, et al., 2004; Kandel et al., 2007; O'Connor et al., 2005; Urban, 2010). However, evidence regarding the role of unpleasant responses has been rather mixed, as some aversive responses seem to promote nicotine dependence while others seem to protect against it (DiFranza et al., 2007; DiFranza, Savageau, Rigotti, et al., 2004; Kandel et al., 2007; Wang et al., 1995). Dizziness can be a symptom of nicotine toxicity but also a behaviourally rewarding sensation. Previous studies suggest that feeling dizzy or high during initial smoking is associated with the transition to regular smoking and nicotine dependence (Chen et al., 2003; DiFranza, Savageau, Rigotti, et al., 2004; O'Connor et al., 2005; Richardson, Okoli, Ratner, & Johnson, 2010; Wang et al., 1995).

Exposure to environmental tobacco smoke (ETS) is one factor that seems to be associated with initial sensitivity to nicotine and the risk for nicotine dependence (Johnson et al., 2010; Okoli, Richardson, & Johnson, 2008), although the underlying mechanisms are not yet well elucidated. Exposure to high levels of ETS is capable of producing plasma nicotine concentrations comparable to those in active smokers (Al-Delaimy, Fraser, & Woodward, 2001; Dimich-Ward, Gee, Brauer, & Leung, 1997; Jarvis, Russell, & Feyerabend, 1983) and can engender substantial brain nicotinic

acetylcholine receptor occupancy (Brody et al., 2012). In theory, exposure to ETS may be capable of inducing behavioural or neuronal adaptations similar to those in active substance use such as tolerance or sensitization (i.e., decreases or increases in the strength of a response to a substance induced by past experienced with the substance). Therefore, responses to the first dose of nicotine may differ as a function of past ETS exposure. Previous studies showed that adolescents exposed to a higher number of smokers in their social environment were more likely to report feeling dizzy, relaxed, good, and high when smoking for the first time compared to adolescents with less exposure to smokers in their environment (Okoli, Rayens, & Hahn, 2007). Similarly, the number of smoking peers distinguished smoking adolescents who displayed at least four nicotine dependence symptoms from smoking adolescents who never experienced any symptom of dependence (Johnson et al., 2010). Parental smoking has been found to be associated with an increased incentive salience of nicotine (i.e., 'wanting more') after nicotine administration in non-smokers (Perkins et al., 2009).

In addition to environmental factors, genetic factors play a substantial role in the development of nicotine dependence (Laucht et al., 2008; Lerman, Schnoll, & Munafo, 2007; Perkins, Lerman, Grottenthaler, et al., 2008; Ray et al., 2006; Voisey et al., 2012). Candidate genes may relate directly to nicotine dependence phenotypes through nicotine's biological action (e.g., genes related to enzymes responsible for nicotine metabolism) or indirectly through the brain's reward systems (e.g., genes related to opioid and dopaminergic neurotransmission). Nicotine acts on the brain's nicotinic cholinergic receptors resulting in release of dopamine and endogenous opioids (beta-endorphins and enkephalins). Dopamine release is associated with increased feelings of reward and reinforcement and critical in drug-induced reward. The binding of beta-endorphins by μ-opioid receptors facilitates dopamine release (Balfour, 2004; Berrendero, Kieffer, & Maldonado, 2002). Genetic variants in reward-related candidate genes may modulate receptor biology or neurochemistry, thus affecting vulnerability to nicotine dependence by an increased or decreased responsiveness of the brain's reward system to nicotine administration (Verhagen, Kleinjan, & Engels, 2012).

To date, little is known about the role of genetic influences in initial sensitivity to nicotine. A couple of laboratory studies have examined the role of genetic influences in proximal measures of sensitivity to nicotine, respectively reward and reinforcement from nicotine. Reward (i.e., hedonic value or liking of drug) and reinforcement (i.e., a drug is self-administered more than a placebo) are central facets of the dependence process, as both are necessary in novel smokers for smoking's motivational effects to develop. Previous studies suggested that several genetic polymorphisms (SNP's) in reward-related candidate genes are associated with sensitivity to nicotine, respectively the μ-opioid receptor (OPRM1) A118G polymorphism, the dopamine D2 receptor (DRD2) TaqIA polymorphism, and the dopamine D4 receptor (DRD4) 48 bp VNTR polymorphism (Perkins, Lerman, Coddington, Jetton, et al., 2008; Perkins, Lerman, Grottenthaler, et al., 2008; Ray et al., 2006; Zhang, Wang, Johnson, Papp, & Sadee, 2005).

With regard to the OPRM1 A118G polymorphism, smokers homozygous for the A-allele were more sensitive to nicotine versus denicotinized cigarettes (i.e., they displayed greater differences in subjective ratings of satisfaction and strength). Also, smoking women homozygous for the A-allele displayed a higher preference for

cigarettes in a nicotine choice paradigm (Ray et al., 2006). Up to this point, the biological mechanisms of the OPRM1 receptor are not well elucidated. While Bond et al. (1998) described the minor G-allele to be the gain-of-function variant (i.e., stronger affinity to bind beta-endorphins), Beyer, Koch, Schroder, Schulz, and Hollt (2004) found no differences in receptor binding properties between the common A-allele and the minor G-allele. Zhang et al. (2005) suggested that the G-allele was the loss-of-function variant and, therefore, associated with reduced feelings of reward in response to nicotine intake. Although the biological mechanisms remain unclear, previous laboratory studies among smokers suggest that individuals homozygous for the A allele of the OPRM1 SNP would display higher sensitivity to nicotine and increased nicotine reward. With regard to the DRD2 TaqIA polymorphism, smokers homozygous for the C-variant showed increased liking of cigarettes during positive mood, while those carrying the T-variant reported increased liking of cigarettes during negative mood (Perkins, Lerman, Grottenthaler, et al., 2008). Also, male non-smokers homozygous for the T-allele showed stronger perceptions of nicotine effects, increased anger, and reduced fatigue (Perkins, Lerman, Coddington, Jetton, et al., 2008). The T-allele has been associated with reduced dopamine D2 receptor availability and dopamine binding capacities (Noble, 2003; Pohjalainen et al., 1998; Thompson et al., 1997), which is hypothesized to be associated with reduced feelings of reward. Although both variants seem to be associated with smoking reward, albeit under different circumstances, it is hypothesized that carriers of the T-allele of the DRD2 TaqIA SNP would display higher sensitivity to nicotine, as the T-allele has been linked to increased perceptions of the effects of nicotine.

With regard to the DRD4 48 bp VNTR polymorphism, non-smoking carriers of the 7-repeats allele showed greater aversive symptoms (i.e., decreased positive affect and vigor, increased saliva cortisol) and increased feelings of buzz after receiving intravenous nicotine administration (Perkins, Lerman, Coddington, Jetton, et al., 2008). Biologically, the 7-repeats allele is associated with suppressed expression of the gene, which may result in chronically enhanced levels of the second messenger cyclic adenosine menophosphate (cAMP), which is associated with an increased sensitivity to substances (Wand, Levine, Zweifel, Schwindinger, & Abel, 2001). Based on previous research, it is expected that carriers of the 7-repeats allele of the DRD4 48 bp VNTR SNP would display higher sensitivity to nicotine, as they seem to display more aversive symptoms and feelings of buzz in response to nicotine.

The aim of this study was to examine the role of exposure to environmental smoking (by parents, siblings, and peers) and selected SNP's (OPRM1 A118G, DRD2 TaqIA, DRD4 bp VNTR) in reward-related candidate genes in adolescents' self-reported responses to the first dose of nicotine. We hypothesized that adolescents with higher exposure to environmental smoking would display increased rewarding sensations and diminished aversive sensations to the first dose of nicotine. Also, we hypothesized that genetic variation would explain inter-individual differences in adolescents' responses to the first dose of nicotine. Up to this point, no study has examined genetic influences in initial smoking experiences among adolescents. Finally, we examined gene-environment interactions in adolescents' responses to initial smoking. Previous research shows that the environment can either enhance or attenuate an underlying genetic vulnerability (Nilsson, Oreland, Kronstrand, & Leppert, 2009). Possibly,

exposure to ETS may have different effects across carriers of different genetic polymorphisms and genetic risk may augmented by exposure to ETS. Among exposed adolescents, a genetic vulnerability may additionally increase the risk of experiencing rewarding sensations and/or diminished aversive sensations during initial smoking.

Methods

Participants and procedure

Data of a 5-wave longitudinal study focusing on genetic and environmental influences on substance use among Dutch adolescents were used. The first assessment of the study took place in January 2010 and was followed by four assessments with four-month intervals between assessments. A total of 1,399 adolescents were recruited through 22 schools in the Netherlands. Active informed consent for study participation and gene analysis was obtained from the adolescents as well as their parents. At baseline (T1), saliva samples were collected for DNA extraction (Oragene, DNA Genotek Inc). During each wave, participants filled out an online or paper-and-pencil questionnaire during school hours. Across the five waves, 1,360 (97.2%), 1,230 (87.9%), 1183 (84.6%), 1,188 (84.9%), and 1,099 (78.1%) adolescents participated at Time 1 (T1), Time 2 (T2), Time 3 (T3), Time 4 (T4), and Time 5 (T5), respectively. The research design for this study was approved by an independent medical ethical committee (METiGG 9.118 NL27940, Utrecht, The Netherlands).

For the present study, we used data from the fourth wave, as the questions regarding initial smoking experiences were introduced at this wave, at a time when adolescents had a mean age of 13.9 years (SD=0.6). At T4, 296 out of 1,188 adolescents (24.9%) had ever tried smoking. Among those, 171 adolescents (57.8%) reported that they had ever inhaled. Initial responses to smoking were assessed only among inhalers (cf. DiFranza, Savageau, Fletcher, et al., 2004).

Measures

Smoking status

Smoking status was assessed on a nine-point scale with response options ranging from (1) 'I have never smoked, not even a single puff' and (9) 'I smoke at least once a day' (cf. Kremers, Mudde, & de Vries, 2001) To distinguish between current smokers and current non-smokers, the scale was recoded into a dichotomous variable (0= I tried smoking, but I don't smoke anymore; 1=I smoke at least once in a while).

Environmental smoking and exposure to environmental smoking

Parental smoking. Parental smoking was assessed using the following questions: "Does your father/mother smoke?" Responses options were "no, he/she never smoked", "no, he/she quit smoking", and "yes, he/she smokes". Responses were recoded into paternal smoking (no, yes) and maternal smoking (no, yes). Exposure to smoking by father/mother was assessed using the question "How often does your father/mother smoke when you are with him/her?" Response options were "Less than

once a week", "once a week", "2-3 times a week", 4-6 times a week", "once per day", "2-3 times per day", 4-5 times per day", and "More than 5 times per day". Responses were recoded to reflect (1) no exposure, (2) occasional exposure, (3) weekly exposure, and (4) daily exposure.

Sibling smoking. The number of smoking siblings (0, 1, 2 or more) was assessed using the question "How many of your brothers/sisters smoke?" Exposure to smoking by siblings was assessed using the question "How often do your brothers/sisters smoke when you are with them?" Response options were "Less than once a week", "once a week", "2-3 times a week", 4-6 times a week", "once per day", "2-3 times per day", 4-5 times per day", and "More than 5 times per day". Responses were recoded to reflect (1) no exposure, (2) occasional exposure, (3) weekly exposure, and (4) daily exposure.

Peer smoking. Peer smoking was assessed by asking adolescents "How many of your friends smoke?" Response options were (1) None, (2) Less than half, (3) Half of them, (4) More than half, and (5) All of them. Exposure to smoking by peers was assessed using the question "How often do your friends smoke when you are with them?" Response options were "Less than once a week", "once a week", "2-3 times a week", 4-6 times a week", "once per day", "2-3 times per day", 4-5 times per day", and "More than 5 times per day". Responses were recoded to reflect (1) no exposure, (2) occasional exposure, (3) weekly exposure, and (4) daily exposure.

Genotyping

DNA was isolated from saliva using the Oragene system (DNA Genotek Inc., Kanata, Ontario, Canada). The DRD2 (rs1800497) and OPRM1 (rs1799971) polymorphisms were genotyped using Taqman analysis. The DRD4 48 bp repeat polymorphism in exon 3 of the dopamine receptor gene was genotyped using simple sequence length analysis.

For the polymorphisms DRD2 (rs1800497) and OPRM1 (rs1799971) readymade Taqman Allelic Discrimination assay were ordered. (Taqman Allelic Discrimination ID: DRD2 (rs1800497), C___7486676_10, reporter 1: VIC-A-Allele, forward assay and OPRM1 (rs1799971), C___8950074_1_, VIC-A-allele, forward assay, Applied Biosystems, Nieuwerkerk a/d IJssel, The Netherlands). Genotyping for the polymorphisms DRD2 (rs1800497) and OPRM1 (rs1799971) was carried out in a volume of 5 μl containing 10 ng of genomic DNA, 1x Taqman Mastermix (2x; Applied Biosytems, Nieuwerkerk a/d Ijssel, The Netherlands) and 0.5x Taqman assay (40x). Each amplification for the Taqman Allelic Discrimination assays C___7486676_10 and C___8950074_1_ was performed by an initial denaturation at 95°C for 12 min, followed by 40 cycles of denaturation at 92°C for 15 seconds and annealing/extension at 60°C for 1 minute, this was carried out on a 7500 Fast Real-Time PCR System. Genotypes were scored using the algorithm and software supplied by the manufacturer (Applied Biosystems).

The DRD4 48 bp repeat polymorphism was genotyped with PCR on 10 ng genomic DNA using 0.5 μM fluorescently labeled forward primer (VIC-5'-GCGACTACGTGGTC-TACTCG-3') and reverse primer (5'-AGGACCCTCATGGCCTTG-3'), 1x GC buffer I TaKaRa (Westburg, Leusden, The Netherlands), 0.4 mM dNTPs TaKaRa(Westburg, Leusden, The Netherlands), 1M Betaïne and 0.05 U TaKaRa LA Taq (Westburg, Leusden, The Netherlands). The cycling conditions for the polymerase chain reaction started with 1 min at 94°C, followed by 35 cycles of 30 sec at 94°C, 30 sec at the optimized annealing temperature (58°C), and 1 min at 72°C, then followed by an extra

5 min at 72°C. The product of the amplification was diluted 1:1 in H_2O. Subsequent determination of the length of the alleles was performed by direct fragment length analysis on an automated capillary sequencer (ABI3730, Applied Biosystems, Nieuwerkerk a/d Ijssel, The Netherlands) using standard conditions (1 ul of the diluted PCR product together with 9.7 ul formamide and 0.3ul GeneScan-600 Liz Size Standaard™ (Applied Biosystems, Nieuwekerk aan den Ijsel, the Netherlands)). Results were analyzed with genemapper version 4.0 (Applied Biosystems, Nieuwerkerk a/d Ijssel, The Netherlands). Analyses of the DRD4 PCR fragments showed fragment length at 378 bp (2 repeats),426 bp (3 repeats) , 474 bp (4 repeats), 522 bp (5 repeats), 570 bp (6 repeats), 618 bp (7 repeats), 666 bp (8 repeats).

All genotyping assays have been validated earlier and 5% duplicates and blanks were taken along as quality controls during genotyping. Genotyping was performed in a CCKL-accredited laboratory at the Department of Human Genetics of the Radboud University Nijmegen Medical Centre in Nijmegen. Generally, 5% blanks as well as duplicates between plates were taken along as quality controls during genotyping. Distribution of the OPRM1, the DRD2, and the DRD4 genotype in the study was in accordance with the Hardy-Weinberg equilibrium (p=.62, p=.71, p=.53, respectively). A total of 116 adolescents (77.9%) were homozygous for the A-allele of the OPRM1 polymorphism. A total of 30 adolescents (20.1%) were carriers of at least one G-allele of the OPRM1 polymorphism and were considered members of the risk group. A total of 88 adolescents (59.1%) were homozygous for the C-allele of the DRD2 polymorphism. A total of 58 adolescents (38.9%) were carriers of at least one T-allele of the DRD4 polymorphism and were considered members of the risk group. A total of 41 adolescents (27.5%) were carriers of at least one long, ≥7 repeats allele of the DRD4 polymorphism and were considered members of the risk group.

Responses to initial smoking

Among all adolescents who reported inhaling on a cigarette, nicotine-induced reward (i.e., the hedonic value of nicotine or subjective liking of nicotine) was assessed using the question: “When you first inhaled cigarette smoke, did it feel good?” Also, initial smoking experiences were measured using the question: “When you first inhaled cigarette smoke, did you experience any of these symptoms: coughing, pain in the chest, irritated eyes, bad taste in mouth, upset stomach, feeling like you are going to throw up, vomiting, feeling dizzy, feeling light-headed, feeling relaxed, getting a rush, feeling a buzz?” These items were recoded into summary scores reflecting the number of endorsed unpleasant symptoms (coughing, pain in the chest, irritated eyes, bad taste in mouth, upset stomach, feeling like you are going to throw up, vomiting), pleasant symptoms (feeling relaxed, getting a rush, feeling a buzz), and dizziness (feeling dizzy, feeling lightheaded). The items were derived from DiFranza, Savageau, Rigotti, et al. (2004) and symptom subscale scores have previously been found to predict the emergence of nicotine dependence symptoms among adolescence.

Power analyses

To determine statistical power for testing gene-environment interactions, we conducted power-analyses for a case-only design for the three different genotypes (OPRM1, DRD2, DRD4) using the program Quanto (Gauderman, 2006). In these power analyses,

the outcome measure was determined as the risk of reporting liking of initial smoking. The estimation of the parameters necessary for the power calculations was based on previous studies examining risk of different adolescent smoking phenotypes (e.g., risk of progression to smoking and risk of having a high risk dependence profile).

A previous nation-wide study among Dutch adolescents showed that 15% of all smoking adolescents could be classified as having a high dependence profile (Kleinjan et al., 2010). Based on a previous study by Laucht et al. (2008) on the effects of genetic variation in dopamine gene variants on different adolescent smoking phenotypes, the genetic relative risk was fixed at 1.3. Based on a study by Kleinjan et al. (2010), in which 9.3% of smokers without a smoking mother had a high dependence profile compared to 13.8% of adolescents with a smoking mother (RR = 1.5), the environmental relative risk was fixed at 1.5. Furthermore, we imputed an estimation of the allele frequency and the prevalence of the environmental risk factor at the population level. We assumed that approximately 30% of the sample would have the DRD2 A-allele and 20% would have the OPRM1 G-allele. Laucht et al. (2008) reported that 25% of adolescents had the DRD4 7-repeat allele. Finally, in 2011, a total of 25% of the Dutch population was identified as a smoker (Stivoro, 2011). The prevalence of smoking in the environment was therefore fixed at 25%.

For the OPRM1, DRD2 and DRD4 a dominant model was assumed (i.e., the presence of both 1 and 2 risk alleles increases risk (cf. Laucht et al., 2008). To detect an interaction effect assuming an overall 2.5-fold increase in risk of reporting liking of initial smoking for environmentally exposed risk gene carriers compared to non-exposed non-carriers, with 80% power and a false positive rate of 5%, the sample size required would be 156 individuals for OPRM1, 177 individuals for DRD2, and 163 for DRD4.

Strategy for analyses

All analyses were conducted using SPSS 19. Descriptive statistics and correlations between study variables were computed. Linear regression analyses and logistic regression analyses were used to assess the relation between exposure to environmental smoking, genetic polymorphisms, and responses to initial smoking in adolescents. Both crude effects and adjusted effects (controlled for age, gender, and smoking status) were reported. To examine interaction effects between predictors, we applied the approach recommended by Hayes and Matthes (2009) (i.e., interaction terms were created as a product of the mean-centered predictors and were entered into the regression model in a subsequent step after the main effects were entered). The amount of missing data on the predictor variables ranged from 2.3% to 15.8%. The amount of missing data on the outcome variables ranged from 2.3% to 5.3%. The SPSS default procedure (complete-case-analysis) was used to handle missing data.

Results

Sample description and correlations

Table 1 displays demographic characteristics of the sample and the distribution of predictor variables. Within the sample, most participants smoked rather infrequently (only 33.6% reported daily or weekly smoking). On average, participants smoked 8.5

Table 1 Sample characteristics among inhalers

Characteristics	
Age (*M*, *SD*)	13.9 (0.6)
Gender (%)	
Female	50.9
Smoking frequency (%)	
Tried and quit	44.4
Less than once per month	15.2
At least once per month	8.8
At least once per week	11.1
At least once per day	20.5
Paternal smoking (%)	
Yes	36.5
Maternal smoking (%)	
Yes	31.7
Sibling smoking (%)	
Yes	36.2
Peer smoking (%)	
Yes	87.7
Exposure to smoking by father (%)	
No exposure or occasional exposure	70.7
Weekly exposure	13.8
Daily exposure	15.6
Exposure to smoking by mother (%)	
No exposure or occasional exposure	75.5
Weekly exposure	9.6
Daily exposure	15.0
Exposure to smoking by sibling (%)	
No exposure or occasional exposure	80.0
Weekly exposure	12.3
Daily exposure	7.7
Exposure to smoking by peers (%)	
No exposure or occasional exposure	24.9
Weekly exposure	53.2
Daily exposure	31.8
OPRM1 (%)	
AA	79.5
AG/GG	20.5
DRD2 (%)	
CC	60.3
CT/TT	39.7
DRD4 (%)	
< 7 repeats	71.5
≥ 7 repeats	28.5

Table 2 Percentages of sensations experienced during initial smoking

Sensation during initial smoking	
Liking of initial smoking (%)	39.5
Unpleasant sensations during initial smoking (%)	
Coughing	54.8
Pain in the chest	10.7
Irritated eyes	19.2
Bad taste in mouth	72.2
Upset stomach	11.4
Feeling like you are going to throw up	7.9
Vomiting	4.8
Pleasant sensations during initial smoking (%)	
Feeling relaxed	57.2
Getting a rush	16.8
Feeling a buzz	27.7
Feelings of dizziness during initial smoking (%)	
Feeling dizzy	41.0
Feeling lightheaded	49.4
Total number of unpleasant sensations (%)	
0	26.3
1	32.3
2	21.6
3 or more	19.8
Total number of pleasant sensations (%)	
0	36.5
1	36.5
2	16.2
3	10.8
Total number of sensations of dizziness (%)	
0	43.1
1	24.0
2	32.9

(*SD*=19.0) cigarettes per week. Table 2 displays the frequency of sensations experienced during initial smoking. A total of 64 (39.5%) participants reported liking of initial smoking. The most frequently reported symptoms during initial smoking were coughing (54.8%), feeling relaxed (57.2%), and feeling lightheaded (49.4%). Unpleasant symptoms during initial smoking were associated with symptoms of dizziness (r=.35, p<.001), but unrelated to pleasant symptoms (r=-.03, p=.68). Pleasant symptoms were unrelated to symptoms of dizziness (r=.12, p=.12).

Logistic regression analyses predicting liking when first inhaling

Table 3 displays the results of the univariate and multivariate logistic regression models assessing the association between exposure to environmental smoking, SNP's, and

Table 3 Univariate and multivariate regression analyses predicting responses to initial smoking

	Liking		Pleasant responses		Unpleasant responses		Dizziness	
	Crude OR (C.I.)	Adjusted OR (C.I.)	Crude Beta (S.E.)	Adjusted Beta (S.E.)	Crude Beta (S.E.)	Adjusted Beta (S.E.)	Crude Beta (S.E.)	Adjusted Beta (S.E.)
Paternal smoking	.88 (.46-1.72)	.80 (.40-1.58)	.08 (.16)	.08 (.17)	.08 (.18)	.14 (.17)	.08 (.14)	.07 (.15)
Maternal smoking	1.42 (.72-2.83)	1.31 (.65-2.65)	.11 (.17)	.10 (.17)	**-.15 (.18)**	-.14 (.19)	.01 (.15)	-.01 (.15)
Sibling smoking	1.02 (.63-1.64)	.96 (.58-1.57)	.09 (.12)	.08 (.12)	.06 (.13)	.08 (.13)	-.06 (.11)	-.08 (.11)
Peer smoking	**1.53 (1.10-2.11)**	**1.48 (1.04-2.09)**	**.21 (.07)**	**.20 (.08)**	-.11 (.08)	-.08 (.09)	.06 (.07)	.01 (.07)
Exposure by father	1.10 (.84-1.53)	1.06 (.81-1.39)	.13 (.07)	.12 (.07)	.01 (.07)	.03 (.07)	.04 (.06)	.01 (.06)
Exposure by mother	1.30 (.99-1.72)	1.27 (.96-1.69)	.05 (.07)	.05 (.07)	**-.20 (.07)**	**-.19 (.08)**	.00 (.06)	-.01 (.06)
Exposure by sibling	.92 (.66-1.29)	.88 (.62-1.25)	.02 (.08)	-.01 (.08)	.05 (.09)	.08 (.09)	-.02 (.07)	-.06 (.07)
Exposure by peers	**1.74 (1.13-2.70)**	**1.75 (1.11-2.76)**	.14 (.08)	.11 (.09)	-.10 (.09)	-.08 (.10)	.13 (.08)	.08 (.08)
OPRM1	**2.50 (1.09-5.73)**	**2.37 (1.01-5.55)**	.08 (.20)	.06 (.20)	-.08 (.23)	-.07 (.23)	-.05 (.18)	-.06 (.18)
DRD2	.99 (.50-1.91)	1.00 (.49-2.04)	-.06 (.17)	-.06 (.16)	**.18 (.19)**	**.19 (.19)**	-.02 (.15)	-.03 (.15)
DRD4	1.01 (.48-2.13)	.86 (.39-1.88)	.06 (.18)	.03 (.18)	.06 (.21)	.08 (.21)	-.03 (.16)	-.05 (.16)

Note. Adjusted for age, gender, and smoking status. Bold font indicates effects at the level of $p<.05$.

sensations during initial smoking. Liking when first inhaling was significantly associated with exposure to smoking by friends, in both univariate and multivariate analysis (OR=1.74, CI=1.13-2.70 and OR=1.75, CI=1.11-2.76, respectively). Adolescents who were more frequently exposed to smoking by their friends were more likely to report liking when first inhaling. Also, liking when first inhaling was significantly associated with genetic variation in the OPRM1 polymorphism, in both univariate and multivariate analyses (OR=2.50, CI=1.09-5.73 and OR=2.37, CI=1.01-5.55, respectively). Carriers of the G-allele of the OPRM1 polymorphism were significantly more likely to report liking when first inhaling. Genetic variation in the DRD2 and DRD4 polymorphism were unrelated to liking of initial smoking, as were smoking by parents and siblings. None of the gene-environment interactions were significant.

Linear regression analyses predicting pleasant symptoms when first inhaling

The number of pleasant symptoms was significantly associated with peer smoking, in both univariate and multivariate analysis (Beta=.21, $p=.01$ and Beta=.20, $p=.02$, respectively). Adolescents who were more frequently exposed to smoking by their friends reported a higher number of pleasant symptoms when first inhaling. Genetic variation in the OPRM1, DRD2, and DRD4 polymorphism were unrelated to the experience of pleasant symptoms, as were smoking by parents, siblings, and peers. None of the gene-environment interactions were significant.

Linear regression analyses predicting unpleasant symptoms when first inhaling

The number of unpleasant symptoms was significantly associated with exposure to smoking by mother, in both univariate and multivariate analysis (Beta=-.20, $p=.01$ and Beta=-.19, $p=.02$, respectively). Adolescents who reported exposure to smoking in the household by mother reported a lower number of unpleasant symptoms when first inhaling. Also, the number of unpleasant symptoms was significantly associated with genetic variation in the DRD2 polymorphism, in both univariate and multivariate analysis (Beta=.18, $p=.04$ and Beta=.19, $p=.03$, respectively). Carriers of the CC versus the CT/TT DRD2 polymorphism reported a lower number of unpleasant symptoms when first inhaling. Genetic variation in the OPRM1 and DRD4 polymorphism were unrelated to the experience of unpleasant symptoms, as were smoking by fathers, siblings, and peers. None of the gene-environment interactions were significant.

Linear regression analyses predicting dizziness when first inhaling

None of the assessed genetic polymorphisms (OPRM1, DRD2, and DRD4) nor any of the measures of environmental smoking was significantly associated with the experience of dizziness when first inhaling. None of the gene-environment interactions were significant.

Discussion

In the present study, adolescents with a higher exposure to peer smoking were more likely to report liking of initial smoking and reported more pleasant symptoms during initial smoking (e.g., relaxation, rush). Previous research also showed that environmental smoking is associated with more pleasant symptoms during initial smoking (Okoli et al., 2008) and an increased incentive salience of nicotine (Perkins et al., 2009). Enhanced liking and pleasant sensations among adolescents exposed to smoking peers may be explained by physiological processes (i.e., sensitization to nicotine induced by pharmacological exposure to nicotine in the past) as well as psychosocial processes (e.g., social modelling, normative perceptions). In addition, adolescents with a higher exposure to maternal smoking reported a lower number of unpleasant symptoms during initial smoking (e.g., coughing, nausea, irritations). Similar findings are reported in the alcohol research literature (i.e., a family history of alcoholism predicts lower sensitivity to the subjective and performance-impairing effects of alcohol) (Pollock, 1992). Interestingly, peer smoking and maternal smoking seem to differentially influence initial smoking experiences among adolescents (i.e., enhanced rewarding sensations versus dampened aversive sensations). The fact that the source of ETS exposure, not merely the level of ETS exposure, determines adolescents' responses to nicotine may indicate that psychosocial processes play at least some part in adolescents' initial smoking experiences.

In addition to environmental smoking, genetic variation in two candidate genes was associated with initial responses to nicotine. We found that adolescents carrying the G-variant of the OPRM1 A118G SNP were more likely to report liking of initial smoking. Studies investigating the biological function of OPRM1 A118G SNP have reported inconsistent findings (Verhagen et al., 2012). Up to this point, it is unclear whether the minor G-allele or the common A-allele constitutes the gain-of-function variant (i.e., stronger affinity to bind beta-endorphins), associated with increased dopaminergic activity and feelings of reward in response to nicotine intake. Previous laboratory research among smokers suggest that individuals homozygous for the A-allele would display higher sensitivity to nicotine and increased nicotine reward (Ray et al., 2006), but these findings may not generalize to adolescents who report their experiences in response to the first active dose of nicotine. Our findings provide preliminary evidence that, during initial smoking experiences of nicotine-naive adolescents, the G-variant of the OPRM1 A118G SNP is associated with increased feelings of reward in response to the first active dose of nicotine.

Moreover, adolescents homozygous for the C-variant of the DRD2 TaqIA polymorphism reported a lower number of unpleasant symptoms during initial smoking, indicating a lower sensitivity to nicotine. Conversely, Perkins, Lerman, Grottenthaler, et al. (2008) reported that individuals homozygous for the T-variant showed stronger perceptions of nicotine effects, indicating higher nicotine sensitivity among T-allele carriers. The T-allele has been proposed to be associated with reduced feelings of reward due to reduced receptor availability and dopamine binding capacities (Noble, 2003; Pohjalainen et al., 1998; Thompson et al., 1997). Therefore, carriers of the C-variant may be more likely to progress to regular smoking and dependence as they experience greater reward from nicotine's dopamine-stimulating effects (Laucht et al., 2008). However, how this variant may affect the experience of aversive sensations is not clear. It should be noted that the role of aversive sensations during initial smoking is not yet clear. While some aversive sensations seem to promote nicotine dependence, others seem to protect against it (DiFranza, Savageau, Fletcher, et al., 2004). In contrast to the Sensitivity Model (Pomerleau, Collins, Shiffman, & Pomerleau, 1993), the Exposure Model (in Audrain-McGovern, 2009) proposes that reduced, not enhanced, initial sensitivity predicts greater risk of nicotine dependence. The rationale is that experiencing few aversive effects from smoking makes subsequent experimentation more likely. Future studies will need to clarify whether aversive sensations during initial smoking constitute a risk or a protective factor in the transition to regular smoking and nicotine dependence among youth.

Contrary to our expectations, no association between the DRD4 VTNR polymorphism and initial smoking experiences among adolescents was observed. Previously, carriers of the 7-repeats allele displayed more aversive symptoms and increased feelings of buzz in response to nicotine administration (Perkins, Lerman, Coddington, Jetton, et al., 2008). Possibly, these differences in findings may be due to differences in study methodology (laboratory study assessing immediate responses to intravenous nicotine administration versus survey study assessing retrospective reports to nicotine inhalation) or study population (non-smoking adults versus adolescents who had initiated smoking). In line with this, it is possible that variation in different dopamine genes associates differentially with different phenotypes of nicotine dependence. Laucht et al. (2008) found that variation in the DRD4 VNTR SNP was associated with smoking initiation and an early age of onset, while variation in other dopamine gene SNPs (DRD2 rs4648317, DRD2 TaqIA) were related to smoking continuation and nicotine dependence. Previous research suggested a link between DRD4 and novelty seeking (i.e., dopaminergically modulated tendency toward explorative activity in novel situations) (Kluger, Siegfried, & Ebstein, 2002; Laucht, Becker, El-Faddagh, Hohm, & Schmidt, 2005). Possibly, the DRD4 SNP may associate more strongly with character traits which predispose adolescents for nicotine dependence (e.g., novelty seeking), while other dopamine gene SNPs may associate more strongly with specific nicotine dependence phenotypes such as nicotine sensitivity.

In the present study, no gene-environment interactions in adolescents' responses to initial smoking were found, suggesting that exposure to environmental smoking has the same effects across carriers of different genetic polymorphisms and that genetic risk is not augmented by exposure to ETS. It should be noted, however, that interactions between genetic risk factors and exposure to environmental smoking cannot be ruled out based on the present findings. First, this study only examined the role of three specific SNP's. While previous studies indicate that these SNP's are related to nicotine sensitivity and nicotine reward, it is possible that other SNP's may interact with environmental smoking in shaping initial responses to nicotine. Second, although this study found no evidence that genetic risk is modulated by exposure to ETS, it cannot be ruled out that gene-environment interactions become relevant during a later stage of smoking (e.g., emergence of nicotine dependence, manifestation of nicotine dependence). Finally, multiple loci are likely to be involved in initial responses to nicotine. Because of linkage disequilibrium (i.e., non-random association between

alleles), genotyping several SNPs within the OPRM1, DRD2 and DRD4 genes and adjacent genes is necessary to gain insight into associations with other reward-related variants.

Several limitations should be acknowledged. First, initial smoking experiences were assessed using retrospective self-report, bearing the potential for biased recall. Yet, as the present study aimed to assess the development of smoking behaviour after recent onset, the sample was quite young and initial smoking experiences are likely to be recent. Also, previous studies indicate good short-term temporal validity of pleasant and unpleasant sensations (Urban & Sutfin, 2010) and feelings of dizziness (Riedel, Blitstein, Robinson, Murray, & Klesges, 2003). Also, retrospective reports of initial responses predict prospective responses to nicotine administered in laboratory settings, indicating that they reflect stable and reliable responses to nicotine (Perkins, Lerman, Coddington, & Karelitz, 2008; Pomerleau, Pomerleau, Mehringer, Snedecor, & Cameron, 2005). Of concern are variations in self-dosing of nicotine. Possibly, differences in initial responses to nicotine may stem from differences in the amount of inhaled nicotine. We tried to reduce variation in self-dosing by examining responses to nicotine only among inhalers (i.e., to ensure exposure to an active dose of nicotine during inhaling) (cf. DiFranza, Savageau, Fletcher, et al., 2004). Finally, it should be noted that the present sample size was rather small, which may have resulted in an increased risk of type II error (i.e., false negatives), particularly when effects are small. This may explain that no significant main effect of the DRD4 SNP or significant interaction effects have been found. Findings will need to be replicated in studies with larger sample sizes. Collaborative efforts using pooled data from several studies in a meta-analysis may help to overcome challenges related to power limitations in genetic research.

This study suggests several recommendations for future research. To determine concurrent and predictive validity of initial smoking experiences, future research may examine how these experiences relate to other responses to nicotine (e.g., nicotine reward, nicotine reinforcement, affective responses, physiological responses) and nicotine dependence phenotypes (progression to regular smoking, development of nicotine dependence, high nicotine dependence profile). To clarify whether exposure to ETS can induce tolerance and sensitisation, future research will need to determine if inter-individual differences in responses to nicotine are indeed the result of pharmacological exposure to nicotine (i.e., the absorption of nicotine from ETS). Alternatively, psychosocial processes (e.g., availability and accessibility of tobacco, social modelling, normative perceptions) or a genetic vulnerability (i.e., shared genetic make-up between family members) rather than pharmacological exposure may explain the association between environmental smoking and responses to initial smoking among adolescents. Comparison between self-report measures and biological markers of ETS exposure may help to distinguish psychosocial from physiological processes in future studies.

In summary, this study indicates that exposure to ETS (by peers and mothers) as well as genetic variation in reward-related candidate genes (OPRM1 A118G SNP, the DRD2 TaqIA SNP) modulate responses to initial smoking among adolescents. Implications of the present study encompass enhanced attention to the effects of ETS exposure and genetic predispositions in the initial stages prior to the onset of nicotine dependence among youth. Future research will need to clarify the mechanisms underlying the

relation between exposure to ETS and initial responses to smoking (genetic, physiological or psychosocial) and to examine associates and consequences of responses to initial smoking among adolescents.

Chapter 5

Bidirectional influences between parents and children in smoking behaviour

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Abstract

Background: The present study investigated longitudinal associations and bidirectional influences between family members in smoking behaviour using a longitudinal, full family design. Family systems provide a powerful social context in which modeling and imitation take place. In current literature, however, bidirectional associations between parents and children in smoking behaviour are seldom considered. Methods: Participants were 426 families, including mothers, fathers, and two adolescent children. Associations were assessed over five waves with yearly intervals using a cross-lagged model in structural equation modeling. Results: Findings demonstrate that families resemble an interactive system affording smoking contagion across family members. Results suggest that associations between parents and children are bidirectional, that is, parental smoking behaviour influences adolescent smoking behaviour and adolescent smoking behaviour influences parental smoking behaviour. There is insufficient evidence to conclude that longitudinal associations between family members are generally bidirectional, as only unidirectional longitudinal associations were found between between siblings and partners. Conclusions: The present study extends previous research on the intergenerational transmission of smoking behaviour by demonstrating bidirectional influences between parents and children in smoking behaviour. Moreover, the present study suggests that family members may be susceptible to adjust their smoking behaviour across time in response to smoking behaviour within the family.

Introduction

Cigarette smoking continues to be a substantial problem with detrimental health consequences for the individual and tremendous costs for society (WHO, 2010). Smoking prevalence among adults and adolescents remains high and past decreases in smoking prevalence are beginning to level off (Vemer, Rutten-van Mölken, Kaper, Hoogenveen, van Schayck, & Feenstra, 2010). In the Netherlands, smoking prevalence rates are high, with 28% of adults being smokers and 21% of 10 to 19 years-olds having smoked during the past four weeks (STIVORO, 2009).

Familial influences are established predictors of individual smoking behaviour. The family system is one of the most important social environments, particularly for youth. Within families behavioural similarities are common. On one hand, shared genetic factors may partially explain behavioural similarities within families. Heritable allelic variations in several genes encoding for example dopamine and serotonin receptors and transporters (do Prado-Lima et al., 2004; Kremer, et al., 2005; Laucht et al., 2008; Lerman et al., 1999; Sabol et al., 1999; Skowronek, Laucht, Hohm, Becker, & Schmidt, 2006; Vandenbergh et al., 2007), nicotinic acetylcholine receptors (Berretini et al., 2008; Fowler, Lu, Johnson, Marks, & Kenny, 2011; Saccone et al., 2007), and metabolizing enzymes (Audrain-McGovern et al., 2007) have been shown to be related to varying phenotypes of smoking behaviour and nicotine dependence. On the other hand, social learning may also explain behavioural similarities within families. A theoretical account of environmental influences in individual behaviour is provided by Social Learning Theory (SLT; Bandura, 1977). According to SLT, human behaviour is learned observationally within a social context through continuous reciprocal interactions. In social learning, both cognitive learning as well as behavioural learning is regarded as important. Cognitive learning, on one hand, incorporates the acquisition of knowledge, beliefs, norms, and values by mental processes, such as the formation of mental representation of objects or events, and occurs through observation of behaviour in the social environment. Behavioural learning, on the other hand, incorporates modeling or imitation of behaviour and may occur either spontaneously and without awareness or intentionally (Chartrand & Bargh, 1999; Van Baaren, 2003). Individuals seem particularly likely to adopt behaviour if they perceive that the behaviour has a functional value or if the model is liked by or similar to the individual. Experimental research has shown that imitation of behaviour is functional, as it facilitates social interactions and increases liking between interaction partners (Chartrand & Bargh, 1999; Van Baaren, 2004).

Smoking initiation in youth has been shown to be strongly influenced by familial smoking. Non-smoking children and adolescents have an increased risk to initiate smoking when exposed to parental smoking and sibling smoking (Leonardi-Bee, Jere, & Britton, in press). Presumably, the effect of familial smoking on youth is mediated, at least partially, by smoking-related cognitions, such as attitudes towards smoking, beliefs about smoking, normative perceptions of smoking, or self-efficacy to refrain from smoking. Several studies have indeed shown that children who are exposed to a high level of environmental smoking display more positive and tolerant attitudes towards smoking (Brook, Mendelberg, Galili, Priel, & Bujanover, 1999; Porcellato, Dugdill, Springett, & Sanderson, 1999), more normative perceptions of smoking (Otten, Engels, Prinstein, 2009), and a stronger intention to smoke (Porcellato et al., 1999).

When smoking behaviour is established, social modeling and imitation seem also relevant in explaining individual smoking behaviour. Two experimental studies have shown that adolescents and young adults adjust their smoking intensity (i.e., number of cigarettes) to the smoking behaviour of a confederate (Harakeh, Engels, Van Baaren, & Scholte, 2007; Kniskern, Bigland, Lichtenstein, Ary, & Bavry, 1983). Kniskern and colleagues (1983) concluded that adolescents smoke more cigarettes in the presence of a smoking model compared to when being alone. Harakeh and colleagues (2007) demonstrated that, in a bar setting, smoking condition (non-smoking model, light smoking model, heavy smoking model) strongly affected the smoking intensity of young adults. They concluded that in the presence of a smoking model smokers were more likely to smoke the first, second, and third cigarette during a one-hour interaction, even when controlling for craving.

In the present study, we evaluated the extent to which similar behavioural adjustments in smoking behaviour take place within the family system. A particular aim of the present study is to evaluate bidirectional associations between family members in smoking behaviour. Parental smoking has been repeatedly shown to affect adolescent smoking (Avenevoli & Merikangas, 2003; Leonardi-Bee et al., in press). However, the reverse is seldom considered. Yet, social modeling and imitation seem to be fundamental processes which may apply in equal measure to all family members.

Recent studies indicate that bidirectional influences between parents and children constitute structural rather than incidental effects. For example, using a cross-lagged model, Huver, Engels, Vermulst, and De Vries (2007) found that adolescent smoking behaviour was a stronger predictor of anti-smoking parenting practices than vice versa. While anti-smoking house rules decreased across time as a result of adolescent smoking, the frequency of communication about smoking increased. Similarly, Otten, Van der Zwaluw, Van der Vorst, and Engels (2008) evaluated bidirectional associations in family alcohol use. As expected, results indicate that alcohol use in parents is predictive of future alcohol use in children. Interestingly, alcohol use of older children also affected alcohol use of both mothers and fathers across time.

In summary, the present study investigated longitudinal associations among family members in smoking intensity as well as bidirectional influences between parents and children. Associations between family members in smoking behaviour were evaluated across a period of five years using a longitudinal, full-family design. We expected to find positive associations between smoking intensity of family members. In addition, we hypothesized that associations between parents and children are bidirectional, as both parents and children are likely to be susceptible to processes related to modeling and imitation.

Methods

Participants and design

Data were derived from the Dutch 'Family and Health' Survey, which is a longitudinal study of five waves with yearly intervals starting in 2002 (for more detailed information see Van der Vorst, Engels, Dekovic, Meeus, & Vermulst, 2007). A total of 428 families participated in the first measurement. To evaluate longitudinal associations in family

smoking, the present study selected a total of 426 families who provided data on smoking intensity for all family members on at least two measurements.

Addresses of families were selected from 22 registers of municipalities in the Netherlands. Selected families received an invitation letter and were asked to return an enclosed response form if they agreed to participate in the study. Initially, 885 families agreed to participation. Subsequently, families were contacted by telephone to establish whether they fulfilled inclusion criteria, i.e. parents are living together and are biologically related to the children. Families with twins or with children who had mental or physical disabilities were excluded from the study. A total of 765 families met all criteria. Further selections were made to ensure an equal distribution of adolescent's educational level and an equal number of possible sibling dyads. Finally, 428 families were invited to participate in the study (i.e., 108 boy-boy, 118 boy-girl, 96 girl-boy, 106 girl-girl). The families were visited at home by a trained interviewer. Questionnaires were completed individually by all family members. Families were asked not to discuss the questionnaires with each other. Each family received an incentive of 30 euro's (USD 39) per measurement. The numbers of participating families across time were 428 (T1), 416 (T2), 404 (T3), 356 (T4), and 326 (T5), resulting in a response rate of 76% across waves.

Each family consisted of both biological parents and two adolescent children. At T1, the older siblings were between 14 and 17 years (mean = 15.22, SD = 0.60) and the younger siblings were between 13 and 15 years (mean = 13.35, SD = 0.50). Mothers were between 35 and 56 (mean = 43.85, SD = 3.55) and fathers were between 37 and 62 (mean = 46.19, SD = 4.01). Average educational level of parents was relatively high. A total of 49% of mothers and 58% of fathers had followed the highest level of secondary education or college education, while 11% of mothers and 14% of fathers reported following special or lower education.

Measures

Smoking intensity of all family members was measured as the number of cigarettes smoked per week. Mothers and fathers were asked to report the average number of cigarettes smoked per week. Children were asked to report the average number of cigarettes smoked during a week (Monday to Friday) and during a weekend. Both items were summed per child. At T1, a total of 87 mothers (20.4%), 100 fathers (23.5%), 72 older siblings (16.9%), and 32 younger siblings (7.5%) reported smoking. For smokers, the average number of cigarettes smoked per week was 80.92 (SD = 52.87) for mothers, 87.25 (SD = 77.85) for fathers, 31.36 (SD = 35.31) for older siblings, and 23.48 (SD = 24.70) for younger siblings. For the entire sample, the average number of cigarettes smoked per week was 15.8 (SD = 39.68) for mothers, 19.02 (SD = 50.91) for fathers, 4.30 (SD = 16.87) for older siblings, and 1.60 (SD = 8.60) for younger siblings. Because the measure number of cigarettes smoked per week was obviously skewed, due to a preponderance of scores at the scale minimum (i.e., overdispersion of zeros), the scores of all family members were log-transformed. Previous research has shown that self-reported current parental and adolescent smoking is moderately to highly related to proxy reports of smoking obtained by family members (Harakeh, Engels, de Vries, & Scholte, 2006), indicating that family members are aware of each others smoking behaviour.

Attrition Analyses

Of the 426 families at T1, 326 (76%) participated again at T5. Families lost to follow-up at T5 were compared with the remaining families on education, smoking status, and smoking intensity of all family members using independent sample t-tests and chi-square tests. In families lost to follow-up, mothers ($\chi^2 = 7.36$, $p < .05$), fathers ($\chi^2 = 13.40$, $p < .001$), older children ($\chi^2 = 21.00$, $p < .001$), and younger children ($\chi^2 = 20.27$, $p < .001$) were significantly more likely to have lower education. Also, in families lost to follow-up, mothers ($\chi^2 = 7.55$, $p < .01$), but not fathers ($\chi^2 = 0.62$, $p = 0.83$) nor older children ($\chi^2 = 0.29$, $p = 0.86$) or younger children ($\chi^2 = 1.68$, $p = 0.20$), were more likely to be smokers. Among smokers, smoking intensity was unrelated to loss to follow up among mothers ($t = 0.94$, $p = .35$), fathers ($t = 1.05$, $p = .30$], older children ($t = 0.48$, $p = .64$), and younger children ($t = 1.37$, $p = .18$).

Statistical analyses

Regression equations were estimated to construct the conceptual model using Mplus 5 (Muthén & Muthén, 2007). To model dependencies among family members, an embedded cluster model (TYPE=COMPLEX and CLUSTER option) was used; therefore, the standard errors of the estimates were corrected for non-independence of family-members.

Analyses proceeded in several steps. First, a basic ("autoregressive") model (model 1) was estimated. The basic model included solely the effects of the background variables (i.e., age, education, and gender of adolescents) on smoking behaviour of all family members, stability paths (autoregressive paths) within smoking behaviour over time, and within-time correlations between family members' smoking behaviour. Next, a full ("bidirectional") model (model 2) was estimated by adding cross-lag paths between family members' smoking behaviour to the basic model.

Model fit was evaluated by way of the: (a) root-mean square error of approximation (RMSEA), (b) comparative fit index (CFI), and (c) Tucker-Lewis index (TLI). Preferably, RMSEA values should be less than or equal to .05 and CFI and TLI values should be above .90 (Bentler & Bonett, 1980). Additionally, chi-square values, degrees of freedom, and *p*-values are reported. To compare the relative model fit between the basic model and the bidirectional model, a nested model comparison was conducted and relative model fit was judged from a scaled chi-square difference test, using adjusted chi-square values based on an algorithm for non-normal data (Satorra, 2000). Associations between smoking behaviour of family members are evaluated based on standardized path coefficients (partial correlation coefficients controlling for the effect of other variables included in the model) and *p*-values. To account for nonnormality in the data, parameters were estimated using the MLR option in Mplus. To test indirect paths between family members within a model, we used MODEL CONSTRAINT statements in Mplus.

Results

Model fit statistics

The basic model included the effects of the background variables, the stability paths between smoking behaviour over time, and the within-time correlations between family members. The model showed good fit to the data, CFI = .94, TLI = .92, and RMSEA = .05. The bidirectional model included cross-lag effects between family members in addition to the effects in the basic model. This model also showed good fit to the data, CFI = .95, TLI = .91, RMSEA = .05. Nested model comparisons are presented in Table 1. According to the significant chi-square test, the null hypothesis that the two models equally fit the data was rejected: the addition of the cross-lag paths in the bidirectional model appeared a better fit to the data than the autoregressive model, $\Delta\chi^2(48) = 74.80$, $p < .01$.

Path estimates

Background variables. In the bidirectional model, higher maternal education predicted lower levels of maternal smoking intensity (Beta = -.13, $p < .01$), smoking intensity of oldest child (Beta = -.17, $p < .001$), and smoking intensity of youngest child (Beta = -.16, $p < .001$). Smoking intensity of the oldest child was additionally predicted by gender (Beta = .10, $p < .05$, girls had higher smoking intensity than boys).

Autoregressive paths. As displayed in Figure 1, the autoregressive paths showed that smoking behaviour of all family members was highly stable over time (Beta between .60 and .91).

Cross-lag paths. All significant cross-lag paths are displayed in Figure 1. Significant cross-lag paths between family members included a partner effect M4 to F5 (i.e., smoking intensity of mothers at T4 significantly predicted smoking intensity of fathers at T5; Beta = .12, $p < .05$), a sibling effect Y4 to O5 (i.e., smoking intensity of youngest at T4 significantly predicted smoking intensity of older siblings at T5; Beta = .14, $p < .05$), a parent-child effect M3 to Y4 (i.e., smoking intensity of mothers at T3 significantly predicted smoking intensity of younger siblings at T4; Beta = .12, $p > .05$), and the child-parent effects O1 to T2 (i.e., smoking intensity of older siblings at T1 significantly predicted smoking intensity of fathers at F2; Beta = .05, $p < .05$), O2 to T2 (i.e., smoking intensity of older siblings at T2 significantly predicted smoking intensity of fathers at F2; Beta = .06, $p < .05$), and Y3 to M4 (i.e., smoking intensity of younger siblings at T3 significantly predicted smoking intensity of mothers at T4; Beta = .09, $p < .05$).

Indirect effects

In addition to direct effects between family members, we also tested for the potential indirect effects M3 to O5 (via Y4) and Y3 to F5 (via M4). No evidence was found for an effect from mother to oldest via youngest (Beta = .02, $p = .11$, 95% confidence interval = .00 - .07) or an effect from youngest to father via mother (Beta = .01, $p = .15$, 95% confidence interval = .00 - .03). Hence, the effects identified in this family analysis appear to be rather direct than indirect.

Table 1 Model fit statistics and model comparison for nested structural equation models

Model	Included parameters in model	No. of Cross-Member Paths	df	c	χ^2		CFI	TLI	RMSEA	Model Comparison	cd	$\Delta\chi^2$	Δdf	p
1	Basic model	0	294	1.30	546.29		.938	.918	.045					
2	Full model	48	246	1.29	472.17		.945	.912	.046	2 vs. 1	1.35	74.80	48	< .01

Note: c = weighting constant for computing the chi-square statistic using robust estimation method; *cd* = weighting constant for the difference between two chi-square values using robust estimation. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

Table 2 Standardized path coefficients and p-values for cross-lag paths and autoregressive paths (stability paths) of the full model

		Mother		Father		Oldest		Youngest	
		Beta	SE	Beta	SE	Beta	SE	Beta	SE
T1 → T2	Mother	.91*	.03	.07	.06	.00	.04	-.04	.05
	Father	.02	.03	.78*	.05	.05	.04	.11	.06
	Oldest	.01	.01	.05*	.02	.77*	.05	.05*	.04
	Youngest	.03	.02	.01	.03	.01	.05	-.03	.08
T2 → T3	Mother	.84*	.05	.02	.05	.04	.04	-.03	.04
	Father	.08	.05	.76*	.05	.02	.04	.02	.04
	Oldest	.03	.03	.06*	.03	.73*	.05	.07	.05
	Youngest	-.02	.03	-.01	.04	.07	.06	.70*	.05
T3 → T4	Mother	.83*	.05	.02	.04	.02	.06	.12*	.05
	Father	.04	.06	.81*	.05	-01	.04	.00	.03
	Oldest	-.06	.04	.00	.04	.68*	.06	.01	.05
	Youngest	.09*	.04	.05	.04	.04	.06	.72*	.05
T4 → T5	Mother	.91*	.04	.12*	.05	.00	.04	.03	.04
	Father	.01	.02	.78*	.05	-.04	.04	-05	.04
	Oldest	.01	.02	-.02	.04	.78*	.03	-.04	.04
	Youngest	-.05	.03	.03	.04	.14*	.06	.68*	.03

Note: * p < .05.

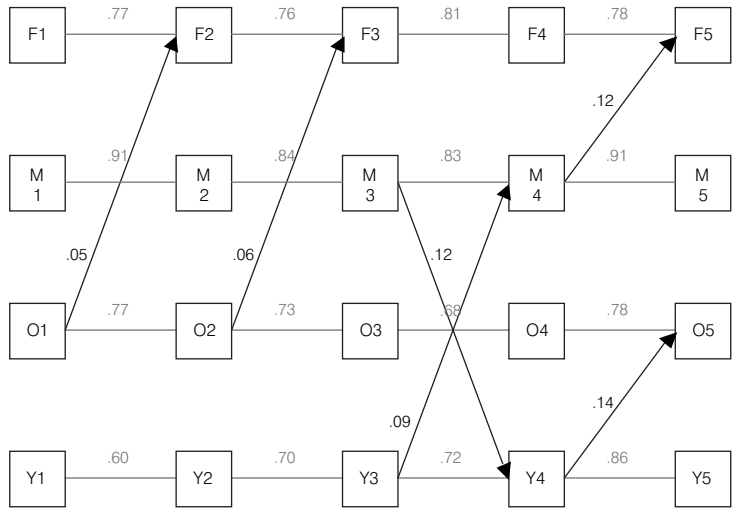

Figure 1 Standardized path coefficients for significant paths of full model

Note. Numbers denote time points of data collection. All displayed paths are controlled for demographic variables and are significant at the level of $p < .05$.
F = smoking intensity of father, M = smoking intensity of mother, O = smoking intensity of oldest child, Y = smoking intensity of youngest child.

Table 3 Cross-sectional associations (within-time correlations) between family members in the full model

		Mother	Fathers	Oldest
T1 – T1	Mother	-	-	-
	Father	.41*	-	-
	Oldest	.06	.03	-
	Youngest	.14*	.09	.35*
T2 – T2	Mother	-	-	-
	Father	.05	-	-
	Oldest	.00	-.02	-
	Youngest	.07*	-.09	.17*
T3 – T3	Mother	-	-	-
	Father	.22*	-	-
	Oldest	.12*	.06	-
	Youngest	.08	.10*	.22*
T4 – T4	Mother	-	-	-
	Father	.04	-	-
	Oldest	.05	.02	-
	Youngest	.04	-.01	.18*
T5 – T5	Mother	-	-	-
	Father	-.05	-	-
	Oldest	.07	.05	-
	Youngest	.00	.08	.17*

Note: * $p < .05$.

Discussion

The aim of the present study was to investigate longitudinal associations among family members and bidirectional associations between parents and children in smoking intensity. Associations among family members were assessed using a full-family design with five yearly waves. As expected, results demonstrate several longitudinal associations between smoking behaviour of family members as well bidirectional influences between parents and children in smoking behaviour. No evidence was found for indirect effects between family members (i.e., an effect from one family member to another family member via a third family member).

Longitudinal associations included a partner effect (i.e., smoking intensity of mothers predicted smoking intensity of fathers), a sibling effect (i.e., smoking intensity of younger adolescents predicted smoking intensity of older adolescents), a parent-child effect (smoking intensity of mothers predicted smoking intensity of younger adolescents), and several child-parent effects (smoking intensity of older

adolescents predicted smoking intensity of fathers and smoking intensity of younger adolescents predicted smoking intensity of mothers). Results consistently showed positive associations between smoking intensity of family members, indicating contagion of smoking behaviour within families across time.

The present findings are consistent with previous research. The effects of parental smoking and sibling smoking on adolescent smoking have been well established in a recent meta-analytic review (Leonardi-Bee et al., in press). Also, partners have been shown to influence each other's smoking behaviour (Etcheverry & Agnew, 2008; Manchon Walsh et al., 2007). However, the finding that parents are susceptible to the smoking behaviour of their adolescent children is novel. While past research has established that adult smoking behaviour is affected by the smoking behaviour of household members (Boyle, Solberg, Asche, Maciosek, Boucher, & Pronk, 2007; Chandola, Head, & Bartley, 2004; Sienkiewicz-Jarosz, Zatorski, Baranowska, Rygglewicz, & Bienkowski, 2009), the specific role of child smoking is seldom considered. Moreover, most studies have emphasized the effects of household smoking on relapse to smoking after abstinence, while the effects of household smoking on individual smoking behaviour are rarely evaluated.

The present study indicates that familial influences in smoking extend beyond the well-acknowledged effects of parental smoking and sibling smoking on adolescent smoking. Interestingly, parents seem similarly susceptible to the influences of their partners and children. Previous research supports the idea that children influence their parents. For example, Huver and colleagues (2007) used a longitudinal cross-lagged model to evaluate bidirectional associations between anti-smoking parenting practices, anti-smoking house rules, and adolescent smoking behaviour across three subsequent years. They showed that anti-smoking house rules decreased as a result of adolescent smoking behaviour, while communication about smoking increased. The decrease in anti-smoking house rules was particularly pronounced for smoking parents. Also, many parents are motivated to quit smoking, to reduce smoking, and to reduce second-hand smoke exposure in the household for the sake of their children (Borland, Yong, Cummings, Hyland, Anderson, & Fong, 2006; Gilpin, White, Farkas, & Pears, 1999; Okah, Choi, Okuyemi, & Ahluwalia, 2002). Possibly, this motivation may decrease in parents when children initiate smoking themselves, and even when parents quit smoking, chance to relapse is more may be more likely, resulting in the maintenance of parental smoking.

As mentioned earlier, heritability of genetic variations associated with smoking behaviour may partly explain behavioural similarities between family members. Particularly, the development of more established smoking patterns during adolescence in children with smoking parents and siblings may be attributable to shared genetic factors. Heritable genetic variability has been shown to be associated with smoking initiation and smoking progression in adolescence (Laucht et al., 2008). In addition to genetic factors, which explain approximately 50% of the variance in individual smoking behaviour (Vandenbergh et al., 2007), other mechanisms underlying the link between familial smoking and individual smoking need to be considered. Automatic or unconscious imitation of behaviour provides one explanation. Indeed, experimental research has shown that the presence of a smoking model, and a higher number of cigarettes smoked by the model, increases individual smoking behaviour (Harakeh et al., 2007; Kniskern et al., 1983). While automatic or unconscious imitation may constitute

a direct effect, more indirect effects may also be relevant in explaining family smoking behaviour. For example, cue-exposure and cue-reactivity seem plausible mechanisms in explaining individual susceptibility to familial influences. Environmental smoking leads to increased exposure to smoking-related cues (e.g., sight or smell of cigarettes). In smokers, mere exposure to smoking-related cues has been shown to be associated with robust increases in autonomic physiological arousal responses as well as craving and urges to smoke which, in turn, are associated with smoking behaviour (Carter & Tiffany, 1999; Miranda, Rohsenow, Monti, Tidey, Ray, 2008; Tong, Bovbjerk, & Erblich, 2007). Additionally, familial smoking behaviour may also affect intra- as well as interpersonal processes within families (i.e., normative perceptions, parenting, smoking house rules, parental motivation to quit or reduce smoking, chance of relapse following smoking cessation).

The present study did not distinguish between effects of family member smoking in smokers versus non-smokers. Determinants of smoking initiation and smoking intensity differ, therefore effects of familial smoking may vary across smoking and non-smoking adolescents. While previous research indicates that both the risk of smoking initiation in adolescence (Leonardi-Bee et al., in press) and the amount smoked by adolescents (Harakeh et al., 2007) are predicted by environmental smoking, mechanisms associated with familial smoking are likely to differ among smoking and non-smoking adolescents. For example, familial smoking may be associated with an increased experience of cue-reactivity and cue-induced craving in smoking adolescents, however this mechanism seems unlikely in non-smoking adolescents. In non-smoking adolescents, other mechanisms may explain an increased susceptibility to smoking. For example, non-smoking children of smoking parents have been found to display biased reactions (e.g., attentional biases) in response to smoking-related cues (Forestell, Dickter, Wright, & Young, 2011; Lochbühler, Otten, Voogd, & Engels, 2011), which may in turn predispose children for smoking. Future research needs to determine whether effects of familial smoking differ across subgroups (e.g., non-smoking and smoking adolescents or moderate and highly-dependent smokers) and whether mechanisms of action may differ accordingly.

In the present study, there seems to be a certain degree of specificity to the observed associations between smoking behaviour of family members. For example, longitudinal associations between smoking behaviour of family members were not generally found at each yearly assessment, but were observed rather sporadically across the five-year study period. Two different types of explanation may account for this. First, from a statistical viewpoint, the present study is underpowered to comprehensively detect all nonzero effects (for more detailed information on statistical power in structural equation modeling, see Bentler & Chou, 1997; Tanaka, 1987). Therefore, the present study may have failed to comprehensively detect associations between family members. Related, the reported associations are controlled for the effects of all other variables in the model, representing solely the unique variance after statistical redundancy between variables has been removed. From a theoretically viewpoint, variability in smoking behaviour may have contributed to the variability in findings, particularly in adolescents. As adolescents were rather young and still considered to be in the process of smoking acquisition, their smoking behaviour may be quite variable over time. Self-reported smoking behaviour may only provide a momentary impression

of adolescents' smoking behaviour, possibly explaining the variability in associations with adolescent smoking behaviour. Finally, the inclusion of non-smokers makes the analysis rather conservative. The inclusion of non-smoking families is likely to attenuate cross-lag effects, as there is no change in smoking behaviour in families consisting of non-smokers across time. It should be noted that, in the present study, there is insufficient evidence to conclude that longitudinal associations between family members are generally bidirectional. For example, in the present study, only unidirectional longitudinal associations were found between between siblings and between partners. Future research needs to determine whether bidirectional associations between family members constitute structural rather than incidental findings and whether associations between smoking behaviour of family members differ across particular subgroups (e.g., families with versus without smoking restrictions at home).

Several limitations of the present study should be acknowledged. First, the observed cross-lagged effects from children to parents were rather small. However, given the relatively small sample size and the large size of the model that was estimated, even small effects are noteworthy. Moreover, results of the present study demonstrated that the smoking behaviour of all family members was highly stable across time, specifically for parents (i.e., the standardized autoregressive path coefficients were very high). Particularly when a criterion variable is 'difficult-to-influence', small effects are considered important (Prentice & Miller, 1992). A second limitation pertains to the measurement of smoking behaviour in the present study. Smoking behaviour of family members was self-reported and might thereby be subject to reporting biases or social desirability. However, past research has shown that self-report of smoking behaviour is rather accurate when confidentiality is assured and that self-reported smoking is comparable to biological assessments of smoking (Dolcini, Adler, & Ginsberg, 1996). Finally, generalizability of the findings may be limited due to specific sample characteristics. In the present sample, education of parents was relatively high and, therefore, the study sample may not be representative of the general population. Also, attrition analysis indicated an underrepresentation of lower educated families as well as families with smoking mothers. Therefore, a certain caution in generalizing the findings to the general population is warranted.

Implications of findings encompass greater emphasis on the effects of familial smoking, and child smoking in particular, in smoking cessation interventions and tobacco control efforts. Family systems constitute a powerful social context in which contagion of smoking behaviour takes place. When household smoking levels are high, prevention and interventions in tobacco control may be more effective when taking a dynamic system perspective in addition to an individual perspective into account. For example, interventions may inform smokers about the effects of household smoking, encourage the implementation of household smoking bans, and provide suggestions to improve support between family members.

In summary, the present study contributes to the current literature on familial influences in smoking by demonstrating contagion of smoking behaviour within families across time. Of particular interest is the finding that associations between smoking behaviour of parents and children are bidirectional. Adolescents as well as their parents seem similarly susceptible to adjust their smoking behaviour in response to familial smoking.

Part 2

A smoking cessation intervention for parents: Results of a randomized controlled trial

Chapter 6

Effectiveness of proactive telephone counselling for smoking cessation in parents: Study protocol of a randomized controlled trial

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Abstract

Background: Smoking is the world's fourth most common risk factor for disease, the leading preventable cause of death, and it is associated with tremendous social costs. In the Netherlands, the smoking prevalence rate is high. A total of 27.7% of the population over age 15 years smokes. In addition to the direct advantages of smoking cessation for the smoker, parents who quit smoking may also decrease their children's risk of smoking initiation. Methods/Design: A randomized controlled trial will be conducted to evaluate the effectiveness of proactive telephone counselling to increase smoking cessation rates among smoking parents. A total of 512 smoking parents will be proactively recruited through their children's primary schools and randomly assigned to either proactive telephone counselling or a control condition. Proactive telephone counselling will consist of up to seven counsellor-initiated telephone calls (based on cognitive-behavioural skill building and Motivational Interviewing), distributed over a period of three months. Three supplementary brochures will also be provided. In the control condition, parents will receive a standard brochure to aid smoking cessation. Assessments will take place at baseline, three months after start of the intervention (post-measurement), and twelve months after start of the intervention (follow-up measurement). Primary outcome measures will include sustained abstinence between post-measurement and follow-up measurement and 7-day point prevalence abstinence and 24-hours point prevalence abstinence at both post- and follow-up measurement. Several secondary outcome measures will also be included (e.g., smoking intensity, smoking policies at home). In addition, we will evaluate smoking-related cognitions (e.g., attitudes towards smoking, social norms, self-efficacy, intention to smoke) in 9-12 year old children of smoking parents. Discussion: This study protocol describes the design of a randomized controlled trial to evaluate the effectiveness of proactive telephone counselling in smoking cessation. It is expected that, in the telephone counselling condition, parental smoking cessation rates will be higher and children's cognitions will be less favorable about smoking compared to the control condition. Trial registration: The protocol for this study is registered with the Netherlands Trial Register NTR2707.

Introduction

Cigarette smoking continues to be a serious problem with detrimental health consequences for the individual and tremendous costs for society (WHO, 2008). In the Netherlands, the smoking prevalence rate is high, with 27.7% of the population above 15 years smoking (Stivoro, 2009). A substantial part of Dutch adult smokers intend to quit smoking in the future (Stivoro, 2009). Unfortunately, most quit attempts fail, and approximately three-quarters of unaided quitters resume smoking within three months (Powell, Dawkins, West, Powell, & Pickering, 2010).

Several intervention programs have been shown effective in increasing the chance of successful smoking cessation. However, only a minority of smokers makes use of such programs (Hughes, Marcy, & Nauds, 2009; Swartz Woods & Haskins, 2007). A possible explanation for this low rate may be that most programs rely on the smoker to take the initiative (Friend & Levy, 2001). Proactive recruitment approaches to smoking cessation are scarce, even though such approaches may greatly enhance use of cessation support and, in turn, successful smoking cessation.

In the present study, smoking parents will be proactively recruited through their children's primary schools to participate in a randomized controlled trial evaluating the effectiveness of telephone counselling to aid smoking cessation. Telephone counselling has previously been shown to be effective in increasing smoking cessation rates in a meta-analytic review (Stead, Perera, & Lancaster, 2006). A recent Australian study utilized a proactive recruitment approach to increase smokers' use of telephone cessation support. In this study, 52% of identified smokers from a randomly called sample of 48,014 households agreed to participate in a randomized controlled trial to evaluate the effectiveness of telephone counselling in smoking cessation. Participants receiving telephone counselling were significantly more likely to report 7-day point prevalence abstinence at the 4-month (13.8% versus 9.6%) and 7-month assessment (14.3% versus 11%) compared to participants in the control condition (Tzelepis et al., 2011). As demonstrated in this study, proactive recruitment into telephone counselling seems an efficient way to increase use of cessation support and to enhance rates of smoking cessation in the general population.

In addition to the direct health benefits for smokers, smoking cessation of parents may have incremental effects for their children. Smoking behaviour of parents is an important risk factor for smoking initiation and smoking behaviour of children. A recent meta-analysis concluded that smoking behaviour of one parent significantly increases the child's risk to initiate smoking, and smoking behaviour of both parents adds to this risk (Leonardi-Bee, Jere, & Britton, in press). As nicotine is severely addictive, experimentation with and uptake of smoking is hazardous behaviour. Prevention of children's exposure to factors that increase their risk of smoking initiation constitutes a significant task in tobacco control.

The effects of parental smoking on child smoking are likely to be mediated by children's smoking-related cognitions (e.g., attitudes towards smoking, normative beliefs about smoking, risk and benefit perceptions, tobacco refusal self-efficacy, intention to smoke). Previous research has shown that children of smoking parents are more likely to have more tolerant and positive attitudes towards smoking (Brook, Mendelberg, Galili, Priel, & Bujanover, 1999; Porcellato, Dugdill, Springett, & Sanderson,

1999), more normative perceptions of smoking (Otten, Engels, & Prinstein, 2009), and a stronger intention to smoke (Porcellato et al., 1999). Smoking-related cognitions, in turn, have been established as prospective predictors of smoking initiation in adolescents (Carvajal, Wiatrek, Evans, Knee, & Nash, 2000; Song et al., 2009).

Parental smoking cessation, however, has been shown to constitute an efficient way to decrease children's risk of smoking initiation (Bricker et al., 2006). The shorter the exposure to family models who smoke, the less likely it is that children will initiate smoking themselves (Gilman et al., 2009). The effect of parental smoking cessation has been shown to be mediated by their children's cognitions. In a recent study, 49% of the prospective relationship between parental smoking cessation and smoking behaviour of children was significantly mediated by negative attitudes toward smoking and tobacco refusal self-efficacy (Wyszynski, Bricker, & Comstock, 2011). Presumably, telephone counselling to aid parental smoking cessation may have measureable effects in children of smoking parents as well.

The primary aim of this study is to conduct a 2-arm randomized controlled trial to evaluate the effectiveness of proactive telephone counselling in increasing cessation rates among smoking parents. In addition, we will evaluate differences in smoking-related cognitions among children of parents in the telephone counselling and in the control condition. Three assessments among parents and children will take place (baseline, three months after start of the intervention, and twelve months after start of the intervention). Primarily, we expect higher smoking cessation rates among parents in the telephone counselling condition than in the control condition. Also, we expect children of parents in the telephone counselling condition to have more negative attitudes towards smoking, less normative perceptions of smoking, higher self-effectiveness to refrain from smoking, and a lower intention to start smoking than will children of parents in the control condition.

Methods

Study Design

The present study is a 2-arm (telephone counselling versus control condition) randomized controlled trial with three assessments during a period of approximately one year. Participants will be 512 smoking parents and their 9-12 year old children. After giving informed consent and after completing the baseline assessment, 256 parents will be randomly assigned to the telephone counselling condition and 256 parents to the control condition. In the telephone counselling condition, parents will receive up to seven counsellor-initiated telephone calls and three supplementary brochures over a period of approximately three months. In the control condition, parents will receive a standard brochure on smoking cessation. Parent and child assessments will be identical across conditions and take place at baseline, three months after start of the intervention (post-measurement), and twelve months after start of the intervention (follow-up measurement). In both conditions, each parent-child couple will receive an incentive of 100 euro for their participation in all assessments.

Participants

Recruitment. Smoking parents will be recruited through their children's primary schools. Primary school boards will be asked to distribute study invitation letters to all children aged 9-12 years and request that children give these letters to their parents. Study invitation letters include information about the study (e.g., purpose of study, length of the study, frequency of assessments, eligibility criteria). Parents will be able to register for the study by returning a form with their contact information in an enclosed envelope. Registration will also be possible via the study website, via e-mail, or via telephone.

Eligibility Criteria. Eligibility criteria are stated clearly in the study invitation letter. Inclusion criteria for the present study are: 1) being at least a weekly smoker, 2) being a parent/caretaker of a child in (Dutch) grade 6-8 (9-12 years old), 3) having the intention to quit smoking (currently or in the near future), and 4) giving informed consent. Upon registration, written informed consent of parents will be obtained. The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen approved the study's protocol.

Randomization. Assignment to a group will be performed by a member of the research group who is not involved in the present study. Participants will be stratified by gender, educational level, and smoking intensity (as reported by participants in the baseline questionnaire). If partners who live in the same household participate in the study, randomization will be carried out at household level to avoid contamination between conditions.

Sample size calculation

Based on similar studies, we expected a 6% difference in 7-day point prevalence abstinence rates between the telephone counselling condition and the control condition at 12-months assessment (13% versus 7%, respectively). A statistical power of .80 was targeted. Hypotheses will be tested at a two-sided significance level of .05. The calculated sample size was corrected for participants who will be lost to attrition. Additionally, the sample size was corrected to allow for supplementary analyses of mediation and moderation.

Study intervention

Theoretical basis of the intervention. Telephone counselling will be based on Motivational Interviewing (MI) and cognitive behavioural skill building. MI is considered a client-centered, directive method to enhance intrinsic motivation for behavioural change by exploring and resolving ambivalence (Miller & Rollnick, 2002). MI's primary goal is to trigger a decision and enhance commitment to this decision, for example by eliciting and selectively reinforcing change talk. MI's empathic, non-confrontational style may be particularly helpful in addressing smokers' ambivalence and defensiveness and in providing a safe counselling environment for smoking parents. When parents express a desire to quit smoking, telephone counselling will shift to cognitive-behavioural skill building. Smokers will be encouraged to create a supportive environment for quitting (e.g., arrange for smoking substitutes, avoid exposure to smoking cues). The overall approach to skill building is a problem-solving one. Smokers are encouraged to identify key barriers to quitting and to remaining quit (e.g., stress, urges and cravings,

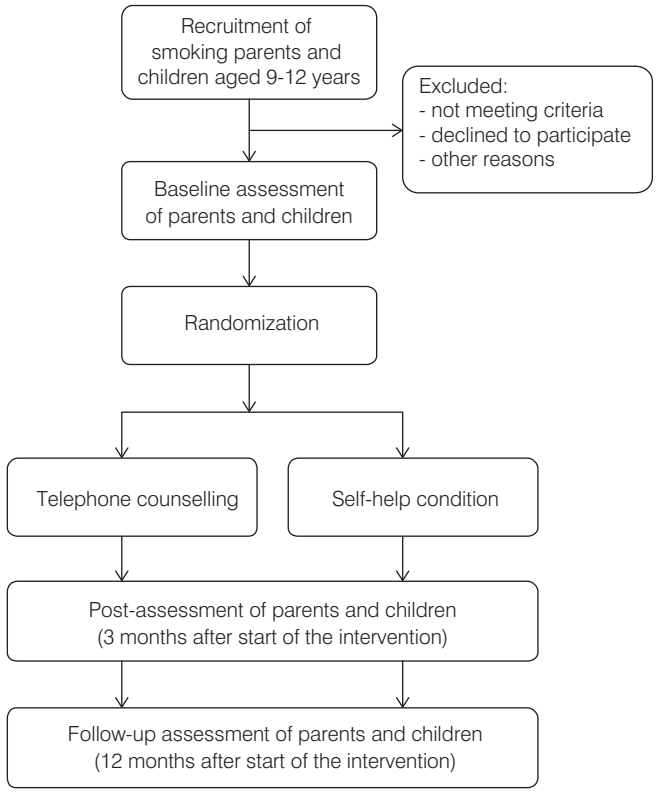

Figure 1 Study design

exposure to smoking cues, dysfunctional cognitions), to identify practical solutions, and to implement and evaluate these solutions. Cognitive-behavioural skill building will also incorporate relapse prevention strategies (e.g., anticipation of difficult situations/ lapse to smoking). During telephone counselling, motivation to quit and self-efficacy to quit will be continuously monitored by counsellors. Counsellors will alternate MI and cognitive-behavioural skill building according to the participant's current need for motivation enhancement or skill enhancement.

Telephone counselling condition. In the telephone counselling condition, parents receive proactive telephone counselling based on MI and cognitive-behavioural skill building. Each participant receives up to seven counsellor-initiated phone calls across a period of approximately three months, respectively one 30-minute intake session and up to six additional 10-minute sessions. Telephone counselling will be conducted by professionals of STIVORO (Dutch expert centre for tobacco control). All counsellors are trained and experienced in the delivery of telephone counselling to

support smoking cessation. Two different call schedules will be applied to participants who are willing to set a quit date and participants who are not willing to set a quit date.

Participants who are willing to set a quit date. Participants who are willing to set a quit date are offered 1-2 preparatory phone calls before undertaking a quit attempt. During the first phone call, participants are encouraged to set a quit date within 10-12 days. In the following, participants are offered up to six phone calls to support maintenance of smoking cessation. The phone calls focus on the following topics: reasons for smoking and reasons for quitting, nicotine dependence and nicotine withdrawal, craving, coping with difficult situations, weight gain and irritability, and relapse prevention. The first phone call (intake call) will take place approximately 10-12 days before the quit date; the second phone call will take place approximately three days after quit date; the third phone call approximately seven days after quit date; the fourth phone call approximately two weeks after quit date; the fifth phone call approximately four weeks after quit date; the sixth phone call approximately eight weeks after quit date; and the seventh phone call approximately twelve weeks after quit date.

Participants who are not willing to set a quit a date. Participants who are not willing to set a quit date will receive three phone calls. These phone calls are intended to increase the participant's motivation for smoking cessation by use of Motivational Interviewing. During these calls, counsellors aim to explore the participant's reasons for smoking and for quitting, to resolve ambivalence, and to enhance the participant's intrinsic motivation for behavioural change. Participants will receive the second phone call approximately three weeks after the first phone call (intake call). Approximately four weeks later the third phone will be made.

Supplementary brochures. All participants in the telephone counselling condition will receive three supplementary brochures on smoking cessation. All brochures are 4-page, colour-printed, A4-sized booklets which are designed specifically for the present study. The brochures have the following themes: 1) Deciding and preparing, 2) Undertaking a quit attempt, 3) Maintenance of smoking cessation. Each brochure includes additional information about smoking and smoking cessation, tips and exercises, and motivation or self-efficacy enhancing messages. Additionally, each brochure contains information which is relevant to parents (e.g., information about effects of second-hand smoke exposure for children). Participants will receive the first brochure immediately after start of the telephone counselling, the second brochure approximately 2-3 weeks after start of the telephone counselling, and the last brochure approximately 5-6 weeks after start of the telephone counselling.

Control condition. Participants in the control condition will receive a standard brochure (by STIVORO) on smoking cessation (Stoppen met roken: Willen en kunnen [Quitting smoking: Wanting to quit and being able to quit]). The brochure is a 40-page, colour-printed booklet (size: 12 x 16 centimeters). The brochure will be sent to participants randomized to the control condition within two weeks after baseline assessment. The brochure is divided into 5 parts: information about smoking and smoking cessation, reasons for quitting, tips and exercises, and maintenance of smoking cessation. At the end of the study, telephone counselling will be offered to all participants in the control condition.

Data collection

An overview of the study design is presented in Figure 1. The baseline measurement will take place between January and July 2011. It is expected that the majority of the questionnaires will be administered digitally (the rest will be administered via mail). The post-measurement will take place approximately three months after start of the intervention. The follow-up assessment follows approximately twelve months after start of the intervention. At all three assessments, questionnaires will be filled in by both the parent and the child. Procedures will be identical across assessments.

Outcomes

In the proposed study, telephone counselling aims to increase cessation rates among smoking parents. The primary outcome measures will be: 1) sustained abstinence between post-measurement and follow-up measurement, 2) 7-day point prevalence abstinence at post-measurement (three months post-intervention) and follow-up measurement (twelve months post-intervention), and 3) 24-hours point prevalence abstinence at post-measurement and follow-up measurement. Additionally, biochemical validation of self-reported smoking cessation will be reported for a random sample (30%) of all study participants who report 7-day point prevalence at follow-up assessment, thereby allowing to estimate the occurrence of over-reporting of abstinence. Secondary outcome measures will include: a 50% reduction in the number of cigarettes smoked per day, occurrence of abstinence of at least 24 hours at some point during the study, implementation of smoking restrictions at home, increase in motivation to quit, use of and adherence to nicotine replacement therapy, number and duration of quit attempts, and change in smoking-related cognitions (e.g., attitudes towards smoking, self-efficacy, social norms). In addition, secondary outcomes will include smoking-related cognitions of children (e.g., attitudes towards smoking, self-efficacy, social norms, intention to smoke) and smoking behaviour of children.

Statistical analyses

Analyses will be conducted to check whether the randomization has resulted in an equal baseline distribution of relevant participant characteristics across both conditions. In case of group differences at baseline, confounding variables will be included in subsequent analyses. To evaluate smoking cessation rates across groups, we will use logistic regression models. Effect sizes as well as confidence intervals will be reported. To evaluate smoking-related cognitions across groups (in both parents and children), analyses-of-variance and regression analyses will be used. Mediation and moderation will be tested in Mplus. In accordance with the intent-to-treat principle, all participants randomized to a condition will be included in analyses testing of the study hypotheses. In addition, a complete-case analysis will also be conducted, that is, only participants with outcome data on all assessments will be included in the analysis.

Discussion

The present study protocol presents the design of a randomized controlled trial evaluating the effectiveness of proactive telephone counselling in smoking parents. The purpose of telephone counselling is to increase smoking cessation rates among parents. We hypothesize that cessation rates will be higher in the telephone counselling condition compared to the control condition, both at three-months post-measurement as well as twelve-months follow-up measurement. Additionally, we hypothesize that children of parents receiving telephone counselling will have more negative attitudes towards smoking, perceive stronger social norms against smoking, have higher self-efficacy to refrain from smoking, and have a lower intention to start smoking than will children of parents in the control condition.

Strengths of the study include a 12-month follow-up assessment, which meets smoking cessation research recommendations (Hughes, Keely, Niaura, Ossip-Klein, Richmond, & Swan, 2003). A limitation of the study is that smoking cessation will be assessed by self-report. However, the present study counteracts reporting biases by informing participants that a random sample of participants will be asked for biochemical validation of self-reported smoking cessation. Biochemical validation of self-reported smoking cessation will be reported for a subsample (30%) of all study participants who report 7-day point prevalence at follow-up assessment, thereby allowing to correct for over-reporting of abstinence. Another potential limitation is that the impact of the intervention on children's cognitions about smoking may be limited by the degree to which their parents quit smoking.

Results of the present study can be of help in adapting telephone counselling and in tailoring telephone counselling to the needs of particular subgroups. If the intervention is found effective, it can be advertised through schools to reach the population of smoking parents. If children are found to benefit from this intervention, proactive recruitment of smoking parents into telephone counselling may be incorporated in national prevention campaigns, such as the "Healthy School and Drugs" program (Malmberg et al., 2010), which has already been implemented in numerous schools, institutions, and treatment facilities.

The proposed study will evaluate the effectiveness of proactive telephone counselling to aid smoking cessation among smoking parents. Additionally, it will evaluate whether children of smoking parents receiving telephone counselling have less favorable cognitions about smoking than do children of parents in the control condition. The results of this study will provide insight into parent characteristics and intervention characteristics associated with successful smoking cessation. In addition, the proposed study will provide insight into the intergenerational transmission of smoking-related cognitions as well as the associates and antecedents of favorable smoking-related cognitions in preadolescents.

Chapter 7

School-based promotion of cessation support: Reach of proactive mailings and acceptability of treatment in smoking parents recruited into cessation support through primary schools

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Abstract

Background: Several forms of cessation support have been shown effective in increasing the chance of successful smoking cessation, but cessation support is still underutilized among smokers. Proactive outreach to target audiences may increase use of cessation support. Methods: The present study evaluated the efficiency of using study invitation letters distributed through primary schools in recruiting smoking parents into cessation support (quitline support or a self-help brochure). Use and evaluation of cessation support among smoking parents were examined. Results: Findings indicate that recruitment of smokers into cessation support remains challenging. Once recruited, cessation support was well received by smoking parents. Of smokers allocated to quitline support, 88% accepted at least one counselling call. The average number of calls taken was high (5.7 out of 7 calls). Of smokers allocated to receive self-help material, 84% read at least some parts of the brochure. Of the intention-to-treat population, 81% and 69% were satisfied with quitline support or self-help material, respectively. Smoking parents were significantly more positive about quitline support compared to self-help material ($p<.001$). Conclusions: Cessation support is well-received and well-used among smoking parents recruited through primary schools. Future studies need to examine factors that influence the response to offers of cessation support in samples of nonvolunteer smokers. Trial registration: The protocol for this study is registered with the Netherlands Trial Register NTR2707.

Introduction

Cigarette smoking constitutes a serious burden to health and economy (WHO, 2008). Connecting smokers to effective cessation services is a public health priority. The majority of smokers intend to quit smoking and a substantial proportion of smokers make repeated quit attempts (Shiffman et al., 2008). When attempting to quit, relapse is the most probable outcome. Approximately, three-quarters of unaided quitters resume smoking within three months (Powell, Dawkins, West, & Pickering, 2010). In a meta-analytic review of unaided smoking cessation, it was concluded that only 7% of unaided quit attempts last longer than 10 months (Baillie, Mattick, & Hall, 1995). Several forms of cessation support have been shown effective in increasing the chance of successful smoking cessation (Lancaster, Stead, Silagy, & Sowden, 2000). However, only a minority of smokers make use of such programs. In the United States, 37% of smokers who have tried to quit smoking report that they had ever read written material on smoking cessation, 12% had called a quitline, and 9% had attended individual counselling (Hughes, Marcy, & Naud, 2009). Similar rates on the use of cessation treatments are reported by Shiffman and colleagues (Shiffman, Brockwell, Pillitteri, & Gitchell, 2008). In the Netherlands, one third of quitters report that they received assistance in quitting and less than 1% of smokers contact the national quitline (Willemsen, van de Meer, & Bot, 2008).

Smoking parents represent an important subpopulation among adult smokers. Forty percent of smokers live with a child younger than 18 years old (Hitchman, Fong, Zanna, Hyland, & Bansal-Travers, 2011). Twenty percent of parents are self-reported smokers (Winickoff et al., 2006). Parental smoking is detrimental, not only to the parent, but also the child. A recent meta-analysis concluded that the risk of smoking uptake in adolescence is nearly threefold when both parents smoke (Leonardi-Bee, Jere, & Britton, 2011). Moreover, smoking parents frequently expose their children to second-hand smoke (Alwan, Siddiqi, Thomson, & Cameron, 2010; Evans, Sims, Judge, & Gilmore, 2012), which is associated with a variety of adverse health outcomes including childhood asthma, respiratory infections, and decreased lung growth in children (Pitsavos et al., 2002; Sturm, Yeatts, & Loomis, 2004). Smoking parents may be particularly motivated to quit smoking. Smoker's primary reasons for wanting to quit are concerns about the health consequences of their smoking (McCaul et al., 2006). Nearly two-thirds of adult smokers express concern for modelling smoking to children (Hitchman et al., 2011). In a telephone survey, 64% of parent smokers indicated that they would accept telephone cessation support if recommended (Winickoff et al., 2006). Also, parents of children with smoking-related illnesses display a particularly high motivation to quit (Halterman, Borrelli, Conn, Tremblay, & Blaakman, 2010; Winickoff, Hillis, Palfrey, Perrin, & Rigotti, 2003). Connecting smoking parents to cessation support may yield important health benefits for both parents and children. Parents who quit smoking will not only improve their own health, but will also reduce the risk of physical illness (Halterman et al., 2004), smoking initiation (Otten, Engels, van de Ven, & Bricker, 2007), and regular smoking (Bricker et al., 2003) in their children.

Proactive outreach may increase use of cessation support. Proactive outreach is the systematic targeting of all individuals in a defined population of smokers and the attempt to engage smokers with varying levels of motivation. Up to this point, efforts to

engage smoking parents have almost exclusively focused on clinical settings (Roseby et al., 2003; Winickoff et al., 2010; Winickoff et al., 2003). While these efforts are valuable, proactive outreach of health care practices and hospitals may not extend to the general population of smoking parents. Public schools are a highly promising but understudied venue for reaching parents who smoke. Promoting cessation support through schools has the potential to reach a major proportion of smoking parents, thus yielding high potential public health impact. Also, schools are likely to constitute a 'teachable setting', that is, smokers may be more likely to make use of cessation support when reminded of their role as parents. To date, no study has evaluated the use of primary schools as a venue to promote smoking cessation among parents.

Previous studies have used varying approaches to increase smoker's exposure to cessation support (e.g., direct mailings, health care provider outreach, telephone recruitment, or media advertisements). Offering cessation support through mailings has been shown to yield response rates between 2-11% in smokers identified from general practice and health care provider records (Gilbert, Nazareth, & Sutton, 2007; Gilbert et al., 2012; McClure et al., 2006; McDonald, 1999). Recruitment rates tend to be higher for interpersonal recruitment, with recruitment rates ranging between 44-65% (Boyle et al., 2007; Peterson et al., 2009; Tzelepis et al., 2009). While interpersonal recruitment (e.g., telephone recruitment) may constitute an efficient way to recruit smokers into clinical trials, this approach may be less feasible for implementation into the health care system, where few resources for recruitment are available. Though response rates vary considerably between studies and recruitment approaches, previous studies indicate that proactive outreach has considerable potential to connect smokers to cessation support.

Several forms of cessation support have demonstrated efficacy in increasing the chance of successful smoking cessation (Lancaster et al., 2000). Telephone counselling, or quitline support, has been shown effective in increasing smoking cessation rates in a meta-analytic review (Stead, Perera, & Lancaster, 2006). Data from the European Smoking Cessation Helplines Evaluation study (ESCHER), which assesses cessation rates after quitline use in several European countries, showed point prevalent abstinence rates between 12% and 28% and prolonged abstinence rates between 4% and 15% at one-year follow-up (Willemsen, van de Meer, & Bot, 2008). Self-help materials (i.e., didactic materials giving information and advice on how to quit smoking) have also demonstrated efficacy in a meta-analytic review, which concluded that non-tailored self-help materials have a small benefit compared to no intervention (Lancaster & Stead, 2005). Therefore, self-help materials constitute a cost-effective method to support otherwise unaided quit attempts, which can be disseminated easily and has the potential to help a large proportion of smokers.

The aim of the present study was two-fold: First, we sought to evaluate the reach of mailings distributed through primary schools in recruiting smoking parents into cessation support (i.e., school-based promotion of cessation support using mailings). Second, among smoking parents recruited into cessation support through primary schools, we compared use and acceptability of two cessation treatments with high potential public health impact: telephone counselling versus self-help material.

Methods

Participants

Smoking parents were recruited through primary schools across several municipalities in the Netherlands. Primary schools were contacted by research assistants and were asked to distribute study invitation letters to parents. To increase the participation rate of schools, demands on schools were kept to a minimum (i.e., schools were asked to give the study invitation letters to the children and children were requested to give the letters to their parents). A total of 890 primary schools were contacted and 438 schools (49.2%) agreed to participate. In total, approximately 35,000 study invitation letters were mailed to schools. For the present study, schools were asked to give the letters only to children aged 9-12 years (Dutch grade 6-8; US grade 4-6). Study invitation letters included information about the study and eligibility criteria. Parents registered for the study by returning a form with their contact information in an enclosed envelope. Registration was also possible via e-mail, via telephone, or via the study website. Inclusion criteria were: 1) being at least a weekly smoker, 2) being a parent/caretaker of a child between 9-12 years old, 3) having the intention to quit smoking (currently or in the future), and 4) giving informed consent for participation of parent-child dyad. A total of 622 parents registered for the present study. A total of 512 parents were enrolled in the present study (returned informed consent form and baseline questionnaire).

Procedure

An overview of the study design is presented in Figure 1. The baseline measurement took place between January and July 2011. Parents and children were asked to individually fill out a questionnaire (via a website or on paper). For the present study, only the parent data were used. More detailed information regarding the use of the child data can be found in the study protocol (Schuck, Otten, Kleinjan, Bricker, & Engels, 2011). After the baseline assessment, parents were randomly assigned to either the telephone counselling condition (n=256) or the self-help brochure condition (n=256). A computer program was used to generate a randomization schedule. Allocation of participants to trial conditions was done by a member of the research group who was not involved in the present study. Participants were stratified by gender, educational level, and smoking intensity. Within 2 weeks after baseline assessment, parents were either called to schedule the first counselling call or they received the self-help brochure. The post-measurement took place approximately three months after start of the intervention (i.e., receiving the intake call or the self-help brochure). Further details on the study methodology can be found in the study protocol (Schuck et al., 2011). Parent-child couples received an incentive of 100 euro (approximately 127 US dollars) for their participation in all assessments. The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen approved of the study.

Conditions

Proactive telephone counselling. Participants in the telephone counselling condition received up to seven counsellor-initiated phone calls (i.e., one 30-minute intake call and up to six additional 10-minute calls) across a period of approximately three months. Telephone counselling was based on Motivational Interviewing (Miller &

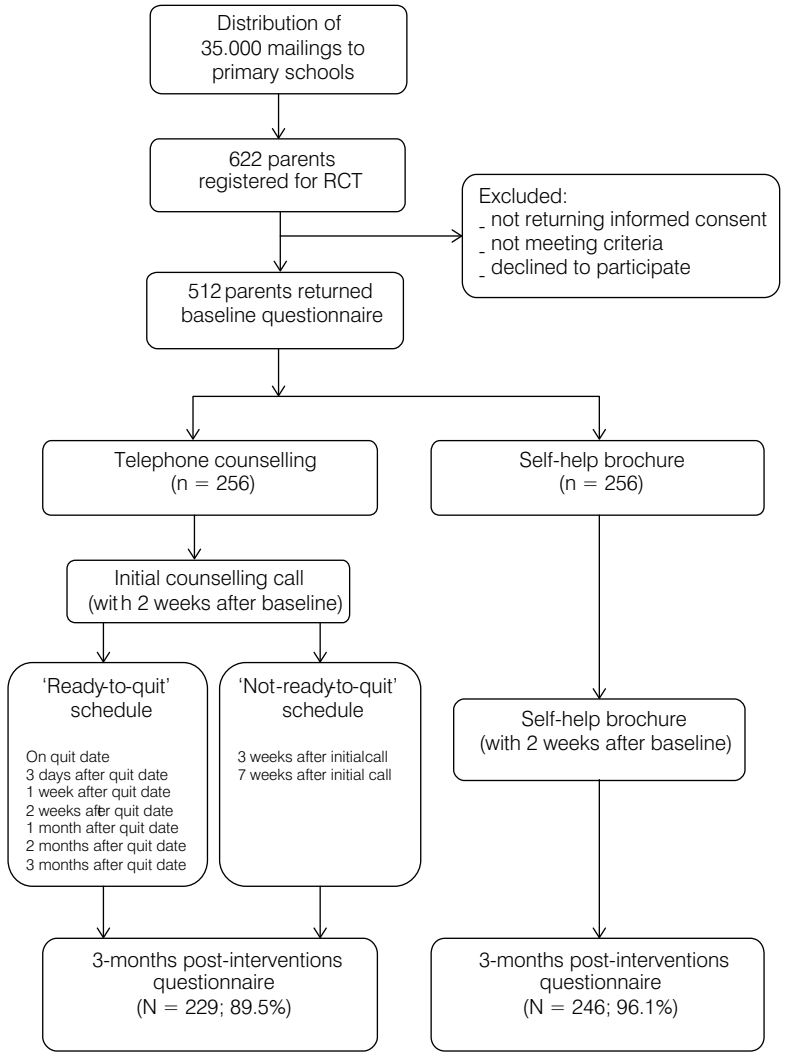

Figure 1 Flowchart

Rollnick, 2002) and cognitive-behavioural skill building. Counselling calls were conducted by counsellors of STIVORO, the non-profit Netherlands national quitline. All counsellors were trained and experienced in the delivery of telephone counselling.
During the intake call, the participants were asked if they wanted to set a quit date. Participants who wanted to set a quit date were encouraged to set a quit date within 10-12 days following the intake call. Subsequently, up to six additional phone calls were

offered to support the initiation and maintenance of abstinence (Figure 1). Emphasis was put on psycho-education, intrinsic motivation for behavioural change, behavioural support, and relapse prevention. Participants who were not willing to set a quit a date were offered up to two additional phone calls (Figure 1). Emphasis was put on exploring ambivalence and increasing the participant's intrinsic motivation to quit smoking using Motivational Interviewing (W. R. Miller & S. Rollnick, 2002). If participants during any one call indicated that they wanted to set a quit date, they were offered additional phone calls to support the initiation and maintenance of abstinence.

In addition to the counselling calls, all participants in the telephone counselling condition received three accompanying booklets (4 pages, colour-print), which were designed specifically for the present study. Each booklet contained didactic information, tips and advice on how to initiate and maintain abstinence, motivational or self-efficacy enhancing messages, as well as 'parent-relevant information' (e.g., effects of SHS on children, suggestions to involve children in process of smoking cessation, strategies to manage parent-specific stressors). Participants received the booklets at three time points throughout telephone counselling (immediately after start of telephone counselling, three weeks after start of telephone counselling, and six weeks after start of telephone counselling).

Self-help brochure. Participants in the self-help condition received a 40-page, colour-printed self-help brochure[2] for smoking cessation copyrighted by Stivoro. The brochure included didactic information on nicotine dependence and the health benefits associated with quitting smoking, tips and advice on how to initiate and maintain abstinence, instruction in the use of cognitive and behavioural skills to avoid triggers to smoke and cope with urges to smoke, and strategies for managing a lapse or relapse to smoking. The brochure was divided into five parts: reasons for quitting, craving and withdrawal, preparing to quit, help with quitting, and maintenance of abstinence. The brochure was based on empirically supported practices for advice on smoking cessation, such as psycho-education, advice, tips, and exercises (Lancaster & Stead, 2005).

Measures

Baseline characteristics

The baseline questionnaire included the variables gender, age, nationality, education, material status, employment status, cigarettes per day, years of smoking, nicotine dependence (FTND; Fagerstrom & Furberg, 2008), ever made a quit attempt and quit attempt in the past 12 months (Gilpin, Stillman, Hartman, Gibson, & Pierce, 2000), intention to quit (Hitchman et al., 2011), other household smokers, and selected smoking-related illnesses of parent and child (e.g., cardiovascular disease, chronic respiratory illness).

2 Dutch name of brochure: *Stoppen met roken: Willen en kunnen*

Use and acceptability of cessation support

Telephone counselling condition. Participants in the telephone counselling condition were asked to report how many counselling calls they received (0, 1, 2, 3, 4, 5, 6, 7, 8 or more). Participants who received at least one counselling call were asked to which degree the call(s) helped with (1) motivation to quit or to stay quit, (2) coping with withdrawal symptoms, (3) coping with craving, (4) coping with situations that trigger craving, (5) prevention of a lapse or relapse, and (6) motivation to try again after a lapse or relapse. Ratings were: didn't help, helped a little, and helped a lot. In addition, participants indicated to which degree they received emotional support and practical tips from the counsellors. Ratings were: not at all, a little, a lot. Also, participants were asked whether they had tried tips suggested during counselling (none, a few, a lot). Finally, participants indicated their satisfaction with the length of the intervention (too short, about right, too long), their overall satisfaction with telephone counselling (very unsatisfied, unsatisfied, satisfied, very satisfied), and whether they would make use of the STIVORO quitline again (no, yes).

Also, participants in the telephone counselling condition were asked how many accompanying booklets they received (0, 1, 2, 3). Recipients were asked to which extent they read the booklets (none or very little, less than half, more than half, in full) and whether they used tips provided in the booklets (none, a few, a lot). Also, recipients were asked to indicate to which extent the booklets helped with varying areas of difficulties and their overall satisfaction with the booklets (see above).

Self-help brochure condition. Participants in the self-help material condition were asked whether they received a brochure (yes, no). Recipients were asked to which extent they read the brochure (none or very little, less than half, more than half, in full) and whether they tried tips suggested in the brochure (none, a few, a lot). To evaluate acceptability of the brochure, recipients were asked the same questions about the brochure as participants in the telephone counselling condition were asked about the counselling calls (i.e., the extent the brochure helped with varying areas of difficulties, the extent to which participants received emotional support and practical tips, satisfaction with the length of brochure, overall satisfaction with brochure).

Strategy for analysis

Participant characteristics at baseline are presented. To determine whether the randomization resulted in an equal baseline distribution of participant characteristics across conditions, chi-square tests and *t*-tests for independent samples were conducted. Use and acceptability of cessation support in both conditions are summarized. Differences between the two conditions in acceptability of cessation support were examined using chi-square tests. Post-measurement data are presented for recipients-only as well as for the intention-to-treat population. Statistical testing and report of results pertain to the intention-to-treat population.

Attrition

At post-measurement, 229 participants (89.5%) completed the questionnaire in the telephone counselling condition and 246 (96.1%) completed the questionnaire in the self-help brochure condition. Attrition was significantly higher in the telephone counselling condition than the self-help brochure condition ($\chi^2 = 8.42$, $p=.004$).

Participants lost at post-measurement were compared with the remaining participants on age, gender, education, number of cigarettes smoked per day, nicotine dependence, and intention to quit. In the entire sample, participants lost at post-measurement did not differ significantly from the remaining participants on any of these variables. In the telephone counselling condition, participants lost at post-measurement smoked significantly more cigarettes per day at baseline ($M=18.8$, $SD=11.3$) compared to the remaining participants ($M=15.4$, $SD=7.5$, $t=1.99$, $p=.05$). No other differences were found on the assessed variables.

Results

Descriptive statistics at baseline

Table 1 displays sample characteristics at baseline for the entire sample and by condition. At baseline, there were no significant differences between the telephone counselling condition and the self-help brochure condition in the assessed variables.

Reach and costs of mailings distributed through primary schools

Reach of mailings was defined as the ratio of the number of participants enrolled to the number of participants eligible (i.e., recruitment efficiency). In total, approximately 35,000 mailings were distributed to primary schools, which led to the recruitment of 512 smoking parents out of approximately 10,000 households (30%) which are estimated to include at least one smoking parent (Otten, Engels, & van den Eijnden, 2005; Schuck, Otten, Engels, & Kleinjan, 2012), yielding a response rate of approximately 5%.

The total cost for recruitment was 11,131 euro (approximately 14,728 USD), consisting of 2,732 euro in personnel cost (for the principal investigator and a research assistant), 7,467 euro in copy charges (making and mailing the materials), and 300 euro in telephone cost. Overall cost per enrolled participant was 21.74 euro (approximately 28.31 USD).

Use and acceptability of telephone counselling

Table 2 and 3 display use and acceptability of telephone counselling. A total of 224 participants (88%) received at least one counselling call, and 212 (83%) received at least three calls. Of participants who received calls, the mean number of calls received was 5.7 ($SD=1.7$).

Of all participants randomized to telephone counselling, the majority reported that the calls helped with motivation to quit or stay quit (82%), withdrawal (79%), cravings to smoke (80%), dealing with triggers of craving or difficult situations (79%), preventing a lapse or relapse (78%), or motivation after a lapse or relapse (78%). Also, the majority of participants received emotional support (68%) and practical tips (82%) from the counsellor. Most participants reported that they made use of these tips (79%). The majority of participants (74%) thought that the length of telephone counselling was about right. Overall, 81% were satisfied or very satisfied with telephone counselling and 67% reported that they would make use of telephone counselling again.

Of all participants randomized to telephone counselling, 211 (82%) recalled receiving at least one accompanying booklet. A total of 125 participants (49%) read the booklets in full, and 66 participants (26%) read at least some parts of the booklets. The

Table 1 Characteristics of participants at baseline

Characteristics	Total sample (N=512)	Telephone counselling (n=256)	Self-help brochure (n=256)	*p*-value
Age (*M*, *SD*)	42.2 (5.4)	42.3 (5.9)	42.0 (5.1)	.59
Gender (%)				
Female	52.5	51.2	53.9	.54
Nationality (%)				
Dutch	97.9	97.7	98.0	.76
Education (%)				
Low	15.2	16.4	14.1	
Medium	56.6	56.3	57.0	
High	26.2	25.4	27.0	.74
Marital status (%)				
Never married	12.5	12.9	12.1	
Married	67.6	67.6	67.6	
Divorced/separated	19.1	19.1	19.1	
Widowed	0.6	0.4	0.8	.94
Employment status (%)				
Unemployed	15.8	14.5	17.2	
Casual	3.5	3.9	3.1	
Part time	37.5	35.2	39.8	
Full time	43.0	46.5	39.5	.38
Cigarettes per day (*M*, *SD*)	16.2 (7.8)	15.7 (8.0)	16.8 (7.7)	.14
Years of smoking (*M*, *SD*)	24.9 (7.7)	25.1 (7.4)	24.6 (8.0)	.43
FTND score (*M*, *SD*)	4.0 (2.4)	4.0 (2.4)	4.0 (2.4)	.81
Ever made a quit attempt (%)				
Yes	95.3	95.7	94.9	.68
Quit attempt in past 12 months (%)				
Yes	36.1	38.3	34.0	.31
Quitting intention (%)				
Within one month	33.6	33.6	33.6	
Within 6 months	33.0	35.2	30.9	
Within 12 months	23.4	20.3	26.6	
Not within 12 months	9.7	10.9	8.6	.31
Partner smoking (%)				
Yes	33.4	30.9	35.9	.20
Cardiovascular disease				
Yes	1.6	1.2	2.0	.48
Chronic respiratory illness				
Yes	7.8	7.0	8.6	.51
Chronic respiratory illness child (%)				
Yes	14.6	14.5	14.8	.90
Confidence in quitting (0-10)	6.1 (2.0)	6.1 (1.9)	6.1 (2.0)	.82
Importance of quitting (0-10)	8.9 (1.6)	8.9 (1.5)	8.9 (1.6)	.98

Table 2 Reported use of telephone counselling and self-help brochure at post-measurement among the intention-to-treat sample (and among recipients)

	Telephone counselling condition		Self-help brochure condition	
Received call(s)/ brochure	Yes No	87.5% 2.0%	Yes No	89.1% 7.0%
Number of calls taken/ amount of brochure read	1-2 calls 3-4 calls 5-6 calls 7 or more calls	4.3% (4.9%) 15.6% (17.9%) 32.4% (37.2%) 34.8% (39.9%)	Not read Read less than half Read more than half Read in full	5.1% (5.7%) 10.9% (12.3%) 7.8% (8.8%) 64.8% (73.1%)
Use of tips	None A few tips A lot of tips	7.8% (9.0%) 59.4% (68.2%) 19.9% (22.9%)	None A few tips A lot of tips	37.5% (42.1%) 45.3% (50.9%) 6.3% (7.0%)

majority (57%) reported that they have made use of the tips provided in the booklets. The majority of participants reported that the accompanying booklets helped with motivation to quit or stay quit (70%), withdrawal (69%), cravings to smoke (67%), dealing with triggers of craving or difficult situations (67%), preventing a lapse or relapse (66%), or motivation after a lapse or relapse (62%). Overall, 72% were satisfied or very satisfied with the booklets. Results are displayed in Table 4.

Use and acceptability of self-help brochure

Table 2 and 3 display use and acceptability of the self-help brochure. Of all participants randomized to the self-help brochure condition, 228 (89%) recalled receiving the self-help brochure. A total of 166 participants (65%) reported that they read the brochure in full, 48 (19%) read at least some parts of the brochure, and 13 participants (5%) did not read the brochure.

Of all participants randomized to the self-help brochure condition, the majority reported that the brochure helped with motivation to quit or stay quit (68%), withdrawal (63%), cravings to smoke (61%), dealing with triggers of craving or difficult situations (66%), preventing a lapse or relapse (64%), or motivation after a lapse or relapse (64%). A total of 38% of participants reported that they received emotional support, 72% received practical tips, and 52% reported that they have made use of these tips. Most participants (73%) thought that the length of brochure was about right. Overall, 69% were satisfied or very satisfied with the brochure.

Comparison between telephone counselling and self-help brochure

Use and acceptability of telephone counselling were compared to use and acceptability of the self-help brochure. Participants randomized to telephone counselling were significantly more likely to report that cessation support helped with motivation to quit or stay quit ($\chi^2 = .28.32$, $p<.001$), withdrawal ($\chi^2 = 26.87$, $p<.001$), cravings to smoke ($\chi^2 = 38.18$, $p<.001$), dealing with triggers of craving or difficult situations ($\chi^2 = 21.57$,

Table 3 Evaluation of telephone counselling and self-help brochure at post-measurement

			Recipients-only		Intention-to-treat	
			Telephone counselling condition (n=224)	Self-help brochure condition (n=228)	Telephone counselling condition (n=256)	Self-help brochure condition (n=256)
Telephone counselling/ brochure helped with	Motivation to quit or stay quit	Not at all A little A lot	5.4% 27.8% 66.8%	22.9% 63.4% 13.7%	4.7% 24.2% 58.2%	20.3% 56.3% 12.1%
	Withdrawal	Not at all A little A lot	9.4% 39.5% 51.1%	28.6% 56.8% 14.5%	8.2% 34.4% 44.5%	25.4% 50.4% 12.9%
	Cravings to smoke	Not at all A little A lot	8.1% 35.0% 57.0%	31.3% 57.3% 11.5%	7.0% 30.5% 49.6%	27.7% 50.8% 10.2%
	Triggers of craving or difficult situations	Not at all A little A lot	9.0% 35.9% 55.2%	25.6% 65.2% 9.3%	7.8% 31.3% 48.0%	22.7% 57.8% 8.2%
	Preventing a lapse or relapse	Not at all A little A lot	10.3% 32.7% 57.0%	27.8% 61.7% 10.6%	9.0% 28.5% 49.6%	24.6% 54.7% 9.4%
	Motivation after a lapse or relapse	Not at all A little A lot	10.3% 30.5% 59.2%	27.8% 58.6% 13.7%	9.0% 26.6% 51.6%	24.6% 52.0% 12.1%
Received	Emotional support	Not at all A little A lot	22.4% 34.1% 43.5%	56.8% 40.1% 3.1%	19.5% 29.7% 37.9%	50.4% 35.5% 2.7%
	Practical tips	Not at all A little A lot	5.4% 18.4% 76.2%	19.4% 55.9% 24.7%	4.7% 16.0% 66.4%	17.2% 49.6% 21.9%
Length of telephone counselling/ brochure		Too short About right Too long	10.8% 84.8% 4.5%	15.0% 81.9% 3.1%	9.4% 73.8% 3.9%	13.3% 72.7% 2.7%
Overall satisfaction with telephone counselling/ brochure		Unsatisfied Satisfied Very satisfied	6.7% 41.7% 51.6%	22.5% 72.7% 4.8%	5.9% 36.3% 44.9%	19.9% 64.5% 4.3%

Table 4 Evaluation of accompanying booklets in the telephone counselling condition at post-measurement among the intention-to-treat sample

Recalled receipt of booklet(s)		Yes No	82.4% 7.0%
Amount read		None Less than half More than half In full	7.8% 10.5% 15.2% 48.8%
Booklet(s) helped with	Motivation to quit or stay quit	Not at all A little A lot	12.5% 40.2% 29.3%
	Withdrawal	Not at all A little A lot	13.3% 40.6% 28.1%
	Cravings to smoke	Not at all A little A lot	14.8% 41.8% 25.4%
	Triggers of craving or difficult situations	Not at all A little A lot	14.8% 42.6% 24.6%
	Preventing a lapse or relapse	Not at all A little A lot	16.4% 43.4% 22.2%
	Motivation after a lapse or relapse	Not at all A little A lot	19.9% 37.9% 24.2%
Use of tips		None A few tips A lot of tips	25.0% 52.3% 4.7%
Overall satisfaction with booklet(s)		Unsatisfied Satisfied Very satisfied	10.2% 57.0% 14.8%

$p<.001$), preventing a lapse or relapse ($\chi^2 = 22.13$, $p<.001$), or motivation after a lapse or relapse ($\chi^2 = 22.13$, $p<.001$). Moreover, participants randomized to telephone counselling were significantly more likely to report that they received emotional support ($\chi^2 = 55.59$, $p<.001$), they were more likely to receive practical tips ($\chi^2 = 20.24$, $p<.001$), and they were more likely to make use of these tips ($\chi^2 = 64.79$, $p<.001$). Overall, significantly more participants were satisfied or very satisfied with telephone counselling compared to the self-help brochure ($\chi^2 = 22.27$, $p<.001$).

Discussion

The present study sought to evaluate the feasibility and acceptability of connecting smoking parents to cessation support through their children's primary schools. As with other populations, recruiting smokers into clinical trials is challenging (Lopez et al., 2008; Ross et al., 1999). In the present study, the distribution of 35,000 mailings through primary schools led to the recruitment of 515 smoking parents out of approximately 10,000 households (30%) which are estimated to include at least one smoking parent (Otten et al., 2005; Schuck et al., 2012), yielding a response rate of approximately 5%, which is in line with earlier studies which require participants to respond to printed information material or mass media (Gilbert et al., 2007; Gilbert et al., 2012; McClure et al., 2006; McDonald, 1999). It should be noted that the response rate yielded by the present approach is likely to be an underestimation of the response rate which may potentially be achieved using the present approach. First, the present study employed several inclusion criteria (e.g., willingness to fill out questionnaires, participation as parent-child dyad). The response rate is likely to be higher when no inclusion criteria are employed. In line with this, the number of smokers who initially responded to the study invitation letters was considerably higher than the number of smokers who eventually enrolled in the present study (i.e., returned informed consent and baseline questionnaire). Second, the number of eligible subjects in the target population constitutes an estimation which may be subject to imprecision. Overestimation of the prevalence of parental smoking and non-adherence to instructions in schools and children may have lead to an underestimation of the actual response rate among smoking parents. However, previous studies have employed similar procedures (i.e., procedures using estimations of the denominator) to determine rates of recruitment in defined populations (McClure et al., 2006; McDonald, 1999). It should be noted that, even though the response rate of smoking parents to one-time mailings was rather low, the level of motivation to quit in smoking parents who responded to the mailings was quite diverse (two-thirds of respondents were not ready to quit within one month), providing preliminary evidence that low-intensity outreach targeting both smokers who are not yet ready to quit as well as smokers who are ready to quit may engage smokers with varying characteristics and levels of motivation to quit. In the Netherlands, less than 1% of smokers contact the national quitline (Willemsen et al., 2008). Therefore, even low-intensity outreach (e.g., one-time mailings) may be useful in increasing smoker's exposure to and use of cessation support. The findings are in line with previous research demonstrating high recruitment efficiency as well as high cost-effectiveness of recruitment strategies which disseminate information material to target audiences through print and media (Harris et al., 2003). The fact that half of the approached schools agreed to distribute mailings to parents indicates that schools generally approve of offering cessation support to smoking parents and are willing to participate in school-based smoking cessation promotion programs when demands on schools are kept to a minimum.

The present study offers several directions for future research. First of all, future studies will need to examine factors that influence the response to offers of cessation support in samples of nonvolunteer smokers. Possibly, offering a variety of cessation support services (nicotine replacement therapy, medication, behavioural counselling, web-based support, self-help material) may improve use of cessation support among smokers. Also, periodic mailings may increase the response rate among smokers. In smokers, motivation to quit is unstable over time and may change rather spontaneously (Hughes, Keely, Fagerstrom, & Callas, 2005; West & Sohal, 2006). Repeated offers of cessation support may capitalize on these variations in smoker's motivation to quit. To achieve an impact on smoking parents at the population level, proactive outreach efforts may additionally capitalize on 'teachable moments' in clinical settings such as consultancy and hospitalization for respiratory illness in children, prenatal consultancy, or postpartum hospital stays (Winickoff et al., 2010; Winickoff et al., 2003).

While recruitment of smokers into cessation support remains challenging, the reported use of cessation support among proactively recruited smokers was high and evaluations of cessation support were remarkably positive. Among all participants randomized to telephone counselling, almost 90% accepted at least one counselling call and more than 80% received three or more counselling calls. Overall, more than 80% of smoking parents were satisfied or very satisfied with telephone counselling. There was very little variability in the evaluation of telephone counselling, indicating that telephone counselling was generally well-received among smoking parents. In addition to telephone counselling, smoking parents also received three accompanying booklets. The accompanying booklets were read by 75% of parents and 72% were satisfied with the booklets. Supplementary materials may provide tailored information to target audiences and may be used as an increment or booster to generic interventions (e.g., telephone counselling), as they were well-received and read by participants who participated in telephone counselling. With regard to the self-help brochure, more than 80% reported that they read at least some parts of the brochure and nearly 70% were satisfied or very satisfied with the brochure. Self-help materials are a cost-effective method to support otherwise unaided quit attempts, which can be disseminated easily. In general, self-help material seems to be well-received and may be of interest to smoking parents, though findings clearly demonstrate that smoking parents are more favourable about telephone counselling than self-help material. Interpersonal contact and the counsellor's use of motivation interviewing techniques (e.g., empathic listening, non-judgemental exploration of ambivalence) may be one reason for the positive evaluation of telephone counselling among smoking parents. The present findings are in line with previous studies showing that quitline services are well-received, even by non-volunteer smokers (Tzelepis et al., 2009; Willemsen et al., 2008).

Several limitations should be acknowledged. First of all, the results of the present study are based on self-report. Social desirability or memory biases may have influenced the recall of the use of cessation support. Also, attrition was significantly higher in the telephone counselling condition compared to the self-help brochure condition, indicating selective drop-out (possibly due to differences in contact frequency or differences in satisfaction with treatment). Yet, the attrition rate in the present study was rather low, and few differences were observed between the remaining participants and participants lost to attrition. Also, all results pertain to the intention-to-treat population, therefore satisfaction with treatment is likely to be underestimated rather than overestimated. As study participants were aware of the two-arm design, it is possible that treatment preferences at the start of the study may have affected treatment evaluations, possibly resulting in an underestimation of

satisfaction with treatment, particularly among participants receiving the self-help brochure. It should be acknowledged that study procedures that deviated from standard practice procedures may limit generalizability (completion of assessments and use of incentives). The effectiveness of the proactive telephone counselling offered to smoking parents will be examined in a separate manuscript once follow-up data collection has been completed.

To summarize, the present study evaluated use and acceptability of telephone counselling and self-help material among smoking parents who were recruited into cessation support using mailings distributed through primary schools. In the present study, the response rate to offers of cessation support was rather low (5%), though it may be improved by offering varying types of cessation services and employing fewer requirements for participation. Once recruited into cessation support, both telephone counselling and self-help material were well-used and well-evaluated by smoking parents. The findings demonstrate that parents were clearly more positive about telephone counselling compared to self-help materials.

Chapter 8

Effectiveness of proactive quitline counselling for smoking parents recruited through primary schools: Results of a randomized controlled trial

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Abstract

BACKGROUND: Smoking parents account for 20-40% of adult smokers. Tobacco smoking is detrimental to parents as well as their children. This study tested the effectiveness of tailored quitline counselling among smoking parents recruited into cessation support through school-based recruitment. METHODS: Smoking parents were recruited into a 2-arm randomized controlled trial through primary schools and allocated to either quitline counselling and tailored supplementary materials (n=256) or a standard self-help brochure (n=256). Assessments were at baseline, three months after start of the intervention, and twelve months after start of the intervention. FINDINGS: Parents who received quitline counseling were more likely to report 7-day point prevalence abstinence at 12-month assessment (34.0% vs. 18.0%, OR=2.35, CI=1.56-3.54) than those who received a standard self-help brochure. Parents who received quitline counseling were also more likely to use nicotine replacement therapy ($p<.001$). Among parents who did not achieve abstinence, those who received quitline counseling smoked fewer cigarettes at 3-month assessment ($p<.001$) and 12-month assessment ($p<.01$), were more likely to make a quit attempt ($p<.01$), to achieve 24-hours abstinence ($p<.001$), and to implement a complete home smoking ban ($p<.05$) than those who received a standard self-help brochure. INTERPRETATION: Quitline counseling tailored to smoking parents is an effective method for helping parents quit smoking and promoting parenting practices that protect their children from adverse effects of smoking. TRIAL REGISTRATION: This study is registered with the Netherlands Trial Register NTR2707.

Introduction

Parents who smoke, who account for 20 to 40% of all smokers (Hitchman et al., 2011; Otten et al., 2005; Schuck et al., 2012; Winickoff et al., 2006), harm their own health and that of their children and place their children at high risk for taking up smoking (Leonardi-Bee et al., 2011). And nearly two-thirds of adult smokers express concern for modeling smoking to children (Hitchman et al., 2011). The majority of parent smokers indicate that they would accept cessation support such as telephone counselling if recommended (Winickoff et al., 2006). Connecting smoking parents to effective smoking cessation services can have important health benefits for both parents and children (Bricker et al., 2003; Halterman et al., 2004; Otten et al., 2007).

Unfortunately, engaging parents who smoke into cessation interventions is challenging, as smokers usually do not utilize available cessation treatments. In the United States, only 37% of smokers who have tried to quit smoking in the past report that they had ever read written material on smoking cessation and 12% had called a quitline (Hughes, 2009; Shiffman, Brockwell, Pillitteri, & Gitchell, 2008). In the Netherlands, one third of quitters report receiving assistance in quitting and less than 1% of smokers contact the national quitline (Willemsen, van der Meer, Bot, 2008). Research suggests that the use of cessation support can be increased substantially by different strategies aimed to increase awareness of available services among the smoking population (Borland & Segan, 2006).

Both quitline counselling and self-help materials are effective cessation treatments (Lancaster & Stead, 2005; Stead et al., 2006) characterized by modest efficacy and high population-level reach, thus yielding high potential public health impact. Tailoring available interventions to address smokers in their role as parents may increase reach as well as efficacy of existing treatments. Generic quitline counselling is highly suitable for tailoring as it can be adapted to the smoker's specific needs and supplementary materials can be easily added to provide population-specific information. This study aimed to examine the effectiveness of quitline counselling tailored to smoking parents who were recruited through primary schools. By now, a variety of interventions have demonstrated efficacy in increasing parental smoking cessation and decreasing parental exposure to second-hand smoke (SHS) among children (Roseby et al., 2003; Rosen et al., 2012). Offering cessation support to smoking parents in 'teachable settings' (McBride, Emmons, & Lipkus, 2003) such as pediatric clinics, birth clinics, and physician offices can engage a high proportion of parents (Winickoff et al., 2003; Winickoff et al., 2010). Primary schools may constitute such a 'teachable setting', that is, smokers may be more likely to make use of cessation support when reminded of their role as a parent (i.e., greater cognitive, emotional, and physiological responses may be triggered when reminding smokers of their role as parents of young children, which may in turn influence motivational and behavioural responses such as quit attempts). Benefits of schools include easy access to the target population and reach of a major proportion of smoking parents. To date, they are an understudied venue for promoting smoking cessation among parents.

This study aimed to examine the effectiveness of quitline counselling and tailored materials compared to a standard self-help brochure for increasing cessation rates among smoking parents. We hypothesized that quitline counselling tailored to smoking

parents would be effective in increasing abstinence rates (primary outcomes). Also, we hypothesized that quitline counselling would increase quit attempts, occurrence of 24-hours abstinence, use of NRT and pharmacological treatment, intention to quit, implementation of home smoking bans, and reduce daily cigarette consumption and nicotine dependence (secondary outcomes).

Methods

Study overview

The present study was a 2-arm randomized, controlled, home-based trial conducted among smoking parents. The study was funded by the Netherlands Organization for Health Research and Development and approved by the ethics committee of the Faculty of Social Sciences, Radboud University Nijmegen. All participants provided written informed consent. The study is registered in the Netherlands Trial Register (NTR2707) and the full study protocol is publicly available (Schuck et al., 2011). The baseline measurement took place between January and July 2011. Data collection was completed in October 2012.

Study design

This study was a parallel-group trial with three assessments (Figure 1). Smoking parents were randomly assigned to receive intensive proactive quitline counselling (administered by the Dutch national quitline) in combination with supplementary materials tailored to smoking parents (n=256) or a standard self-help brochure (n=256). Smoking parents were recruited through their children's primary schools across the Netherlands. Primary schools were contacted by research assistants and asked to distribute study invitation letters to parents through children. Out of 890 contacted schools, 438 schools (49.2%) agreed to participate. Approximately 35,000 letters were mailed to schools for distribution to all children in US grade 4-6 (age 9-12 years, the aim was to target pre-adolescents who can reliably fill in questionnaires). Parents registered to take part by mail, e-mail, telephone, or via a website. Subsequently, consent forms and baseline questionnaires were send to participants. In this trial, both parents and children were asked to complete separate questionnaires (via a website or on paper, based on personal preference). In the present report, only outcomes among parents were examined. Outcomes among children will be examined in a separate report. More detailed information regarding all aims and research questions of this trial can be found in the study protocol (Schuck et al., 2011).

After the baseline assessment, parents were randomly assigned to treatment condition (quitline counselling or self-help brochure). Allocation of participants to trial conditions was done by an independent member of the research group using a computer-generated allocation sequence. To ensure equal group sizes, allocation was done in blocks of 10. To ensure balance of key characteristics, stratified randomization was used based on the stratifying variables gender, educational level (low: no high school diploma/no vocational training, medium: vocational training or high school diploma, high: college degree), and cigarettes per day (less than 10, 10 to 20, 21 or more). The independent researcher prepared a list of study participants and their

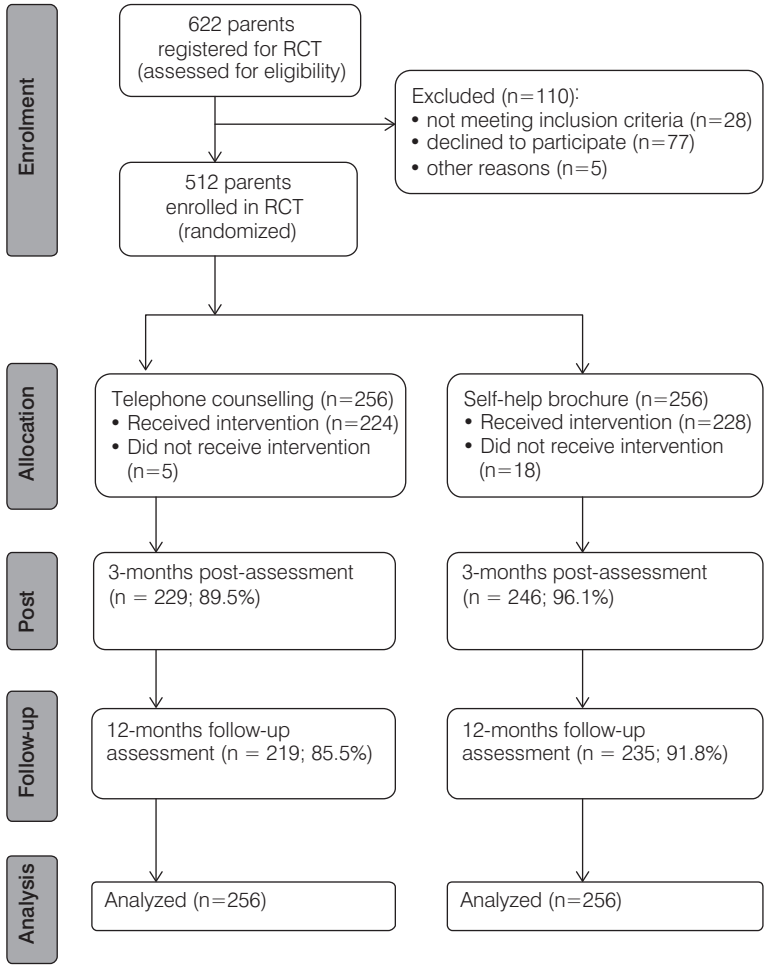

Figure 1 Flow diagram of recruitment and progress throughout the study

allocated treatment. Based on this list, the first author prepared the mailings which informed study participants about the treatment they would receive.

Within the 2 weeks following allocation consignment, parents were either called by the quitline to schedule the first counselling call or were sent the self-help brochure. The follow-up measurements took place three months and twelve months after start of the intervention. Trial procedures were the same across treatment conditions. Assessment procedures were the same across all three assessments (i.e., parents and children were each asked to complete separate questionnaires). Each parent-child dyad received 100 euro (as of December 2013, approximately 135 US dollars) for participation in all three assessments.

Participants

Participants were daily or weekly smokers and parents or caretakers of a child between 9-12 years old. They were considering quitting smoking (currently or in the future) and provided informed consent for study participation for themselves and their children.

Treatment conditions

Intensive proactive quitline counselling tailored to smoking parents. Participants in the tailored quitline counselling condition received up to seven counselor-initiated phone calls across a period of three months. Counselling was based on cognitive-behavioural skill building and Motivational Interviewing. Calls were conducted by counsellors of the Dutch national quitline. All counsellors received extensive training and had several years of experience in the delivery of telephone counselling.

In the following, the most important treatment components are described. During the 30-minute intake call, counsellors put emphasis on information gathering (e.g., assess current and past smoking behaviour, readiness to quit, confidence in quitting, and history of past quit attempts) and building general rapport (e.g., establish a friendly and professional relationship, explain treatment programme, elicit and answer questions). Also, counsellors provided information on smoking and smoking cessation (e.g., give information about the workings mechanisms of nicotine, the harm caused by smoking, and the benefits of quitting) and asked for reasons for wanting and not wanting to quit (e.g., discuss ambivalent feelings and conflicting motivations). Among participants who were ready to quit, counsellors aimed to facilitate action planning (e.g., discuss convenient days to quit, help generating a quit plan) and goal setting (e.g., encourage setting a quit date within 10-12 days). Also, counsellors aimed to facilitate barrier identification and problem solving (e.g., identify general barriers or difficult situations, discuss general coping strategies). Moreover, counsellors discussed use of NRT or a pharmacological treatment (e.g., explain benefits and potential side effects) and recommended use if participants smoked ten cigarettes per day or more. In the second call, counsellors focused mainly on assessing withdrawal symptoms and providing information on withdrawal symptoms (e.g., normalize withdrawal symptoms, describe how long withdrawal symptoms typically last, what causes them, and means to alleviate them). Throughout all calls, counsellors prompted review of actions, coping strategies, and goals. Furthermore, counsellors reviewed difficult situations and aimed to facilitate problem (including giving advice on changing routine, environmental restructuring, conserving mental resources, avoiding cues to smoking, use of cognitive strategies such as 'positive thinking' or 'emotional surfing', and use of social support). At the end of each call, counsellors assessed importance of quitting and confidence in quitting.

Towards the end of counselling, counsellors focused on relapse prevention and coping (e.g., anticipate and normalize lapses, identify strategies to prevent lapses or to avoid lapses turning into relapse). Throughout all calls, counsellors aimed to boost motivation and self-efficacy (e.g., give encouragement and bolster confidence in ability to quit) and complimented the client for efforts, progresses, and achievements. Generally, the counsellors style incorporated use of reflective listening, eliciting client views, prompting commitment from the client, summarizing information and client decisions, and providing reassurance.

Among participants who were not ready to set a quit a date, counsellors emphasized building general rapport, helping the smoker to arrive at a clear understanding of his or her feelings about quitting smoking (e.g., identify reasons for wanting and not wanting to quit, discuss conflicting motivations), aimed to increase the participant's intrinsic motivation to quit using Motivational Interviewing techniques[22] (e.g., elicit and selectively reinforce change talk), and gave information about options for later support.

All participants in the quitline condition also received three accompanying booklets titled *Smoke-free parents*[3], which were designed for this study as tailored supplementary materials. Each booklet (4 pages, colour-print) contained didactic information, tips and advice, motivational messages, as well as 'parent-relevant information' (e.g., effects of SHS on children, strategies to manage parent-specific stressors). The booklets were sent to all participants at three time points throughout the study (i.e., immediately after the first call, two weeks after the first call, and six weeks after the first call). The time points were chosen to correspond with the contents of the booklets (i.e., deciding and preparing, initiating and maintaining abstinence, prevention of relapse).

Standard self-help brochure. The comparison condition was selected to be a credible treatment alternative to quitline counselling with high potential population-level reach. Participants received a 40-page, colour-printed self-help brochure[4] including didactic information on nicotine dependence and the health benefits of quitting smoking, tips and advice on how to initiate and maintain abstinence, instruction in the use of cognitive and behavioural skills to avoid triggers to smoke and cope with urges to smoke, and strategies for managing a lapse or relapse to smoking. Also, information on the use of NRT and pharmacotherapy was provided. The contents were based on empirically supported practices for advice on smoking cessation (Lancaster & Stead, 2005).

Measures

Baseline assessment. The baseline questionnaire included the demographic variables age, gender, and educational level ('What is your highest level of completed education?') and the following smoking-related variables: cigarettes per day ('How may cigarettes do you smoke per day?'), years of smoking ('For how many years have you been smoking?'), nicotine dependence level (FTND; Fagerstrom et al., 1996), quit attempt ever and quit attempt in the past 12 months, intention to quit ('Have you ever tried to quit smoking?, 'Have you tried to quit smoking in the past 12 months?''), smoking status of partner ('Does your partner smoke?'), and presence of selected smoking-related illnesses of parent and child ('Do you/does your child suffer from a chronic respiratory illness, for example asthma?'). Additionally, confidence in quitting ('How confident are you that you are able to quit?') and importance of quitting ('How important is quitting smoking to you?') were assessed on ten-point scales.

Process Measures. At 3-months post-measurement, participants in the quitline counselling condition were asked how many counselling calls they received. Participants in the self-help material condition were asked whether they received the brochure and to what extent they read the brochure.

3 Dutch name of booklets: *Rookvrij opvoeden*

4 Dutch name of brochure: *Stoppen met roken: Willen en kunnen*

Outcome Measure. The primary outcome measure was 7-day point prevalence abstinence at 12-months follow-up (defined as 'Have you smoked during the past seven days, even a single puff?' and 'Have you used any other form of tobacco during the past seven days, for example pipes or cigars?'). Secondary measures were 7-day point prevalence abstinence at 3-months and prolonged abstinence (defined as report of 7-day point prevalence abstinence at 3-months and 12-months and report of cessation for a period of at least six months at 12-months). Also measured were use of and adherence to NRT and pharmacotherapy, smoking characteristics, and implementation of a home smoking ban.

A random subsample of parents (36/133) who reported point prevalence abstinence at 12-months was approached for biochemical validation. Research assistants collected breath carbon monoxide (CO) using a portable CO monitor (Micro CO, Micro Direct, Inc. Lewiston, Maine) and saliva samples for cotinine analysis using NicAlert dipstick (Nyomax, Hasbrouck Heights, New Jersey). Cut-off scores of 8 parts per million for CO and 10 nanograms per millimetre for cotinine were used to define abstinence.

Statistical analyses

Abstinence rates were compared in the full sample as randomized (intention-to-treat sample) and in the samples excluding the 31 participants known not to have received their assigned treatment (treated sample), with treatment considered to have failed in participants lost to follow-up. Cessation rates were compared using the odd ratios with 95% confidence interval, and logistic regression models were used to adjust for baseline characteristics. Also, absolute percentage-point differences between abstainers in the two conditions and their corresponding confidence intervals were reported. For additional outcomes, multiple imputation was used to handle missing data (SPSS 19), which ranged from 7.4% to 16.4%. The multiple imputation incorporated the key characteristics at baseline, the primary outcome, and the secondary outcomes. Ten imputed data sets were generated. In addition, sensitivity analyses were performed with assumptions of extreme high or low values (i.e., best or worst) among all participants for whom no data was available to assess the maximum influence of loss to follow-up and to test the robustness of the results. We used bivariate logistic regression analyses for dichotomous outcomes, univariate analyses of variance for continuous outcomes, and chi-square difference tests for categorical outcomes. The analyses did not control for clustering effects, as a clustered data structure was considered unlikely given the sampling rate of parents per school (i.e., 512 parents were recruited from 438 schools reflecting a response rate of approximately 5%).

The study was designed to detect a significant between-group difference of 6% (i.e., 13% vs. 7%) for the primary outcome, with 80% power and at an alpha level of .05. The effect size estimates were based on a previous trial examining the effects of telephone counselling among smoking mothers (Curry et al., 2003). The calculated sample size was corrected for a 20% loss-to-follow-up, resulting in a sample size of 256 participants per group.

Results

Characteristics of the participants

Key participant characteristics are displayed in Table 1. Overall, 52.5% of the participants were female and the mean age was 42.2 years. They smoked on average 16.2 cigarettes per day. More than 90% of the participants had tried to quit smoking in the past. Nearly 36% of participants reported the existence of a complete home smoking ban.

In the quitline counselling condition, 224 participants (87.5%) recalled receiving at least one counselling call and 212 (82.8%) recalled receiving at least three calls. Of participants who received calls, the mean number of calls received was 5.5 (SD=1.8). A total of 211 participants (82.4%) recalled receiving at least one supplementary brochure. A total of 125 participants (48.8 %) reported that they read the supplementary brochures in full, 66 participants (25.7 %) read at least some parts of the brochures, and 20 participants (7.8%) did not read the brochures. In the self-help brochure condition, 228 (89.1%) recalled receiving the brochure. A total of 166 participants (64.8%) reported that they read the brochure in full, 48 (18.8%) read at least some parts of the brochure, and 13 participants (5.1%) did not read the brochure.

Figure 1 shows the flow of participants through the trial. The follow-up rate for the primary outcome was 88.7% (454 participants). There was a significant difference in the follow-up rate between treatment groups (85.5% in the quitline counselling condition and 89.5% in the self-help brochure condition, $\chi^2 = 4.98$, p=.03), which may be due to the higher intensity and higher contact frequency in the quitline counselling condition. Participants lost at follow-up did not differ on baseline characteristics compared with the remaining participants, neither across nor within conditions (all p>.05).

Outcomes

Smoking cessation rates. Table 2 shows a benefit of tailored quitline counselling on smoking cessation, as measured on the basis of the primary outcome variable (day point prevalence at 12-months) (OR=2.35, CI=1.56-3.54). The net improvement in the abstinence rate with quitline counselling was 16 percentage points. There was also evidence of an effect on the secondary outcomes, 7-day point prevalence at 3-months (OR=5.83, CI=3.72-9.13) and 6-months prolonged abstinence at 12-months (OR=4.92, CI=2.71-8.93). Effect sizes were only marginally altered in logistic regression models that adjusted for all the baseline characteristics shown in Table 1.

Use of NRT and pharmacological treatment. Table 3 shows a benefit of tailored quitline counselling on the secondary outcomes, use of NRT (p<.001), and adherence to NRT (p<.001), but not on use of or adherence to pharmacotherapy.

Outcomes among parents who did not report abstinence. Table 4 shows a benefit of tailored quitline counselling on the secondary outcomes number of cigarettes smoked per day at 3-months (p<.001) and 12-months (p<.001), 50%-reduction in the number of cigarettes smoked per at 3-months (p<.001) and 12-months (p<.01), and nicotine dependence levels at 3-months (p=.01) and 12-months (p<.01), occurrence of quit attempt at 3-months (p<.001) and 12-months (p<.001), occurrence of 24-hours abstinence at 3-months (p<.001) and 12-months (p<.001, duration of longest quit attempt at 12-months (p<.001), and implementation of a complete home smoking ban (p>.01). No effect was observed on intention to quit at 12-months (p=.13).

Table 1 Key characteristics of study participants at baseline

Characteristics	Total sample (N = 512)	Telephone counselling (n = 256)	Self-help brochure (n = 256)
Age (*M*, *SD*)	42.2 (5.4)	42.3 (5.6)	42.0 (5.1)
Gender % (n)			
Female	52.5 (269)	51.2 (131)	53.9 (138)
Nationality % (n)			
Dutch	97.9 (501)	97.7 (250)	98.0 (251)
Education % (n)			
Low	15.2 (78)	16.4 (42)	14.1 (36)
Medium	56.6 (290)	56.3 (144)	57.0 (146)
High	26.2 (134)	25.4 (65)	27.0 (69)
Marital status % (n)			
Never married	12.5 (64)	12.9 (33)	12.1 (31)
Married	67.6 (346)	67.6 (173)	67.6 (173)
Divorced/widowed	19.7 (101)	19.5 (50)	19.9 (51)
Employment status % (n)			
Unemployed	15.8 (81)	14.5 (37)	17.2 (44)
Casual	3.5 (18)	3.9 (10)	3.1 (8)
Part time	37.5 (192)	35.2 (90)	39.8 (102)
Full time	43.0 (220)	46.5 (119)	39.5 (101)
Cigarettes per day (*M*, *SD*)	16.2 (7.8)	15.7 (8.0)	16.8 (7.7)
Years of smoking (*M*, *SD*)	24.9 (7.7)	25.1 (7.4)	24.6 (8.0)
FTND score (*M*, *SD*)	4.0 (2.4)	4.0 (2.4)	4.0 (2.4)
Ever made a quit attempt % (n)			
Yes	95.3 (488)	95.7 (245)	94.9 (243)
Quit attempt in past 12 months % (n)			
Yes	35.7 (183)	37.9 (97)	33.6 (86)
Quitting intention % (n)			
Within one month	33.6 (172)	33.6 (86)	33.6 (86)
Within 6 months	33.0 (169)	35.2 (90)	30.9 (79)
Within 12 months	23.4 (120)	20.3 (52)	26.6 (68)
Not within 12 months	9.8 (50)	10.9 (28)	8.6 (22)
Partner smoking % (n)			
Yes	33.4 (171)	30.9 (79)	35.9 (92)
Cardiovascular disease % (n)			
Yes	1.6 (8)	1.2 (3)	2.0 (5)
Chronic respiratory illness % (n)			
Yes	7.8 (40)	7.0 (18)	8.6 (22)
Chronic respiratory illness child % (n)			
Yes	14.6 (75)	14.5 (37)	14.8 (38)
Confidence in quitting (*M*, *SD*)	6.1 (2.0)	6.1 (1.9)	6.1 (2.0)
Importance of quitting (*M*, *SD*)	8.9 (1.6)	8.9 (1.5)	8.9 (1.6)
Complete home smoking ban % (n)	35.5 (182)	35.2 (90)	35.9 (92)

Note. FTND = Fagerström Test for Nicotine Dependence. There were no significant differences ($p < .05$) between the treatment groups on any measure.

Table 2 Smoking cessation outcomes

Outcome measure	Telephone counselling	Self-help brochure	Percentage-point difference (95% CI)	Unadjusted OR (95% CI)	Adjusted OR[a] (95% CI)
ITT sample (N=512)	(n = 256)	(n = 256)			
Primary outcome: % (n) 7-day PP at 12 months	34.0 (87)	18.0 (46)	16.0 (8.5 –23.5)	2.35 (1.56 - 3.54)	2.81 (1.76 - 4.49)
Secondary outcome: % (n) 7-day PP at 3 months	44.5 (114)	12.1 (31)	32.4 (25.1 –39.7)	5.83 (3.72 - 9.13)	6.89 (4.18 - 11.36)
Secondary outcome: % (n) 6-months PA at 12 months	23.4 (60)	5.9 (15)	17.5 (11.6 – 23.5)	4.92 (2.71 - 8.93)	5.51 (2.81 - 10.59)
Treated sample (N=481)	(n = 243)	(n = 238)			
Primary outcome: % (n) 7-day PP at 12 months	35.8 (87)	18.9 (45)	16.9 (9.1 – 24.7)	2.39 (1.58 - 3.63)	2.97 (1.84 - 4.80)
Secondary outcome: % (n) 7-day PP at 3 months	44.9 (114)	11.8 (28)	35.1 (27.7 – 42.6)	6.63 (4.15 - 10.58)	8.13 (4.81 - 13.74)
Secondary outcome: % (n) 6-months PA at 12 months	24.7 (60)	5.9 (14)	18.8 (12.6 – 25.0)	5.25 (2.84 - 9.69)	6.06 (3.09 - 11.89)

Note. OR=odds ratio; CI=confidence interval. ITT=Intention-to-treat – sample as randomized. Treated sample – excluding 31 participants known not to have received their assigned intervention. In accordance with the Russell Standard criteria, loss to follow-up was classified as treatment failure. [a]Adjusted for all baseline characteristics shown in Table1.

Table 3 Use of and adherence to NRT and pharmacotherapy at 12-months follow-up

	Telephone counselling (n=256)	Self-help brochure (n=256)	*p*
Use of NRT: % (n)			
Yes	48.4 (124)	20.9 (49)	<.001
No	51.6 (132)	79.1 (186)	
Type of NRT*: % (n)			
Only nicotine patches	66.1 (82)	46.4 (26)	<.01
Only nicotine gum	18.5 (23)	21.4 (12)	
Only nicotine lozenges	9.7 (120)	10.7 (6)	
Combination	5.6 (7)	21.4 (12)	
Adherence to NRT*: % (n)			
Less than two weeks	29.8 (34)	60.7 (34)	<.001
2-4 weeks	21.0 (26)	21.4 (12)	
At least 4 weeks	52.4 (65)	17.9 (10)	
Use of pharmacotherapy: % (n)			
Yes	13.7 (35)	10.5 (27)	.33
No	86.3 (221)	89.5 (229)	
Type of pharmacotherapy*: % (n)			.27
Varenicline	82.9 (29)	96.3 (26)	
Bupropion	14.3 (5)	3.7 (1)	
Both	2.9 (1)	0.0 (0)	
Adherence to pharmacotherapy*: % (n)			.99
Less than two weeks	25.7 (9)	29.6 (8)	
2-4 weeks	28.6 (10)	29.6 (8)	
4-12 weeks	31.4 (11)	29.6 (8)	
At least 12 weeks	14.3 (5)	11.1 (3)	

*Note. Multiple imputation was used to handle missing data. NRT=Nicotine replacement therapy.*Type and adherence only assessed among participants who reported use of NRT and pharmacotherapy.*

Sensitivity analyses. To assess the maximum influence of loss to follow-up on the results and to determine the robustness of findings, a sensitivity analysis was conducted with assumptions of extreme values (i.e., lowest or highest values in range) among all participants for whom no data was available. In the scenario in which the worst possible outcomes were assumed, the results still showed a benefit of telephone counselling on use of NRT (OR= 2.89, CI=1.94-4.31), adherence to NRT (χ^2=20.48, p<.001), 50%-reduction in number of cigarettes smoked per day at 3-months and 12-months (OR=1.76, CI=1.07-2.88 and OR=1.87, CI=1.10-3.18, respectively), occurrence of a quit attempt at 3-months (OR= 1.93, CI=1.26-2.96), achieving 24-hours abstinence at 3-months and 12-months (OR= 2.33, CI=1.51-3.59 and OR= 1.82, CI=1.20-2.74, respectively), and duration of quit attempt (χ^2=18.02, p<.001).

Table 4 Secondary outcomes among participants in the telephone counselling condition and self-help condition who did not report abstinence at 3-months (n=142 and n=225) and 12-months follow-up (n=169 and n=210)

	Telephone counselling	Self-help Brochure	*p*
Cigarettes per day (M, SD)			
3-months	10.3 (6.4)	13.3 (7.8)	<.001
12-months	11.1 (6.4)	13.3 (6.7)	<.01
50% reduction (%, n)			
3-months	41.5 (59)	20.9 (47)	<.01
12-months	33.7 (57)	17.6 (37)	<.01
FTND-score (M, SD)			
3-months	2.9 (2.0)	3.5 (2.3)	.04
12-months	3.0 (2.2)	3.6 (2.2)	.01
Quit attempt (%, n)			
3-months	78.2 (111)	49.3 (111)	<.001
12-months	85.2 (144)	68.1 (143)	<.01
24-hours abstinence (%, n)			
3-months	65.5 (93)	35.1 (79)	<.001
12-months	78.1 (132)	53.8 (113)	<.001
Duration of longest quit attempt* (%, n)			<.001
Less than one week	21.8 (31)	46.9 (67)	
1-4 weeks	31.7 (43)	31.5 (45)	
1-3 months	23.9 (36)	15.4 (22)	
More than 3 months	22.5 (34)	6.3 (9)	
Implementation of complete home smoking ban between baseline and 12-months** (%, n)	39.5 (45)	26.1 (36)	.03
Quitting intention at 12-months (%, n)			.53
Within one month	15.4 (26)	11.0 (23)	
Within 6 months	25.4 (43)	31.0 (65)	
Within 12 months	32.0 (54)	34.3 (72)	
Not within 12 months	27.8 (47)	23.8 (50)	

*Note. Multiple imputation was used to handle missing data. FTND=Fagerström Test of Nicotine Dependence.*Duration of longest quit attempt among smokers who reported a quit attempt (TC group: n=142, SH group: n=143). **Implementation of complete home smoking ban among smokers who did not report a home smoking ban at baseline (TC group: n=114, SH group: n=138).*

Biochemical validation of self-reported abstinence. Of all 133 participants who reported 7-day point prevalence abstinence at 12-months, a random sample of 36 participants (27%) was approached for biochemical validation. A total of 22 participants could be visited (9 declined and 5 could not be reached). Of those 22 participants, 18

provided bio-samples that were consistent with their self-reported abstinence. There was no significant difference in the declination rate or the disconfirmation rate between the quitline counselling condition and the self-help condition. Based on these data, a correction was applied to the self-reported abstinence rate of the total trial population, assuming that the percentage of negative bio-samples lies somewhere between 18 and 32 (50-88.9%) out of 36. Applying this correction to the observed abstinence rates yields estimated abstinence rates between 17.0-30.2% (point-prevalence abstinence at 12-months), 22.3-39.6% (point-prevalence abstinence at 3-months), and 11.7-20.8% (prolonged abstinence) for the quitline condition and estimated abstinence rates between 9.0-16.0% (point-prevalence abstinence at 12-months), 6.1-10.8% (point-prevalence abstinence at 3-months), and 2.9-5.2% (prolonged abstinence) for the self-help condition.

Discussion

This study evaluated the effectiveness of tailored quitline counselling in aiding smoking cessation among smoking parents recruited into cessation support through their children's primary schools. Findings indicate that outreach through primary schools can engage smoking parents with varying levels of motivation to quit and that schools may be a useful venue to increase exposure to cessation support among smoking parents.

As hypothesized, abstinence rates were significantly higher among parents receiving quitline counselling than parents receiving the self-help brochure. Thirty-four percent of smoking parents receiving quitline counselling reported point prevalence abstinence at 12-months assessment. Although previous smoking cessation trials (Miguez & Becona, 2008) have reported similar abstinence rates, the effect size of telephone counselling observed in this trial (OR=2.35, 95% CI=1.56 to 3.54) is quite large in comparison to the effect size estimated by a meta-analytic review (OR=1.56, 95% CI=1.38 to 1.77; Stead, Perera, & Lancaster, 2006). Several explanations may account for this finding. Possibly, smoking parents may be particularly receptive to telephone counselling compared to the general population of smokers. A recent meta-analysis (Rosen et al., 2012) of studies examining the effects of different smoking cessation interventions among parents also showed a high average quit rate among parents (23.1%). Also, it is possible that the tailored supplementary materials may have increased the effectiveness of generic quitline counselling among parents. Finally, it is possible that the observed effects may be specific for the Netherlands. The prevalence of smoking in other countries is much lower compared to the Netherlands, therefore remaining smokers in other countries may be more difficult to treat (Irvin & Brandon, 2000). Also, quitline counselling is usually not free to smokers in the Netherlands. Therefore, smokers randomized to quitline counselling may have been particularly motivated to quit.

In the self-help brochure condition, 18% of smoking parents reported point prevalence abstinence at 12-months assessment. A meta-analysis reported that standard non-tailored self-help material produced quit rates between 2% and 10% (Lancaster & Stead, 2005). In comparison, quit rates of 5% to 7% have been reported

for smokers who received no intervention (Baillie et al., 1995; Lancaster & Stead, 2005).[15,29] The superior abstinence rates that we found suggest that the use of a standard self-help brochure may have beneficial effects in supporting otherwise unaided quit attempts among smoking parents. However, conclusions regarding the effect of the self-help brochure are limited by the absence of a no-treatment control condition.

In addition, secondary outcomes showed that parents who received quitline counselling were more likely to make a quit attempt, achieve 24-hours abstinence, use NRT, use NRT for a longer period of time, smoke less cigarettes per day, display lower nicotine dependence, and implement a complete home smoking ban. Similar effects of quitline counselling have been previously reported (Miguez & Becona, 2008; Tzelepis et al., 2011; Zhu et al., 2002). Parents who received quitline counselling were not more likely to use a pharmacological treatment for cessation. The fact that pharmacological treatment required a prescription by a general practitioner may explain the low usage and the absence of group differences in the present study. Also, treatment condition did not affect intention to quit among parents who continued smoking which may be explained by a ceiling effect as intentions to quit among parents were already quite high at the start of the study.

This study provides preliminary evidence that low-intensity outreach (e.g., one-time mailings) through primary schools constitutes a feasible strategy to successfully engage and retain smoking parents in smoking cessation interventions. The distribution of 35,000 mailings led to the recruitment of 512 smoking parents out of approximately 10,000 households (30%) which are estimated to include at least one smoking parent, yielding a response rate of approximately 5% (i.e., five times the reach of the current reactive model of quitline usage). In the Netherlands, less than 1% of smokers contact the national quitline (Willemesen et al., 2008). Therefore, even low-intensity outreach may be useful in increasing smoker's exposure to and use of cessation support. In previous work, we provide preliminary evidence suggesting that low-intensity outreach to smoking parents through primary schools might be a cost-effectiveness population-level strategy in a critically important population which might be worth pursuing given that the reach is replicated outside of an incentivized trial situation (Schuck et al., 2013).

Several limitations should be acknowledged. First, generalizability may be limited by the specific sample characteristics. Baseline characteristics indicate that participants were higher educated than the general population. Also, study procedures that deviated from normal quitline procedures may limit generalizability (no quitline costs and use of incentives). Also, smoking status was determined by self-report. Although quitline intervention trials do not usually conduct biochemical validation of cessation because there are: (1) low rates of biochemical data provision by study participants, (2) low demand characteristics to misreport cessation status, especially in comparison with in-person clinic based studies, the authors attempted to increase trial rigor by collecting biochemical measures among a subsample of study participants. In this study, we found a biochemically-validated verification rate of 82%, suggesting that the self-reported abstinence rates may be inflated and that cessation rates may be lower outside of a demanding trial situation. In this study, we did not find significant differences in biochemical validation rates between conditions, although this may be due to power

limitations. Yet, given the substantial differences in self-reported cessation rates between participants in the telephone counselling condition and the self-help condition, group differences are likely to be robust. In general, the results of the biochemical assessment should be interpreted with caution, as biochemical validation was conducted among a small sample and yielded a limited data collection response rate of 61% (22 of the 36 randomly sampled parents). Finally, the control condition (self-help brochure) was a minimal intervention. For a more stringent evaluation, future studies should use an active treatment control with equal contact time.

This study has key implications. First, it indicates that the high priority population of smoking parents may be particularly receptive to cessation support and that targeting smoking parents through primary schools and using tailored interventions can potentially increase reach and effectiveness of available cessation treatments. We showed that delivery of generic quitline counselling together with tailored materials can have a large impact on the subpopulation of smoking parents, suggesting that quitline counselling may be highly disseminable to different subpopulations of smokers. Second, the results of this study have the potential to shape tobacco control policy for smoking parents by providing a highly disseminable model of proactive recruitment of parents into quitlines. In several countries, including the Netherlands, quitline counselling is not systematically integrated into the health care system. If cost-effectiveness can be established, this model has the potential to affect the prevalence of smoking at the adult population level and impact national public health policies for smoking intervention delivery.

In summary, the present study demonstrated that tailored quitline counselling is effective in increasing abstinence rates among smoking parents recruited through primary schools. Even among parents who did not achieve abstinence, quitline counselling produced noteworthy results. Future research will need to further improve current approaches to connect smokers to cessation support as well as improve the effectiveness of available cessation treatments.

Chapter 9

Moderators and non-specific predictors of cessation treatment outcome among smoking parents

Submitted as:
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Abstract

Background: Smoking parents constitute an important subpopulation among adult smokers. Connecting smoking parents to cessation support can have important health benefits for both parents as well as their children. To improve the effectiveness of available cessation treatments, more work is needed to understand for whom and under what circumstances available treatments work. Methods: In the present study, we conducted secondary analyses of a randomized controlled trial in which smoking parents were randomly assigned to receive quitline counselling (n=256) or a self-help brochure (n=256). We examined non-specific predictors of treatment outcome and treatment moderators to identify subgroups of parents who are particularly likely to benefit from treatment. Endpoints were 7-day point prevalence abstinence and 6-months prolonged abstinence at 12-months post-measurement. Potential non-specific outcome predictors and treatment moderators included established socio-demographic characteristics and smoking-related variables as well as parent-specific variables of participants at baseline. Results: Male gender, higher employment status, a lower number of cigarettes smoked per day, higher levels of confidence in quitting, presence of a child with a chronic respiratory illness, and wanting to quit for the health of one's child predicted abstinence at 12-months post-intervention assessment regardless of treatment condition (non-specific outcome predictors). Significant treatment moderators (indicating which subgroups respond differentially to one treatment over another) were intention to quit and educational level. Intention to quit and educational level did not predict abstinence among parents receiving quitline counselling, but higher intention to quit end higher educational level predicted abstinence in the self-help condition. Conclusions: Several general as well as parent-specific characteristics were identified that increase the likelihood of positive treatment outcome among smoking parents. Parents with a lower intention to quit and a lower socio-economic status may be more likely to achieve abstinence when receiving quitline counselling compared to a self-help brochure. If replicated, these results may inform future randomized trials and clinical practice.

Introduction

Connecting smokers to effective cessation services is a public health priority. Smoking parents constitute a high priority population segment, accounting for 20-40% of adult smokers (Hitchman, Fong, Zanna, Hyland, & Bansal-Travers, 2011; Otten, Engels, & van den Eijnden, 2005; Schuck, Otten, Engels, & Kleinjan, 2012; Winickoff et al., 2006). Tobacco smoking is detrimental, not only to the parent, but also to the child who is exposed to second-hand smoke and who is at an increased risk of smoking initiation in adolescence (DiFranza, Aligne, & Weitzman, 2004; Leonardi-Bee, Jere, & Britton, 2011). Parents who quit smoking will not only improve their own health, but will also reduce the risk of physical illness (Halterman et al., 2004), smoking initiation (Otten, Engels, van de Ven, & Bricker, 2007), and regular smoking (Bricker et al., 2003) in their children.

Research suggests that smoking parents may be particularly motivated to quit (Halterman, Borrelli, Conn, Tremblay, & Blaakman, 2010; Hitchman et al., 2011; Winickoff, Hillis, Palfrey, Perrin, & Rigotti, 2003). Offering cessation support to smoking parents in 'teachable settings' such as pediatric clinics, birth clinics, and physician offices can engage a high proportion of parents (Winickoff, Hillis, et al., 2003). Recently, we have shown that offering cessation support through primary schools can be a useful approach in increasing exposure to and use of cessation support among smoking parents with easy access to the target population and potentially high reach (Schuck, 2013). By now, a variety of interventions have demonstrated efficacy in increasing parental smoking cessation and decreasing parental exposure to SHS among children (Rosen, Noach, Winickoff, & Hovell, 2012).

To improve the effectiveness of available cessation treatments, treatment selections should be guided by knowledge about which treatment is likely to yield the greatest efficacy. Up to this point, research investigating moderators of outcome (i.e., pre-treatment variables that predict treatment outcome) among evidence-based smoking cessation treatments is lacking. We recently reported results from a randomized controlled trial which demonstrated efficacy of quitline counselling compared to a standard self-help brochure in increasing smoking cessation rates among smoking parents (Schuck, Bricker, Otten, Kleinjan, & Engels, in press). The high point prevalence abstinence rates at one-year follow-up in the quitline counselling condition and the self-help condition (34% and 18% respectively) suggest that both intervention modalities have beneficial effects in supporting cessation among smoking parents, which is supported by meta-analytic reviews within the general population of smokers (Lancaster & Stead, 2005; Stead, Perera, & Lancaster, 2006).

To match clients to the optimal treatment, more work is needed to understand non-specific predictors of treatment outcome as well as treatment moderators. Non-specific predictors provide prognostic information by clarifying which subgroups of clients will respond more or less favourably to treatment in general. Treatment moderators provide prescriptive information about optimal treatment selection by identifying subgroups of clients who are likely to benefit more from one treatment than another. Evaluation of non-specific predictors and moderators can provide important information to clinical practitioners as well as investigators to help find the most appropriate treatment for a client and to clarify the best choice of inclusion and exclusion criteria to maximize statistical power in future clinical trials.

In the present study, we compared two treatment modalities delivered to the population segment of smoking parents: quitline counselling versus a standard self-help brochure. Both intervention modalities are characterized by potentially high reach, thus yielding high potential public health impact (Glasgow, Vogt, & Boles, 1999). Both treatments are based on principals from cognitive-behaviour therapy (i.e., including didactic information, instruction in the use of behavioural and cognitive coping skills, and strategies for managing a lapse or relapse to smoking). In addition, quitline counselling also makes use of Motivational Interviewing (MI), which is a client-centered and directive method to enhance intrinsic motivation for behavioural change (Miller & Rollnick, 2002). MI's primary goal is to trigger a decision and to enhance commitment to this decision, for example by exploring and resolving ambivalence and by eliciting and selectively reinforcing change talk. While standard self-help materials may be an easy-to-disseminate, low-threshold treatment for smokers who display a high readiness to quit and high levels of self-efficacy, quitline counselling may be particularly beneficial among smokers who are ambivalent about quitting or who are not yet ready to quit.

In the present study, we examined potential non-specific outcome predictors and treatment moderators using established predictors of smoking cessation among the general population of smokers (e.g., key socio-demographic variables and smoking-related variables) as well as potential parent-specific predictors of smoking cessation (e.g., child health). Characteristics which have been found to be associated with the natural history of smoking cessation include older age, male gender, higher income, lower levels of cigarette consumption, lower levels of nicotine dependence, stronger desire to quit smoking, reasons for quitting, and absence of other smokers in the household (Hymowitz et al., 1997; Rose, Chassin, Presson, & Sherman, 1996). Among nonvolunteer smokers who were proactively recruited into quitline counselling, an indicator of nicotine dependence and intention to quit were consistent predictors of abstinence (Tzelepis et al., 2013). Previous research also indicated that subgroups of clients show greater improvement in one treatment compared to another. For example, smokers with a tobacco-related illness and smokers living with non-smoking children have been shown to benefit more from a web-based tailored cessation intervention compared to a web-based non-tailored cessation intervention (Strecher, Shiffman, & West, 2006).

The aim of the present study was to examine whether key socio-demographic characteristics (age, gender, education, employment status, material status), smoking-related characteristics (cigarettes smoked per day, nicotine dependence, previous quit attempt, motivation to quit, partner smoking, confidence in quitting, importance of quitting, chronic respiratory illness), and parent-specific characteristics (chronic respiratory illness of child, number of children in household, wanting to quit for health of child) constitute non-specific predictors of treatment outcome or treatment moderators in the population of smoking parents. Based on previous literature, we expected that several socio-demographic and smoking-related characteristics (i.e., higher socio-economic status, lower levels of nicotine dependence/cigarette consumption, absence of smoking partner, higher intention to quit, higher confidence in quitting) would increase general treatment success. We also hypothesized that wanting to quit for the health of the child and having a child with a chronic respiratory illness may increase motivation and thereby success in quitting among smoking

parents. With regard to treatment moderators, we hypothesized that quitline counselling (which is more intense, more guided, and has greater potential to increase intrinsic motivation compared to self-help material) would yield greater efficacy among parents who may benefit from more assistance (i.e., lower educated and more dependent parents) and parents who may benefit from motivational interviewing techniques (i.e., parents with a lower motivation to quit).

Methods

Participants

Smoking parents were recruited using mailings through primary schools across several municipalities in the Netherlands. Parents registered for the study by returning a form with their contact information in an enclosed envelope. Inclusion criteria were: 1) being at least a weekly smoker, 2) being a parent/caretaker of a child between 9-12 years old, 3) having the intention to quit smoking (currently or in the future), and 4) giving informed consent for participation of parent-child dyad. A total of 512 smoking parents participated in the present study.

Procedure

The baseline measurement of the RCT took place between January and July 2011 (questionnaires were filled in via a data collection website or on paper). After the baseline assessment, parents were randomly assigned to either the telephone counselling condition (n=256) or the self-help brochure condition (n=256). Within 2 weeks after the baseline assessment, parents were either called to schedule the first counselling call or they received the self-help brochure. The post-measurement took place approximately three months after start of the intervention (i.e., after receiving the intake call or the self-help brochure). The follow-up measurement took place approximately twelve months after start of the intervention. The detailed design and Consolidated Standards of Reporting Trials (CONSORT) diagram can be found published in Schuck and colleagues (2011) and Schuck and colleagues (in press). The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen approved of the study.

Measures

Potential moderators at baseline

Socio-demographic variables. These variables included age, gender, education (low, medium, high), material status (never married, married, divorced/widowed), and employment status (unemployed, casually employed, part-time employed, full-time) employed.

Smoking-related variables. These variables included the number of cigarettes smoked per day, years of smoking, nicotine dependence level (FTND; Fagerstrom & Furberg, 2008), past quit attempt (never, ever, in past 12 months), intention to quit (Hitchman et al., 2011), current smoking status of partner (smoker, non-smoker), and

presence of a chronic respiratory illness such as asthma (no, yes). Also, confidence in quitting and importance of quitting were assessed on a ten-point scale.

Child-related variables. These variables included the number of children living in the household, the presence of a chronic respiratory illness such as asthma in child (no, yes), and wanting to quit for the health of the child (no, yes).

Treatment condition

Proactive telephone counselling. Participants in the telephone counselling condition received up to seven counsellor-initiated phone calls (i.e., one 30-minute intake call and up to six additional 10-minute calls) across a period of approximately three months. Counselling calls were conducted by counsellors of the non-profit Dutch national quitline, which is part of Stivoro (Dutch expert centre on tobacco control). Telephone counselling was based on Motivational Interviewing (Miller & Rollnick, 2002) and cognitive-behavioural skill building. All counsellors were trained and experienced in the delivery of telephone counselling.

Among participants who were willing to set a quit date, emphasis was put on providing didactic information, increasing intrinsic motivation for behavioural change, providing support in the use of behavioural and cognitive coping skills to avoid triggers to smoke and deal with urges to smoke, and providing strategies for managing a lapse or relapse to smoking. Use of NRT or a pharmacological treatment (varenicline, bupropion) was recommended if participants smoked ten cigarettes per day or more. Among participants who were not willing to set a quit a date, emphasis was put on exploring ambivalence and increasing the participant's intrinsic motivation to quit smoking using Motivational Interviewing (Miller & Rollnick, 2002).

In addition to the counselling calls, all participants in the quitline counselling condition received three accompanying booklets titled *Smoke-free parents*[5] (4 pages, A4-format, colour-print). Each booklet contained didactic information, tips and advice on how to initiate and maintain abstinence, motivational or self-efficacy enhancing messages, as well as 'parent-relevant information' (e.g., effects of SHS on children, suggestions to involve children in process of smoking cessation, strategies to manage parent-specific stressors). Participants received the booklets at three time points throughout telephone counselling (immediately after start of counselling, three weeks after start of counselling, and six weeks after start of counselling). More detailed treatment information is reported in Schuck et al. (2013).

Self-help brochure. Participants in the self-help material condition received a 40-page, colour-printed self-help brochure[6] for smoking cessation copyrighted by Stivoro. The brochure included didactic information on nicotine dependence and the health benefits associated with quitting smoking, tips and advice on how to initiate and maintain abstinence, instruction in the use of cognitive and behavioural skills to avoid triggers to smoke and cope with urges to smoke, and strategies for managing a lapse or relapse to smoking. Also, information on the use of NRT or a pharmacological treatment was provided. The brochure was divided into five parts: reasons for quitting, craving and withdrawal, preparing to quit, help with quitting, and maintenance of abstinence. The brochure was based on empirically supported practices for advice on smoking cessation (Lancaster & Stead, 2005).

5 Dutch name of booklets: *Rookvrij opvoeden*

6 Dutch name of brochure: *Stoppen met roken: Willen en kunnen*

Outcome Measures

7-day point prevalence abstinence at 12-months post-intervention assessment was measured using the question 'Have you smoked during the past seven days, even a single puff?' and 'Have you used any other form of tobacco during the past seven days, for example pipes or cigars?' 6-months prolonged abstinence at 12-months follow-up measurement was achieved when participants reported 7-day point prevalence abstinence at 12-months post-intervention assessment and indicated that they had quit smoking for a period of at least six months.

Statistical analyses

Statistical analyses were conducted using SPSS 19 (SPSS Inc. Chicago, IL). To identify non-specific predictors of treatment effectiveness among smoking parents, we conducted bivariate logistic regression analyses among all smoking parents. The dependent variables were 7-day point prevalence abstinence and 6-months prolonged abstinence at 12-months after start of the intervention. The independent variables were the selected putative non-specific predictors/moderators at baseline (socio-demographic, smoking-related, and child-related characteristics of the smoking parents). Significant predictors of abstinence in univariate analyses were entered into a multivariate regression model.

To identify treatment-specific moderators, we conducted moderation analyses using hierarchical logistic regression. The dependent variable was 7-day point prevalence abstinence at 12-months follow-up measurement and the independent variables were treatment condition and the selected putative moderators at baseline (socio-demographic, smoking-related, and child-related characteristics of the study participants). Treatment condition was entered on the first step, the putative moderator was entered on the second step, and the interaction term between treatment condition and the putative moderator was entered on the third step. Statistical analysis of moderators was performed following the guidelines of Kraemer, Wilson, Fairburn, and Agras (2002) for evaluating moderators of treatment-effects in randomized trials. Dichotomous baseline variables (including treatment condition) were coded as -0.5 and 0.5 and continuous baseline variables were centered at their mean.

Results

Descriptive Statistics at Baseline

Flow of participants through the trial has been reported elsewhere (Schuck et al., 2013). Table 1 displays descriptive statistics for all potential predictors/moderators at baseline. No significant differences between the telephone counselling condition and the self-help brochure condition were observed on any of these variables.

Table 1 Descriptive statistics for all potential baseline predictors

Characteristics	Total sample	Quitline counselling	Self-help brochure	*p*
Socio-demographic				
Age (*M*, *SD*)	42.2 (5.4)	42.3 (5.6)	42.0 (5.1)	.59
Gender (%)				
Female	52.5	51.2	53.9	.54
Education (%)				
Low	15.2	16.4	14.1	
Medium	56.6	56.3	57.0	
High	26.2	25.4	27.0	.74
Employment status (%)				
Unemployed	15.8	14.5	17.2	
Casual	3.5	3.9	3.1	
Part time	37.5	35.2	39.8	
Full time	43.0	46.5	39.5	.38
Marital status (%)				
Never married	12.5	12.9	12.1	
Married	67.6	67.6	67.6	
Divorced/widowed	19.7	19.5	19.9	.97
Smoking-related				
Cigarettes per day (*M*, *SD*)	16.2 (7.8)	15.7 (8.0)	16.8 (7.7)	.14
Years of smoking (*M*, *SD*)	24.9 (7.7)	25.1 (7.4)	24.6 (8.0)	.43
FTND score (*M*, *SD*)	4.0 (2.4)	4.0 (2.4)	4.0 (2.4)	.80
Quit attempt (%)				
Never	4.7	4.3	5.1	.58
Ever, but not in past year	59.6	57.8	61.3	
In past year	35.7	37.9	33.6	
Intention to quit (%)				
Not within twelve months	9.8	10.9	8.6	
Within twelve months	23.4	20.3	26.6	
Within six months	33.0	35.2	30.9	
Within one month	33.6	33.6	33.6	.31
Partner smoking (%)				
Yes	33.4	30.9	35.9	.20
Confidence in quitting (0-10)	6.1 (2.0)	6.1 (1.9)	6.1 (2.0)	.82
Importance of quitting (0-10)	8.9 (1.6)	8.9 (1.5)	8.9 (1.6)	.98
Chronic respiratory illness				
Yes	7.8	7.0	8.6	.51
Child-related				
Chronic respiratory illness child (%)				
Yes	14.6	14.5	14.8	.90
Number of children in household (*M*, *SD*)	2.2 (0.7)	2.2 (0.7)	2.2 (0.7)	.66
Wanting to quit for child (%)				
Yes	85.0	87.1	82.8	.18

Table 2 Odd ratios and 95% confidence intervals of baseline characteristics on 7-day point prevalence abstinence and 6-months prolonged abstinence at 12-months follow-up among smoking parents

Baseline characteristics	7-day Point-Prevalence Abstinence		6-months Prolonged Abstinence	
	Crude	Model	Crude	Model
Socio-demographic				
Age	1.01 (0.98-1.05)	n/a	1.04 (0.99-1.08)	n/a
Gender	1.50 (1.01-2.23)*	1.60 (1.04-2.46)***	1.59 (0.99-2.56)[a]	n/a
Education	1.11 (0.81-1.51)	n/a	0.92 (0.64-1.33)	n/a
Employment status	1.21 (0.99-1.48)[a]	n/a	1.29 (1.00-1.65)*	1.32 (1.00-1.73)*
Marital status	0.98 (0.69-1.39)	n/a	0.87 (0.58-1.32)	n/a
Chronic respiratory illness	1.80 (0.92-3.53)	n/a	0.89 (0.36-2.20)	n/a
Smoking-related				
Cigarettes per day	0.93 (0.91-0.96)***	0.94 (0.90-0.98)**	0.94 (0.91-0.97)***	0.93 (0.88-0.98)**
Years of smoking	0.98 (0.96-1.01)	n/a	1.00 (0.97-1.03)	n/a
Nicotine dependence	0.85 (0.78-0.92)***	0.97 (0.86-1.11)	0.90 (0.82-0.99)*	1.08 (0.93-1.27)
Quit attempt	0.93 (0.61-1.40)	n/a	0.83 (0.54-1.26)	n/a
Intention to quit	1.48 (1.19-1.84)***	1.32 (1.03-2.46)*	1.40 (1.08-1.81)*	1.27 (0.96-1.68)
Partner smoking	0.77 (0.50-1.18)	n/a	0.66 (0.39-1.12)	n/a
Confidence in quitting	1.23 (1.10-1.37)***	1.14 (1.00-1.29)*	1.14 (1.00-1.29)*	1.06 (0.92-1.22)
Importance of quitting	1.02 (0.90-1.16)	n/a	0.99 (0.86-1.15)	n/a
Child-related				
Child chronic respiratory illness	1.88 (1.12-3.16)*	1.91 (1.09-3.34)*	2.12 (1.19-3.77)*	2.14 (1.17-3.92)*
Number of children in household	1.22 (0.90-1.66)	n/a	0.94 (0.66-1.37)	n/a
Wanting to quit for child	2.64 (1.31-5.30)**	2.55 (1.19-5.48)*	3.20 (1.25-8.17)*	2.74 (1.04-7.22)*
R^2		0.16		0.12

Note. * $p < .05$; ** $p < .01$; *** $p < .001$, [a] < .06.

Table 3 Odd ratios and 95% confidence intervals of moderators on 7-day point prevalence abstinence and 6-months prolonged abstinence at 12-months follow-up for the telephone counselling condition and the self-help brochure condition

Endpoint	Moderator	Condition	OR (95%-CI)	*P*-Value
7-day Point-Prevalence Abstinence	Intention to Quit*	Telephone counselling Self-help brochure	1.26 (0.96-1.65) 2.03 (1.37-3.02)	.10 <.001
	Educational Level**	Telephone counselling Self-help brochure	0.78 (0.52-1.16) 2.15 (1.25-3.68)	.22 <.01
6-months Prolonged Abstinence	Intention to Quit[a]	Telephone counselling Self-help brochure	1.21 (0.90-1.63) 0.71 (1.26-4.16)	.22 <.01
	Educational Level	Telephone counselling Self-help brochure	0.91 (0.59-1.42) 1.03 (0.51-2.09)	.69 .93

Note. Interaction term significant at the level of: * $p < .05$; ** $p < .01$; [a] < .06.

Non-specific predictors of 7-day point prevalence abstinence and 6-months prolonged abstinence at 12-months assessment

Table 2 display univariate and multivariate associations between potential predictors of outcome and point prevalence abstinence and prolonged abstinence at 12-months assessment. In the multivariate model predicting point prevalence abstinence, gender (OR=1.60, CI=1.04-2.46), number of cigarettes smoked per day (OR=0.94, CI=0.90-0.98), intention to quit (OR=1.32, CI=1.03-2.46), confidence in being able to quit (OR=1.14, CI=1.00-1.29), presence of a child with a chronic respiratory illness (OR=1.91, CI=1.09-3.34), and wanting to quit for the health of the child (OR=2.55, CI=1.19-5.48) were significant outcome predictors across treatment conditions. In the multivariate model predicting prolonged abstinence, employment status (OR=1.32, CI=1.00-1.73), number of cigarettes smoked per day (OR=0.93, CI=0.88-0.98), presence of a child with a chronic respiratory illness (OR=2.14, CI=1.17-3.92), and wanting to quit for the health of the child (OR=2.74, CI=1.04-7.22) were significant outcome predictors across treatment conditions.

Treatment moderators of 7-day point prevalence abstinence and 6-months prolonged abstinence at 12-months assessment

In the prediction of point prevalence abstinence, there was a significant interaction between treatment condition and educational level (OR=.36, CI=.18-.71, p<.01). In the quitline counselling condition, educational level was not predictive of point prevalence abstinence (OR=.78, CI=.52-1.16). In the self-help brochure condition, higher

educational level was associated with an increased likelihood of being abstinent (OR=2.15, CI=1.25-3.68). Also, there was a significant interaction between treatment condition and intention to quit (OR=0.62, CI=0.38-1.00, p=.05). In the quitline counselling condition, intention to quit was not predictive of point prevalence abstinence (OR=1.26, CI=0.96-1.65). In the self-help brochure condition, higher intention to quit was associated with an increased likelihood of being abstinent (OR=2.03, CI=1.37-3.02). In the prediction of prolonged abstinence, there was a marginally significant interaction between treatment condition and intention to quit (OR=0.53, CI=0.27-1.03). In the quitline counselling condition, intention to quit was not predictive of prolonged abstinence (OR=1.21, CI=0.90-1.63). In the self-help brochure condition, higher intention to quit was associated with an increased likelihood of prolonged abstinence (OR=2.29, CI=1.26-4.17).

Discussion

In the present study, we examined non-specific predictors of treatment outcome and treatment moderators among smoking parents receiving quitline counselling and self-help material to provide information on general treatment responses and to guide specific treatment selections in tobacco addiction. Several characteristics at baseline were examined including previously established predictors of treatment outcome among the general population of smokers as well as specific parent-specific variables which have not been previously examined in relation to treatment responses.

Among the subpopulation of smoking parents, non-specific predictors of treatment that were observed consistently for point prevalence abstinence and prolonged abstinence were a lower number of cigarettes smoked per day, the presence of a child with a chronic respiratory, and wanting to quit for the health of one's child. Additionally, male gender, a higher intention to quit, and higher confidence in being able to quit predicted point prevalence abstinence and higher employment status predicted prolonged abstinence among smoking parents. Similar findings have been observed in previous studies among unaided quitters (Hymowitz et al., 1997; Rose et al., 1996; Tucker, Ellickson, & Klein, 2002), nonvolunteer smokers proactively recruited into quitline counselling (Tzelepis et al., 2013), smokers receiving computer-generated support materials for smoking cessation (Haug et al., 2010; Velicer, Redding, Sun, & Prochaska, 2007), and smokers receiving treatment in a smoking cessation outpatient clinic (Ferguson, Bauld, Chesterman, & Judge, 2005). The present study extends current literature by examining the role of parents-specific characteristics in treatment responses. Among smoking parents, the presence of a child with a chronic respiratory illness and wanting to quit for the health of one's child was associated with an increased likelihood to achieve point prevalence abstinence and prolonged abstinence at one-year after start of the treatment. Previous studies indicated that the majority of parents are concerned about modelling smoking to their children (Hitchman et al., 2011) and that parents of children with a smoking-related illness display a particularly high motivation to quit (Halterman et al., 2010; Winickoff, McMillen, et al., 2003). The present study is the first to show that these factors do not only increase motivation to quit, but also actual success in quitting when receiving treatment.

Moreover, the present study indicates that certain subgroups of parents may respond better to one treatment compared to another. In the prediction of point prevalence abstinence and prolonged abstinence, intention to quit appears to be a consistent treatment moderator (i.e., intention to quit did not predict abstinence among parents receiving quitline counselling, but higher intention to quit predicted abstinence among parents in the self-help condition), indicating that parents with a lower intention to quit are more likely to achieve abstinence when receiving quitline counselling compared to a self-help brochure. Higher intention or readiness to quit is a consistent predictor of abstinence in untreated and treated smokers (Ferguson et al., 2005; Spencer, Pagell, Hallion, & Adams, 2002; Velicer et al., 2007). As hypothesized, telephone counselling (which is based on motivational interviewing and aims to increase intrinsic motivation for behavioural change) may be more potent than self-help materials in increasing motivation to quit and subsequent success in quitting among smokers who may not yet be ready to quit at the start of the intervention.

In addition, educational level was a significant treatment moderators in the prediction of point prevalence abstinence, but not prolonged abstinence among smoking parents. Although caution should be exercised in interpreting this finding, parents with a lower education may be more likely to benefit from from quitline counselling than a self-help brochure. Although self-help materials can be beneficial even in smokers with low socio-economic status (SES; Brandon et al., 2012), it is possible that low SES smokers benefit more from an intervention that can make up for some of the inherent disadvantages of their social status. Possibly, content and reading level of self-help material may not match the needs of lower SES smokers. Also, inter-individual differences in needs can be better addressed in individual counselling than self-help materials.

Several limitations of the present study should be acknowledged. First of all, the endpoints (smoking status) were determined by self-report, which may be subject to reporting biases such as a social desirability bias. Also, generalizability of the findings may be limited by the specific sample characteristics. Participants were higher educated than the general population in the Netherlands. Also, the present study examined only two types of interventions (i.e., quitline counselling and standard self-help material). The results may not generalize to other interventions such as pharmacological interventions or web-based interventions. Similarly, the present study examined only a limited number of predictor variables. While these variables were selected based on theory and literature, it is possible that other relevant variables may not have been included. Finally, it should be noted that multiple analyses were conducted, which may result in an inflated type I error (i.e., chance findings). However, examining the role of parent-specific characteristics had an exploratory objective, aiming to generate hypotheses rather than testing them.

In conclusion, several preliminary recommendations can be made from the present study, given that the results can be replicated and consistently observed. Health care providers need to acknowledge that smoking parents represent a high priority population segment among adult smokers and that certain parent-specific characteristics (i.e., having a child with a chronic respiratory illness and wanting to quit for the health of the child) can provide predictive information about treatment responses. Specific treatment selections should be made in accordance with baseline characteristics (e.g., intention to quit and educational level/socio-economic status). Knowledge about characteristics that increase responsiveness to treatment (e.g., knowledge about parenting values that motivate parents to quit) can be used to tailor existing interventions (e.g., if these variables can be influenced, a quit attempts may be more likely to be successful). Also, knowledge about these characteristics can be used to approach smoking parents (e.g., recruitment rates may be higher if campaigns, invitation letters, and information material address these characteristics in smokers and smoking parents). Importantly, quitline counselling seems effective regardless of intention to quit, suggesting that proactive recruitment into quitline counselling may increase cessation rates even nonvolunteer smokers who may not be ready to quit at baseline. Similarly, quitline counselling seems effective even in smokers with lower SES, thereby bearing the potential to reduce health disparities and social inequalities. In conclusion, the present study provides preliminary evidence that there may be a number of pre-treatment characteristics that influence responsiveness to treatment and that should be taken into account in treatment selections.

Chapter 10

Self-efficacy and acceptance of cravings to smoke underlie the effectiveness of quitline counselling among smoking parents

Submitted as:
Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. Self-efficacy and acceptance of cravings to smoke underlie the effectiveness of quitline counselling among smoking parents.

Abstract

Background: Few studies have examined why smoking cessation interventions are effective, and none have done so for telephone-based smoking cessation interventions among adults. The aim of this study was to examine the mediating processes underlying the effectiveness of quitline cessation support among smoking parents. Methods: Data were used of a two-arm randomized controlled trial in which smoking parents, who were recruited through primary schools, received either quitline counselling (n=256) or a self-help brochure (n=256). The endpoint was 6-months prolonged abstinence at 12-months follow-up measurement, with 86.7% outcome data retention. Putative mediators of treatment effectiveness included smoking-related cognition (positive outcome expectancies of smoking, self-efficacy), emotions (negative affect, perceived stress, depressive symptoms), and smoking cue coping methods (avoidance coping, acceptance coping) assessed at 3-months post-measurement. Results: Significant effects of quitline support on positive outcome expectancies of smoking, self-efficacy, negative affect, avoidance of external cues to smoking, and acceptance of internal cues to smoking were found. Increased self-efficacy to refrain from smoking in stressful and tempting situations and increased acceptance of cravings to smoke significantly mediated the effect of quitline support on prolonged abstinence and explained 25.1% of the observed variance in the outcome. Conclusions: Self-efficacy to refrain from smoking and acceptance of cravings (willingness to experience smoking cravings) were strong mediators of prolonged abstinence at 12-months follow-up. During intervention implementation, monitoring of treatment effects on self-efficacy and acceptance of cravings may provide guidance to further improve the potency and cost-effectiveness of quitlines smoking cessation treatments.

Introduction

Cigarette smoking constitutes a substantial public health problem (USDHHS, 2012; WHO, 2010). A range of psychological treatments has been shown effective in increasing smoking cessation (Lancaster, Stead, Silagy, & Sowden, 2000), but relatively little is known about the mechanisms underlying effective treatments. Although randomized controlled trials are frequently conducted to examine the effectiveness of smoking cessation treatments, few studies report mediators of treatment outcome among evidence-based smoking cessation treatments (i.e., the underlying processes responsible for treatment-induced change). Understanding the extent to which psychological processes are changed by cessation treatments and the extent to which these processes subsequently affect treatment success may provide guidance to further improve the potency and cost-effectiveness of available treatments (Kraemer, Wilson, Fairburn, & Agras, 2002).

Telephone counselling or quitline support has demonstrated effectiveness in numerous studies and a meta-analytic review (Stead, Perera, & Lancaster, 2006). In addition, accumulating evidence indicated that quitline support is a cost-effective public health intervention (Cromwell, Bartosch, Fiore, Hasselblad, & Baker, 1997; Kahende, Loomis, Adhikari, & Marshall, 2009; Lichtenstein, 2007; Tomson, Helgason, & Gilljam, 2004). Quitline services are available to nearly all smokers in Western Europe and North America, thus yielding high potential public health impact.

Smoking parents represent a high priority subpopulation, accounting for 20-40% of adult smokers (Hitchman, Fong, Zanna, Hyland, & Bansal-Travers, 2011; Otten, Engels, & van den Eijnden, 2005; Schuck, Otten, Engels, & Kleinjan, 2012; Winickoff et al., 2006) . Parental smoking cessation will not only improve the health of the parent, but will also reduce the risk of physical illness (Halterman et al., 2004), smoking initiation (Otten, Engels, van de Ven, & Bricker, 2007), and regular smoking (Bricker et al., 2003) in their children. Therefore, promoting smoking cessation among parents is a major aim in the treatment and prevention of nicotine addiction. We recently reported results of a randomized controlled trial which demonstrated effectiveness of quitline counselling compared to a standard self-help brochure in increasing cessation rates among the population of smoking parents (Schuck, Bricker, Otten, Kleinjan, & Engels, in press). In this trial, quitline counselling was found to be highly effective in increasing sustained abstinence rates at one-year follow-up among smoking parents compared to a self-help brochure (23.4% and 5.9%, $p < .001$).

To build on these important outcomes, this study sought to identify the underlying psychological processes that mediate the effectiveness of quitline support among parents. To do so, we compared the effects of quitline counselling, based on cognitive-behavioural therapy and motivational interviewing, to standard self-help materials on several putatively targeted processes (i.e., cognitions, emotions, coping).

Cognitive-behavioural therapy (CBT) is the current standard counselling approach to smoking cessation, which aims to change dysfunctional smoking-related cognitions, to teach methods to avoid or control cues or situations that trigger smoking, and to teach strategies for mood management (Forman, Herbert, Moitra, Yeomans, & Geller, 2007). Motivational Interviewing (MI; Miller & Rollnick, 2002) is a client-centered approach, which aims to enhance commitment by resolving ambivalence and by

focusing on personal values and goals to design and implement behavior change strategies. Although MI is not necessarily a mindfulness- or acceptance-based treatment (ACT), it is consistent with many of the same principles, and being mindful of one's thoughts, feelings, and sensations (i.e., allowing thoughts, emotions, and sensations to come and go without trying to control them) is often part of *third-generation* treatments such as MI (Bricker, Wyszynski, Comstock, & Heffner, 2013). Psychological processes intended to be targeted by CBT- and MI-based counselling include smoking-related cognitions such as positive outcome expectancies of smoking and perceived ability to refrain from smoking in stressful and tempting situations (i.e., self-efficacy), emotions such negative affect, perceived stress, and depressive symptoms, as well as behavior such as avoidance of external smoking-related cues and acceptance of internal cues to smoking.

Previous studies support a role of these psychological processes in successful smoking cessation. Dysfunctional smoking-related cognitions (e.g., positive outcome expectancies of smoking) have been shown to hinder the initiation of abstinence and to predict treatment failure (Vangeli, Stapleton, Smit, Borland, & West, 2011). A large body of research has demonstrated that smokers with higher self-efficacy to refrain from smoking are more likely to initiate and maintain abstinence during unaided as well as aided quit attempts (Gwaltney, Metrik, Kahler, & Shiffman, 2009; Schnoll et al., 2011; Shiffman et al., 2000). In addition to smoking-related cognitions, emotions (e.g., post-cessation affect, perceived stress, depressive symptoms) have been found to play a substantial role in the outcome of smoking cessation efforts. Increases in negative affect following a quit attempt have been shown to predict relapse to smoking in unaided quitters and treatment-seekers (Kenford et al., 2002; Shiffman et al., 1996; Shiffman & Waters, 2004). Similarly, perceiving high levels of stress has been shown to increase the risk of relapse to smoking during unaided and aided attempts at cessation (Carey, Kalra, Carey, Halperin, & Richards, 1993; D'Angelo, Reid, Brown, & Pipe, 2001). Depressed mood is generally assumed to predict poor treatment outcome among smokers, although findings have been mixed (Berlin & Covey, 2006). Finally, the use of coping strategies (e.g., avoidance of external cues to smoking and acceptance of cravings to smoke) also plays a role in the outcome of a quit attempt. Among recent quitters, cognitive coping was found to be strongly associated with remaining abstinent in tempting situations. Quitters who reported using coping strategies during temptations to smoke were 12 times more likely to remain abstinent during a tempting situation than those who did not (Shiffman et al., 1996). Recently, acceptance of cravings to smoke has been shown to mediate the effectiveness of web-based and face-to-face ACT for smoking cessation (Bricker et al., 2013; Gifford et al., 2011).

The objective of the present study was to examine whether cognitions, emotions, and coping are putative mediators underlying the effectiveness of quitline counselling for smoking parents. We hypothesized that smoking parents receiving quitline counselling would report less positive outcome expectancies of smoking, increased self-efficacy, lower negative affect, perceived stress, and depressive symptoms, as well as increased avoidance of external cues to smoking and increased acceptance of cravings to smoke (willingness to experience sensations that cue smoking without trying to control them). We hypothesized that these variables would, in turn, predict smoking cessation at 12-months follow-up. To test whether these variables constitute

putative mediators of the effectiveness of quitline counselling, we conducted mediation analyses. Understanding the extent to which quitline counselling changes psychological processes which subsequently contribute to successful smoking cessation is valuable in understanding the active and redundant elements in treatment. This knowledge may help to further improve the potency, delivery efficiency, and cost-effectiveness of quitline counselling by revealing which psychological processes need to be further targeted to enhance treatment effectiveness. To our knowledge, this is the first study to examine mediators of an adult smoking cessation quitline intervention.

Methods

Participants

Smoking parents were recruited through primary schools across the Netherlands. Primary schools were contacted by research assistants and asked to distribute study invitation letters to parents through children. A total of 438 schools agreed to distribute study invitation letters to all children in US grade 4-6 (age 9-12 years). Children were instructed to give the letters to their parents. Parents registered for the study by mail, e-mail, telephone, or website. Inclusion criteria were: 1) being at least a weekly smoker, 2) being a parent/caretaker of a child between 9-12 years old, 3) having the intention to quit smoking (currently or in the future), and 4) giving informed consent for participation of parent-child dyad. A total of 622 parents registered and 512 parents were enrolled. Full reports of the study design, the recruitment procedure, and effectiveness of the intervention among parents are published elsewhere (Schuck et al., 2011; Schuck et al., 2013; Schuck et al., in press).

Procedure

The present study was designed as a two-arm randomized controlled trial with three assessments (Figure 1). After registration, parents were sent the baseline questionnaire. The baseline assessment took place between January and July 2011. After the baseline assessment, parents were randomly assigned to either a quitline counselling condition (n=256) or a self-help brochure condition (n=256). Allocation of parents to trial conditions was done by an independent member of the research group using a computer program which generated a randomization schedule. Participants were stratified by gender, educational level, and smoking intensity. Within 2 weeks after baseline assessment, parents assigned to the quitline counselling condition were called by the quitline to schedule the first counselling call and parents assigned to the self-help condition were sent the self-help brochure. The post-measurement took place three months after start of the intervention. The follow-up measurement took place twelve months after start of the intervention. Assessment methods were the same across all three measurements. Participants received 100 euro (approximately 127 US dollars) for participation in all three assessments. The study was approved by the ethics committee of the Faculty of Social Sciences, Radboud University Nijmegen. The protocol is registered in the Netherlands Trial Register (NTR2707).

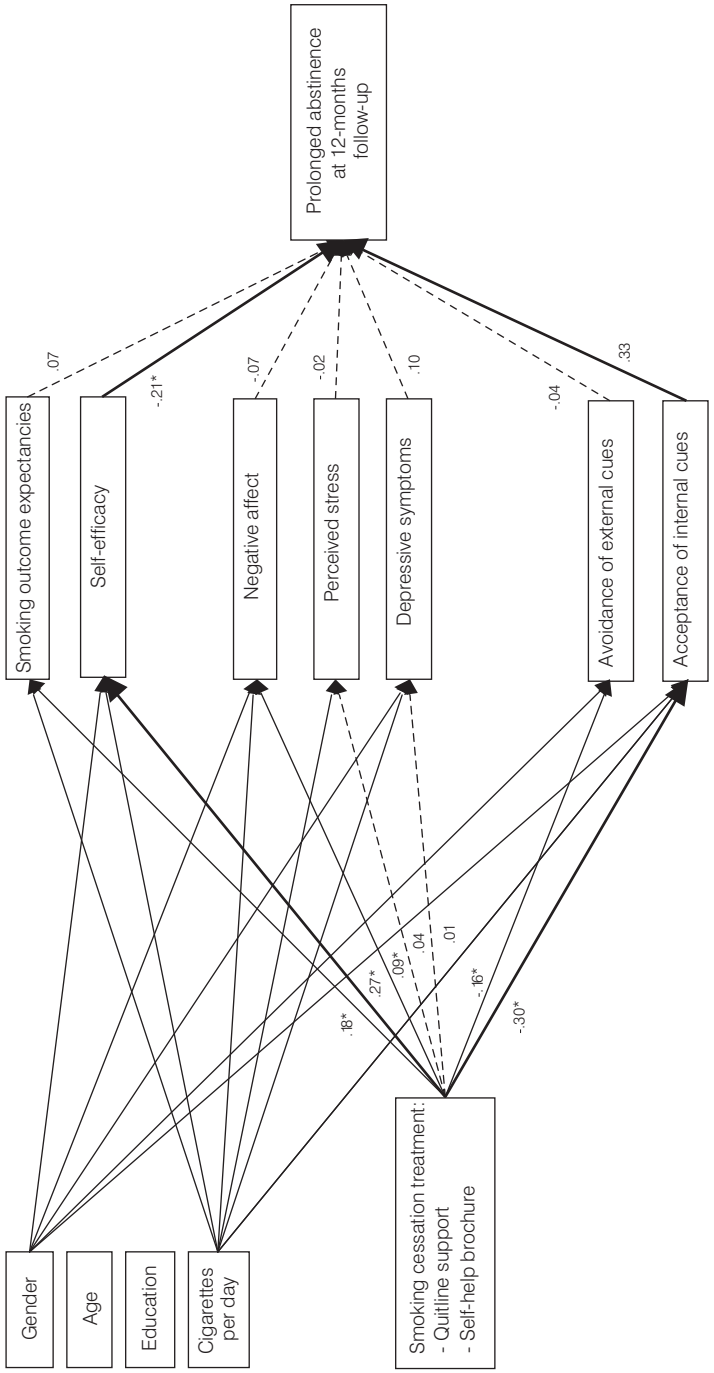

Figure 1 Standardized path coefficients of the structural equation model testing direct and indirect associations between study variables

Note. * indicates p< .05. For confounds, only significant paths are displayed.
Solid lines indicate significant paths. Bold lines indicate significant indirect effects.
Correlations between putative mediators and direct effects between predictors and outcome are included in the model, but not displayed.

Measures

Treatment condition

Quitline Counselling. Participants in the quitline counselling condition received up to seven counsellor-initiated phone calls across a period of three months. Calls were conducted by counsellors of the Dutch national quitline. Counselling was based on cognitive-behaviour therapy (CBT) and Motivational Interviewing (MI; Miller & Rollnick, 2002). Emphasis was put on providing didactic information on nicotine dependence, exploring ambivalence regarding smoking and quitting, enhancing intrinsic motivation for behavioural change, providing behavioural support (anticipation of difficult situations and discussing coping strategies), and relapse prevention. The counselling topics also included, as needed, weight control, stress management, and mood management. Next to CBT-based and MI-based components, the counselling also included acceptance-focused components (e.g., emotional surfing to cope with cravings). Use of nicotine replacement therapy (NRT) or a pharmacological treatment was recommended if participants smoked ten cigarettes per day or more. All participants in the quitline condition also received three accompanying booklets titled *Smoke-free parents*, which were designed for this study as tailored supplementary materials. Each booklet contained didactic information, tips and advice, motivational messages, as well as 'parent-relevant information' (e.g., effects of SHS on children, strategies to manage parent-specific stressors). A more detailed description of the treatment can be found published in Schuck et al. (2013).

Standard Self-Help Brochure. Parents in the self-help brochure condition received a 40-page, colour-printed self-help brochure including didactic information on nicotine dependence and the health benefits associated with quitting smoking, tips and advice on how to initiate and maintain abstinence, instruction in the use of cognitive and behavioural skills to avoid triggers to smoke and cope with urges to smoke, and strategies for managing a lapse or relapse to smoking. Also provided was information on the use of NRT or a pharmacological treatment, including the recommendation of use for those who smoke at least 10 cigarettes per day. The brochure was based on empirically supported practices for advice on smoking cessation (Lancaster & Stead, 2005).

Putative treatment mediators

Smoking-related cognitions.

Smoking outcome expectancies. To assess smoking outcome expectancies, participants were asked to indicate the degree to which they agree with ten statements using the Pros of Smoking Scale (Dijkstra & De Vries, 2000). Response options ranged from 1 (totally disagree) to 4 (totally agree). Example items are: "Smoking helps cope with stress" and "Smoking helps relax". A mean score was calculated, with higher scores meaning more perceived benefits of smoking (X=2.33, *SD*=.65). Internal consistency was good (Cronbach's alpha = .85). Smoking outcome expectancies have been previously shown to distinguish between smokers who planning to quit and smokers who are not planning to quit (Dijkstra, de Vries, & Bakker, 1996).

Self-efficacy. To assess self-efficacy (i.e., confidence in one's ability to refrain from smoking), participants were asked to indicate the perceived difficulty not to smoke in

eight smoking-specific situations (cf. Velicer, Diclemente, Rossi, & Prochaska, 1990). Response options ranged from 1 (very easy) to 5 (very difficult). Example items are: "To refuse a cigarette when offered one, I find ..." and "Not smoking when feeling angry, I find ...". A mean score was calculated, with higher scores meaning higher perceived difficulty to resist smoking in specific situations (X=3.06, SD=.83). Internal consistency was good (Cronbach's alpha = .85). Self-efficacy to refrain from smoking has been previously shown to predict the initiation and maintenance of abstinence from smoking (Gwaltney et al., 2009; Schnoll et al., 2011; Shiffman et al., 1996).

Emotions.

Negative affect. To assess negative affect, participants were asked to indicate the extent to which they experienced 10 particular emotions within the past week using the negative affect scale of the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988). Response options ranged from 1 (very slightly) to 5 (very much). Example items are: 'Distressed', 'Upset', and 'Irritable'. A sum score was calculated, with higher scores meaning more negative affect (X=16.58, SD=6.45). Internal consistency was good (Cronbach's alpha = .89). The PANAS has been demonstrated to constitute a reliable and valid measure among non-clinical samples (Crawford & Henry, 2004), and negative affect has been shown to predict smoking cessation (Kenford et al., 2002, Shiffman et al., 1996; Shiffman & Waters, 2004).

Perceived stress. To assess perceived stress, the four-item version of the Perceived Stress Scale (PSS-4; Cohen et al., 1983) was used. Participants were asked to indicate the degree to which they experienced situations as stressful during the past month (e.g., 'In the last month, how often have you felt confident about your ability to handle your personal problems?'). Response options ranged from 1 (never) to 5 (very often). A sum score was calculated, with higher scores meaning higher perceived stress (X=9.69, SD=2.81). Internal consistency was acceptable (Cronbach's alpha = .72). The PSS-4 has demonstrated acceptable psychometric properties among non-clinical samples (Herrero & Meneses, 2004) and perceived stress has been shown to predict smoking cessation (Carey et al, 1993; D'Angelo et al., 2001).

Depressive symptoms. To assess the presence of depressive symptoms, The Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) was used. Participants were asked to indicate the extent to which 20 items applied to them during the past week. Response options ranged from (1) rarely or none of the time (less than once a week) to (4) most or all of the time (5-7 days a week). A sum score was calculated, with higher scores meaning more depressive symptoms (X=30.47, SD=9.31). Internal consistency was excellent (Cronbach's alpha = .92). The CES-D has been demonstrated to constitute a reliable and valid measure to assess the level of depressive symptoms among the general population (Radloff, 1977) and depressive symptoms has been shown to predict smoking cessation (Berlin et al., 2006).

Coping.

Avoidance of external cues. To assess avoidance of external cues to smoking, we used two subscales of the Processes of Change (Prochaska, Velicer, DiClemente, & Fava, 1988), respectively stimulus control and counter-conditioning. In each subscale, respondents were asked to indicate to which extent they used four different coping

strategies. Response options ranged from 1 (never) to 5 (very often). An example item of the stimulus control subscale is: 'I remove things from my home that remind me of smoking'. An example item of the counter-conditioning subscale is:' I do something else instead of smoking when I need to relax or deal with tension'. A sum score of both subscales was calculated, with higher scores meaning greater avoidance of external cues to smoking (X=2.00, SD=.80). Internal consistency was good (Cronbach's alpha = .88). Evidence for the external validity of the processes of change has reported previously (Prochaska et al., 1988).

Acceptance. To assess acceptance (willingness to experience physical cravings that cue smoking without trying to control them), an adaptation of the Avoidance and Inflexibility Scale (AIS; Gifford et al., 2004) was used that has been previously published in Bricker, Wyszynski, Comstock, and Heffner (2013). Respondents were asked to indicate the extent to which they were willing to experience physical cravings (9 items) which cue smoking. Response options ranged from (1) Not at all to (5) Very willing. A mean score was calculated, with higher scores meaning greater acceptance of cravings to smoke (X=3.14, SD=.61). Internal consistency was acceptable (Cronbach's alpha = .70). Recently, acceptance has been found to mediate the effects of ACT for smoking cessation (J. Bricker et al., 2013; Gifford et al., 2011).

Outcome

Prolonged abstinence at follow-up. Prolonged abstinence was defined as consistent responses to the following self-reports: 1) abstinence for a period of at least six months at follow-up measurement, and 2) 7-day point prevalence abstinence ('Have you smoked during the past seven days, even a single puff?' and 'Have you used any other form of tobacco during the past seven days, for example pipes or cigars?'). Participants with missing outcome data were assumed to be smokers (i.e., intention-to-treat analysis).

Strategy for analyses

To evaluate the effects of treatment condition (quitline support versus self-help material) on prolonged abstinence via the putative mediators, a path model was estimated using structural equation modelling (SEM) in Mplus 5 (Muthen, 2007). The model included direct effects between baseline covariates (age, gender, education), treatment condition, the putative mediators at 3-months post-measurement (smoking-related cognitions, emotions, and coping), and prolonged abstinence at 12-months follow-up. The model also included the indirect effects between treatment condition and prolonged abstinence through the putative mediators. Direct associations between variables were assessed based on standardized path coefficients and p-values. Indirect effects (i.e., mediation effects) were tested using a bootstrap method in Mplus (Shrout & Bolger, 2002).

Of the 512 participants, 68 (13.3%) had missing responses on the outcome variable (prolonged abstinence) and were assumed to be smokers. The amount of missing data on the putative mediators ranged from 7.0% to 7.6%. Missing values on mediator variables were substituted in Mplus using full information maximum likelihood (FIML) estimation.

Results

Descriptive analyses

Key characteristics of participants at baseline are displayed in Table 1 for the entire sample and by condition. At baseline, there were no significant differences in participant characteristics between the quitline counselling condition and the self-help brochure condition on any of these variables.

Path model testing effects of quitline counselling on prolonged abstinence

To examine the effects of quitline counselling on prolonged abstinence, we tested a path model which included solely the effect of treatment condition on prolonged abstinence, controlling for gender, age, educational level, and number of cigarettes smoked per day. The estimated path model was fully saturated. Consistent with previous findings (Schuck et al., in press), quitline counselling had a significant effect on prolonged abstinence (beta=-.21, SE=.03, $p<.001$). Parents receiving quitline counselling were significantly more likely to report prolonged abstinence at 12-months follow-up assessment compared to parents receiving self-help materials.

Path model testing effects of quitline counselling on prolonged abstinence through psychological processes

The estimated path model (Figure 1) was fully saturated. There were significant effects of treatment condition on several psychological processes. Smoking parents receiving quitline counselling reported less positive outcome expectancies of smoking (beta=.18, SE=.04, $p<.001$), increased self-efficacy (beta=.27, SE=.05, $p<.001$), lower negative affect (beta=.09, SE=.02, $p=.05$), as well as increased avoidance of external cues to smoking (beta=-.12, SE=.02, $p=.001$), and increased acceptance of cravings to smoke (beta=-.30, SE=-.06, $p<.001$) compared to parents receiving self-help materials. In addition, when the avoidance of external cue subscales (i.e., stimulus control and counterconditioning) were also included as separate scales, the results remained unchanged (results not shown). Parents in the quitline condition did not differ significantly from parents in the self-help condition on perceived stress and depressive symptoms.

Of the putative mediators measured at post-measurement, self-efficacy (beta=-.21, SE=-.02, $p<.001$) and acceptance of cravings to smoke (beta=.33, SE=.03, $p<.001$) were significant predictors of prolonged abstinence at follow-up. The effect of treatment condition on prolonged abstinence was statistically mediated by self-efficacy (indirect effect=-.04, SE=.01, $p<.001$) and acceptance of cravings to smoke (indirect effect=-.08, SE=.02, $p<.001$). There was no significant direct effect of treatment condition on prolonged abstinence, indicating that the effect of quitline counselling on prolonged abstinence was fully mediated by increased self-efficacy and acceptance coping of participants.

Table 1 Key characteristics of participants at baseline

Characteristics	Total sample	Telephone counselling	Self-help brochure	*p*-value
Age (*M*, *SD*)	42.2 (5.4)	42.3 (5.6)	42.0 (5.1)	.59
Gender (%)				
Female	52.5	51.2	53.9	.54
Nationality (%)				
Dutch	97.9	97.7	98.0	.53
Education (%)				
Low	15.2	16.4	14.1	
Medium	56.6	56.3	57.0	
High	26.2	25.4	27.0	.74
Marital status (%)				
Never married	12.5	12.9	12.1	
Married	67.6	67.6	67.6	
Divorced/widowed	19.7	19.5	19.9	.97
Employment status (%)				
Unemployed	15.8	14.5	17.2	
Casual	3.5	3.9	3.1	
Part time	37.5	35.2	39.8	
Full time	43.0	46.5	39.5	.38
Cigarettes per day (*M*, *SD*)	16.2 (7.8)	15.7 (8.0)	16.8 (7.7)	.14
Years of smoking (*M*, *SD*)	24.9 (7.7)	25.1 (7.4)	24.6 (8.0)	.43
FTND score (*M*, *SD*)	4.0 (2.4)	4.0 (2.4)	4.0 (2.4)	.80
Ever made a quit attempt (%)				
Yes	95.3	95.7	94.9	.68
Quit attempt in past 12 months (%)				
Yes	35.7	37.9	33.6	.31
Quitting intention (%)				
Within one month	33.6	33.6	33.6	
Within 6 months	33.0	35.2	30.9	
Within 12 months	23.4	20.3	26.6	
Not within 12 months	9.8	10.9	8.6	.31
Partner smoking (%)				
Yes	33.4	30.9	35.9	.20
Cardiovascular disease				
Yes	1.6	1.2	2.0	.48
Chronic respiratory illness				
Yes	7.8	7.0	8.6	.51
Chronic respiratory illness child (%)				
Yes	14.6	14.5	14.8	.90
Confidence in quitting (0-10)	6.1 (2.0)	6.1 (1.9)	6.1 (2.0)	.82
Importance of quitting (0-10)	8.9 (1.6)	8.9 (1.5)	8.9 (1.6)	.98

Discussion

Quitline counselling has been shown to be highly effective in increasing smoking cessation rates among parents who smoke (Schuck et al., in press). In this study, we examined the effects of quitline counselling on several psychological processes (cognitions, emotions, and coping), and we explored whether these psychological processes constitute putative mediators underlying the effectiveness of quitline counselling among smoking parents. To our knowledge, this is the first study to examine mediators of an adult smoking cessation quitline intervention.

As hypothesized, the present study demonstrates that parents who received quitline counselling display less positive smoking outcome expectancies, higher self-efficacy to refrain from smoking in stressful and tempting situations, lower negative affect, increased avoidance of external stimuli that cue smoking, and increased acceptance of cravings to smoke (i.e., willingness to experience cravings that cue smoking without trying to control them) compared to parents who received the self-help brochure. These results are in line with theoretical perspectives regarding the effects of CBT- and MI-based treatment, as these processes are supposedly targeted by treatment, as well as findings from previous trials evaluating mediators of cessation treatment (Bricker & Tollison, 2011; Bricker et al., 2013; Bricker, Mann, Marek, Liu, & Peterson, 2010; Gifford et al., 2011; Lerman et al., 2002). However, parents who received quitline counselling did not differ from parents who received the self-help brochure on perceived stress or depressive symptoms. The effects of quitline counselling on these variables were explored as stress management and mood management were optional components of quitline counselling. Although it is possible that quitline counselling for smoking cessation may affect those variables among subsamples of participants (e.g., those who actually opted for stress or mood management), the findings indicate that quitline counselling does not generally decrease perceived stress or depressive symptoms compared to self-help materials.

Mediation analyses identified two significant and important mechanisms underlying the effectiveness of quitline counselling among smoking parents, respectively increased self-efficacy to refrain from smoking in stressful and tempting situations and increased willingness to experience sensations that cue smoking. Numerous studies have demonstrated that self-efficacy is one of the most consistent predictors of the initiation and maintenance of abstinence during unaided as well as aided quit attempts (Gwaltney et al., 2009; Schnoll et al., 2011; Shiffman et al., 2000). Also, recent smoking cessation trials have found that changes in self-efficacy between baseline and follow-up mediates the effect of the intervention on smoking cessation (Bricker et al., 2010; Stanton, Lloyd-Richardson, Papandonatos, de Dios, & Niaura, 2009; Vidrine, Arduino, & Gritz, 2006). Increasing self-efficacy to initiate and maintain abstinence is a major aim in most treatment approaches, including CBT- and MI-based treatments. The present study confirms that quitline counselling successfully enhances self-efficacy to refrain from smoking among parents, which subsequently increases the likelihood of successful smoking cessation.

A novel finding is that increased willingness to experience cravings that cue smoking (experiential acceptance) was a significant mechanism of action underlying the effectiveness of quitline counselling. Increasing acceptance of urges to smoke and

allowing intense sensations, cognitions, and emotions that cue smoking to come and go without trying to control them is a major aim among acceptance-based treatment approaches such as ACT (Hayes, Levin, Plumb-Vilardaga, Villatte, & Pistorello, 2013). Preliminary evidence indicates that acceptance-based treatments compare favorably with CBT and pharmacotherapy in increasing smoking cessation rates (Bricker et al., 2013; Gifford et al., 2004; Hernandez-Lopez, Luciano, Bricker, Roales-Nieto, & Montesinos, 2009). Several studies have demonstrated that increases in acceptance of internal triggers mediate the efficacy of acceptance-based treatments for a variety of outcomes including smoking cessation (Bricker et al., 2013; Forman et al., 2007; Gifford et al., 2004). The present study suggests that, compared to a self-help brochure, quitline counselling enhanced participant's willingness to experience cravings that cue smoking among smoking parents (i.e., willingness to experience these sensations without trying to control them), which subsequently contributed to successful smoking cessation. Although quitline counselling does not generally encompass acceptance-focused treatment components, the counselling protocol and supplementary brochures used in the present study included mindfulness- and acceptance-focused elements (e.g., emotional surfing to cope with craving). Overall, these results are consistent with recent research showing that CBT-based smoking cessation interventions can increase acceptance of smoking cues, albeit less strongly than acceptance-focused interventions such as ACT (Bricker et al., 2013).

Although quitline counselling resulted in less positive smoking outcome expectancies, lower negative affect, and increased avoidance of external cues to smoking, these changes were not shown to underlie the effectiveness of quitline counselling. Previous studies have shown that dysfunctional cognitions do particularly hinder the initiation of abstinence (Vangeli et al., 2011). The defining feature of cognitive therapy (CT) is the hypothesis that therapeutic effects are mediated by changes in cognitions, and the hypothesized purpose of CT is to change dysfunctional cognitive structures (Beck, 1993a, 1993b). However, the majority of the few empirical studies actually conducted on this topic have not supported these hypotheses (Forman et al., 2007). Similarly, although previous research has shown that negative affect decreases the chance of successful smoking cessation (Kenford et al., 2002; Lerman et al., 2002; Shiffman & Waters, 2004), the present findings indicate that negative affect does not contribute to successful smoking cessation. Finally, in the present study, avoidance of external cues to smoking was unrelated to successful smoking cessation. Although the enhancement of avoidance coping skills (such as stimulus control) is a major aim in CBT, research has not supported the idea that use of behavioural coping strategies enhances smoking cessation (Herzog, 2002). Similarly, previous research indicated that coping is important in the maintenance of abstinence, however, findings showed that only cognitive coping (e.g., thinking about the positive consequences of smoking), not behavioural coping (e.g., distracting activity), was effective in preventing a lapse to smoking (Shiffman et al., 1996). In summary, the present findings support the hypothesis that increased self-efficacy to refrain from smoking and increased willingness to experience cravings that cue smoking constitute the mechanisms of action by which quitline counselling increases smoking cessation rates.

The present study has key implications. First, during intervention implementation, the potency of an intervention may be increased by ensuring that the intervention

sufficiently focuses on the participant's self-efficacy to refrain from smoking as well as the participant's willingness to experience cravings that cue smoking (experiential acceptance). Incorporating acceptance-based or mindfulness-base components into CBT-based treatments (i.e., emphasizing acceptance rather than avoidance of cognitions, emotions, and sensations) may help to improve the effectiveness of available cessation treatments. Second, it might be important to monitor self-efficacy and experiential acceptance among participants during intervention implementation. Such monitoring could provide ongoing feedback for counsellors, which may be used to adjust the treatment content in order to increase treatment effectiveness.

Several limitations of the present study should be acknowledged. First, in the present study, the putative mediators were only assessed at post-measurement, not at baseline measurement. Therefore, it is possible that study participants may have differed on these processes at baseline and that baseline differences rather than treatment differences predict smoking cessation. However, the random allocation to treatment condition makes baseline group differences rather unlikely and participants did not differ on any of the assessed key characteristics. Moreover, it is conceivable that some participants quit smoking before the mediators were assessed, thus making the direction of causal inferences harder to determine. Accordingly, in order to provide a causal inference that quitline counselling causes change in psychological processes which subsequently cause successful smoking cessation, a more rigorous design is needed. Second, although self-reported cessation was conservatively defined (six-months prolonged abstinence), the use of biochemically verified cessation as endpoint would have been ideal.

In conclusion, this study identified two mechanisms of action underlying the effectiveness of quitline counselling among smoking parents: 1) increased self-efficacy to refrain from smoking in stressful and tempting situations and 2) increased acceptance of cravings to smoking (willingness to experience sensations that cue smoking without trying to control them). Efficient targeting of self-efficacy and acceptance of cravings during intervention implementation may increase the effectiveness and cost-effectiveness of smoking cessation treatments.

Chapter 11

Connecting smoking parents to cessation support: Effects on smoking-related cognitions and smoking initiation among children

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Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. Connecting smoking parents to cessation support: Effects on smoking-related cognitions and smoking initiation among children.

Abstract

Background: Parental smoking is associated with an increased risk of smoking initiation among youth. Parental smoking cessation can attenuate this risk. This study examined whether telephone-based cessation support for parents and subsequent parental smoking cessation affects smoking-related cognitions and the risk of smoking initiation among children of smoking parents. *Methods:* Data of a two-arm randomized controlled trial were used in which 512 smoking parents were recruited into cessation support through primary schools. After baseline assessment, smoking parents were randomly assigned to quitline cessation counselling or a control condition (i.e., self-help brochure). At 12-months follow-up assessment, prolonged abstinence among parents and smoking-related cognitions and smoking initiation among children were measured using questionnaires. *Results:* No evidence was found that children of parents who received quitline cessation support (compared to a self-help brochure) or children of parents who achieved prolonged abstinence (compared to continued smoking) differ in smoking outcome expectancies, perceived safety of smoking, self-efficacy to refrain from smoking, or susceptibility to smoking. No significant difference in smoking initiation rates were found between children of parents who quit and children of parents who continued smoking (3.9% vs. 5.9%, respectively, OR=.63, CI=.18-2.19, p=.47). *Conclusions:* This study is the first to examine the effects of an evidence-based smoking cessation intervention for parents on smoking-related cognition and smoking initiation in children of smoking parents. No evidence was found that telephone-based cessation support or subsequent parental smoking cessation affects smoking-related cognitions or smoking initiation among elementary schoolchildren. Longer maintenance of smoking cessation or longer follow-up periods may be required to observe effects of parental smoking cessation among children.

Introduction

Parental smoking is a major, but modifiable risk factor for adverse health outcomes in children. Smoking parents account for 20-40% of adult smokers (Hitchman, Fong, Zanna, Hyland, & Bansal-Travers, 2011; Winickoff et al., 2006), and approximately one third of children live with at least one parent who smokes (King et al., 2009; Otten, Engels, & van den Eijnden, 2005; Schuck et al., 2012). Exposure to environmental tobacco smoke (ETS) is associated with numerous adverse health outcomes including childhood asthma, higher rates of respiratory infections, decreased lung growth, sudden infant death syndrome, behavioural problems, and neuro-cognitive decrements (DiFranza, Aligne, & Weitzman, 2004) as well as increased health service use and costs (Lam, Leung, & Ho, 2001). In addition, a recent meta-analysis concluded that the risk of smoking uptake in adolescence is nearly threefold when both parents smoke (Leonardi-Bee, Jere, & Britton, 2011).

Previous research suggests that parental smoking cessation has the potential to significantly reduce adverse health outcomes as well as the risk of smoking uptake among youth. In longitudinal studies, parental smoking cessation has been found to reduce the risk of physical illness (Halterman et al., 2004), smoking initiation (Farkas, Distefan, Choi, Gilpin, & Pierce, 1999; Otten, Engels, van de Ven, & Bricker, 2007), and regular smoking (Bricker et al., 2003) among children. To our knowledge, no prior study has yet examined whether the active promotion of cessation support and subsequent parental smoking cessation may attenuate susceptibility to smoking and the risk of smoking initiation among children of smoking parents. Although a variety of interventions (e.g., cessation support, health behavior counselling) have demonstrated efficacy in increasing parental smoking cessation and decreasing exposure to ETS among children in recent meta-analytic reviews (Priest, 2010; Rosen, Noach, Winickoff, & Hovell, 2012), we are not aware of any trial that examined intervention outcomes in children other than child exposure to ETS.

Finding preventive effects of an evidence-based smoking cessation intervention for parents among their children would provide a strong case for increasing the active promotion of smoking cessation interventions for parents within public and clinical settings (e.g., public schools, paediatric offices, birth clinics). Recently, we showed that among parents recruited into cessation support through their children's primary schools, telephone-based cessation counselling in combination with tailored supplementary materials is highly effective in increasing parental cessation rates and the likelihood of implementing a complete home smoking ban (Schuck, Bricker, Otten, Kleinjan, & Engels, submitted). Generally, smoking cessation interventions for parents, aim to provide information regarding the adverse effects of ETS exposure, to enhance the implementation of household smoking bans, and to support the initiation and maintenance of abstinence from smoking. Yet, telephone counselling has demonstrated a higher potency in enhancing parental smoking cessation and the implementation of home smoking bans (Schuck et al., in press). Also, it has been shown that smoking parents were more satisfied with telephone counselling compared to self-help material (Schuck et al., 2013) and that telephone counselling can be disseminated to a broad population of smokers, as treatment effects are similar across varying subgroups of clients (Schuck et al., submitted). In the present study, we aimed to examine the effects

of telephone-based cessation counselling for parents (compared to self-help material) and effects of subsequent parental smoking cessation (compared to continued smoking) on smoking-related cognitions and the risk of smoking initiation among 9-12 year-old children of smoking parents.

Previous research suggested that the susceptibility to smoking may already develop at a rather young age, and that smoking parents may predispose youth towards smoking even prior to adolescence, the developmental period in which smoking is usually initiated. Among elementary schoolchildren and pre-adolescents, parental smoking has been found to be associated with more positive and tolerant attitudes towards smoking (Andrews, Hampson, Greenwald, Gordon, & Widdop, 2010; Brook, Mendelberg, Galili, Priel, & Bujanover, 1999; Porcellato, Dugdill, Springett, & Sanderson, 1999), a higher perceived safety of smoking (Schuck et al., 2012), increased attention towards smoking-related cues (Lochbuehler, Otten, Voogd, & Engels, 2012), and a higher susceptibility to smoking in the future (Schuck et al., 2012). Currently, it is assumed that smoking-related cognitions and a susceptibility to smoking precede smoking initiation among youth. In prospective studies, smoking-related cognitions and susceptibility to smoking have been found to predict uptake of and experimentation with smoking among adolescents (Carvajal, Wiatrek, Evans, Knee, & Nash, 2000; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Song et al., 2009). Therefore, among pre-adolescents, smoking-related cognitions and susceptibility to smoking seem to constitute early indicators of an increased risk of smoking in the future.

Previous research suggests that favourable smoking-related cognitions and the risk of smoking initiation are modifiable and can be influenced by parental smoking cessation. In a prospective study, it was shown that the risk of daily smoking was reduced by 39% among children of parents who quit smoking, compared to children of parents who continued smoking (Bricker et al., 2003). Negative attitudes toward smoking and tobacco refusal self-efficacy together significantly mediated 49% of the prospective relationship between parental smoking cessation and child daily smoking (Wyszynski, Bricker, & Comstock, 2011). While these findings pertain to unaided parental smoking cessation, it is expected that aided parental smoking cessation (e.g., use of cessation support) may have similar effects in children of smoking parents.

In sum, the present study used data of a randomized controlled trial, in which smoking parents were recruited into cessation support through their children's primary schools, to examine the effects of telephone-based cessation counselling among parents (i.e., participation in telephone-based cessation counselling and subsequent smoking cessation) on smoking-related cognitions and smoking initiation in their 9-12 year-old children. We expected that telephone-based cessation counselling for parents (compared to self-help material) and subsequent parental smoking cessation (compared to continued smoking) would predict less favorable smoking-related cognitions (i.e., less positive smoking outcome expectancies, a higher perceived risk perceptions of smoking, higher self-effectiveness to refrain from smoking, lower susceptibility to smoking in the future) as well as a decreased risk of smoking initiation among children.

Methods

Participants

Parent-child dyads were recruited through primary schools across the Netherlands. Primary schools were contacted by research assistants and asked to distribute study invitation letters to parents through children. A total of 438 schools agreed to distribute study invitation letters to all children in US grade 4-6 (age 9-12 years, as children had to be old enough to fill in self-report questionnaires and as this is the age group immediately preceding adolescent smoking initiation). Children were instructed to give the letters to their parents. Parents registered for the study by mail, e-mail, telephone, or website. Inclusion criteria were: 1) being at least a weekly smoker, 2) being a parent/caretaker of a child between 9-12 years old, 3) having the intention to quit smoking (currently or in the future), and 4) giving informed consent for participation of parent-child dyad. A total of 622 parent-child dyads registered and 512 parent-child dyads were enrolled. Full reports of the study design, the recruitment procedure, and effectiveness of the intervention among parents are published elsewhere (Schuck et al., 2011; Schuck et al., 2013; Schuck et al., in press).

Procedure

The present study was designed as a two-arm randomized controlled trial with three assessments among parents and children (Figure 1). The baseline measurement took place between January and July 2011. Parents and children were asked to individually fill out a questionnaire (via a website or on paper). After the baseline assessment, parents were randomly assigned to receive either telephone-based cessation counselling (n=256) or a self-help brochure (n=256). Children received no intervention. Allocation of parents to trial conditions was done by an independent member of the research group using a computer program which generated a randomization schedule. Parents were stratified by gender, educational level, and smoking intensity. Within two weeks after baseline assessment, parents assigned to the telephone-based cessation counselling condition were called by the quitline to schedule the first counselling call while parents assigned to the self-help condition were sent the self-help brochure. The post-measurement took place three months after start of the intervention. The follow-up measurement took place twelve months after start of the intervention. For this study, only baseline data and 12-months follow-up data were used. Each parent-child dyad received 100 euro (approximately 127 US dollars) for participation in all three assessments. The study was approved by the ethics committee of the Faculty of Social Sciences, Radboud University Nijmegen. The protocol is registered in the Netherlands Trial Register (NTR2707).

Measures

Treatment condition among parents.

Telephone-based cessation counselling. Participants in the telephone-based cessation counselling condition received up to seven counsellor-initiated phone calls across a period of three months. Calls were conducted by counsellors of the Dutch national quitline. Counselling was based on cognitive-behaviour therapy (CBT) and Motivational Interviewing (MI; Miller & Rollnick, 2002). Emphasis was put on providing

didactic information on nicotine dependence, exploring ambivalence regarding smoking and quitting, enhancing intrinsic motivation for behavioural change, providing behavioural support (anticipation of difficult situations and discussing coping strategies), and relapse prevention. Use of nicotine replacement therapy (NRT) or a pharmacological treatment was recommended if participants smoked ten cigarettes per day or more. All participants in the quitline condition also received three accompanying booklets titled *Smoke-free parents*, which were designed for this study as tailored supplementary materials. Each booklet contained didactic information, tips and advice, motivational messages, as well as 'parent-relevant information' (e.g., effects of SHS on children, strategies to manage parent-specific stressors). A more detailed description of the treatment can be found in Schuck and colleagues (submitted).

Self-Help Brochure. Parents in the self-help brochure condition received a 40-page, colour-printed self-help brochure including didactic information on nicotine dependence and the health benefits associated with quitting smoking, tips and advice on how to initiate and maintain abstinence, instruction in the use of cognitive and behavioural skills to avoid triggers to smoke and cope with urges to smoke, and strategies for managing a lapse or relapse to smoking. Also, provided was information on the use of NRT or a pharmacological treatment, including the recommendation of use for those who smoke at least 10 cigarettes per day. The brochure was based on empirically supported practices for advice on smoking cessation (Lancaster & Stead, 2005).

Parental smoking cessation. Six-months prolonged abstinence was defined as consistent responses by parents to the following two self-reports: 1) abstinence for a period of at least six months at follow-up measurement, and 2) 7-day point prevalence abstinence at 12-months follow-up assessment ('Have you smoked during the past seven days, even a single puff?' and 'Have you used any other form of tobacco during the past seven days, for example pipes or cigars?').

Children's smoking outcome expectancies. To assess smoking outcome expectancies at 12-months follow-up, children were asked to indicate the degree to which they agree with ten statements using the Pros of Smoking Scale (Dijkstra & De Vries, 2000). Response options ranged from 1 (totally disagree) to 4 (totally agree). Example items are: "Smoking helps cope with stress" and "Smoking helps relax". Higher scores indicate more positive smoking outcome expectancies. Internal consistency was good at baseline and follow-up measurement (Cronbach's alpha = .85 and .95, respectively). Positive smoking outcome expectancies have been found to be associated with an increased susceptibility to smoking and smoking initiation in the future (Buller et al., 2003; Song et al., 2009).

Perceived safety of casual smoking in children. To assess perceived safety of casual smoking at 12-months follow-up, children were asked to indicate the degree to which they agree with three statements on a scale ranging from 1 (totally disagree) to 4 (totally agree). The following items were used: "There is no harm in smoking a cigarette once in a while", "It is safe to smoke for only one or two years", and "If you only smoke once in a while you won't become addicted". Higher scores indicate a higher perceived safety of casual smoking. Internal consistency was acceptable at baseline and follow-up measurement (Cronbach's alpha = .66 and .80, respectively). The measure

has been found to be associated with smoking status among adolescents (Siegel, Alvaro, & Burgoon, 2003) and susceptibility to smoking among children (Schuck et al., 2012).

Self-efficacy to refrain from smoking in children. To assess refusal self-efficacy (i.e., confidence in one's ability to refrain from smoking) at 12-months follow-up, children were asked to indicate the perceived difficulty not to smoke in six smoking-specific situations. Response options ranged from 1 (very difficult) to 6 (very easy). Example items are: "To refuse a cigarette when offered one, I find ..." and "Explaining to other people why I do not want to smoke, I find ...". Higher scores indicate higher self-efficacy to refrain from smoking. Internal consistency was good at baseline and follow-up measurement (Cronbach's alpha = .87 and .90, respectively). The measure has been found to prospectively predict smoking onset among non-smoking adolescents (Hiemstra, Otten, & Engels, 2012).

Intention to refrain from smoking in children. To assess susceptibility to smoking at 12-months follow-up, children were asked to indicate the degree to which they agree with three statements. Response options ranged from 1 (definitely not) to 4 (definitely yes). Example items are: "Do you think you will try a cigarette soon" and "If one of your best friends were to offer you a cigarette, would you smoke it?". Higher scores indicate a higher susceptibility to smoking. Internal consistency was good at baseline and follow-up measurement (Cronbach's alpha = .70 and .84, respectively). The measure has been found to predict smoking experimentation at four-year follow-up among never-smokers (Pierce et al., 1996).

Smoking initiation. To assess onset of smoking, children were asked: "Have you ever smoked, even if only a single puff?" Children reporting that they had never smoked, not even a single puff, were considered never-smokers. Children reporting that they had smoked were considered initiators (cf. Schuck, Kleinjan, Otten, Engels, & DiFranza, 2013).

Strategy for analyses.

Descriptive statistics of parents and children at baseline are displayed in Table 1. Correlations between smoking-related cognitions among children are displayed in Table 2. To examine the effects of group (i.e., treatment condition and parental smoking cessation), we compared 1) children of recipients of telephone counselling to children of recipients of self-help material and 2) children of parents who achieved prolonged abstinence to children of parents who continued smoking.

To examine group effects on child cognitions (smoking outcome expectancies, perceived safety of smoking, self-efficacy, susceptibility to smoking), a 2 (group) x 2 (time: baseline, follow-up) repeated measures MANOVA was conducted, to control for correlations between smoking-related cognitions. To examine group effects on smoking initiation, logistic regression analyses were conducted (only baseline never-smokers were included in these analyses). The amount of missing data on the predictor variable (parental smoking cessation) was 11.3%. The amount of missing data on the outcome variables (smoking-related cognitions and smoking initiation in children) ranged from 13.7% to 13.9%. As outcome retention rate was high, the analyses were conducted using complete-case-analyses.

Table 1 Descriptive statistics for baseline characteristics of parent-child dyads

Characteristics	Total sample	Telephone counselling	Self-help brochure	*p*
Parents				
Age (*M*, *SD*)	42.2 (5.4)	42.3 (5.6)	42.0 (5.1)	.59
Gender (%)				
Female	52.5	51.2	53.9	.54
Nationality (%)				
Dutch	97.9	97.7	98.0	.53
Education (%)				
Low	15.2	16.4	14.1	
Medium	56.6	56.3	57.0	
High	26.2	25.4	27.0	.74
Marital status (%)				
Never married	12.5	12.9	12.1	
Married	67.6	67.6	67.6	
Divorced/widowed	19.7	19.5	19.9	.97
Employment status (%)				
Unemployed	15.8	14.5	17.2	
Casual	3.5	3.9	3.1	
Part time	37.5	35.2	39.8	
Full time	43.0	46.5	39.5	.38
Cigarettes per day (*M*, *SD*)	16.2 (7.8)	15.7 (8.0)	16.8 (7.7)	.14
Years of smoking (*M*, *SD*)	24.9 (7.7)	25.1 (7.4)	24.6 (8.0)	.43
FTND score (*M*, *SD*)	4.0 (2.4)	4.0 (2.4)	4.0 (2.4)	.80
Quitting intention (%)				
Within one month	33.6	33.6	33.6	
Within 6 months	33.0	35.2	30.9	
Within 12 months	23.4	20.3	26.6	
Not within 12 months	9.8	10.9	8.6	.31
Partner smoking (%)				
Yes	33.4	30.9	35.9	.20
Children				
Age (M, SD)	10.5 (1.0)	10.5 (1.0)	10.5 (1.0)	.72
Gender (%)				
Female	50.4	52.7	48.0	.15
Smoking status (%)				
Never-smoked	91.0	93.3	91.7	
Tried, but no smoking within last month	7.4	6.6	8.2	.31

Note. FTND = Fagerström Test for Nicotine Dependence.

Results

Descriptive statistics

Baseline characteristics. Key characteristics of parents and children at baseline are displayed in Table 1 for the entire sample and by condition. At baseline, there were no significant differences in participant characteristics between the telephone-based cessation counselling condition and the self-help brochure condition on any of these variables, suggesting that randomization was successful. Correlations between study variables are displayed in Table 2.

Table 2 Pearson and Spearman correlations between child variables at baseline

Measures	1	2	3	4	5	6	7
1 Age	-	-.02	.06	-.09*	.02	.13**	.08
2 Gender		-	.05	.02	.08	.08	.08
3 Smoking outcome expectancies			-	.32***	-.26***	.29***	.19***
4 Perceived safety of smoking				-	-.21***	.20***	.07
5 Self-efficacy					-	.40***	-.09
6 Susceptibility to smoking						-	.23***
7 Smoking initiation							-

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Smoking-related cognitions and behaviour across time. Table 3 displays means and standard deviations of smoking-related cognitions as well as smoking initiations rates among children. For the four types of smoking-related cognitions, the repeated measures MANOVA showed a significant main effect of time, $F(4, 432) = 19.28$, $p < .001$, $\eta_p^2 = .15$, indicating that, among the entire sample, smoking-related cognitions changed between baseline and follow-up measurement. Follow-up univariate ANOVAs revealed that this change in cognitions was significant for all four outcome measures, namely smoking outcome expectancies, $F(1, 435) = 7.57$, $p = .01$, $\eta_p^2 = .02$, perceived safety of smoking, $F(1, 435) = 12.36$, $p < .001$, $\eta_p^2 = .05$, self-efficacy, $F(1, 435) = 14.19$, $p < .001$, $\eta_p^2 = .07$, and susceptibility to smoking, $F(1, 435) = 5.11$, $p = .02$, $\eta_p^2 = .00$. Comparisons revealed a decrease in positive outcome expectancies of smoking and perceived safety of smoking as well as an increase in self-efficacy to refrain from smoking among the entire sample of children. Yet, a small but significant increase was observed in susceptibility to smoking. With regard to smoking initiation, a total of 38 children (7.4%) reported having tried smoking at baseline. At follow-up, a total of 24 previous never-smokers (5.2%) reported having tried smoking since baseline assessment.

Effects of telephone-based cessation counselling (compared to a self-help brochure). The repeated measures MANOVA showed no significant condition by time interaction effect on the four types of smoking-related cognitions, $F(4, 432) = 0.51$,

Table 3 Child outcomes for the entire sample and by treatment condition (TC, SH) and parental smoking cessation (quitter, smoker)

Child Outcome	Group	Baseline	Follow-up
Smoking outcome expectancies (M, SD)	Sample	1.46 (.53)	1.36 (.65)
	TC	1.45 (.50)	1.33 (.64)
	SH	1.47 (.56)	1.39 (.66)
	Quitter	1.45 (.48)	1.34 (.63)
	Smoker	1.45 (.53)	1.37 (.66)
Perceived safety of smoking (M, SD)	Sample	1.81 (.91)	1.57 (.84)
	TC	1.79 (.84)	1.52 (.78)
	SH	1.84 (.96)	1.62 (.89)
	Quitter	1.66 (.89)	1.50 (.81)
	Smoker	1.85 (.91)	1.59 (.84)
Self-efficacy (M, SD)	Sample	5.12 (.95)	5.41 (.82)
	TC	5.10 (.99)	5.38 (.84)
	SH	5.15 (.92)	5.45 (.80)
	Quitter	5.26 (.75)	5.42 (.78)
	Smoker	5.13 (.95)	5.41 (.83)
Susceptibility to smoking (M, SD)	Sample	1.27 (.43)	1.32 (.52)
	TC	1.27 (.41)	1.30 (.47)
	SH	1.27 (.45)	1.34 (.56)
	Quitter	1.28 (.42)	1.27 (.40)
	Smoker	1.27 (.43)	1.32 (.53)
Smoking initiation rate (%)	Sample	7.4	5.2
	TC	6.6	4.7
	SH	8.2	5.6
	Quitter	7.1	3.9
	Smoker	7.6	5.9

Note. TC = Telephone counselling, SH = Self-help brochure.

p =.73, η_p^2 = .01, indicating that smoking-related cognitions among children did not develop differently across time as a function of treatment condition. The logistic regression analysis predicting smoking initiation among never-smoking children at baseline showed no significant effect of treatment condition (OR=1.09, CI=.48-2.50, p=.83, 4.7% versus 5.6% smoking initiation rate in the telephone counselling condition and the self-help condition, respectively).

Effects of parental smoking cessation (compared to continued parental smoking). The repeated measures MANOVA showed no significant group by time interaction effect, $F(4, 431) = 1.27$, p=.28, indicating that smoking-related cognitions among children did not develop differently across time as a function of parental smoking cessation. The logistic regression analysis predicting smoking initiation among never-smoking children at baseline showed no significant effect of parental smoking cessation (OR=.63, CI=.18-2.19, p=.47, 3.9% versus 5.9% smoking initiation rate among children of parents who quit and children of parents who continued to smoke, respectively). As parental smoking cessation may be confounded with socio-demographic or smoking-related characteristics, additional analyses were conducted to control for child age, child gender, educational level of parent, and number of cigarettes smoked by parent at baseline. Controlling for potential confounds did not change the results (results not shown). As the impact of parental smoking cessation may be moderated by the smoking status of the other parent, additional analyses were conducted only among parents without a smoking partner. However, this did not change the results (results not shown).

Discussion

In this study, data of a randomized controlled trial were used to examine the effects of school-based recruitment of smoking parents into cessation support (telephone-based cessation counselling vs. self-help material) and subsequent parental smoking cessation (prolonged abstinence vs. continued smoking) on 9-12 year-old children of smoking parents (smoking-related cognitions or uptake of smoking). To our knowledge, no prior study has examined effects of smoking cessation interventions for parents on child outcomes other than child exposure to ETS.

The findings showed no evidence that participation of parents in telephone-based cessation counselling affected smoking-related cognitions or uptake of smoking among their 9-12 year-old children compared to receiving self-help material. Finding preventive effects of an evidence-based smoking cessation intervention for parents among children could provide a strong case for increasing the active promotion of smoking cessation interventions for parents within public and clinical settings (e.g., public schools, paediatric offices). Although telephone-based cessation counselling provides health behaviour education and has been shown to generally enhance the implementation of household smoking bans and to increase parental smoking cessation rates (Schuck et al., submitted), the findings indicate that mere participation of parents in telephone-based cessation counselling - possibly even without the occurrence of behavioural change - was insufficient to affect smoking-related cognitions and smoking initiation among elementary schoolchildren within the observed period of time.

Contrary to our expectations, however, no evidence was found that parental smoking cessation affects smoking-related cognitions or uptake of smoking in children. At one-year follow-up assessment, children of parents who reported prolonged abstinence from smoking did not differ from children of parents who did not achieve abstinence on smoking outcome expectancies, perceived safety of causal smoking, self-efficacy to refrain from smoking, or susceptibility to smoking. Different explanations

may account for the lack of an effect of parental smoking cessation on child cognitions. First, it is possible that parental smoking cessation needs to be maintained for a longer period of time before effects on child cognition may be observed. In this study, parental smoking cessation implies that parents had quit smoking for a period of minimally six and maximally twelve months (as six-months prolonged abstinence was reported one year after the baseline assessment). Possibly, long-term smoking cessation (e.g., maintained cessation for at least one or two years) may be necessary to reduce favourable smoking-related cognitions and susceptibility to smoking among children. Alternatively, it is possible that the employed outcome measures do not adequately capture change in cognitions induced by parental smoking cessation. Although differences have been observed between children of smoking parents and children of non-smoking parents on these outcome measures (Schuck et al., 2013; Schuck, Otten, Engels, & Kleinjan, 2011), it is possible that risk attenuation (as opposed to risk amplification) may be more readily captured by other outcome measures (e.g., unconscious processes or implicit cognitions such as attentional biases, interpretation biases, or memory biases).

Similarly, and also contrary to our expectations, there was no reliable difference in the number of children that initiated smoking between baseline and follow-up assessment between parents who quit smoking and parents who continued smoking. Previous research found that parental smoking cessation decreases the risk of daily smoking among adolescents. Bricker and colleagues (2003) found smoking prevalence rate of 37% among high-school students with two currently smoking parents, rates of 27-32% among students with one currently smoking parent, rates of 19-26% among students with at least one formerly smoking parent, and a rate of 14% among students with two never-smoking parents. In the present study, the smoking initiation rate between baseline and follow-up assessment among the entire sample of children was quite low (5.2%). Although a 2%-difference in smoking initiation rates was observed between children of parents who quit smoking and parents who continued to smoke (3.9% vs. 5.9%, respectively), this difference was not statistically significant. Possibly, the observed lack of an effect of parental smoking cessation on smoking initiation among children may be explained by power limitations associated with the low rate of smoking initiation in this young sample of elementary schoolchildren. It is possible that the effects of parental smoking cessation on smoking behaviour of children may become apparent during later development, especially during adolescence (e.g., the developmental period in which smoking is usually initiated). Alternatively, it is possible that parental smoking cessation needs to be maintained for a longer period of time before effects among children may be observed. Again, it is possible that long-term smoking cessation may be necessary to reduce the risk of smoking initiation among children. Future studies will need to determine whether smoking cessation interventions for parents may have preventive effects among children. The use of longer follow-up periods and observation of the effects of parental smoking cessation within different age groups will be necessary to further understand if preventive effects on children may be achieved through offering evidence-based smoking cessation treatments to parents.

Several limitations of the present study should be acknowledged. First, although self-reported smoking cessation was conservatively defined (six-months prolonged

abstinence at one-year follow-up assessment), the use of biochemically verified cessation as endpoint would have been ideal. However, previous research concluded that the results obtained using self-report measures and biochemical verification are usually consistent and that biochemical verification is not always necessary, particularly in large-scale population-based studies (Glasgow et al., 1993; SRNT, 2002) . Furthermore, longer follow-up periods (e.g., assessments after two or three years) would be desirable to further understand the effects of parental smoking cessation among children, especially during adolescent years, the developmental period in which smoking is usually initiated.

In conclusion, this study is the first to examine the effects of an evidence-based smoking cessation intervention for parents on smoking-related cognitions and smoking initiation among their children. No evidence was found that telephone-based cessation counselling for parents (compared to self-help material) or parental smoking cessation following treatment (compared to continued smoking) affects smoking-related cognition and behaviour among elementary schoolchildren. As smoking initiation rates are rather low during elementary years, the observation of different age groups and the use of longer follow-up periods is required to further understand if preventive effects on children may be achieved through offering evidence-based smoking cessation treatments to parents.

Chapter 12

General Discussion

Part 1: Effects of environmental smoking on youth

Part 1 of this thesis aimed to contribute to a better understanding of the effects of environmental smoking on never-smoking pre-adolescents and adolescents who recently initiated smoking. The main findings will be summarized and discussed in the light of the existing knowledge. Implications for theory, practice, and research will be addressed. Following this discussion, the general limitations of the present findings, directions for future research, and concluding remarks regarding the findings will be given.

Summary of the main findings of Part 1

Chapter 2 - The role of environmental smoking in children's smoking-related cognitions and susceptibility to smoking

This study reports the effects of environmental smoking on smoking-related cognitions and susceptibility to smoking among never-smoking children. The results showed that children with smoking parents, siblings, and peers reported more positive smoking outcome expectancies. Children with smoking parents also reported a higher perceived safety of casual smoking and more cue-triggered desire to smoke. In turn, perceiving a higher safety of casual smoking and more cue-triggered desire to smoke were associated with a higher susceptibility to initiate smoking in the future. Children's perceived safety of casual smoking and cue-triggered desire to smoke mediated the association between parental smoking and children's susceptibility to smoking.

Chapter 3 - Responses to environmental smoking in never-smoking children: Can symptoms of nicotine addiction develop in response to environmental tobacco smoke exposure?

This study describes the effects of environmental smoking on psycho-behavioural symptoms in response to environmental tobacco smoke (ETS) among never-smoking children. The results showed that 6% of never-smoking children reported craving (i.e., wanting or desire to smoke), 8% reported cue-triggered desire to smoke, and 20% reported behavioural symptoms (e.g., feeling restless, trouble sleeping) in response to ETS exposure. A greater number of smokers in the child's social environment was associated with more symptoms of cue-triggered desire to smoke and more behavioural symptoms in response to ETS.

Chapter 4 - Initial responses to the first dose of nicotine in novel smokers: The role of exposure to environmental smoking and genetic predisposition

This study reports the effects of environmental smoking and genetic variation in three reward-related candidate genes (OPRM1 A118G, DRD2 TaqIA, DRD4 bp VNTR) on initial responses to the first active dose of nicotine among adolescents who recently initiated smoking. The results showed that adolescents with more exposure to peer smoking were more likely to like initial smoking and report more pleasant sensations during initial smoking. Conversely, adolescents with more exposure to maternal smoking reported less unpleasant sensations during initial smoking. Adolescents

carrying the G-variant of the OPRM1 polymorphism were more likely to like initial smoking and adolescents homozygous for the C-variant of the DRD2 polymorphism reported less unpleasant sensations during initial smoking. No main effect of the DRD4 polymorphism was found. There was no evidence for interactions between any of the three candidate genes and environmental smoking.

Chapter 5 - Bidirectional influences between parents and children in smoking behaviour

This prospective study used a full-family design to examine associations between smoking behaviour of family members. The findings indicated several longitudinal associations between family members' smoking behaviour, indicating that families resemble an interactive system that facilitates smoking contagion across family members. The results suggest that associations between parents and children can be bidirectional, that is, parental smoking behaviour may influence adolescent smoking behaviour and adolescent smoking behaviour may influence parental smoking behaviour.

Table 1 Overview of the main findings of the studies in Part 1 of this thesis

Chapter	Main Findings
2	Never-smoking children with smoking parents, siblings, and peers reported more favourable smoking-related cognitions, which mediated the association between parental smoking and children's susceptibility to smoking.
3	A substantial number of never-smoking children reported symptoms in response to ETS, which is indicative of nicotine addiction among smokers. The number of smokers in the child's social environment was associated with an increased report of these symptoms.
4	Adolescents with more exposure to environmental smoking reported more pleasant and less unpleasant sensation during initial smoking. Moreover, genetic variation in reward-related candidate genes was associated with responses to initial smoking.
5	Within families, several longitudinal associations between family members' smoking behaviour were observed over time. The results suggested that the associations between parents and children can be bidirectional, that is, parental smoking behaviour may influence adolescent smoking and adolescent smoking may influence parental smoking.

Reflections on the main findings of Part 1

The development of smoking and nicotine dependence among youth

The uptake of smoking has been conceptualized as a developmental process characterized by the progression through a series of stages (e.g., Mayhew, Flay, & Mott, 2000). These stages are displayed in Table 3 and can be labelled as follows: (I) never-smoking (non-susceptible), (II) never-smoking (susceptible), (III) tried smoking, but currently not smoking, (IV) experimental smoking, (V) regular smoking, and (VI) daily smoking or established smoking. Generally, these stages can be distinguished based on a cognitive-motivational susceptibility to smoking, the frequency of smoking, and the level of nicotine dependence.

Once smoking is initiated, symptoms of nicotine dependence (e.g., cravings to smoke, symptoms of withdrawal, unsuccessful attempts to quit smoking) can develop rapidly (DiFranza et al., 2000). Nearly one fourth of novice smokers report at least one symptom of dependence within four weeks of initiating monthly smoking (DiFranza et al., 2000), and more than half of all adolescent smokers develop symptoms of dependence within three years (Kandel et al., 2007). In a sample of 14-17 years-old adolescent smokers, 15% displayed substantial nicotine dependence, as defined by a high nicotine-dependence profile consisting of high levels of craving, withdrawal and behavioural dependence (Kleinjan et al., 2012).

Factors that explain individual differences in the susceptibility to progress to regular smoking and nicotine dependence are a major focus of research on the prevention of tobacco use. While research on the predictors of the uptake of smoking and transitions in smoking frequency among adolescents is extensive (for reviews see Conrad, Flay, & Hill, 2006; Freedman, Nelson, & Feldman, 2012; Tyas & Peterson, 1998), relatively few studies have focused on the predictors of susceptibility to smoking among pre-adolescents, and relatively few factors are known which are able to predict progression into nicotine dependence among adolescents who recently initiated smoking (DiFranza et al., 2007).

The studies in this thesis address this gap in the literature and aim to provide more knowledge about early potential risk factors associated with susceptibility to smoking and dependence among youth. To do so, the studies in this thesis employed youth samples, specifically never-smoking pre-adolescents and early adolescents who recently initiated smoking ,which enabled them to identify factors relevant to the initial stages of smoking and dependence. To extend previous research, the studies in this thesis examined novel outcome measures, which may constitute early markers of an increased vulnerability to smoking and dependence. Knowledge regarding early risk factors among youth may help identify individuals vulnerable to addiction, which may potentially contribute to the prevention of nicotine addiction.

Framework on the development of smoking and nicotine dependence

A biopsychosocial framework is often used to explain the development of smoking and nicotine dependence. In this framework, it is assumed that exogenous risk factors (e.g., environmental factors) and endogenous risk factors (e.g., genetic factors) facilitate the emergence of regular smoking and nicotine dependence through physiological processes (e.g., uptake of nicotine in the body resulting in nicotine-induced physiological

Table 2 Stages of smoking

Stage	Characteristic	Definition
Susceptibility to smoking	Never-smoker (not susceptible)	Never-smoker, displays no cognitive-motivational receptivity to smoking.
	Never-smoker (susceptible)	Never-smoker, displays cognitive-motivational receptivity to smoking.
Uptake of smoking behaviour	Initiator	Initiation: Has tried 'at least one puff' of a cigarette, but is currently not smoking.
	Occasional smoker	Occasional/infrequent smoking: Smokes less than once a week.
	Regular smoker	Regular smoking: Smokes at least once a week, but not daily).
	Daily/established smoker	Daily/established smoking: Smokes daily or almost daily.
Progression into dependence	Non-dependent	Non-dependent smoker: No symptoms of nicotine dependence.
	Symptom(s) of dependence	Smoker who displays at least one symptom of nicotine dependence.
	Dependent	Smoker who meets criteria for nicotine dependence according to *DSM* or displays syndrome of selected symptoms of nicotine dependence.
	Severely dependent	Smoker who displays high overall nicotine dependence level or a high-dependence profile (high dependence in all domains of nicotine dependence).

adaptations) and psychosocial processes (e.g., social processes influencing cognition, perception, and motivation). The concept of intermediate phenotypes is used to better understand the mechanisms underlying the emergence of addiction. Intermediate phenotypes describe more proximal markers, characteristics, or indicators of pathological syndromes (e.g., addiction), which are used to understand the gap between predisposing factors at micro-level and the pathological syndrome at macro-level. In this framework, environmental and genetic factors are considered more distal risk factors, while physiology, cognition, motivation, affect, and behaviour are considered more proximal markers of addiction, which may index potential mechanisms in the emergence of smoking and nicotine dependence among youth.

In this thesis, we focused on environmental smoking, as it is one of the most established predictors of smoking among youth (for reviews see Avenevoli &

Merikangas, 2003; Leonardi-Bee et al., 2011; Mayhew et al., 2000). Throughout this thesis, environmental smoking indicates smoking behaviour of parents, siblings, or peers. If not otherwise specified, the term *environmental smoking* is used to describe the presence of at least one smoker in the social environment and the term *exposure to environmental smoking* is used to describe the frequency or intensity with which a smoker smokes in the presence of an individual.

In addition, this thesis also addressed the role of genetic factors. In a meta-analytic review, the genetic contribution to both smoking initiation and smoking persistence was estimated to be approximately 40-60% (Li et al., 2003). There are a number of plausible candidate genes for smoking and nicotine dependence, including genes that regulate nicotine metabolism (e.g., genes encoding nicotinic acetylcholine receptors and nicotine-metabolizing enzymes) and genes that regulate nicotine reward (e.g., genes involved in dopaminergic and opioid neurotransmission). Systematic reviews have identified several polymorphisms of candidate genes associated with smoking behaviour (Al Kousi & Tyndale, 2005; Li et al., 2004, Munafo et al., 2004). In this thesis, we focused on the role of genetic variation in three specific polymorphisms in reward-related candidate genes (OPRM1 A118G SNP, the DRD2 TaqIA SNP, DRD4 bp VNTR), as these polymorphisms have been shown to be involved in nicotine reward (i.e., hedonic value or liking of drug) and nicotine reinforcement (i.e., a drug is self-administered more than a placebo). These factors are crucial in the initial stages of the dependence process, that is, both are necessary for the development of motivational effects of smoking in novel smokers.

In the following section, we provide an in-depth discussion of the role of environmental smoking and genetic predisposition as well as the processes through which these risk factors may operate. The roles of the risk factors and the putative mechanisms are discussed by developmental stage of the dependence process. This discussion is based on the results of the studies in this thesis as well as previous research.

Developmental stage (1): Susceptibility to smoking and initiation of smoking - The role of the social environment in shaping cognition and motivation

A large body of research has demonstrated that environmental smoking is associated with more favourable smoking-related cognitions, a higher susceptibility to smoking, and an increased risk of smoking initiation among youth (Andrews et al., 2010; Brook et al., 1999; Flay et al., 1994; Leonardi-Bee et al., 2011; Lorenzo-Blanco et al., 2012; Kaplan et al., 2001; Mak et al., 2012; Otten et al., 2009; Porcellato et al., 1999; Prokhorov et al., 1995; Scragg et al., 2010; Trasher et al., 2005; Waa et al., 2011; Wyszinski et al., 2011). The Theory of Planned Behaviour (Ajzen, 1998) proposes that cognitive-motivational factors are precursors of smoking behaviour, and existing research has supported this assertion (Andrews et al., 2010; Hampson, 2007).

The studies in this thesis extend previous research, which usually examined the effects of environmental smoking on more general cognitions in adolescents, by examining the effects of environmental smoking on rather specific cognitions in never-smoking elementary schoolchildren. *Chapter 2* showed that children of smoking parents perceived more positive smoking outcome expectancies, a higher safety of casual smoking, and more cue-triggered wanting to smoke, suggesting that smok-

ing-related cognitions among pre-adolescents can be quite specific, as they resemble the cognitions, perceptions, and associations of active smokers (i.e., more positive smoking outcome expectancies, underestimation of the risk associated with smoking, associations between smoking cues and desire to smoke). Children may adopt these rather specific cognitions from smokers in their social environment either because they are overtly displayed or because children make inferences based on the behaviour they observe. Social learning, modelling, imitation, and normative perceptions are candidate processes which may explain the effects of environmental smoking on children. In addition, parental smoking was associated, albeit indirectly, with the lack of a firm intention to refrain from smoking. Reporting a higher safety of casual smoking and more cue-triggered desire to smoke, but not more positive smoking outcome expectancies, mediated this association. This finding may indicate that cognitive elaboration and decision-making processes are less important in shaping smoking intentions, at least among pre-adolescents, compared to other factors such as risk perceptions or cue-triggered desire or temptation to smoke. Possibly, the measures used to assess risk perceptions and cue-triggered desire to smoke may tap into additional constructs such as affect (e.g., anxiety or arousal). More research is needed to reveal the exact construct(s) that characterize children who are susceptible to smoking. In sum, the findings in *Chapter 2* suggest that smoking parents may predispose their never-smoking children towards smoking by shaping children's cognition and motivation already at a young age.

In addition, genetic factors may also play a role in the uptake of smoking. While some studies have reported an effect of genetic variation on smoking initiation (which is usually operationalized as the incidence of taking the first puff of a cigarette), others have not (e.g., Belsky et al., 2013; Laucht et al., 2008; Munafo et al., 2004; Munafo et al., 2009). Although genetic predisposition may drive the development of dependence through neurobiological processes (e.g., receptor functioning, nicotine metabolism, neurotransmitter synthesis or re-uptake), it is less plausible that neurobiological factors can explain the occurrence of smoking initiation (i.e., taking the first puff) among youth. While nicotine-naive individuals may theoretically carry an increased vulnerability to smoking and dependence, smoking initiation seems required to kick off the biologically-based processes assumed to drive the development of dependence (e.g., reward, reinforcement, craving, tolerance, withdrawal) (e.g., DiFranza & Wellman, 2005; DiFranza, Huang, & King, 2012; Everitt & Robbins, 2005). Given the lack of a biologically plausible explanation of how genetically-based addiction-related neurobiology (e.g., receptor functioning, nicotine metabolism, neurotransmitter functioning) may increase the risk of smoking initiation (i.e., taking the first puff), it seems more likely that gene-environment correlates (e.g., home environment, biologically-based behaviour or personality traits such as sensation seeking or peer selection) may account for genetic effects on the uptake of smoking.

In summary, environmental smoking seems to be important in shaping cognition and motivation, which may increase susceptibility to smoking among never-smoking youth. The role of genetic predisposition in the early stages of the smoking processes is less clear. Yet, from a biological perspective, it seems unlikely that neurobiological processes (related to receptor functioning, nicotine metabolism, or neurotransmitter functioning) can account for smoking initiation (i.e., the incidence of taking the first puff

of a cigarette), as active nicotine exposure seems required to kick off the neurobiological processes that drive the emergence of dependence.

Developmental stage (2): Emergence of regular smoking behaviour - Dynamic influences between environmental and constitutional factors

Previous research provided clear support for the role of environmental smoking in smoking behaviour of youth. A systematic review of 87 studies showed evidence of an association between familial smoking and tobacco use among adolescents (Avenevoli & Merikangas, 2003). The authors concluded that parental influences seem to be relatively modest and generally small in magnitude, especially in comparison to other risk factors. Sibling and peer smoking showed greater associations with adolescent smoking.

In this thesis, *Chapter 5* examined the role of familial smoking in individual smoking behaviour. This study extends previous research, which usually examined effects of parental smoking on adolescent smoking but not vice versa, by using a dynamic perspective which considers bidirectional associations between smoking intensity of family members. The findings suggest that parental smoking may influence adolescent smoking and that adolescent smoking may influence parental smoking across time. Candidate mechanisms which may explain similarities in smoking intensity of family members are social modelling and social norms. In this study, although theoretically plausible, genetic heritability of dependence is less likely to explain changes in smoking intensity of family members, given that baseline smoking intensity (an indicator of dependence) was controlled for. The findings generally confirm conclusions from previous research. Although several longitudinal associations between smoking behaviour of family members were observed, these associations were rather small and observed somewhat sporadically across the five-year study period. The findings suggest that the smoking intensity of family members explains changes in individual smoking intensity only to a small extent. Possibly, other factors (e.g., biologically-based constitutional factors, genetic predisposition, other environmental factors) may be more important in explaining decreases or increases in individual smoking behaviour across time.

In addition to environmental smoking, a large body of evidence supports the role of genetic predisposition in the transitions from experimenting with tobacco to regular use of tobacco (Anney et al., 2004; Laucht et al., 2005; Laucht et al., 2008; O'Loughlin et al., 2004). For example, a recent longitudinal study reported the effects of polygenic risk (i.e., multilocus genetic risk composite score) on the developmental progression to heavy smoking (Belsky et al., 2013). Individuals with higher polygenetic risk (i.e., a higher multilocus genetic risk composite score) were more likely to convert to daily smoking as teenagers and progressed more rapidly from smoking initiation to heavy smoking. The genetic risk score predicted smoking risk over and above family history of smoking, indicating that genetic factors play an important role in explaining the emergence of regular smoking behaviour among youth.

Moreover, gene-environment interactions seem to be important in understanding progression to regular smoking among youth. Several studies have provided evidence for gene-environment interactions in adolescent smoking behaviour (e.g., Audrain-McGovern et al., 2004; Audrain-McGovern et al., 2006; Hartz et al., 2012; Nilsson et al., 2009). Up to this point, research examining interactions between environmental smoking

and genetic risk is scarce. Yet, preliminary evidence suggests that environmental smoking can either enhance or attenuate progression into smoking among adolescents with a genetic vulnerability (Kleinjan, DiFranza, & Engels, submitted; Nilsson et al., 2009).

In summary, environmental and genetic factors as well as interactions between them influence the development of regular patterns of smoking behaviour among adolescents. The effect of parental smoking on adolescent smoking behaviour may be smaller than the effects of sibling and peer smoking. A vast body of literature suggests that genetic predisposition is an important determinant of the development of regular patterns of tobacco use among youth.

Developmental stage (3): Progression into nicotine dependence - Physiological processes of dependence and psychosocial processes of dependence

A large body of research supports the role of genetic factors in the development of nicotine dependence (Belsky et al., 2013; De Ruyck et al., 2010; Kaprio, 2009; ; Laucht et al., 2008; Saccone et al., 2008; Wei et al., 2012). Supposedly, genetic factors predisposes youth towards the risk of dependence through neurobiological processes. The Sensitivity Model (Pomerleau et al., 1993) proposes that biologically-based constitutional factors regulate the extent of nicotine dependence possible for an individual (i.e., processes are in place prior to initial smoking). The model proposes that sensitive individuals will rapidly develop tolerance to the aversive effects while remaining sensitive to the rewarding effects of nicotine. In contrast, insensitive individuals will experience limited reinforcement from nicotine and may therefore never progress beyond intermittent use. The Sensitization-Homeostasis Model (DiFranza & Wellman, 2005; DiFranza, Huang, & King, 2012) proposes that neurobiological adaptations induced by active smoking drive the development of nicotine dependence (i.e., processes are induced by initial smoking). The model proposes that homeostatic mechanisms responsible for craving, withdrawal, and tolerance are set in motion by nicotine exposure, which in turn drive the progressive development of dependence.

In this thesis, *Chapter 4* examined the role of genetic predisposition in adolescent's responses to initial smoking. Prospective, representative studies have shown that initial responses to smoking are predictive of the risk to develop nicotine dependence among youth (DiFranza et al., 2007; DiFranza et al., 2004; Kandel et al., 2007; Sator et al., 2010), although critics question if self-reported responses to initial responses to smoking can be assessed without risk of bias (e.g., social desirability bias, recall bias). The findings in this thesis showed that genetic predisposition (i.e., carrying the G-variant of the OPRM1 A118G polymorphism and carrying the CC-variant of the DRD2 TaqIA polymorphism) is associated with increased liking and less unpleasant symptoms during initial smoking. The findings confirm previous research showing that individuals at risk for nicotine dependence are characterized by a genetic predisposition related to opioid and dopaminergic neurotransmission. The findings extend previous research by indicating that the biological functioning of reward-related candidate genes may already be important during the early beginnings of the dependence process (i.e., responses to the first active dose of nicotine).

In addition to genetic factors, numerous studies have shown that environmental smoking is associated with a faster development of dependence symptoms and more

severe levels of nicotine dependence (Audrain-McGovern et al., 2009; Bernat, Erickson, Widome, Perry, & Foster, 2008; de Leeuw, Engels, Vermulst, & Scholte, 2009; Hu, Davies, & Kandel, 2006; Johnson et al., 2010; Kandel et al., 2007; Kleinjan et al. 2009; Kleinjan et al., 2010; Kleinjan et al., 2012; Kleinjan, DiFranza, & Engels, submitted; Wang Ho, Lo, & Lam, 2012; Wileyto et al., 2009). Yet, what remains unclear is whether physiological processes (e.g., pre- or postnatal pharmacological exposure to nicotine resulting in nicotine-induced neurophysiological adaptations) or psychosocial processes (e.g., psychosocial factors associated with environmental smoking which shape cognition, motivation, affect, and behaviour regarding tobacco use) explain the effects of environmental smoking.

Support for physiological processes underlying the effects of environmental smoking (i.e., a physiological pathway towards dependence) comes mainly from animal studies (Small, 2010; Yamada, 2010). Hypothetically, frequent or prolonged pharmacological exposure to nicotine absorbed from ETS may alter neurophysiology in the brain (Anthonisen & Murray, 2005), which may be reflected by altered responses to nicotine upon active or passive nicotine exposure. Theoretically, responses of non-smokers to nicotine may become similar to those of active smokers (e.g., tolerance to aversive effects of nicotine, sensitization to rewarding effects of nicotine, withdrawal symptoms after the effects of nicotine wear off) and may predispose nicotine-naive individuals towards an increased risk for developing nicotine dependence once smoking is initiated.

In this thesis, *Chapter 3* and *Chapter 4* examined the role of environmental smoking in responses to nicotine (active and passive exposure), which have been found to characterize individuals with an increased susceptibility to smoking and dependence (DiFranza et al., 2007; DiFranza et al., 2004; Kandel et al., 2007; O'Loughlin et al., 2009; Racicot et al., 2011). The findings in *Chapter 3* showed that, among never-smoking children, environmental smoking is associated with behavioural symptoms in response to ETS (e.g., feeling restless, trouble sleeping) as well as symptoms of cue-triggered wanting to smoke (adapted from cue-triggered craving to smoke such as 'urge to smoke when seeing somebody smoking'). Previous studies have shown similar associations between environmental smoking and responses to ETS on the one hand (Okoli et al., 2007) and self-reported symptoms of dependence on the other hand (Belanger et al., 2008; Racicot et al., 2011). Yet, more data are needed regarding the nature and validity of such reports. The findings in this thesis extend previous research by comparing responses to ETS and self-reported symptoms of dependence between never-smoking children and children who had initiated smoking. The findings showed that never-smoking children did not differ from initiators in behavioural responses to ETS, suggesting that environmental rather than active exposure to nicotine is relevant in shaping these responses. Craving and cue-triggered wanting to smoke, which are considered hallmark symptoms of nicotine dependence among active smokers, were reported significantly more often by initiators than never-smokers, suggesting that active nicotine uptake shapes those responses. In addition, *Chapter 3* reports the psychometric properties of the employed measures. The findings showed a low internal consistency of the measures 'wanting to smoke' and 'cue-triggered wanting to smoke' among non-smokers, indicating that different constructs may underlie these measures among smokers and non-smokers. Therefore, the nature of psycho-behavioural responses to ETS and self-reported

symptoms of nicotine dependence among non-smokers remains unclear and conclusive research is needed regarding adequate measurements. While it is hypothetically possible that these responses may reflect neurophysiological alterations induced by passive pharmacological exposure to nicotine, as explained above, it is also possible that these responses may reflect psychosocial processes (e.g., negative attitudes towards SHS, irritation, social desirability, social norms).

Previous research has provided evidence that psychosocial processes, in addition to physiological processes, may also underlie the association between environmental smoking and risk of smoking among adolescents. Meta-analyses of twin studies have concluded that both genetic as well as environmental factors play a significant role in smoking persistence and nicotine dependence, although genetic effects have generally been found to be larger than environmental effects (Edwards, Maes, Pedersen, & Kendler, 2011; Li et al., 2003; Vink, Willemsen, & Boomsma, 2005). In a large-scale, prospective youth study examining 45 risk predictors, the authors concluded that remarkably few risk factors contributed to individual differences in the susceptibility to develop dependence once exposure to nicotine had occurred (DiFranza et al., 2007). In addition to initial responses to smoking (i.e., relaxation), depressive symptoms, and novelty seeking, an indicator of exposure to environmental smoking (i.e., familiarity with 'Joe Camel') predicted progression into nicotine dependence among novice smokers.

In this thesis, *Chapter 4* showed that environmental smoking (i.e., exposure to peer smoking and maternal smoking) is associated with adolescent's responses to initial smoking. These findings provide tentative support for a role psychosocial processes in the development of nicotine dependence among youth by showing that the source of ETS exposure (i.e.., mothers and peers, but not fathers and siblings), not merely the level of ETS exposure, determines adolescents' responses to nicotine. This finding suggests that psychosocial processes play at least some part in adolescents' initial smoking experiences. The differential influences of exposure sources observed here are in line with previous research. Generally, peers have been found to be the main sources of influence among older adolescents, while both parents and peers have both been found to be influential among younger adolescents (Flay et al., 1994; Vitaro et al., 2004). Additionally, mothers have been shown to have a stronger influence on youth compared to fathers (Leonardi-Bee et al., 2011). The findings suggest that, although genetic predisposition and physiological processes may be highly important in explaining the risk of dependence, psychosocial processes may also contribute to the risk of dependence, that is, environmental smoking may shape responses to tobacco use (for example through outcome expectancies) and tobacco use behaviour (for example through social modelling or social norms), which may potentially enhance or attenuate the risk to develop nicotine dependence among youth.

In summary, both genetic predisposition and environmental smoking are important in explaining the development of nicotine dependence among youth. Physiological processes (e.g., which may be in place prior to active smoking or induced by active smoking) are assumed to characterize the pathway towards nicotine dependence once smoking has been initiated. Possibly, these processes may be accelerated by pre- or postnatal exposure to nicotine (environmental smoking). In addition to physiological processes, psychosocial processes (e.g., social modelling, social norms) also seem to play a role in the risk of dependence.

Implications for research and practice

The studies conducted in *Part 1* of this thesis indicate that environmental smoking is associated with various smoking-related outcomes among never-smoking children and adolescents who recently initiated smoking. Given that future research provides further evidence for the reliability and consistency of these effects, the present findings have several implications for tobacco control practice.

First, knowledge regarding the effects of ETS exposure on youth and approaches to reduce ETS exposure among youth may help shape tobacco control practice as well as policies and regulations. Although smoking bans in public places and smoke-free working environments are enforced in the Netherlands, a large proportion of children and adolescents are still exposed to ETS by parents and caretakers in their homes (Holliday, Moore, & Moore, 2009; The global youth tobacco surveillance system, 2006). Although most parents in smoking households report the use of harm reduction strategies to protect their children from exposure to ETS (e.g., frequent ventilation), only a minority of parents report the use of comprehensive measures such as the implementation of a complete home smoking ban (Spencer, Blackburn, Bonas, Coe, & Dolan, 2005). The present data showed that only one third of parents of elementary schoolchildren report a complete smoking ban at home. Generally, Dutch smokers display a rather low awareness of smoking as a health problem (Willemsen, Kiselinova, Nagelhout, Joossens, & Knibbe, 2012). To change current practice and legislation, a strong health-related rationale for smoke-free homes and cars needs to be presented to smokers and strong arguments for comprehensive anti-smoking legislation and campaigns need to be provided to policy makers in order to effectively reduce exposure of youth to ETS.

Furthermore, the findings may help improve current preventive efforts aimed at reducing the problem of youth smoking. Knowledge regarding factors that predispose youth towards smoking may be used in the early identification of susceptible individuals (i.e., risk groups). In the Netherlands, the prevalence of smoking initiation among youth is still high (18%, Stivoro, 2012). Findings regarding the effectiveness of national prevention programs have been quite mixed. At least three Dutch studies suggested that national prevention programs (*Smoke Alert, European Smoking Prevention Framework Approach, Ik rook niet*) may be effective in decreasing smoking initiation rates, at least in the short-term or among subgroups of adolescents (Crone, Dijkstra, & Frissen, 2005; de Jong, Segaar, & de Vries, 2012; de Vries, et al., 2006). However, two recent large-scale trials examining the effectiveness of universal prevention programs (*Smoke-free Kids, The Healthy School and Drugs Project)* have found no intervention effect on smoking initiation rates among pre-adolescents and adolescents (Hiemstra, Ringlever, Otten, van Schayck, Jackson, & Engels, submitted; Malmberg et al., submitted), and one trial has even reported adverse effects of a prevention program (*European Smoking Prevention Framework Approach)* on smoking initiation rates among native Dutch adolescents (de Vries et al., 2006). Possibly, selective prevention programs, targeting individuals at high risk for smoking uptake, may be necessary to achieve a reduction in the prevalence of youth smoking at the population level. The findings in this thesis may help identify and approach susceptible individuals for selective prevention of tobacco use.

Once risk characteristics are known, susceptible individuals may be directly targeted and directed to information material or interventions (e.g., flyers directing youth to internet-based programs or applications). Alternatively, susceptible individuals may be identified, for example through universal prevention programs or screenings, and offered tailored interventions (for an example of a tailored intervention among primary schoolchildren see Cremers, Mercken, Oenemoa, & De Vries, 2012). The findings in this thesis suggest that a susceptibility to smoking may already develop at a rather young age (i.e., among pre-adolescence). Therefore, comprehensive efforts to prevent smoking initiation among high-risk youth groups may need to address both adolescents and pre-adolescents (see also Cremers et al., 2012).

Finally, the findings suggest that individuals at risk for developing nicotine dependence may be characterized, at least to some extent, by a genetic predisposition. In the future, genetic profiling may potentially contribute to the prevention and treatment of nicotine addiction (i.e., the identification of subgroups at risk for dependence or subgroups responsive to treatment). In the medical area, genetic risk profiling has potential use in risk stratification as well as prognostic and therapeutic decision-making (Patel et al., 2012). In the area of smoking cessation, previous research has tentatively suggested that providing individuals with personalized information regarding their genetic risk information may enhance their motivation to change behaviour and promote actual behavioural change (Cameron et al., 2009; De Viron et al., 2012; Lautenbach et al., 2013; Marteau & Lerman, 2001; Wright et al., 2006). At present, the challenges of genetic risk profiling are clearly acknowledged (e.g., McBride et al., 2010; Lautenbach et al., 2013). Yet, in the future, genetic risk profiling may become a useful tool in the prevention of nicotine addiction. Previous research conducted in the United States indicates a reasonable level of interest in genetic testing for nicotine addiction susceptibility among adolescents (Tercyak et al., 2006). Providing susceptible individuals with genetic risk information may possibly prevent uptake of and experimentation with smoking among adolescents vulnerable to addiction. However, before genetic risk information can be applied in practice, a strong body of evidence is needed regarding the effectiveness of genetic risk profiling and providing individuals with genetic risk information, with a particular focus on costs, benefits, safety, and practical feasibility.

The findings in *Part 1* of this thesis also have implications for current and future research. First, the findings highlight the potential psychometric shortcomings of the measures currently employed to assess self-reported symptoms indicative of nicotine dependence (e.g., craving and cue-triggered craving to smoke) among non-smokers. The present findings indicate that these measures may reflect different underlying constructs among non-smokers and smokers. As previous research has not yet examined the validity of such measures among non-smokers, the present findings stress the need for a cautious interpretation of such findings as well as the need for more rigorous research designs in the future. Similarly, the findings in this thesis highlight the possible bidirectionality between smoking-related variables (e.g., cognitions, behaviour) and stress the need for a cautious interpretation of cross-sectional associations as well as the need to consider bidirectionality between variables.

Limitations

The following section discusses the main limitations of the studies in *Part 1* of this thesis. An in-depth discussion of the limitations of each of these studies can be found in *Chapter 2-5.* Suggestions regarding how future research may address some of these limitations are provided in the section *Directions for future research*.

Cross-sectional study design

In *Chapter 2-4,* cross-sectional study designs have been used to examine the association between environmental smoking and smoking-related outcomes in youth. Cross-sectional study designs do not allow for interferences regarding temporal precedence or causality between study variables. Moreover, it is possible that confounded variables may account for the observed associations between study variables.

Assessment of smoking and (exposure to) environmental smoking

In *Chapter 2-5,* smoking, environmental smoking, and exposure to environmental smoking were self-reported by youth, thereby possibly being subject to reporting biases (e.g., poor or biased recall, social desirability). Previous research has shown that self-reported smoking is rather accurate when confidentiality is assured and that self-reported smoking is comparable to biological assessments of smoking (Dolcini, Adler, & Ginsberg, 1996). Previous research has also indicated that children are reliable reporters of the smoking behaviour in their social environment (Harakeh, Engels, de Vries, & Scholte, 2006). However, self-reports of exposure to ETS are more likely to be subject to reporting bias. Precise recall of exposure to ETS may decrease quickly due to memory deficits or memory biases, leading to potential over- or underreporting of exposure to environmental smoking.

Psychometric properties of outcome measures

The interpretation of the findings in *Chapter 2-4* is limited by the psychometric shortcomings of the outcome measures employed in this thesis. In particular, data regarding construct, concurrent, and predictive validity is lacking for some of the smoking-related outcomes. For example, the measures to assess *wanting to smoke* and *cue-triggered wanting to smoke* among non-smokers (which were adapted from measures of craving and cue-triggered craving) have been validated only among smokers and data regarding validity is lacking among non-smokers. The findings showed that both measures had a low internal consistency among non-smokers, suggesting that they may reflect different underlying constructs among smokers and non-smokers. Therefore, caution needs to be exercised in the interpretation of such self-reported symptoms among non-smokers. In addition, the potential limitations of the measure *responses to initial smoking* should be acknowledged. As these responses are self-reported, they may be vulnerable to poor or biased recall. Additionally, the measure may be susceptible to imprecision or measurement error, as variation in self-reported responses to nicotine may relate to variation in self-dosing of nicotine, which cannot be controlled in survey research. Although previous research provides support for the concurrent validity of self-reported responses to smoking and

physiological responses to nicotine administered in laboratory settings (Perkins et al., 2008; Pomerleau et al., 2005) as well as the predictive validity of self-reported responses in the development of dependence (DiFranza et al., 2004; DiFranza et al., 2007; Kandel et al., 2007), replication and refinement studies are desirable.

Power limitations

The findings in *Chapter 4-5* may possibly be limited by low statistical power. These studies encompass analyses (e.g., analyses of genetic data, complex statistical modelling techniques), which require rather large sample sizes to achieve adequate statistical power. In relation to the complexity of the analyses, the employed sample size in *Chapter 4-5* was rather small, which may have resulted in an increased risk of type II error (i.e., failure to detect significant population effects), particularly when effects are small (which is often the case with genetic main effects or gene-environment interactions).

Directions for future research

The following section discusses several conceptual and methodological considerations, which may contribute to an improved understanding of the development of nicotine dependence. Several suggestions are provided regarding how future research may address some of the key challenges in understanding the pathways leading to and the processes underlying nicotine addiction.

Understanding the role of environmental smoking

For a comprehensive understanding of the effects of environmental smoking, more information is needed regarding the characteristics of environmental smoking (e.g., the source of exposure, the context in which exposure takes place, the frequency and intensity of exposure). Several methodological techniques have great potential to overcome the shortcomings of self-reports (e.g., poor or biased recall, social desirability), for example the use of well-validated biomarkers of nicotine exposure reflecting pharmacological exposure to ETS (cf. Dolcini et al., 2003), the use of personal badge monitors reflecting individual exposure to ETS (cf. Eisner et al., 2005), or the use of real-time indoor monitors reflecting nicotine concentrations within certain locations (cf. Apelberg et al, 2013). Comparing different methods of assessment may help to distinguish psychosocial (e.g., social aspects of environmental smoking related to social modelling of tobacco use, availability and accessibility of tobacco, development of cognition, perception, or motivation) from physiological processes (i.e., physiological alterations induced by pre- or postnatal nicotine exposure) that influence the risk of developing nicotine dependence.

Understanding the role of genetic predisposition

To clarify the role of genetic predisposition in the process towards dependence (particularly in the initial stages of the dependence process), larger sample sizes are needed to replicate and extend the previous findings regarding the role of genetic factors in the risk of dependence (e.g., the role of genetic factors in adolescents' initial

responses to nicotine). As sample size remains a common methodological challenge of many genetic studies, collaborative efforts to pool data from several studies in a meta-analysis may help overcome challenges related to low statistical power and inconsistent findings across genetic studies. Alternative genetic approaches (e.g., use of multi-locus genetic risk composite scores, cf. Belsky et al., 2013) may also be applied in addition to candidate gene studies and genome-wide association studies.

Understanding the mechanisms underlying nicotine addiction

In order to understand the development of dependence and to gain more insight into the pathways towards dependence (i.e., paths from risk factor to pathological syndrome), future research will need to identify the mechanisms underlying addiction. Understanding the mechanisms of pathological syndromes, such as nicotine addiction, is vital in developing effective prevention and intervention strategies. The following section discusses how future research may address some of the key challenges in understanding the mechanisms underlying nicotine addiction. First, we will discuss how putative mechanisms can be identified. Then, we will discuss how putative mechanisms can be established.

Step 1. Identifying a putative mechanism: Validation and refinement of concepts

In this thesis, we examined several constructs (i.e., cognition, motivation, behavioural responses, affective responses), which may mediate the relation between risk factors on the one hand and the risk of dependence on the other hand. Two lines of research may continue this work in the future. First, future research will need to examine the psychometric properties of the mediators proposed in this thesis. Second, future research will need to identify additional or more refined mediators and examine their role in the risk of dependence. Directions for both lines of research are provided below.

First, future studies will need to lay the groundwork to determine validity (e.g., reliability, concurrent validity, predictive validity) of the putative mediators proposed in this thesis. Subsequently, the role of these variables in the development of dependence as well as predictors and associates of these variables can be fully examined. Regarding cognitive-motivation factors, future studies may compare different types of cognitions (general cognitions vs. specific cognitions; implicit vs. explicit cognitions) to determine the specific types that contribute to an increased risk of dependence among youth. Regarding psycho-behavioural symptoms, future research will be needed to further clarify the nature of these symptoms. Qualitative data gathered in focus groups may help clarify how never-smokers and never-smoking youth understand and interpret the employed measures. Regarding initial responses to nicotine, future studies may examine how self-reported responses assessed in surveys and physiological responses assessed in the laboratory relate to each other, whether there are meaningful differences between different self-reported sensations (e.g., pleasant sensations, unpleasant sensations, dizziness) and different responses assessed in the laboratory (e.g., nicotine sensitivity, nicotine reward, nicotine reinforcement, physiological responses, affective responses). Furthermore, these studies could examine whether the different measures may differentially contribute to the development of nicotine dependence among youth.

Moreover, future research will need to identify additional or more refined mediators, such as intermediate phenotypes. Intermediate phenotypes describe more proximal

markers, characteristics, manifestations, or indicators of pathological syndromes and can be of neurophysiological, neuroanatomical, biochemical, endocrinological, cognitive, motivational, affective, or behavioural nature (Audrain-McGovern, Nigg, & Perkins, 2009). Intermediate phenotype represent more defined and quantifiable measures, which are thought to involve fewer determinants and interacting pathways than the full pathological syndrome. Additionally, they are often physiologically more proximal to the putative genetic influences, therefore they may be more sensitive measures in genetic studies. Putative intermediate phenotypes of addiction, which may be of interest to future research, are phenotypes related to reward, anxiety, attention, arousal, or cognitive control. Physiological processes (e.g., heart rate, skin conductance, cortisol levels), cognitive biases (e.g., attentional biases, memory biases, interpretation biases), and behavioural responses (e.g., approach and avoidance tendencies, inhibitory abilities) may also be of interest to gain a more comprehensive understanding of the development of nicotine addiction.

Step 2. Establishing a mechanism of addiction: From mediator to working mechanism

When aiming to establish a mechanism of addiction (i.e., process responsible for the emergence of addiction), several requirements need to be met (Kazdin, 2007). Those requirements include the establishment of strong associations, dose-response relations, and temporal order among the hypothesized cause, mechanism, and outcome. Moreover, specificity and consistency to the effect of the hypothesized mechanism need to be established. Finally, a plausible and coherent explanation of the hypothesized relation among the cause, mechanisms, and outcome needs to be provided.

To provide evidence for *associations, dose-response relations, and temporal order* among risk factors, a putative mechanism, and the risk of dependence, studies with strong methodological rigour are required. Past studies examining the effects of environmental smoking and genetic predisposition in the risk of dependence have often relied on cross-sectional designs. More rigorous study designs are needed, such as prospective, multi-wave studies which follow the development of dependence among novice smokers across time and examine the mediating processes between risk factors and the development of dependence. In addition, systematic reviews and meta-analyses are needed to synthesize and integrate all available evidence. In this area of research, a large amount of studies is available and review studies are needed to provide an overview of the literature, an assessment of the quality of evidence, as well as reliable and unbiased estimates of effects. Up to this point, we are not aware of any review that systematically examined the association between environmental smoking and the risk to progress into nicotine dependence. Similarly, although various psychological theories (e.g., social learning theories, cognitive theories) have proposed mediating processes in the development of addiction (e.g., cognitions, motivation, behavioural intentions), no attempt has yet been made to scrutinize these theoretical assertions.

In addition, research needs to provide evidence for the *specificity and consistency* to the effect of a putative mechanism. Although prospective studies and systematic reviews can provide high levels of evidence, those designs may not be sufficient when examining variables with time-varying effects (i.e., variables that do not remain constant

across time), such as symptoms in response to ETS. To understand whether altered responses to nicotine are indeed the result of pharmacological exposure to nicotine (rather than psychosocial processes associated with environmental smoking), future research will need to link the occurrence of symptoms to the occurrence of pharmacological exposure using designs that are able to capture such dynamic processes (i.e., time-varying processes). Ecological Momentary Assessments (EMA; Myin-Germeys et al., 2009) may be particularly useful in assessing time-varying processes, such as the association between psycho-behavioural symptoms in response to ETS and exposure to ETS. EMA is characterized by repeated measurements assessing individual's current or very recent states or behaviours in their natural environments, which enhances the validity of self-reports (Shiffman, Stone & Huffard, 2008). When used in combination with objective measures of ETS exposure (e.g., personal badges, indoor monitors, biological markers), symptoms may be directly linked to levels of ETS exposure (while controlling for other variables), thereby enabling the evaluation of specific and consistent dose-response relations across time.

Finally, research needs to provide *a plausible and coherent explanation* of the putative working mechanism of addiction. After identifying refined intermediate phenotypes of addiction, those phenotypes (e.g., cognitive, affective, or behavioural responses) can be validated in relation to neurophysiological functioning, which can potentially map the neural structures or neurophysiological processes involved, which can help provide a plausible account of the working mechanisms of addiction. Neurophysiological correlates of intermediate phenotypes of addiction may be activation in certain relevant brain areas (e.g., the brains reward circuitry areas), as reflected for example by functional magnetic resonance imaging techniques (fMRI) or electro-encephalogram techniques (EEG). Validating intermediate phenotypes (e.g., behavioural responses) in relation to neural, neurobiological, or physiological functioning, could provide stronger support for a physiological pathway towards dependence (i.e., the idea that pharmacological exposure to nicotine shapes responses to nicotine and smoking behaviour through neurophysiological adaptations). In particular, prospective research designs, which can establish a temporal order among pharmacological exposure, intermediate phenotypes, neurophysiological indices, and the development of dependence may provide valuable knowledge regarding neurophysiological processes in the development of nicotine dependence.

Concluding statement

The studies in *Part 1* of this thesis contribute to a better understanding of the effects of environmental smoking in the risk to develop nicotine dependence among youth. The findings consistently show that environmental smoking is associated with varying smoking-related outcomes, which may predispose youth towards smoking and dependence already at a rather young age. The findings presented in this thesis may help identify vulnerable individuals in order to prevent smoking initiation and the development of nicotine dependence among youth.

Part 2: A smoking cessation intervention for parents: Results of a randomized controlled trial

Part 2 of this thesis aimed to contribute to current knowledge of enhancing smoking cessation among the high-priority population of smoking parents. This section summarizes and discusses the main findings in the light of existing knowledge. Implications for theory, practice, and research are addressed. Following this discussion, the general limitations of the present findings, directions for future research, and concluding remarks regarding the findings are given.

Summary of the main findings of Part 2

Chapter 6 - Effectiveness of proactive telephone counselling for smoking cessation in parents: Study protocol of a randomized controlled trial
This chapter describes the study protocol of the randomized controlled trial to examine the effects of tailored quitline counselling and self-help materials among smoking parents, registered with the Netherlands Trial Register (NTR2707). The chapter does not include empirical data.

Chapter 7 - School-based promotion of cessation support: Reach of proactive mailings and acceptability of treatment in smoking parents recruited into cessation support through primary schools
This study reports the reach and acceptability of the school-based approach used to recruit smoking parents into cessation support. The findings indicated that recruitment of smokers into cessation support remains challenging. The distribution of mailings through primary schools yielded a response rate of approximately 5% (i.e., five times the reach of the current reactive model of quitline usage). Once recruited, cessation support was well received by smoking parents. Of smokers allocated to quitline support, 88% accepted at least one counselling call. The average number of calls taken was high (5.7 out of 7 calls). Of smokers allocated to receive self-help material, 84% read at least some parts of the brochure. Of the intention-to-treat population, 81% and 69% were satisfied with quitline support and self-help material, respectively. Smoking parents were significantly more positive about quitline support compared to self-help material.

Chapter 8 - Effectiveness of proactive quitline counselling for smoking parents recruited through primary schools: Results of a randomized controlled trial
This study reports the results of a randomized controlled trial, which examined the effectiveness of tailored quitline counselling compared to self-help material in increasing smoking cessation rates among parents. The results showed that parents who received quitline counselling were more likely to report 7-day point prevalence abstinence at 3-months assessment (44.5% vs. 12.1%), 7-day point prevalence abstinence at 12-months assessment (34.0% vs. 18.0%), and prolonged abstinence at 12-months assessment (23.4% vs. 5.9%). Parents who received quitline counselling were significantly more likely to use nicotine replacement therapy. Among parents who

did not achieve abstinence, those who received quitline counselling smoked fewer cigarettes at 3-months assessment and 12-months assessment. They were also more likely to make a quit attempt, to achieve 24-hours abstinence, and to implement a complete home smoking ban.

Chapter 9 - Moderators and non-specific predictors of cessation treatment outcome among smoking parents
This study identified general predictors of treatment outcome (non-specific predictors) and treatment-specific predictors of treatment outcome (moderators), which help identify subgroups of clients who are particularly likely to benefit from smoking cessation treatment. The results showed that several baseline characteristics were predictive of prolonged smoking cessation at 12-months follow-up assessment, regardless of treatment condition (non-specific predictors of treatment outcome). These predictors were male gender, higher employment status, a lower number of cigarettes smoked per day, higher levels of confidence in quitting, presence of a child with a chronic respiratory illness, and wanting to quit for the health of one's child. Moreover, two significant moderators of treatment outcome, indicating which subgroups respond differentially to one treatment over another, were identified. These moderators were intention to quit and educational level. Intention to quit and educational level did not predict abstinence among parents receiving quitline counselling, but higher intention to quit and higher educational level predicted abstinence in the self-help condition.

Chapter 10 – Self-efficacy and acceptance of cravings to smoke underlie the effectiveness of quitline counselling among smoking parents
This study examines mediators of the effectiveness of smoking cessation treatment to gain insight into the mechanisms underlying treatment, which operate to produce behavioural change. The results showed that parents who received quitline counselling displayed less positive smoking outcome expectancies, higher self-efficacy to refrain from smoking in stressful and tempting situations, lower negative affect, increased avoidance of external stimuli that cue smoking, and increased acceptance of cravings to smoke (i.e., willingness to experience cravings that cue smoking without trying to control them) compared to parents who received the self-help brochure. Mediation analyses identified two mechanisms underlying the effectiveness of quitline counselling (i.e., processes that explain the effect of quitline counselling on smoking cessation). These mechanisms were increased self-efficacy to refrain from smoking in stressful and tempting situations and increased willingness to experience sensations that cue smoking.

Chapter 11 - Connecting smoking parents to cessation support: Effects on smoking-related cognitions and smoking behaviour in their children
This study examined the effects of promoting parental smoking cessation (use of cessation support and subsequent parental smoking cessation) on smoking-related cognitions and smoking behaviour in children of smoking parents. No evidence was found that children of parents who received evidence-based telephone-based cessation support (compared to a self-help brochure) or children of parents who

achieved six-months prolonged abstinence (compared to continued smoking) differ in smoking outcome expectancies, perceived safety of smoking, self-efficacy to refrain from smoking, or susceptibility to smoking. No significant difference in smoking initiation rates were found between children of parents who quit and children of parents who continued smoking (3.9% vs. 5.9%, respectively).

Table 3 Main findings of the studies in Part 2 of this thesis

Chapter	Main findings
6	Description of the study protocol of the randomized controlled trial. No empirical data are reported.
7	School-based promotion of cessation support constitutes a feasible, low-cost approach to connect smokers to cessation support. Both quitline counselling and self-help material were well-used and well-evaluated by smoking parents. Parents were clearly more positive about quitline counselling compared to self-help material.
8	Quitline counselling was more effective compared to self-help material in increasing abstinence rates at 12-months assessment among smoking parents (34.0% vs. 18.0%). Even among parents who did not achieve abstinence, quitline counselling had positive effects.
9	Parents who wanted to quit for the health of their child and parents of a child with a chronic respiratory illness were more likely to benefit from cessation treatment. Smokers with a lower intention to quit or a lower educational level were more likely to benefit from quitline counselling compared to self-help material.
10	Two mechanisms that underlie the effectiveness of quitline counselling were identified. Quitline counselling increased self-efficacy to refrain from smoking in stressful and tempting situations and increased willingness to experience cravings to smoke, which contributed to successful smoking cessation.
11	No evidence was found that parental smoking cessation affects smoking-related cognitions or smoking initiation among their elementary schoolchildren.

Reflections on the main findings of Part 2

Increasing use of available cessation support: Targeting receptive populations

Although many smoking cessation interventions have demonstrated efficacy (Lancaster & Stead, 2000), cessation support – although effective - is underutilized among smokers. There is a need to identify efficient ways to increase smokers' use of cessation support. One way to increase the reach of available interventions is the use of proactive outreach to systematically target a defined population of smokers. Certain populations of smokers may be more likely to quit when they receive cessation support (i.e., receptive smokers), or they (or their social environment) may experience greater benefit when they achieve smoking cessation (i.e., high-priority smokers). Tailoring recruitment approaches to address specific subgroups may increase smoker's willingness to make use of cessation support.

In this thesis, we evaluated the reach and effectiveness of a smoking cessation intervention for parents, which constitute a high-priority subpopulation among adult smokers. Parents are the main source of exposure to ETS among children (Holliday et al., 2009), which is associated with numerous adverse child health outcomes (DiFranza et al., 2004; Leonardi-Bee et al., 2011). Research has shown that promoting smoking cessation among parents will not only improve the health of the parent, but also the health of their child (Bricker et al., 2003; Chassin, et al., 2002; den Exter Blokland et al., 2004; Halterman et al., 2004; Otten, et al., 2007). It has been suggested that smoking parents may be particularly receptive to offers of cessation support. Generally, health concerns constitute the primary reason for smokers to want to quit. Smoking parents may not only be concerned about the effects of smoking on their own health, but also about the effects of their smoking on the health of their children. Therefore, it is possible that smoking parents may generally display a higher motivation to quit smoking or that they are more willing to make use of cessation support compared to the general populations of smokers.

In this thesis, we examined the feasibility of targeting the population of smoking parents through their children's primary schools using a low-intensity approach (i.e., one-time mailings). The findings in this thesis indicate that this low-intensity, school-based recruitment approach constitutes a feasible approach to connect smoking parents to cessation support. Yet, the findings do not provide any evidence that parents respond differently to offers of cessation support compared to the general population of smokers, as the response rate of smoking parents in the present trial (approximately 5%) was comparable to the response rate in other studies which required smokers to respond to offers of cessation support (2-11%; Gilbert, Nazareth, & Sutton, 2007; McClure, Richards, Westbrook, Pabiniak, & Ludman, 2007; McDonald, 1999). Yet, it is important to note that the present trial may not be directly comparable to previous studies. In this thesis, a highly demanding randomized controlled trial was conducted, which required both parents as well as their children to complete rather extensive questionnaires repeatedly. Moreover, the present trial required random allocation of parents to a treatment condition (i.e., parents were not allowed to select a preferred treatment themselves). These trial requirements may have prevented parents from responding to offers of cessation support. Conversely, the financial incentive

offered for participation may have motivated parents to take part in this trial. Therefore, the response rate among smoking parents to offers of cessation support might be different outside of a demanding, incentivized trial situation, such as the one described in this thesis.

The present trial is the first to evaluate the use of public schools as a venue to recruit smoking parents into cessation support. Previous studies have used different approaches such as direct mailings, health care provider outreach, telephone recruitment, or media advertisements. Recruitment rates tend to be higher for interpersonal recruitment (44-65%; Boyle et al., 2007; Peterson et al., 2009; Tzelepis et al., 2009) compared to approaches which require smokers to respond to mailings (2-11%; Gilbert et al., 2007; McClure et al., 2007; McDonald, 1999). Yet, interpersonal approaches are less feasible for implementation into the health care system, where few resources (i.e., personnel, time, money) are available. This thesis shows that one-time mailings distributed through primary schools are a feasible, low-cost alternative to connect smoking parents to cessation support. The fact that approximately half of the approached schools agreed to distribute mailings to parents indicates that public schools generally approve of offering cessation support to smoking parents and are willing to participate in the promotion of cessation support, given that demands on schools are kept low. Therefore, the present thesis provides a highly disseminable model of connecting parent smokers to cessation support, which can be implemented at the population level.

Enhancing effectiveness of quitline counselling: Tailoring treatment to target populations

A large body of evidence has demonstrated that quitline counselling is an effective intervention to increase the likelihood of successful smoking cessation (for a review and meta-analysis see Stead, Perera, & Lancaster, 2006), although the effects among subpopulations of smokers are not yet systematically studied. Due to their efficacy and broad reach, quitline services can have a large potential population impact. To further enhance the effectiveness of quitlines, counselling may be adapted to provide more personalized or population-specific treatment, which may be better able to address the specific needs of certain subgroups of smokers. In this thesis, we examined the effects of quitline counselling in combination with supplementary material tailored to smoking parents in comparison to a minimal intervention (standard self-help material).

The findings show that quitline counselling together with supplementary brochures tailored to parents is highly effective in increasing abstinence rates among the high-priority population of smoking parents. In the telephone counselling condition, 34% of smoking parents achieved point prevalence abstinence at one-year follow-up assessment compared to 18% of smoking parents in the self-help condition. In addition, even among parents who did not achieve abstinence, quitline counselling produced noteworthy results. Parents who received quitline counselling smoked fewer cigarettes per day, displayed lower levels of nicotine dependence, and they were more likely to implement a complete home smoking ban compared to parents who received self-help material.

In this thesis, the effects of telephone counselling among smoking parents were substantially larger than the effects reported in previous studies. In a meta-analysis examining the effectiveness of telephone counselling (Stead, Perera, & Lancaster,

2006), the relative odds of achieving abstinence increased by 1.37 (95% CI = 1.26 to 1.50) among smokers assigned to telephone counselling compared to smokers assigned to self-help. In the present study among smoking parents, we found that receiving telephone counselling increased the likelihood of being abstinent by 2.35 (95% CI = 1.56 to 3.54) compared to receiving self-help. The effect size observed in this thesis provides preliminary evidence that smoking parents may be particularly receptive to telephone counselling compared to the general population of smokers. The idea that smoking parents respond particularly well to cessation treatment has also been tentatively supported by previous research. A recent meta-analysis of 18 studies examining the effects of different smoking cessation interventions (including face-to-face counselling, telephone counselling, self-help material, and pharmacological interventions) among parents of young children showed an average quit rate of 23.1% (Rosen et al., 2012). In comparison, a meta-analytic review of recent reviews examining the effects of different smoking cessation interventions (including face-to-face counselling, group therapy, telephone counselling, physician advice, nursing interventions, self-help material, and pharmacological interventions) among adult smokers reported odd ratios between 1.42 and 2.17, corresponding to average quit rates between 4.3 and 13.0% (as the chances of successfully quitting without any help are in the range between 3-6%; Lemmens, Oenema, Klepp Knut, & Brug, 2008).

Several explanations may account for the high quit rates observed among smoking parents. Possibly, smoking parents may be either particularly motivated to quit smoking (e.g., to prevent health adversities among their children or to be good role models for their children) or they may be particularly likely to receive social support or social reinforcement during cessation attempts, which may contribute to successful cessation. Moreover, supplementary materials tailored to smoking parents (which have been added to telephone counselling) may have increased the effectiveness of generic quitline counselling, as previous research has shown that tailored material and advice is more effective and more appealing to target populations (Dijkstra et al., 1999; Lancaster & Stead, 2005; Orleans et al., 1998). However, alternative explanations may also account for the noteworthy effects of telephone counselling among smoking parents observed in this thesis. For example, our recruitment approach may have yielded a rather selective sample of smoking parents, such as parents who already had a strong intention to quit at the start of the study (as those smokers are more likely to respond to offers of cessation support). Yet, only one-third of our sample reported the intention to quit within one month, which is comparable to samples yielded by proactive recruitment approaches (Tzelepis et al., 2010). As this explanation seems rather unlikely, the findings in this thesis tentatively suggest that smoking parents constitute a receptive subpopulation among smokers and that parent-specific tailoring may additionally increase intervention effectiveness when targeting smoking parents.

Personalizing and refining available cessation treatments: Identifying predictors of treatment outcome and mechanisms underlying treatment effectiveness

Currently, various effective cessation treatments exist to help smokers quit smoking. Yet, it is not always clear which cessation treatment may be most suitable for a particular client. Similarly, the processes through which cessation treatments operate to produce

an effect are not well understood (Kazdin, 2007; Murphy et al., 2009). To match clients to the optimal treatment and to further improve the effectiveness of available treatments, a better understanding is needed regarding for whom available treatments work and how they work (Kraemer et al., 2002). In this thesis, we examined general as well as treatment-specific predictors of smoking cessation among smokers receiving two evidence-based cessation treatments (telephone counselling and self-help material). Moreover, we examined putative working mechanisms underlying the effectiveness of telephone counselling for smoking cessation.

The findings in this thesis show that a number of participant characteristics predict abstinence following cessation treatment, regardless of the treatment received (telephone counselling or self-help material). While socio-demographic characteristics and smoking-related characteristics have been previously shown to be associated with smoking cessation, no prior study has examined whether parent-specific characteristics predict successful smoking cessation. The findings are the first to show that smoking parents who (a) have a child with a chronic respiratory illness or who (b) report that they want to quit for the health of their child are more successful in quitting when receiving cessation support. This finding suggests that certain subgroups of smokers, such as parents or caretakers who are concerned about the health of their child, are particularly receptive to cessation support. Again, the findings highlight the potential of targeting the subpopulation of smoking parents in tobacco control efforts and addressing smokers as parents during smoking cessation interventions.

Furthermore, the findings in this thesis indicate that certain subgroups of smokers respond better to one treatment compared to another. While smokers with different characteristics were equally likely to achieve smoking cessation when receiving telephone counselling, smokers with a lower educational level and a lower intention to quit smoking had a better chance to achieve smoking cessation when receiving quitline counselling compared to self-help material. These findings indicate that quitline counselling is an effective intervention, which can be disseminated to a broad population of smokers. As the effectiveness of quitline counselling does not vary with client characteristics, quitline counselling may help reduce the social inequalities associated with tobacco use and cessation treatment outcome. As the smoking prevalence is higher among disadvantaged groups, and quit attempts are less likely to be successful among those with lower economic status and a lower motivation to quit, interventions that work among these groups are strongly needed to reduce tobacco-related social inequalities (Hiscock, Bauld, Amos, Fiedler, & Munafo, 2012). The findings suggest that individual needs and abilities should be considered when selecting a treatment for a particular client. Yet, given the relatively high costs of telephone counselling in the Netherlands compared to other countries (see Willemsen et al., 2008), cost-benefit analyses may be used to help researchers and health care providers in guiding treatment selections.

Moreover, in this thesis, we identified two mechanisms that underlie the effectiveness of telephone counselling. The identification of the working mechanism driving a treatment effect is important, as targeting the working treatment mechanisms during intervention implementation may help increase the effectiveness and cost-effectiveness of available cessation treatments (Kraemer et al., 2002). The findings indicate that changes in two psychological processes underlie the superior effects of telephone counselling

compared to self-help material. Telephone counselling more strongly increased (a) self-efficacy to refrain from smoking in stressful and tempting situations and (b) acceptance of cravings to smoking (willingness to experience sensations that cue smoking without trying to control them). Changes in those two processes subsequently predicted successful smoking cessation. Self-efficacy (or perceived ability) to refrain from smoking is one of the most consistent predictors of the initiation and maintenance of abstinence during unaided as well as aided quit attempts (Gwaltney et al., 2009; Schnoll et al., 2011; Shiffman et al., 2000). Self-efficacy has also been shown to mediate the effectiveness of different cessation treatments (Bricker et al., 2011; Stanton et al., 2009; Vidrine et al., 2006). Increasing self-efficacy to initiate and maintain abstinence is a major aim in most treatment approaches, including treatments based on cognitive-behaviour therapy and Motivational Interviewing. The finding that telephone counselling also increases acceptance of cravings, which in turn contributes to successful smoking cessation, is novel. Increasing acceptance of sensations, cognitions, and emotions that cue smoking without trying to control them is a major aim of acceptance-based treatment approaches to smoking cessation (e.g., Bricker et al., 2013; Hayes et al., 2013; Hernandez-Lopez et al., 2009), and increases in acceptance have been found to mediate the effectiveness acceptance-based treatments (Bricker et al., 2013; Forman et al., 2007; Gifford et al., 2004). Up to this point, interventions based on cognitive-behaviour therapy have been the standard cessation treatments. The findings in this thesis indicate that adding acceptance-focused treatment components (e.g., mindfulness-based components such as 'emotional surfing' to cope with cravings) to current smoking cessation interventions may help improve the effectiveness of available cessation treatments.

Effects of parental smoking cessation on children

Previous research has indicated that parental smoking cessation reduces the risk of smoking among children (Bricker et al., 2005; Den Exter Blokland et al., 2004). Therefore, promoting smoking cessation among parents may have preventive effects on their children. This study is the first to examine the effects of providing telephone counselling to smoking parents and the effects of subsequent parental smoking cessation on smoking-related cognitions and smoking initiation among their pre-adolescent children.

The findings showed no evidence that quitline counselling for parents (compared to self-help material) or subsequent parental smoking cessation (compared to continued smoking) affect smoking-related cognitions or smoking initiation among elementary schoolchildren. A possible explanation for this lack of an effect is that children in the present sample were rather young (i.e., elementary schoolchildren) and smoking initiation rates were quite low at 12-months follow-up assessment. Therefore, power limitations are likely to explain the lack of an effect on smoking initiation rates among children. Alternatively, it is possible that parental smoking cessation needs to be maintained for a longer period before effects on cognition or behaviour of children can be observed. Possibly, the effects of parental smoking cessation on children may become apparent later during child development (e.g., during adolescence , the developmental period in which smoking is usually initiated), as the maintenance of parental smoking cessation may continue to affect cognition and behaviour of children (i.e., effects of parental smoking cessation may grow or accumulate across time).

Yet, although no effect of parental counselling or cessation on child cognitions or behaviour could be observed, the findings in this thesis demonstrated that telephone counselling effectively enhances parental smoking cessation and the implementation of household smoking bans. Therefore, parental counselling is beneficial not only for parents, but also for their children. Both parental smoking cessation and smoke-free homes are associated with reduced exposure to ETS among children (Spencer, Blackburn, & Bonas, 2005). Thus, promoting telephone counselling among smoking parents may help prevent adverse health outcomes and enhance a positive health development among children of smoking parents, which remains a public health priority and major aim of tobacco control efforts (USDHHS, 2006).

Implications for research and practice

The studies in *Part 2* of this thesis demonstrate that telephone cessation counselling for smoking parents produces noteworthy effects. Moreover, these studies provide valuable knowledge of the types of clients that can benefit from telephone counselling and the processes that underlie the effectiveness of telephone counselling. These findings have several implications for tobacco control practice.

First, the findings in this thesis highlight the potential of targeting receptive subpopulations of smokers to increase the reach and the effectiveness of available smoking cessation interventions. In this thesis, we present a disseminable approach of recruiting a high-priority subgroup of smokers into cessation support and a convenient method to tailor generic interventions to the needs of target population. When developing new intervention campaigns or interventions, similar approaches should be considered. Our model (i.e., the population-level approach to target specific subpopulations and the use of tailored supplementary materials within generic interventions) may help shape similar efforts in research and practice in the future.

Second, the findings in this thesis provide strong support for the effectiveness of quitline counselling, as provided by the Dutch national quitline. They may help integrate the national quitline into the Dutch health care system. Currently, many health insurance companies in the Netherlands will charge a policy excess[7] (co-payment) when smokers file the insurance claim for cessation treatment, which may prevent smokers from using cessation support. Previous research has demonstrated that offering reimbursement for smoking cessation treatments (i.e., behavioural counselling or pharmacological treatment) will lead to a greater use of cessation support as well as increased smoking cessation rates (Kaper, Wagena, Willemsen, van Schayck, 2005; Kaper, Wagena, Willemsen, van Schayck, 2006). Cost-effectiveness analyses indicated that reimbursing treatment costs could be a cost-effective approach to decrease smoking-related health care costs (Kaper, Wagena, van Schayck, & Severens, 2006). The findings in this thesis indicate that the Dutch national quitline is highly effective in enhancing smoking cessation. Given that the effectiveness of the Dutch national quitline can be replicated in the general population of smokers, the findings in this thesis may help foster changes in the health insurance policies regarding the treatment of nicotine addiction. Once cost-effectiveness of the Dutch national quitline is established, health insurance companies may be more inclined to reimburse the treatment costs, which may result in greater use of quitline counselling and, possibly, a lower prevalence of smoking in the Netherlands.

Third, the findings in this thesis may help health care providers determine the most efficient treatment for their clients. This thesis showed that certain client characteristics can provide predictive information about treatment responses. Therefore, when several treatment alternatives are available, selections should be guided by client characteristics. Given the higher costs of telephone counselling compared to self-help material, cost-effectiveness considerations may be helpful in determining the cessation treatment of choice for a particular client. Possibly, for clients who do not display characteristics that indicate that telephone counselling should be the treatment of choice, health education and didactic information on smoking cessation (including information on the use of NRT and pharmacotherapy), provided in the form of self-help material, may be offered as a first-line treatment. For these clients, telephone counselling may be offered as a second-line treatment, or perhaps, following consultation or upon request.

Fourth, the working mechanisms underlying the effectiveness of telephone counselling identified in this thesis may help improve available smoking cessation interventions. Possibly, the potency of available intervention may be increased by ensuring that interventions sufficiently focus on the mechanisms by which a treatment operates to produce an effect. The findings in this thesis suggest that, during intervention implementation, it may be helpful for counsellors to monitor self-efficacy and willingness to experience cravings among smokers during quitting. Such monitoring may provide feedback that can be used to adjust the treatment. Additionally, the findings in this thesis suggest that incorporating acceptance-focused treatment components into standard cessation treatments (e.g., CBT-based treatments) may help improve the effectiveness of available cessation treatments. The use of this knowledge may help develop more efficient cessation treatments, that would incorporate the most potent treatment components.

Finally, the findings in this thesis provide little information regarding the preventive effects of parental smoking cessation on their children. Several explanations may account for the lack of an effect of parental smoking cessation on smoking-related cognition and behaviour of children. Therefore, caution should be exercised when interpreting the findings and their implications for tobacco control practice. Future research will need to further examine the effects of parental smoking cessation on cognition and behaviour of youth. Before firm conclusions can be reached, longer follow-up periods are needed and effects need to be examined among children at different developmental stages.

Limitations

The following section discusses the main limitations of the studies in *Part 2* of this thesis. An in-depth discussion of the limitations of each of these studies can be found in *Chapter 6-10*. Suggestions regarding how future research may address some of these limitations are provided in the section *Directions for future research*.

7 In Dutch: *eigen risico*

Trial design and conclusions

The present trial was designed to compare the effectiveness of telephone counselling to self-help material among the subpopulation of smoking parents. Although the findings provide tentative support that the subpopulation of smoking parents may be particularly receptive to cessation support, firm conclusions regarding parent's motivation to quit smoking, willingness to make use of cessation support, and receptivity to cessation treatment in comparison to other subpopulations of smokers are limited by the absence of an adequate control group to test these specific assumptions. Study designs, which are able to test these assumptions specifically, would need to compare smoking parents with either the general population of smokers or other subpopulations of smokers (e.g., smokers without children, smokers without children in the household).

Self-report of smoking behaviour and biochemical validation

In the present trial, parental smoking cessation was measured using self-report. Although abstinence was defined conservatively (i.e., six-months prolonged abstinence from smoking), biochemical validation of smoking status among participants who reported abstinence would have been ideal. In this thesis, biochemical measures were collected among a subsample of study participants to increase trial rigor. The results of the biochemical validation suggested that abstinence may be over-reported, but between-group differences are likely to be robust.

Generalizability of findings

The findings of the present trial pertain to a specific sample of smoking parents. Compared to the general population in the Netherlands, this sample of study participants had a relatively high education. The specific sample characteristics may limit the generalizability of the findings. In addition, although this research was aimed particularly at the subgroup of smoking parents, it should be noted that the results found among smoking parents might not generalize to the general population of smokers, as smoking parents may differ from the general population of smokers. Finally, it should be noted that study procedures that deviate from normal quitline procedures (i.e., no costs, use of incentives) might limit the generalizability of the findings.

Control condition

In this trial, the control condition to which telephone counselling was compared was a minimal intervention (i.e., self-help brochure). It should be noted that the control condition might have affected the results obtained in a randomized controlled trial. For a more stringent evaluation of the effects of telephone counselling, future studies should use an active treatment control with equal contact time. Additionally, the moderators identified in this thesis (i.e., the characteristics predictive of positive treatment outcome) may be treatment-specific and may not generalize to other types of treatment (e.g., pharmacological treatments).

Directions for future research

Increasing smokers' use of cessation support

The findings in this thesis show that recruitment of smokers into cessation support remains challenging. Future research will need to identify and further improve current approaches to connect smokers to cessation support. For example, future research may compare the efficacy of different recruitment approaches (e.g., different formats or contents of recruitment material) or the efficacy of recruiting smokers from different settings (e.g., public settings such as schools or educational institutions; clinical settings such as hospitals or physician offices). Moreover, future research may target different subpopulations, which may be more receptive to cessation support compared to the general population of smokers. Target populations could be smokers with smoking-related illnesses (e.g., cancer, coronary heart disease, COPD, respiratory illnesses such as asthma), smokers who have family members with smoking-related illnesses, or smokers with other chronic illnesses (e.g., diabetes, hypertension), as continued smoking exacerbates the risk associated with existing diseases and interferes with recovery processes. Furthermore, very heavy smokers or 'hard core' smokers (i.e., smokers who find it hard to quit or do not want to quit) may constitute a population of interest, as they pose a particular high risk to themselves and their social environment. To the best of our knowledge, no prior study has directly compared whether recruitment approach, recruitment setting, or target population may affect receptivity of smokers to cessation treatment. Ideally, future research should identify and evaluate approaches that can be implemented at the population level (as opposed to approaches that are merely used for recruitment of participants into efficacy trials) in order to affect the smoking prevalence at the population level. Importantly, future research will need to examine approaches aimed to increase the use of cessation support outside of highly demanding and incentivized trial situations (i.e., implementation research).

Improving effectiveness of available smoking cessation interventions

Future research will need to further improve the effectiveness of available cessation treatments. Tailoring available interventions to the needs of a particular subgroup of smokers may be one approach to increase the overall effectiveness of generic interventions. Future trials may employ more rigorous designs to examine the effects of adding supplementary material tailored to the needs of particular subgroups of smokers (e.g., smokers living with children, smokers with a smoking-related illness, smokers with diverse ethnic backgrounds) to generic quitline counselling.

In addition, future research may enhance the effectiveness of cessation treatments by identifying the core processes underlying evidence-based treatments. To determine the working mechanisms underlying treatment effectiveness, the criteria for establishing mechanisms of change in treatment research (Kazdin 2007) should be met. In addition, the effectiveness of cessation treatments may be enhanced by ensuring that the most potent treatment components are identified and incorporated in current and future cessation treatments. The findings in this thesis add to a growing number of studies (Bricker, Wyszynski, Comstock, & Heffner, 2013; Gifford et al., 2004; Hernandez-Lopez, Luciano, Bricker, Rosales-Nieto, & Montesinos, 2009) suggesting that acceptance-focused treatments compare well current standard cessation treatments (e.g., CBT-based

intervention and pharmacotherapy). For a rigorous evaluation, future research will need to compare the effects of acceptance-focused treatments to standard cessation treatments in full-scale efficacy trials. Moreover, future research may evaluate the effects of adding acceptance-focused treatment components to standard cessation treatments to increase treatment effectiveness.

Evaluating the effects of parental smoking cessation on children

Since the results regarding the effects of parental smoking cessation on smoking-related cognition and behaviour of children remain rather inconclusive, future research will need to determine the effects of smoking cessation interventions for parents and the effects of parental smoking cessation on children. Adequate sample sizes (ensuring an adequate sample size of children who initiate smoking) and the use of longer follow-up periods will be necessary to determine whether promoting evidence-based smoking cessation treatments and parental smoking cessation among parents can prevent smoking initiation among youth. Comparing the effects of parental smoking cessation among children at different developmental periods (e.g., elementary schoolchildren, pre-adolescents, adolescents) may help further understand the effects of parental smoking cessation on youth.

Concluding statement

The studies in *Part 2* of this thesis contribute to a better understanding of the outcomes as well as the core processes of telephone-based cessation support among the high-priority population of smoking parents. Although approaches to connect smokers to cessation support need to be further refined, cessation support (telephone counselling and self-help material) was well-received and well-used among smoking parents. Telephone counselling was highly effective in increasing smoking cessation rates compared to self-help material. The large effect sizes provide tentative support that smoking parents, as a subgroup of adult smokers, may be particularly receptive to cessation support. In line with this, parents who wanted to quit for the health of their children and parents of children with respiratory illnesses were particularly likely to benefit from smoking cessation treatment. When selecting a treatment for a particular client, health care providers should consider individual needs and abilities (e.g., educational level, motivation to quit smoking) as well as the costs and benefits associated with a particular treatment. The findings presented in thesis may inform practice and future research about ways to improve the effectiveness of available smoking cessation treatments and the potential of targeting specific subpopulations to reduce the prevalence of smoking.

References

References

Ajzen, I. (1998). Models of human social behavior and their application to health psychology. *Psychology and Health, 13*(4), 735-739.

Al-Delaimy, W., Fraser, T., & Woodward, A. (2001). Nicotine in hair of bar and restaurant workers. *New Zeeland Medical Journal, 114,* 80-83.

Al Koudsi, N., & Tyndale, R. F. (2005). Genetic influences on smoking: A brief review. *Therapeutic Drug Monitoring, 27*(6), 704-709.

Alwan, N., Siddiqi, K., Thomson, H., & Cameron, I. (2010). Children's exposure to second-hand smoke in the home: a household survey in the North of England. *Health and Social Care Community, 18*(3), 257-263.

Andrews, J. A., Hampson, A. E., & Barckley, M. (2008). The effect of subjective normative social images of smokers on children's intentions to smoke. *Nicotine and Tobacco Research, 10,* 589-597.

Andrews, J. A., Hampson, A. E., Barckley, M., Gerrard, M., & Gibbons, F. X. (2008). The effect of early cognitions on cigarette and alcohol use in adolescence. *Psychology of Addictive Behaviors, 22,* 96-106.

Andrews, J. A., Hampson, A. E., Greenwald, A. G., Gordon, J., & Widdop, C. (2010). Using the implicit association test to assess children's implicit attitudes toward smoking. *Journal of Applied Social Psychology, 40,* 2387-2406.

Anney, R. J. L, Olsson, C. A., Mehrnoush, L., Patton, G. C., Williamson, R. (2004). Nicotine dependence in a prospective population-based study of adolescents: the protective role of a functional tyrosine hydroxylase polymorphism. *Pharmacogenetics and Genomics, 14*(2), 73-81.

Anthonisen, N., & Murray, R. (2005). A new childhood pathway for transmission of an increased likelihood of smoking? *Canadian Medical Association Journal, 173,* 382-383.

Apelberg, B. J., Hepp, L. M., Avila-Tang, E., Gundel, L., Hammond, S. K., Hovell, M. F. et al. (2013). Environmental monitoring of secondhand smoke exposure. *Tobacco Control, 22,* 147-155.

Arnett, J. J. (2000). Optimistic bias in adolescent and adult smokers and non-smokers. *Addictive Behaviors, 25,* 625-632.

Audrain-McGovern, J., Rodriguez, D., Tercyak, K., Cuevas, J., Rodgers, K., & Patterson, F. (2004). Identifying and characterizing adolescent smoking trajectories. *Cancer Epidemiology and Biomarkers Prevention, 13*(12), 2023-2034.

Audrain-McGovern, J., Rodriguez, D., Wileyto, P., Schmitz, K. H., & Shields, P. G. (2006). Team sport participation buffers the effect of genetic predisposition on adolescent smoking progression. *Archives of General Psychiatry, 63*(4), 433-441.

Audrain-McGovern, J., Koudsi, N. A., Rodriguez, D., Wileyto, P., Shields, G., & Tyndale (2007). The role of CYP2A6 in the emergence of nicotine dependence in adolescents. *Pediatrics, 119,* 264-274.

Audrain-McGovern, J., Nigg J. T., & Perkin, K. (2009). Phenotypes and Endophenotypes: Foundations for genetic studies of nicotine use and dependence. Endophenotypes for nicotine dependence risk at or before initial nicotine exposure. National Cancer Institute Monograph, No. 22, Chapter 8. 2009; 337-386. *Retrieved from http://cancercontrol.cancer.gov/brp/tcrb/monographs/20/m20_8.pdf.*

Avenevoli, S. & Merikangas, K. R. (2003). Familial influences on adolescent smoking. *Addiction, 98*(Suppl. 1), 1-20.

Baillie, A. J., Mattick, R. P., & Hall, W. (1995). Quitting smoking: estimation by meta-analysis of the rate of unaided smoking cessation. *Australian Journal of Public Health, 19*(2), 129-131.

Balfour, D. J. (2004). The neurobiology of tobacco dependence: a preclinical perspective on the role of the dopamine projections to the nucleus accumbens. *Nicotine and Tobacco Research, 6*(6), 899-912.

Bandura, A. (1977). *Social learning theory.* Prentice-Hall, Englewood Cliffs, NJ.

Barnett, T., O'Loughlin, J., Paradis, G., & Renauld, L. (1997). Reliability of proxy reports of parental smoking by pre-adolescents. *Annual Epidemiology, 7,* 396-399.

Beck, A. T. (1993a). Cognitive therapy: Nature and relation to behavior therapy. *The Journal of Psychotherapy Practice and Research, 2*(4), 342-356.

Beck, A. T. (1993b). Cognitive therapy: Past, present, and future. *Journal of Consulting and Clinical Psychology, 61*(2), 194-198.

Becklake, M. R., Ghezzo, H., & Ernst, P. (2005). Childhood predictors of smoking in Adolescence: A follow-up study of Montreal schoolchildren. *Canadian Medical Association Journal, 173,* 377-379.

Bélanger, M., O'Loughlin, J., Okoli, C. T. C., McGrath, J. J., Setia, M., Guyon, L., & Gervais, A. (2008). Nicotine dependence symptoms among young never-smokers exposed to second hand tobacco smoke. *Addictive Behaviors, 33,* 1557-1563.

Belsky, J., Pluess, M., & Widaman, K. F. (2013). Confirmatory and competitive evaluation of alternative gene-environment interaction hypotheses. *Journal of Child Psychology and Psychiatry, 54*(10), 1135-1143.

Benowitz, N. L. (2008). Neurobiology of nicotine addiction: implications for smoking cessation treatment. *American Journal of Medicine, 121*(4 Suppl 1), 3-10.

Bentler, P., & Bonett, G. G. (1980). Significance tests and goodness-of-fit in the analysis of covariance structures. *Psychological Bulletin, 88,* 588-606.

Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods & Research, 16*, 78-117.

Berlin, I., & Covey, L. S. (2006). Pre-cessation depressive mood predicts failure to quit smoking: the role of coping and personality traits. *Addiction, 101*(12), 1814-1821.

Bernat, D. H., Erickson, D. J., Widome, R., Perry, C. L., & Forster, J. L. (2008). Adolescent smoking trajectories: Results from a population-based cohort study. *Journal of Adolescent Health, 43,* 334-340.

Berrendero, F., Kieffer, B. L., & Maldonado, R. (2002). Attenuation of nicotine-induced antinociception, rewarding effects, and dependence in mu-opioid receptor knock-out mice. *The Journal of Neuroscience, 22*(24), 10935-10940.

Berretini, W., Yuan, X., Tozzi, F., Song, K., Francks, C., Chilcoat, H., et al. (2008). -5/ -3 nicotinic receptor subunit alleles increase risk for heavy smoking. *Molecular Psychiatry, 2008*, 368-373.

Beyer, A., Koch, T., Schroder, H., Schulz, S., & Hollt, V. (2004). Effect of the A118G polymorphism on binding affinity, potency and agonist-mediated endocytosis, desensitization, and resensitization of the human mu-opioid receptor. *Journal of Neurochemistry, 89*(3), 553-560.

Bidstrup, P. E., Frederiksen, K., Siersma, V., Mortenson, E. L., Ross, L., Vinther-Larsen, M., Gronbak, M., & Johansen, C. (2009). Social-cognitive and school factors in initiation of smoking among adolescents: A prospective cohort study. *Cancer Epidemiology Biomarkers and Prevention, 18,* 384-392.

Bond, C., LaForge, K. S., Tian, M., Melia, D., Zhang, S., Borg, et al. (1998). Single-ucleotide polymorphism in the human mu opioid receptor gene alters beta-endorphin binding and activity: possible implications for opiate addiction. *Proceedings of the National Academy of Sciences of the United States of America, 95*(16), 9608-9613.

Borland, R., & Segan, C. J. (2006). The potential of quitlines to increase smoking cessation. *Drug and Alcohol Review, 25*(1), 73-78.

Borland, R., Yong, H. H., Cummings, K. M., Hyland, A., Anderson, S., & Fong, G. T. (2006). Determinants and consequences of smoke-free homes: Findings from the International Tobacco Control (ITC) Four Country Survey. *Tobacco Control,15*(3), 42-50.

Boyle, R., G., Solberg, L. I., Asche, S. E., Maciosek, M. V., Boucher, J. L., & Pronk, N. P. (2007). Proactive recruitment of health plan smokers into telephone counselling. *Nicotine and Tobacco Research, 9,* 581-589.

Brandon, T. H, Simmons, V. N., Meade, C. D., Quinn, G. P., Lopez Khoury, E. N., Sutton, S. K., et al. (2012). Self-help booklets for preventing postpartum smoking relapse: a randomized trial. *American Journal of Public Health, 102*(11), 2109-2115.

Bricker, J. B., Leroux, B. G., Peterson, A. V. Jr, Kealey, K. A., Sarason, I. G., Andersen, M. R., et al. (2006). Nine-year prospective relationship between parental smoking cessation and child's daily smoking. *Addiction, 98*, 585-593.

Bricker, J. B., Mann, S. L., Marek, P. M., Liu, J., & Peterson, A. V. (2010). Telephone-delivered Acceptance and Commitment Therapy for adult smoking cessation: a feasibility study. *Nicotine and Tobacco Research, 12*(4), 454-458.

Bricker, J. B., Rajan, K. B., Andersen, M. R., & Peterson, A. V., Jr. (2005). Does parental smoking cessation encourage their young adult children to quit smoking? A prospective study. *Addiction, 100*(3), 379-386.

Bricker, J., & Tollison, S. (2011). Comparison of motivational interviewing with acceptance and commitment therapy: a conceptual and clinical review. *Behavioural and Cognitive Psychotherapy, 39*(5), 541-559.

Bricker, J., Wyszynski, C., Comstock, B., & Heffner, J. L. (2013). Pilot randomized controlled trial of web-based acceptance and commitment therapy for smoking cessation. *Nicotine and Tobacco Research, 15*(10), 1756-1764.

Bricker, T. M., & Frankel, L. K. (2003). Carboxylate groups on the manganese-stabilizing protein are required for efficient binding of the 24 kDa extrinsic protein to photosystem II. *Biochemistry, 42*(7), 2056-2061.

Brody, A. L., Mandelkern, M. A., London, E. D., Khan, A., Kozman, D., Costello, M. R. et al. (2011). Effects of secondhand smoke on occupancy of nicotinic acetylcholine receptors in brain. *Archives of General Psychiatry, 68,* 953-960.

Brody, A. L., Mukhin, A. G., La Charite, J., Ta, K., Farahi, J., Sugar, et al. (2012). Up-regulation of nicotinic acetylcholine receptors in menthol cigarette smokers. *The International Journal of Neuropsychopharmacology*, *21*, 1-10.

Brook, U., Mendelberg, A., Galili, A., Priel, I., & Bujanover, Y. (1999). Knowledge and attitudes of children towards cigarette smoking and its damage. *Patient Education and Counselling, 37,* 49-53.

Buller, D. B., Borland, R., Woodall, W. G., Hall, J. R., Burris-Woodall, P., & Voeks, J. H. (2003). Understanding factors that influence smoking uptake. *Tobacco Control, 12*(4), 16-25.

Carey, M. P., Kalra, D. L., Carey, K. B., Halperin, S., & Richards, C. S. (1993). Stress and unaided smoking cessation: a prospective investigation. *Journal of Consulting and Clinical Psychology, 61*(5), 831-838.

Cameron, L. D., Sherman, K. A., Marteau, T. M., Brown, P. M. (2009). Impact of genetic risk information and type of disease on perceived risk, anticipated affect, and expected consequences of genetic tests. *Health Psychology, 28*(3), 307-316.

Carmelli, D., Swan, G. E., Robinette, D., & Fabsitz, R. (1992). Genetic influence on smoking: A study of male twins. *The New England Journal of Medicine, 327*(12), 829-833.

Carter, B. L., & Tiffany, S. T. (1999). Meta-analysis of cue-reactivity in addiction research. *Addiction, 94,* 327-340.

Carvajal, S. C., Wiatrek, D. E., Evans, R. I., Knee, C. R., Nash, S. G. (2000). Psychosocial determinants of the onset and escalation of smoking: Cross-sectional and prospective findings in multiethnic middle school sample. *Journal of Adolescent Health, 27,* 255-265.

Chandola, T., Head, J., & Bartley, M. (2004). Socio-demographic predictors of quitting smoking: How important are household factors? *Addiction, 99,* 770-777.

Chapman, S., Wong, W.L., & Smith, W. (1993). Self-exempting beliefs about smoking and health: Differences between smokers and ex-smokers. *American Journal of Public Health, 83*(2), 215-219.

Chartrand, T. L., & Bargh, J. A. (1999). The chameleon effect: The perception-behaviour and social interaction. *Journal of Personality and Social Psychology, 76*, 893-910.

Chassin, L., Presson, C. C., Rose J. S., & Sherman S. J. (1996). The natural history of cigarette smoking from adolescence to adulthood: Demographic predictors of continuity and change. *Health Psychology, 15*(10),, 478–484.

Chassin, L., Presson, C., Rose, J., Sherman, S. J., & Prost, J. (2002). Parental smoking cessation and adolescent smoking. *Journal of Pediatric Psychology, 27*(6), 485-496.

Chen, X., Stacy, A., Zheng, H., Shan, J., Spruijt-Metz, D., Unger, J., et al. (2003). Sensations from initial exposure to nicotine predicting adolescent smoking in China: A potential measure of vulnerability to nicotine. *Nicotine and Tobacco Research, 5*(4), 455-463.

Cook, D. G., & Strachan, D. P. (1999). Health effects of passive smoking-10: Summary of effects of parental smoking on the respiratory health of children and implications for research. *Thorax, 54,* 357-366.

Conrad, K. M., Flay, B. R., & Hill, D. (2006). Why children start smoking cigarettes: Predictors of onset, *Addiction, 87*(12), 1711-1724.

Cromwell, J., Bartosch, W. J., Fiore, M. C., Hasselblad, V., & Baker, T. (1997). Cost-effectiveness of the clinical practice recommendations in the AHCPR guideline for smoking cessation. Agency for Health Care Policy and Research. *Journal of the American Medical Association, 278*(21), 1759-1766.

Crone, M. R., Reijneveld, S. A., Willemsen, M.C., van Leerdam, F. J., Spruijt, R. D., Sing, R. A. (2003). Prevention of smoking in adolescents with lower education: A school based intervention study. *Journal of Epidemiology and Community Health, 57,* 675-80.

Dalton, M. A., Bernhardt, A. M., Gibson, J. J., Sargent, J. D., Beach, M. L., Adachi-Mejia, A. M., et al. (2005). Use of cigarettes and alcohol by preschoolers while role-playing as adults: "Honey, have some smokes". *Archives of Pediatrics & Adolescent Medicine, 159*(9), 854-859.

D'Angelo, M. E., Reid, R. D., Brown, K. S., & Pipe, A. L. (2001). Gender differences in predictors for long-term smoking cessation following physician advice and nicotine replacement therapy. *Canadian Journal of Public Health, 92*(6), 418-422.

De Josselin De Jong, S. , Segaar, D., & De Vries, H. (2012). Onderzoeksrapport: Effectiviteit en bereik van e-health interventie Smoke Alert. *Retrieved from http://stivoro.nl/wp-content/uploads/2012/docs/rapporten/jongeren/Onderzoeksrapport_SmokeAlert2%200.pdf*

De Leeuw, R. N. H., Engels, R. C. M. E., & Scholte, R. N. J. (2010). Parental smoking and pretend smoking in young children. *Tobacco Control, 19,* 201-205.

De Leeuw, R. N. H., Engels, R. C. M. E., Vermulst, A. A., & Scholte, R. H. J., (2008). Do smoking attitudes predict behaviour? A longitudinal study on the bi-directional relations between adolescents' smoking attitudes and behaviours. *Addiction, 103*(10), 1713-1721.

De Leeuw, R. N. H., Engels, R. C. M. E., Vermulst, A. A., & Scholte, R. H. J. (2009). Relative risks of exposure to different smoking models on the development of nicotine dependence during adolescence: A five-wave longitudinal study. *Journal of Adolescent Health, 45*(2), 171-178.

De Viron, S., Van der Heyden, J., Ambrosino, E., Arbyn, M., Brand, A., & Van Oyen, H. (2012). Impact of Genetic Notification on Smoking Cessation: Systematic Review and Pooled-Analysis. *Plos One, 7*(7), e40230.

De Vries, H., Dijk, F., Wetzels, J., Mudde, A., Kremers, S., Ariza, C. et al. (2006). The European Smoking Prevention Framework Approach (ESFA): Effects after 24 and 30 months. *Health Education Research, 21,* 116-32.

Den Exter Blokland, E. A., Engels, R. C., Hale, W. W., 3rd, Meeus, W., & Willemsen, M. C. (2004). Lifetime parental smoking history and cessation and early adolescent smoking behavior. *Preventive Medicine, 38*(3), 359-368.

DiFranza, J. R. (2010). Thwarting science by protecting the received wisdom on tobacco addiction from the scientific method. *Harm Reduction Journal, 7,* 26-37.

DiFranza, J. R., Aligne, C. A., & Weitzman, M. (2004). Prenatal and postnatal environmental tobacco smoke exposure and children's health. *Pediatrics, 113*(4), 1007-1015.

DiFranza, J. R., Huang, W., & King, J. (2012). Neuroadaptation in nicotine addiction: Update on the Sensitization-Homeostasis Model. *Brain Science, 2(4),* 523-552.

DiFranza, J., Morello, P., & Gershenson, B. (2012). The retest reliability of nicotine dependence measures. *Addiction Research and Theory, 20,* 55-63.

DiFranza, J. R., Rigotti, N.A., McNeill, A. D., Ockene, J. K., Savageau, J. A., & Coleman, M. (2000). Initial symptoms of nicotine dependence in adolescence. *Tobacco Control, 2000,* 313-319.

DiFranza, J. R., Savageau, J. A., Fletcher, K., O'Loughlin, J. Pbert, L., Ockene, J. K., et al. (2007). Symptoms of tobacco dependence after brief intermittent use: The development and assessment of nicotine dependence in Youth-2 study. *Archives of Pediatrics and Adolescent Medicine, 161,* 704-710.

DiFranza, J. R., Savageau, J. A., Fletcher, K., Ockene, J. K., Rigotti, N. A., McNeill, A., et al. (2004). Recollections and repercussions of the first inhaled cigarette. *Psychology of Addictive Behaviors, 29*(2), 261-272.

DiFranza, J. R., Savageau, J. A., Fletcher, K., Pbert, L., O'Loughlin, J., McNeill, A. et al. (2007). Susceptibility to nicotine dependence: the Development and Assessment of Nicotine Dependence in Youth 2 study. *Pediatrics, 120*(4), 974-983.

DiFranza, J. R., Savageau, J. A., Rigotti, N. A., Fletcher, K., Ockene, J. K., McNeill, A. D. et al. (2002). Development of symptoms of tobacco dependence in youth: 30 month follow-up data from the DANDY study. *Tobacco Control, 11,* 228-235.

DiFranza, J. R., Savageau, J. A., Rigotti, N. A., Ockene, J. K., McNeill, A. D., Coleman, M., et al. (2004). Trait anxiety and nicotine dependence in adolescents: a report from the DANDY study. *Psychology of Addictive Behaviors, 29*(5), 911-919.

DiFranza, J., Wellman, R., Ursprung, S., & Sabiston, C. (2009). The autonomy over smoking scale. *Psychology of Addictive Behaviors, 23*, 656-665.

DiFranza, J. R., & Wellman, R. J. (2005). A sensitization-homeostasis model of nicotine craving, withdrawal, and tolerance: Integrating the clinical and basic science literature. *Nicotine and Tobacco Research, 7(1),* 9-26.

Dijkstra, A., & De Vries, H. (2000). Subtypes of precontemplating smokers defined by different long-term plans to change their smoking behaviour. *Health Education Research, 15*(4), 423-434.

Dijkstra, A., de Vries, H., & Bakker, M. (1996). Pros and cons of quitting, self-efficacy, and the stages of change in smoking cessation. *Journal of Consulting and Clinical Psychology, 64*(4), 758-763.

Dijkstra, A., De Vries, H., & Roijackers, J. (1999). Targeting smokers with low readiness to change with tailored and nontailored self-help materials. *Preventive Medicine, 28*(2), 203-211.

Dimich-Ward, H., Gee, H., Brauer, M., & Leung, V. (1997). Analysis of nicotine and cotinine in the hair of hospitality workers exposed to environmental tobacco smoke. *Journal of Occupational and Environmental Medicine, 39,* 946-948.

Do Prado-Lima, P. A. S., Chatkin, J. M., Taufer, M., Oliveira, G., Silveira, E., Neto, C. A., et al. (2004). Polymorphism of 5HT2A serotonin receptor gene is implicated in smoking addiction. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 128*, 90-83.

Dolcini, M. M., Adler, N. E., Lee, P., Bauman, K. E. (2003). An assessment of the validity of adolescent self-reported smoking using three biological indicators. *Nicotine and Tobacco Research, 5*(4), 473-483.

Dolcini, M.M., Adler, N.E., & Ginsberg, D. (1996). Factors influencing agreement between self-reports and biological measures of smoking among adolescents. *Journal of Research on Adolescence, 6*, 515-542.

Eisner, M. D., Klein, J., Hammond, S. K., Koren, G., Lactao, G., & Iribarren, C. (2005). Directly measured second hand smoke exposure and asthma health outcomes. *Thorax, 60*(10), 814-821.

Embry, D. D., & Biglan, A. (2008). Evidence-based kernels: Fundamental units of behavioral influence. *Clinical Child and Family Psychology Review, 11,* 75-113.

Engels, R. C. M. E., Blokland, E. D. E., De Kemp, R., & Scholte, R. H. J. (2004). Influence and selection processes in friendships and adolescent smoking behaviour. *Journal of Adolescence, 27*, 531-544.

Engels, R. C. M. E., & Willemsen, M. (2004). Communication about smoking in Dutch families: Associations between anti-smoking socialization and adolescent smoking-related cognitions. *Health Education Research, 19*(3), 227-238.

Etcheverry, P. E., & Agnew, C. R. (2008). Romantic partner and friend influences on young adult cigarette smoking: Comparing close others' smoking and injunctive norms over time. *Psychology of Addictive Behaviors, 22,* 313-325.

Evans, K. A., Sims, M., Judge, K., & Gilmore, A. (2012). Assessing the knowledge of the potential harm to others caused by second-hand smoke and its impact on protective behaviours at home. *Journal of Public Health, 34*(2), 183-194.

Fagerstrom, K., & Furberg, H. (2008). A comparison of the Fagerstrom Test for Nicotine Dependence and smoking prevalence across countries. *Addiction, 103*(5), 841-845.

Farkas, A. J., Distefan, J. M., Choi, W. S., Gilpin, E. A., & Pierce, J. P. (1999). Does parental smoking cessation discourage adolescent smoking? *Preventive Medicine, 28*(3), 213-218.

Ferguson, J., Bauld, L., Chesterman, J., & Judge, K. (2005). The English smoking treatment services: one-year outcomes. *Addiction, 100*(2), 59-69.

Flay, B. R., Hu, F. B., Siddiqui, O., Day, L. E., Hedeker, D., Petraitis, J., Richardson, J., & Sussman, S. (1994). Differential influence of parental smoking and friends' smoking on adolescent initiation and escalation of smoking. *Journal of Health and Social Behavior, 35*(3), 248-265.

Flay, B. R., Phil, D., Hu, F. B., & Richardson, J. (1998). Psychosocial predictors of different stages of cigarette smoking among high school students. *Preventive Medicine, 27*, 9–18.

Forestell, C. A., Dickter, C. L., Wright, J. D., & Young, C. M. (2012). Clearing the smoke: Parental influences on non-smoker's attentional biases to smoking-related cues. *Psychology of Addictive Behaviours, 26*(3), 638-643.

Forman, E. M., Herbert, J. D., Moitra, E., Yeomans, P. D., & Geller, P. A. (2007). A randomized controlled effectiveness trial of acceptance and commitment therapy and cognitive therapy for anxiety and depression. *Behavior Modification, 31*(6), 772-799.

Fowler, C. D., Lu, Q., Johnson, P. M., Marks, M. J., & Kenny, P. J. (2011). Habenular 5 nicotine receptor subunit signaling controls nicotine intake. *Nature, 471,* 597-601.

Freedman, K. S., Nelson, N. M., & Feldman, L. L. (2012). Smoking initiation among young adults in the united states and canada, 1998-2010: A systematic review. *Preventing Chronic Disease, 9*, E05,

Friend, K., Levy, D.T. (2001). Smoking treatment interventions and policies to promote their use: A critical review. *Nicotine and Tobacco Research, 3*, 299-310.

Gauderman, M. (2006). Air pollution and children--an unhealthy mix. *The New England Journal of Medicine, 355*(1), 78-9.

Gerrard, M., Gibbons, F. X., Bethin, A. C., & Hessling, R. M. (1996). A longitudinal study on the reciprocal nature of risk behaviors and cognitions in adolescence: What you do is what you think and vice versa. *Health Psychology, 15,* 344-354.

Gifford, E. V., Kohlenberg, B. S., Hayes, S. C., Antonuccio, D. O., Piasecki, M. M., Rasmussen-Hall, M. L., & Palm, K. M. (2004). Acceptance-based treatment for smoking cessation. *Behavior Therapy, 35*(4), 689-705.

Gifford, E. V., Kohlenberg, B. S., Hayes, S. C., Pierson, H. M., Piasecki, M. P., Antonuccio, D. O., & Palm, K. M. (2011). Does acceptance and relationship focused behavior therapy contribute to bupropion outcomes? A randomized controlled trial of functional analytic psychotherapy and acceptance and commitment therapy for smoking cessation. *Behavior Therapy, 42*(4), 700-715.

Gilbert, H., Nazareth, I., & Sutton, S. (2007). Assessing the feasibility of proactive recruitment of smokers to an intervention in general practice for smoking cessation using computer-tailored feedback reports. *Family Practice, 24*(4), 395-400.

Gilbert, H., Sutton, S. R., Leurent, B., Alexis-Garsee, C., Morris, R. W., & Nazareth, I. (2012). Characteristics of a population-wide sample of smokers recruited proactively for the ESCAPE trial. *Public Health, 126*(4), 308-316.

Gilman, S. E., Rende, R., Boergers, J., Abrams, D. B., Buka, S. L., Clark, M. A., et al. (2009). Parental smoking and adolescent smoking initiation: An intergenerational perspective on tobacco control. *Pediatrics*, *123*, 74-281.

Gilpin, E. A., Stillman, F. A., Hartman, A. M., Gibson, J. T., & Pierce, J. P. (2000). Index for US state tobacco control initial outcomes. *American Journal of Epidemiology, 152*(8), 727-738.

Gilpin, E. A., White, M. M., Farkas, A. J., & Pears, J. P. (1999). Home smoking restrictions: Which smokers have them and how they are associated with smoking behaviour. *Nicotine and Tobacco Research, 1,* 153-162.

Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *American Journal of Public Health, 89*, 1322-1327.

Glover, M., Scragg, R., Min, S., Kira, A., Nosa, V., McCool, J., & Bullen, C. (2011). Driving kids to smoke? Children's reported exposure to smoke in cars and early smoking initiation. *Addictive Behaviors, 36,* 1027-1031.

Gritz, E. R., Prokhorov A. V., & Hudmon, K. S., Jones, M. M., Rosenblum, C., Chang, C. C. et al., (2003). Predictors of susceptibility to smoking and ever smoking: A longitudinal study in a triethnic sample of adolescents. *Nicotine and Tobacco Research, 5*(4), 493-506.

Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: a meta-analysis. *Psychology of Addictive Behaviors, 23*(1), 56-66.

Halpern-Felsher, B. L., Biehl, M., Kropp, R. Y., & Rubinstein, M. L. (2004). Perceived risks and benefits of smoking: Differences among adolescents with different smoking experiences and intentions. *Preventive Medicine, 39,* 559-567.

Halterman, J. S., Borrelli, B., Conn, K. M., Tremblay, P., & Blaakman, S. (2010). Motivation to quit smoking among parents of urban children with asthma. *Patient Education and Counselling, 79*(2), 152-155.

Halterman, J. S., Szilagyi, P. G., Yoos, H. L., Conn, K. M., Kaczorowski, J. M., Holzhauer, R. J., et al. (2004). Benefits of a school-based asthma treatment program in the absence of secondhand smoke exposure: results of a randomized clinical trial. *Archives of Pediatrics and Adolescent Medicine, 158*(5), 460-467.

Hampson, S. E., Andrews, J. A., & Barckley, M. (2007). Predictors of the development of elementary-school children's intentions to smoke cigarettes: Hostility, prototypes and subjective norms. *Nicotine and Tobacco Research, 9,* 751-760.

Harakeh, Z., Engels, R. C. M. E., De Vries, H., & Scholte, R. H. J. (2006). Correspondence between proxy and self-reports on smoking in a full family study. *Drug and Alcohol Dependence, 84,* 40-47.

Harakeh, Z., Engels, R. C. M. E., Van Baaren, R. B., & Scholte, R. H. J. (2007). Imitation of cigarette smoking: An experimental study on smoking in a naturalistic setting. *Drug and Alcohol Dependence, 86*, 199-206.

Harakeh, Z., Scholte, R. H. J., De Vries, H., & Engels, R. C. M. E. (2005). Parental rules and communication: Their association with adolescent smoking. *Addiction, 100*, 862-870.

Harris, K. J., Ahluwalia, J. S., Catley, D., Okuyemi, K. S., Mayo, M. S., & Resnicow, K. (2003). Successful recruitment of minorities into clinical trials: The Kick It at Swope project. *Nicotine and Tobacco Research, 5*(4), 575-584.

Hartz, S. M., Short, S. E., Saccone, N. L., Culverhouse, R., Chen, L., Schwantes-An, T.-H. et al., (2012). Increase genetic vulnerability to smoking at CHRNA5 in early-onset smokers. *JAMA Psychiatry, 69*(8), 854-860

Haug, S., Meyer, C., Ulbricht, S., Schorr, G., Ruge, J., Rumpf, H.J, et al. (2010). Predictors and moderators of outcome in different brief interventions for smoking cessation in general medical practice. *Patient Education and Counselling, 78*(1), 57-64.

Hayes, S. C., Levin, M. E., Plumb-Vilardaga, J., Villatte, J. L., & Pistorello, J. (2013). Acceptance and commitment therapy and contextual behavioral science: examining the progress of a distinctive model of behavioral and cognitive therapy. *Behavior Therapy, 44*(2), 180-198.

Hayes, A. F., & Matthes, J. (2009). Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behavior Research Methods, 41*(3), 924-936.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2008). Modeling of palatable food intake in female young adults: Effects of perceived body size. *Appetite, 51*, 512-518.

Hernandez-Lopez, M., Luciano, M. C., Bricker, J. B., Roales-Nieto, J. G., & Montesinos, F. (2009). Acceptance and commitment therapy for smoking cessation: a preliminary study of its effectiveness in comparison with cognitive behavioral therapy. *Psychology of Addictive Behaviors, 23*(4), 723-730.

Herrero, J., & Meneses, J., (2004). Short Web-based versions of the perceived stress (PSS) and Center for Epidemiological Studies-Depression (CESD) Scales: A comparison to pencil and paper responses among Internet users. *Computers in Human Behavior, 22*(5), 830-846.

Herzog, T. A., Lazev, A. B., Irvin, J. E., Juliano, L. M., Greenbaum, P. E., & Brandon, T. H. (2002). Testing for group membership effects during and after treatment: The example of group therapy for smoking cessation. *Behavior Therapy, 33*(1), 29–43.

Hiemstra, M., Ringlever, L. Otten, R., van Schayck, C. P., Jackson, C., & Engels, R. C. M. E. (in press). Long-Term Effects of Smoke-free Kids on smoking initiation: A randomized home-based smoking prevention program for elementary school aged children. *Preventive Medicine*.

Hiemstra, M., Otten, R., & Engels, R. C. M. E. (2012). Smoking onset and the time-varying effects of self-efficacy, environmental smoking, and smoking-specific parenting by using discrete-time survival analysis. *Journal of Behavioral Medicine, 35*(2), 240-251.

Hiscock, A., Bauld, L., Amos, A., Fiedler, J. A., & Munafo, M. (2012). Socioeconomic status and smoking: A review. *Annals of the New York Academy of Sciences*, 1248:107-23.

Hitchman, S. C., Fong, G. T., Zanna, M. P., Hyland, A., & Bansal-Travers, M. (2011). Support and correlates of support for banning smoking in cars with children: Findings from the ITC Four Country Survey. *European Journal of Public Health, 21*(3), 360-365.

Holliday, J. C., Moore, G. F., & Moore, L. A. (2009). Changes in child exposure to secondhand smoke after implementation of smoke-free legislation in Wales: A repeated cross-sectional study. *BMC Public Health, 9*, 430

Hu, M. C., Davies, M., & Kandel, D. B. (2006). Epidemiology and correlates of daily smoking and nicotine dependence among young adults in the United States. *American Journal of Public Health, 96*(2), 299-308.

Hughes, J. R., Keely, J. P., Fagerstrom, K. O., & Callas, P. W. (2005). Intentions to quit smoking change over short periods of time. *Addictive Behaviors, 30*(4), 653-662.

Hughes, J. R., Keely, J. P., Niaura, R. S., Ossip-Klein, D. J., Richmond, R. L., & Swan, G. E. (2003). Measures of abstinence in clinical trials: Issues and recommendations. *Nicotine and Tobacco Research*, *5,* 13-25.

Hughes, J. R., Marcy, T. W., & Nauds, S. (2009): Interest in treatments to stop smoking. J*ournal of Substance Abuse Treatment, 36*, 18-24.

Husten, C. G. (2010). A Call for ACTTION: Increasing access to tobacco-use treatment in our nation. *American journal of preventive medicine, 38*(3), 414-417.

Huver, R., Engels, R. C. M. E., & De Vries, H. (2006). Are anti-smoking parenting practices related to adolescent smoking cognitions and behaviour? *Health Education Research, 21*, 66-77.

Huver, R. M. E., Engels, R. C. M. E., Vermulst, A. A., & De Vries, H. (2007). Bi-directional relations between anti-smoking parenting practices and adolescent smoking behaviour in a Dutch sample. *Health Psychology, 26*, 762-768.

Hymowitz, N., Cummings, K. M., Hyland, A., Lynn, W. R., Pechacek, T. F., & Hartwell, T. D. (1997). Predictors of smoking cessation in a cohort of adult smokers followed for five years. *Tobacco Control*, *6*(2), 57-62.

Irvin, J. E., & Brandon, T. H. (2000). The increasing recalcitrance of smokers in clinical trials. *Nicotine & Tobacco Research*, 2, 79-84.

Jarvis, M. J., Russell, M. A., & Feyerabend, C. (1983). Absorption of nicotine and carbon monoxide from passive smoking under natural conditions of exposure. *Thorax, 38*(11), 829-833.

Johnson, E. O., Chen, L. S., Breslau, N., Hatsukami, D., Robbins, T., Saccone, N. L., et al. (2010). Peer smoking and the nicotinic receptor genes: an examination of genetic and environmental risks for nicotine dependence. *Addiction, 105*(11), 2014-2022.

Joreskog, K. G. (1996). Modeling development: using covariance structure models in longitudinal research. *European Child and Adolescent Psychiatry, 5*(Suppl 1), 8-10.

Kahende, J. W., Loomis, B. R., Adhikari, B., & Marshall, L. (2009). A review of economic evaluations of tobacco control programs. *International Journal of Environmental Research and Public Health, 6*(1), 51-68.

Kandel, D. B., Hu, M. C., Griesler, P. C., & Schaffran, C. (2007). On the development of nicotine dependence in adolescence. *Drug and Alcohol Dependence, 91*(1), 26-39.

Kandel, D. B., Hu, M. C., & Yamaguchi, K. (2009). Sequencing of DMS-criteria of nicotine dependence. *Addiction, 104,* 1393-1402.

Kaplan, C. P., Napoles-Springer, A., Stewart, S. L., & Perez-Stable, E. (2001). Smoking acquisition among adolescents and young Latinas: The role of socioenvironmental and personal factors. *Addictive Behaviors, 26*(4), 531-550.

Kaper, J., Wagena, E. J., Willemsen, M. C., & van Schayck, C. P. (2006). A randomized controlled trial to assess the effects of reimbursing the costs of smoking cessation

therapy on sustained abstinence. *Addiction*, *101*, 1656–1661.

Kaper, J., Wagena, E. J., Willemsen, M. C., & van Schayck, C. P. (2005). Reimbursement for smoking cessation treatment may double the abstinence rate: results of a randomized trial. *Addiction, 100*, 1012–1020.

Kaper, J., Wagena, E. J., van Schayck, C. P., & Severens, J. L. (2006). Encouraging smokers to quit: the cost effectiveness of reimbursing the costs of smoking cessation treatment. *Pharmacoeconomics, 24*(5), 453-64.

Kaprio, J. (2009). Genetic epidemiology of smoking behavior and nicotine dependence. *Journal of Chronic Obstructive Pulmonary Disease, 6*(4), 304-306.

Kardia, S. L., Pomerleau, C. S., Rozek, L. S., & Marks, J. L. (2003). Association of parental smoking history with nicotine dependence, smoking rate, and psychological cofactors in adult smokers. *Addictive behaviors, 28*(8), 1447-1452.

Kassel, J. D. (2000). Smoking and stress: Correlation, causation, and context. *American Psychologist, 55*(10), 1155-1156.

Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology, 3*, 1-27.

Kenford, S. L., Smith, S. S., Wetter, D. W., Jorenby, D. E., Fiore, M. C., & Baker, T. B. (2002). Predicting relapse back to smoking: contrasting affective and physical models of dependence. *Journal of Consulting and Clinical Psychology, 70*(1), 216-227.

King, K., Martynenko, M., Bergman, M. H., Liu, Y. H., Winickoff, J. P., & Weitzman, M. (2009). Family composition and children's exposure to adult smokers in their homes. *Pediatrics, 123,* 569-564.

Kleinjan, M., DiFranza, J. R., & Engels, R. C. M. E. (submitted). Parental smoke exposure and the development of nicotine craving in adolescent novice smokers: The Roles of DRD2, DRD4, and OPRM1 genotypes.

Kleinjan, M., Wanner, B., Vitaro, F., Van den Eijnden, R. J. J. M., Brug, J., & Engels, R. C. M. E. (2010). Nicotine dependence subtypes among adolescent smokers: examining the occurrence, development and validity of distinct symptom profiles. *Psychology of Addictive Behaviors, 24*(1), 61-74.

Kleinjan, M., Vitaro, F., Wanner, B., Brug, J., Van den Eijnden, R. J. J. M., & Engels, R. C. M. E. (2012). Predicting nicotine dependence profiles among adolescent smokers: The roles of personal and social-environmental factors in a longitudinal framework. *BMC Public Health, 12,* 196.

Kluger, A. N., Siegfried, Z., & Ebstein, R. P. (2002). A meta-analysis of the association between DRD4 polymorphism and novelty seeking. *Molecular Psychiatry, 7*(7), 712-717.

Kraemer, H. C., Wilson, G. T., Fairburn, C. G., & Agras, W. S. (2002). Mediators and moderators of treatment effects in randomized clinical trials. *Archives of General Psychiatry, 59*(10), 877-883.

Kremer, I., Bachner-Melman, R., Reshef, A., Broude, L., Nemanov, L., Gritsenko, I. et al. (2005). Association of the serotonin transporter promoter polymorphism with smoking behavior. *American Journal of Psychiatry, 162,* 924-930.

Kremers, S. P., Mudde, A. N., & De Vries, H. (2001). "Kicking the initiation": Do adolescent ex-smokers differ from other groups within the initiation continuum? *Preventive Medicine, 33*(5), 392-401.

Lam, T. H., Leung, G. M., & Ho, L. M. (2001). The effects of environmental tobacco smoke on health services utilization in the first eighteen months of life. *Pediatrics, 107*(6), E91.

Lancaster, T., Stead, L., Silagy, C., & Sowden, A. (2000). Effectiveness of interventions to help people stop smoking: findings from the Cochrane Library. *British Medical Journal 321*(7257), 355-358.

Lancaster, T., & Stead, L. F. (2005). Self-help interventions for smoking cessation. *Cochrane database of systematic reviews* (3).

Larsen, H., Engels, R. C. M. E., Granic, I., & Overbeek, G. (2009). An experimental study on imitation of alcohol consumption in same-sex dyads. *Alcohol and Alcoholism, 44*, 250-255.

Laucht, M., Becker, K., El-Faddagh, M., Hohm, E., & Schmidt, M. H. (2005). Association of the DRD4 exon III polymorphism with smoking in fifteen-year-olds: a mediating role for novelty seeking? *Journal of the American Academy of Child and Adolescent Psychiatry, 44*(5), 477-484.

Laucht, M., Becker, K., Frank, J., Schmidt, M. H., Esser, G., Treutlein, J., et al. (2008). Genetic variation in dopamine pathways differentially associated with smoking progression in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*(6), 673-681.

Lautenbach, D. M., Christensen, K. D., Sparks, J.A., & Green, R. C. (2013). Communicating genetic risk information for common disorders in the era of genomic medicine. *Annual Review of Genomics and Human Genetics, 14*, 491-513.

Lemmens, V., Oenema, A., Klepp Knut, I. & Brug, J. (2008). Effectiveness of smoking cessation interventions among adults: a systematic review of reviews. *European Journal of Cancer Prevention, 17*, 535–544.

Lenzenweger, M. F. (2013). Endophenotype, intermediate phenotype, biomarker definitions, concept camparisons, clarifications. *Depression and anxiety, 30*, 185-189.

Leonardi-Bee, J., Jere, M. L., & Britton, J. (2011). Exposure to parental and sibling smoking and the risk of smoking uptake in childhood and adolescence: A systematic review and meta-analysis. *Thorax, 66*, 847-845

Lerman, C. E., Caporaso, N. E., Audrain, J. Main, D., Bowman, E. D., Lockshin, B. et al. (1999). Evidence suggesting the role of specific genetic factors in cigarette smoking. *Health Psychology, 18,* 14-20.

Lerman, C. E., Roth, D., Kaufmann, V., Audrain, J., Hawk, L., Liu, A., et al. (2002). Mediating mechanisms for the impact of bupropion in smoking cessation treatment. *Drug and Alcohol Dependence, 67*(2), 219-223.

Lerman, C. E., Schnoll, R. A., & Munafo, M. R. (2007). Genetics and smoking cessation improving outcomes in smokers at risk. *American Journal of Preventive Medicine, 33*, 398-405.

Li, M. D., Cheng, R., Ma, J. Z., & Swan, G. E. (2003). A meta-analysis of estimated and environmental effects on smoking behavior in male and female adult twins. *Addiction. 98*(1), 23–31.

Li, M. D., Ma, J. Z., & Beuten, J. (2004). Progress in searching for susceptibility loci and genes for smoking-related behaviour. *Clinical Genetics, 66*(5), 382–392.

Lieb, R., Schreier, A., Pfister, H., & Wittchen, H. U. (2003). Maternal smoking and smoking in adolescents: a prospective community study of adolescents and their mothers. *European addiction research, 9*(3), 120-130.

Leonardi-Bee, J., Jere, M. L., & Britton, J. (2011). Exposure to parental and sibling smoking and the risk of smoking uptake in childhood and adolescence: A systematic review and meta-analysis. *Thorax, 66,* 847-855.

Lochbuehler, K., Kleinjan, M., & Engels, R. C. M. E. (2013). Does the exposure to smoking cues in movies affect adolescents' immediate smoking behavior? *Addictive Behaviors, 38*(5), 2203-2206.

Lochbuehler, K., Otten, R., Voogd, H., Engels, R. C. M. E. (2012). Parental smoking and children's attention to smoking cues. *Journal of Psychopharmacology, 26,* 1010-1016.

Lopez, E. N., Simmons, V. N., Quinn, G. P., Meade, C. D., Chirikos, T. N., & Brandon, T. H. (2008). Clinical trials and tribulations: lessons learned from recruiting pregnant ex-smokers for relapse prevention. *Nicotine and Tobacco Research, 10*(1), 87-96.

Lorenzo-Blanco, E. I., Bares, C., & Delva, J. (2012). Correlates of chilean adolescents' negative attitudes toward cigarettes: the role of gender, peer, parental, and environmental factors. *Nicotin and Tobacco Research, 14*(2), 142-152.

Mak, K. K., Ho, S. Y., & Day, J. R. (2012). Smoking of parents and best friend- independent and combined effects on adolescent smoking and intention to initiate and quit smoking. *Nicotine and Tobacco Research, 14*(9), 1057-1064.

Malmberg, M., Kleinjan, M., Overbeek, G., Vermulst, A. A., Monshouwer, K., Lammers, J., Vollebergh, W. A. M., & Engels, R. C. M. E. (submitted). Effectiveness of the 'Healthy School and Drugs' prevention program on adolescents' substance use: A randomized clustered trial.

Malmberg, M., Overbeek, G., Kleinjan, M., Vermulst, A., Monshouwer, K., Lammers, J., et al. (2010). Effectiveness of the universal prevention program 'Healthy School and Drugs': Study protocol of a randomized clustered trial. *BMC Public Health, 10,* 541.

Manchon Walsh, P., Carrillo, P., Flores, G., Masuet, C., Morchon, S., & Ramon, J. M. (2007). Effects of partner smoking status and gender on long term abstinence rates of patients receiving smoking cessation treatment. *Addictive Behaviors, 32,* 128-136.

Marks, M. J., Stitzel, J. A., & Collins, A. C. (1989). Genetic influences on nicotine responses. *Pharmacology Biochemistry and Behavior, 33*(3), 667-678.

Marteau, T. M., & Lerman, C. (2001). Genetic risk and behavioural change. *British Medical Journal, 322*(7293), 1056–1059.

Matt, G. E., Qintanta, P. J. E., Hovell, M. F., Bernert, J. T., Song, S., Novianti, N. et al. (2004). Households contaminated by environmental tobacco smoke: Sources of infant exposures. *Tobacco Control, 13,* 29-37.

Mayhew, K. P., Flay, b. R., & Mott, J. A. (2000). Stages in the development of adolescent smoking. *Drug and Alcohol Dependence, 59*(1), 61–81.

McBride, C. M., Emmons, K. M., & Lipkus, I.M. (2003). Understanding the potential of teachable moments: the case of smoking cessation. *Health Education Research, 18,* 156-170.

McCaul, K. D., Hockemeyer, J. R., Johnson, R. J., Zetocha, K., Quinlan, K., & Glasgow, R. E. (2006). Motivation to quit using cigarettes: a review. *Addictive Behaviors, 31*(1), 42-56.

McClure, J. B., Greene, S. M., Wiese, C., Johnson, K. E., Alexander, G., & Strecher, V. (2006). Interest in an online smoking cessation program and effective recruitment strategies: results from Project Quit. *Journal of Medical Internet Research, 8*(3), e14.

McClure, J. B., Richards, J., Westbrook, E. O., Pabiniak, C., & Ludman, E. (2007). Research letter: Using a commercial mailing list to recruit smokers: a cautionary tale. *American Journal of Preventive Medicine, 33*(5), 436-437.

McDonald, P. W. (1999). Population-based recruitment for quit-smoking programs: An analytic review of communication variables. *Preventive Medicine, 28*(6), 545-557.

McNeil, A. D. (1991). The development of dependence on smoking in children *British Journal of Addiction, 86*(5), 589-592.

Miguez, M. C., & Becona, E. (2008). Evaluating the effectiveness of a single telephone contact as an adjunct to a self-help intervention for smoking cessation in a randomized controlled trial. *Nicotine and Tobacco Research, 10*, 129-35.

Miller, W.R., & Rollnick, S. (2002). *Motivational Interviewing: Preparing people to change (2nd Ed)*. New York: Guilford Press.

Miranda, R. Jr., Rohsenow, D. J., Monti, P. M., Tidey, J., Ray, L. (2008). Effects of repeated days of smoking cue exposure on urge to smoke and physiological reactivity. *Addictive Behaviors, 33,* 347-353.

Munafo, M., Clark, T., Johnstone, E., Murphy, M., & Walton, R. (2004). The genetic basis for smoking behavior: a systematic review and meta-analysis. *Nicotine and Tobacco Research, 6*(4), 583-597.

Murphy, R., Cooper, Z., Hollon, S. D., & Fairburn, C. G. (2009). How do psychological treatments work? Investigating mediators of change. *Behavior Research and Therapy, 47*(1), 1–5.

Muthén, L., & Muthén, B. (2007). *Mplus user's guide (5th ed.)*. Los Angeles, CA: Muthén & Muthén.

Nilsson, K. W., Oreland, L., Kronstrand, R., & Leppert, J. (2009). Smoking as a product of gene-environment interaction. *Upsala Journal of Medical Sciences, 114*(2), 100-107.

TNS NIPO (2008). *Ruim kwart van stoppers houdt het nog steeds vol*. Retrieved from http://www.tns-nipo.com/tns-nipo/nieuws/van/ruim-kwart-van-stoppers-houdt-het-nog-steeds-vol/

Nichols, T. R., Birnbaum, A. S., Birnel, S., & Botvin, G. J. (2006). Perceived smoking environment and smoking initiation among multi-ethnic urban girls. *Journal of Adolescent Health, 38,* 369–375.

Noble, E. P. (2003). D2 dopamine receptor gene in psychiatric and neurologic disorders and its phenotypes. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 116B*(1), 103-125.

O'Connor, R. J., Kozlowski, L. T., Vandenbergh, D. J., Strasser, A. A., Grant, M. D., & Vogler, G. P. (2005). An examination of early smoking experiences and smoking status in a national cross-sectional sample. *Addiction, 100*(9), 1352-1357.

Oh, D. L., Heck, J. E., Dresler, C., Allwright, S., Haglund, M., Del Mazo, S. S., et al. (2010). Determinants of smoking initiation among women in five European countries: A cross-sectional survey. *BMC Public Health, 10,* 74.

Okah, F. A., Choi, W. S., Okuyemi, K. S., & Ahluwalia, J. S. (2002). Effects of children on home smoking restrictions by inner-city smokers. *Pediatrics, 109,* 244-249.

Okoli, C. T. C., Kelly, T., & Hahn, E. J. (2007). Secondhand smoke and nicotine exposure: A brief review. *Addictive Behaviors, 32,* 1977-1988.

Okoli, C. T. C., Rayens, M. K., & Hahn, E. J. (2007). Behavioral effects of nicotine exposure from secondhand tobacco smoke among bar and restaurant workers. *Addictive Behaviors, 32,* 1922-1928.

Okoli, C. T., Richardson, C. G., & Johnson, J. L. (2008). An examination of the relationship between adolescents' initial smoking experience and their exposure to peer and family member smoking. *Addictive Behaviors, 33*(9), 1183-1191.

Okoli, C. T. C., Richardson, G., Ratner, P. A., & Johnson, J. L. (2009). Non-smoking youths' perceived addiction to tobacco is associated with their susceptibility to future smoking. *Addictive Behaviors, 34,* 1010-1016.

O'Loughlin, J., Paradis, G., Kim, W., DiFranza, J., Meshefedjian, G., McMillan-Davey, E., Wong, S., Hanley, .J, & Tyndale, R. F. (2004). Genetically decreased CYP2A6 and the risk of tobacco dependence: A prospective study of novice smokers. *Tobacco Control, 13*(4), 422-428.

O'Loughlin, J., Karp, I., Koulis, T., Paradis, G., & DiFranza, J. (2009). Determinants of first puff and daily cigarette smoking in adolescents. *American Journal of Epidemiology, 170*(5), 585-597.

Orleans, C. T., Boyd, N. R., Bingler, R., Sutton, C., Fairclough, D., Heller, D., et al. (1998). A self-help intervention for African American smokers: Tailoring cancer information service counselling for a special population. *Preventive Medicine, 27*(5 Pt 2), S61-70.

Otten, R., Engels, R. C. M. E., & Prinstein, M. J. (2009). A prospective study of perception in adolescent smoking. *Journal of Adolescent Health, 44,* 478-484.

Otten, R., Engels, R. C. M. E., van de Ven, M. O., & Bricker, J. B. (2007). Parental smoking and adolescent smoking stages: the role of parents' current and former smoking, and family structure. *Journal of Behavioral Medicine, 30*(2), 143-154.

Otten, R., Engels, R. C. M. E., & van den Eijnden, R. J. (2005). Parental smoking and smoking behaviour in asthmatic and nonasthmatic adolescents. *Journal of Asthma, 42,* 349-355.

Otten, R., Van der Zwaluw, C. S., Van der Vorst, H., & Engels, R. C. M. E. (2008). Parent effects and bidirectional parent-child effects in family alcohol use. *European Addiction Research, 14,* 106-112.

Patel, J. P., Gönen, M., Figueroa, M. E., Fernandez, H., Sun, Z., Racevskis, J., et al (2012). Prognostic relevance of integrated genetic profiling in acute myeloid leukemia. *New England Journal of Medicine, 366(12),* 1079-89.

Peretti-Watel, P., Constance J., Guilbert, P., Gautier, A., Beck, F., & Moatti, J. P. (2007). Smoking too few cigarettes to be at risk? Smokers' perceptions of risk and risk denial, a French survey. *Tobacco Control, 16,* 351-356.

Perkins, K. A., Coddington, S. B., Karelitz, J. L., Jetton, C., Scott, J. A., Wilson, A. S., et al. (2009). Variability in initial nicotine sensitivity due to sex, history of other drug use, and parental smoking. *Drug and Alcohol Dependence, 99*(1-3), 47-57.

Perkins, K. A., Lerman, C., Coddington, S., Jetton, C., Karelitz, J. L., Wilson, A., et al. (2008). Gene and gene by sex associations with initial sensitivity to nicotine in nonsmokers. *Behavioural Pharmacology, 19*(5-6), 630-640.

Perkins, K. A., Lerman, C., Coddington, S., & Karelitz, J. L. (2008). Association of retrospective early smoking experiences with prospective sensitivity to nicotine via nasal spray in nonsmokers. *Nicotine and Tobacco Research, 10*(8), 1335-1345.

Perkins, K. A., Lerman, C., Grottenthaler, A., Ciccocioppo, M. M., Milanak, M., Conklin, C. A., et al. (2008). Dopamine and opioid gene variants are associated with increased smoking reward and reinforcement owing to negative mood. *Behavioural Pharmacology, 19*(5-6), 641-649.

Peterson, A. V., Jr., Kealey, K. A., Mann, S. L., Marek, P. M., Ludman, E. J., Liu, J., et al. (2009). Group-randomized trial of a proactive, personalized telephone counselling intervention for adolescent smoking cessation. *Journal of the National Cancer Institute, 101*(20), 1378-1392.

Pierce, J. P., Choi, W. S., Gilpin, E. A., Farkas, A. J., & Merrit, R. K. (1996). Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychology, 15,* 355-361.

Pitsavos, C., Panagiotakos, D. B., Chrysohoou, C., Skoumas, J., Tzioumis, K., Stefanadis, C., et al. (2002). Association between exposure to environmental tobacco smoke and the development of acute coronary syndromes: The CARDIO2000 case-control study. *Tobacco Control, 11,* 220-225.

Pohjalainen, T., Rinne, J. O., Nagren, K., Lehikoinen, P., Anttila, K., Syvalahti, E. K., et al. (1998). The A1 allele of the human D2 dopamine receptor gene predicts low D2 receptor availability in healthy volunteers. *Molecular Psychiatry, 3*(3), 256-260.

Pollock, V. E. (1992). Meta-analysis of subjective sensitivity to alcohol in sons of alcoholics. *American Journal of Psychiatry, 149*(11), 1534-1538.

Pomerleau, O. F. (1995). Individual differences in sensitivity to nicotine: Implications for genetic research on nicotine dependence. *Behavior Genetics, 25*(2), 161-177.

Pomerleau, O. F., Collins, A. C., Shiffman, S., & Pomerleau, C. S. (1993). Why some people smoke and others do not: New perspectives. *Journal of Consulting and Clinical Psychology, 61*(5), 723-731.

Pomerleau, O. F., Pomerleau, C. S., Mehringer, A. M., Snedecor, S. M., & Cameron, O. G. (2005). Validation of retrospective reports of early experiences with smoking. *Addictive Behaviors, 30*(3), 607-611.

Porcellato, L., Dugdill, L., Springett, J., & Sanderson, F. H. (1999). Primary schoolchildrens' perceptions of smoking: Implications for health education. *Health Education Research, 14,* 71-83.

Powell, J., Dawkins, L., West, R., Powell, J., & Pickering, A. (2010): Relapse to smoking during unaided cessation: Clinical, cognitive and motivational predictors. *Psychopharmacology, 212*, 537-549.

Priest, N., Roseby, R., Polnay, A., Campbell, R., Spencer, N., Webster, P., et al. (2008). Family and carer smoking control programmes for reducing children's exposure to environmental tobacco smoke (Review). *Cochrane Database of Systematic Reviews(4)*, 3), CD001746.

Prentice, D. A., & Miller, D. T. (1992). When small effects are impressive. *Psychological Bulletin, 112,* 160-164.

Prochaska, J. O., Velicer, W. F., DiClemente, C. C., & Fava, J. (1988). Measuring processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology, 56*(4), 520-528.

Prokhorov, A. V., Farkas, A., Gilpin, E., Johnson, M., Bal, D., & Pierce, J. P. (1995). Perception of benefits to smoking cigarettes in adolescents unexposed to smoker in their social environment. *European Journal of Public Health, 5,* 281-285.

Quigley, B. M., & Collins, R. L. (1999). The modeling of alcohol consumption: A meta-analytic review. *Journal of Studies on Alcohol, 60,* 90-98.

Racicot, S., McGrath, J. J., & O'Loughlin, J. (2011). An investigation of social and pharmacological exposure to secondhand tobacco smoke as possible predictors of perceived nicotine dependence, smoking susceptibility, and smoking expectancies among never-smoking youth. *Nicotine and Tobacco Research, 13,* 926-933.

Radloff. L. S. (1977). The CES-D Scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385-401.

Ray, R., Jepson, C., Patterson, F., Strasser, A., Rukstalis, M., Perkins, K., et al. (2006). Association of OPRM1 A118G variant with the relative reinforcing value of nicotine. *Psychopharmacology Berlin, 188*(3), 355-363.

Richardson, C. G., Okoli, C. T., Ratner, P. A., & Johnson, J. L. (2010). Empirical support for a multi-dimensional model of sensations experienced by youth during their initial smoking episodes. *Addiction, 105*(10), 1827-1834.

Riedel, B. W., Blitstein, J. L., Robinson, L. A., Murray, D. M., & Klesges, R. C. (2003). The reliability and predictive value of adolescents' reports of initial reactions to smoking. *Nicotine and Tobacco Research, 5*(4), 553-559.

Ringlever, L., Otten, R., van Schayck, C. P., & Engels, R. C. M. E. (2012). Early smoking in school-aged children with and without a diagnosis of asthma. *European Journal of Public Health, 22,* 394-398.

Robinson, L. A., Klesges, R. C., Zbikowski, S. M., & Glaser, R. (1997). Predictors of risk for different stages of adolescent smoking in a biracial sample. *Journal of Consulting and Clinical Psychology, 65*(4), 653-662.

Rose, J. S., Chassin, L., Presson, C. C., & Sherman, S.J. (1996). Prospective predictors of quit attempts and smoking cessation in young adults. *Health Psychology*, *15*(4), 261-268.

Rosen, L. J, Noach, M. B., Winickoff, J. P., & Hovell, M.F. (2012). Parental smoking cessation to protect young children: a systematic review and meta-analysis. *Pediatrics, 129*(1), 141-152.

Ross, S., Grant, A., Counsell, C., Gillespie, W., Russell, I., & Prescott, R. (1999). Barriers to participation in randomised controlled trials: a systematic review. *Journal of Clinical Epidemiology, 52*(12), 1143-1156.

Sabol, S. Z., Nelson, M. L., Fisher, C., Gunzerath, L., Brody, C. L., Hu, S. et al. (1999). A genetic association for cigarette smoking behavior. *Health Psychology, 18,* 7-13.

Saccone, S. F., Saccone, N. L., Swan, G. E., Madden, P. A. F., Goate, A. M., Rice, J. P., & Bierut, L. J. (2008). Systematic biological prioritization after a genome-wide association study: an application to nicotine dependence. *Bioinformatics, 24*(16), 1805-1811.

Saccone, S. F., Hinrichs, A. L., Saccone, N. L., Chase, G. A., Konvicka, K., Madden, P. A. F. et al. (2007). Cholinergic nicotinic receptor genes implicated in a nicotine dependence association study targeting 348 candidate genes with 3713 SNPs. *Human Molecular Genetics, 16,* 36-49.

Sartor, C. E., Lessov-Schlaggar, C. N., Scherrer, J. F., Bucholz, K. K., Madden, P. A., Pergadia, M. L., et al. (2010). Initial response to cigarettes predicts rate of progression to regular smoking: findings from an offspring-of-twins design. *Addictive Behaviors, 35*(8), 771-778.

Satorra, A. (2000). Scaled and adjusted restricted tests in multi-sample analyses of moment structures. In R. D. H. Heijmans, D. S. G. Pollock, & A. Satorra (Eds.). *Innovations in multivariate statistical analysis: A festschrift for Heinz Neudecker* (pp. 233-247). London: KluwerAcademis.

Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika, 66*, 507-514.

Schechter, M. D., Meehan, S. M., & Schechter, J. B. (1995). Genetic selection for nicotine activity in mice correlates with conditioned place preference. *European Journal of Pharmacology, 279*(1), 59-64.

Schnoll, R. A., Martinez, E., Tatum, K. L., Glass, M., Bernath, A., Ferris, D., et al. (2011). Increased self-efficacy to quit and perceived control over withdrawal symptoms predict smoking cessation following nicotine dependence treatment. *Addictive Behaviors, 36*(1-2), 144-147.

Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. (2013). Proactive recruitment into cessation support: Feasibility of low-intensity recruitment and acceptability of treatment in smoking parents recruited through primary schools. *BMC Public Health, 13*, 381.

Schuck, K., Bricker, J. B., Otten, R., Kleinjan, M., & Engels, R. C. M. E. (in press). Effectiveness of proactive quitline counselling in smoking parents recruited through primary schools: Results of a randomized controlled trial. *Addiction.*

Schuck, K., Kleinjan, M., Otten, R., Engels, R. C. M. E., & DiFranza, J. R. (2013). Responses to environmental smoking in never-smoking children: can symptoms of nicotine addiction develop in response to environmental tobacco smoke exposure? *Journal of Psychopharmacology,* 27(6), 533-540.

Schuck, K., Otten, R., Engels, R. C. M. E., & Kleinjan, M. (2011). The relative role of nicotine dependence and smoking-related cognitions in adolescents' process of smoking cessation. *Psychol Health, 26*(10), 1310-1326.

Schuck, K., Otten, R., Engels, R. C. M. E., & Kleinjan, M. (2012). The role of environmental smoking in smoking-related cognitions and susceptibility to smoking in never smoking 9-12 year old children. *Addictive Behaviors*, 37(12), 1400-1405.

Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. (2011). Effectiveness of proactive telephone counselling for smoking cessation in parents: study protocol of a randomized controlled trial. *BMC Public Health, 11*, 732.

Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. (2013). School-based promotion of cessation support: reach of proactive mailings and acceptability of treatment in smoking parents recruited into cessation support through primary schools. *BMC Public Health, 13*, 381.

Schuster, M. A., Franke, T., & Pham, C. B. (2002). Smoking patterns of household members and visitors in homes with children in the United States. *Archives of Pediatrics and Adolescent Medicine, 156,* 1094-1100.

Scragg, R., Glover, M., Paynter, J., Wong, G., & McCool, J. (2010). Association of parent and best friend smoking with stage of adolescent tobacco smoking. *The New Zealand Medical Journal, 123*(1326), 77-87.

Sherman, S.J., Chassin, L., Presson, C., Seo, D. C., & Macy, J. (2009). The intergenerational transmission of implicit and explicit attitudes toward smoking: Predicting adolescent smoking initiation. *Journal of Experimental Social Psychology, 45*, 313–319.

Shiffman, S., Balabanis, M. H., Paty, J. A., Engberg, J., Gwaltney, C. J., Liu, K. S., et al. (2000). Dynamic effects of self-efficacy on smoking lapse and relapse. *Health Psychology, 19*(4), 315-323.

Shiffman, S., Brockwell, S. E., Pillitteri, J. L., & Gitchell, J. G. (2008). Use of smoking-cessation treatments in the United States. *American Journal of Preventive Medicine, 34*(2), 102-111.

Shiffman, S., Gnys, M., Richards, T. J., Paty, J. A., Hickcox, M., & Kassel, J. D. (1996). Temptations to smoke after quitting: A comparison of lapsers and maintainers. *Health Psychology, 15*(6), 455-461.

Shiffman, S., & Waters, A. J. (2004). Negative affect and smoking lapses: A prospective analysis. *Journal of Consulting and Clinical Psychology, 72*(2), 192-201.

Shrout, P. E., & Bolger, N. (2002). Mediation in Experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7,* 422-445.

Siegel, J. T., Alvaro, E. M., & Burgoon, M. (2003). Perceptions of the at-risk non-smokers: Are potential intervention topics being overlooked? *Adolescent Health, 33,* 458-461.

Sienkiewicz-Jarosz, H., Zatorski, P., Baranowska, A., Rygglewicz, D., & Bienkowski, P. (2009). Predictors of abstinence after first-ever ischemic stroke: A 3-month follow up. *Stroke, 40,* 2592-2593.

Skowronek, M. H., Laucht, M., Hohm, E., Becker, K., & Schmidt, M. H. (2006). Interaction between the dopamine D4 receptor and the serotonin transporter polymorphism in alcohol and tobacco use among 15-year-olds. *Neurogenetics, 7,* 239-246.

Small, E., Shah, H. P., Davenport, J. J., Geier, J. E., Yavarovich, K. R., Yamada, H., et al. (2010). Tobacco smoke exposure induces nicotine dependence in rats. *Psychopharmacology, 2010,* 143-158.

Song, A.V., Morrel, H. E., Cornell, J. L., Ramos, M. E., Biehl, M., Kropp, R. Y., & Halpern-Felsher, B. L. (2009). Perceptions of smoking-related risks and benefits as predictors of adolescent smoking initiation. *American Journal of Public Health, 99,* 487-492.

Spencer, N., Blackburn, C., Bonas, S., Coe, C., & Dolan, A. (2005). Parent reported home smoking bans and toddler (18-30 month) smoke exposure: a cross-sectional survey. *Archives of Disease in Childhood, 90*(7), 670-674.

Spencer, L., Pagell, F., Hallion, M. E., & Adams, T. B. (2002). Applying the transtheoretical model to tobacco cessation and prevention: a review of literature. *American Journal of Health Promotion, 17*(1), 7-71.

Stanton, C. A., Lloyd-Richardson, E. E., Papandonatos, G. D., de Dios, M. A., & Niaura, R. (2009). Mediators of the relationship between nicotine replacement therapy and smoking abstinence among people living with HIV/AIDS. *AIDS Education and Prevention, 21*(3 Suppl), 65-80.

Stead, L. F., Hartmann-Boyce, J., Perera, R., & Lancaster, T. (2013). Telephone counselling for smoking cessation. *Cochrane Database of Systematic Reviews,* 8:CD002850.

Stead, L. F., Perera, R., & Lancaster, T. (2006). Telephone counselling for smoking cessation. *Cochrane Database of Systematic Reviews,* 3:CD002850.

Stivoro (2011). Roken, de harde feiten [Smoking, the hard facts]. Den Haag. Retrieved from http://www.stivoro.nl/Upload/Feiten%20en%20cijfers/Fact%20sheet%20RJM%202011.pdf.

Stivoro (2012). Roken, de harde feiten: Jeugd 2012 [Smoking, the hard facts:Youth 2012]. Den Haag. Retrieved from http://stivoro.nl/wpcontent/uploads/2012/docs/factsheets/jongeren/Fact%20sheet%20RJM%202012.pdf.

Stivoro (2009). Roken, de harde feiten: Volwassenen 2009 [Smoking, the hard facts: Adults 2009]. Den Haag. Retrieved from http://stivoro.nl/wpcontent/uploads/2012/docs/factsheets/volwassenen/Factsheet%202009.pdf.

Strecher, V. J., Shiffman, S., & West, R. (2006). Moderators and mediators of a web-based computer-tailored smoking cessation program among nicotine patch users. *Nicotine and Tobacco Research,* 8(1), 95-101.

Sturm, J. J., Yeatts, K., & Loomis, D. (2004). Effects of tobacco smoke exposure on asthma prevalence and medical care use in North Carolina middle school children. *American Journal of Public Health, 94,* 308-313.

Sullivan, P. F., & Kendler, K. S. (1999). The genetic epidemiology of smoking. *Nicotine and Tobacco Research, 1(Suppl 2)*, S51-57.

Swartz Woods, S., & Haskins, A. E. (2007): Increasing reach of quitline services in a US state with comprehensive tobacco treatment. *Tobacco Control, 16*(1), 33-36.

Tanaka, J.S. (1987). "How big is big enough?": Sample size and goodness of fit in structural equation models with latent variables. *Child Development, 58*, 134-146.

Tercyak, K. P., Peshkin, B. N., Wine, L. A., & Walker L. R. (2006). Interest of adolescents in genetic testing for nicotine addiction susceptibility. *Preventive Medicine, 42*(1), 60-65.

The global youth tobacco surveillance system (2006). WHO report on the global tobacco epidemic, 2009: Implementing smoke-free environments. Retrieved from http://www.who.int /tobacco/mpower/ 2009/ gtcr_download/ en/index.html.

Thompson, J., Thomas, N., Singleton, A., Piggott, M., Lloyd, S., Perry, E. K., et al. (1997). D2 dopamine receptor gene (DRD2) Taq1 A polymorphism: reduced dopamine D2 receptor binding in the human striatum associated with the A1 allele. *Pharmacogenetics, 7*(6), 479-484.

Tomson, T., Helgason, A. R., & Gilljam, H. (2004). Quitline in smoking cessation: a cost-effectiveness analysis. *International Journal of Technology Assessment in Health Care, 20*(4), 469-474.

Tong, C., Bovbjerk, D. H., & Erblich, J. (2007). Smoking-related videos for use in cue-induced craving paradigms. *Addictive Behaviors, 32,* 3034-3044.

Trasher, J. Jackson, C., Arillo-Santillán, E., Sargent, J. D. (2005). Exposure to smoking imagery in popular films and adolescent smoking in Mexico. *American Journal of Preventive Medicine, 35*(2), 95–102.

Tucker, J. S., Ellickson, P. L., & Klein, D. J. (2002). Smoking cessation during the transition from adolescence to young adulthood. *Nicotine and Tobacco Research, 4*(3), 321-332.

Tyas, S. L., & Pederson, L. L. (1998). Psychosocial factors related to adolescent smoking: A critical review of the literature. *Tobacco Control, 7,* 409–*420*.

Tzelepis, F., Paul, C. L., Walsh, R. A., Wiggers, J., Duncan, S. L., & Knight, J. (2009). Active telephone recruitment to quitline services: are nonvolunteer smokers receptive to cessation support? *Nicotine and Tobacco Research, 11*(10), 1205-1215.

Tzelepis, F., Paul, C. L., Walsh, R. A., Wiggers, J., Duncan, S. L., & Knight, J. (2013). Predictors of abstinence among smokers recruited actively to quitline support. *Addiction, 108*(1), 181-185.

Tzelepis, F., Paul, C. L., Wiggers, J., Walsh, R. A., Knight, J., Dunan, S.L, et al. (2010). A randomised controlled trial of proactive telephone counselling on cold-called smokers' cessation rates. *Tobacco Control, 20*(1), 40-46.

Urban, R. (2010). Early smoking experience in adolescents. *Addictive Behaviors, 35*(6), 612-615.

Urban, R., & Sutfin, E. (2010). Do early smoking experiences count in development of smoking?: Temporal stability and predictive validity of an early smoking experience questionnaire in adolescents. *Nicotine and Tobacco Research, 12*(12), 1265-1269.

U.S. Department of Health and Human Services (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General.* Atlanta, GA: Center for Disease Control and Prevention, Office on Smoking and Health. Retrieved from http://www.surgeongeneral.gov/library/index.html

U.S. Department of Health and Human Services (2012). *Preventing tobacco use among youth and young adults: A report of the Surgeon General.* Atlanta, GA: Center for Disease Control and Prevention, Office on Smoking and Health. Retrieved from http://www.surgeongeneral.gov/library/reports/preventing-youth-to-bacco-use/exec-summary.pdf

Vandenbergh, D. J., O'Connor, R. J., Grant, M. D., Jefferson, A. L., Vogler, G. P., Strasser, A. A., et al. (2007). Dopamine receptor genes (DRD2, DRD3 and DRD4) and gene-gene interactions associated with smoking-related behaviors. *Addiction Biology, 12*, 106-116.

Vangeli, E., Stapleton, J., Smit, E. S., Borland, R., & West, R. (2011). Predictors of attempts to stop smoking and their success in adult general population samples: a systematic review. *Addiction, 106*(12), 2110-2121.

Van Baaren, R. B. (2003). *Mimicry: A social perspective*. Doctoral dissertation, Radboud University Nijmegen. Ridderkerk, S.I.: Ridderprint.

Van Baaren, R. B., Holland, R. W., Kawakami et al. (2004). Mimicry and prosocial behaviour. *Psychological Science, 15*, 71-74.

Van der Vorst, H., Engels, R. C. M. E., Dekovic, M., Meeus, W., & Vermulst, A. A. (2005). Alcohol-specific rules, personality, and adolescent' alcohol use: A longitudinal person-environment study. *Addiction, 102*, 1064-1075.

Velicer, W. F., Diclemente, C. C., Rossi, J. S., & Prochaska, J. O. (1990). Relapse situations and self-efficacy: an integrative model. *Addictive Behaviors, 15*(3), 271-283.

Velicer, W. F., Redding, C. A., Sun, X., & Prochaska, J.O. (2007). Demographic variables, smoking variables, and outcome across five studies. *Health Psychology, 26*(3), 278-287.

Verhagen, M., Kleinjan, M., & Engels, R. C. M. E. (2012). A systematic review of the A118G (Asn40Asp) variant of OPRM1 in relation to smoking initiation, nicotine dependence and smoking cessation. *Pharmacogenomics, 13*(8), 917-933.

Vemer, P., Rutten-van Mölken, M. P. H., Kaper, J., Hoogenveen, R. T., van Schayck, C. P., & Feenstra, T. L. (2010). If you try to stop smoking, should we pay for it? The cost-utility of reimbursing smoking cessation support in the Netherlands. *Addiction, 105*, 1088-1097.

Vidrine, D. J., Arduino, R. C., & Gritz, E. R. (2006). Impact of a cell phone intervention on mediating mechanisms of smoking cessation in individuals living with HIV/AIDS. *Nicotine & Tobacco Research, 8*(1), 103-108.

Vink, J. M., Willemsen, G., & Boomsma, D. I. (2005). Heritability of smoking initiation and nicotine dependence. *Behavior Genetics, 35*(4):397-406.

Vitaro, F., Wanner, B., Brendgen, M., Gosselin, C., & Gendreau, P. L. (2004). Differential contribution of parents and friends to smoking trajectories during adolescence. *Addictive Behaviors, 29,* 831-835.

Voisey, J., Swagell, C. D., Hughes, I. P., van Daal, A., Noble, E. P., Lawford, B. R., et al. (2012). A DRD2 and ANKK1 haplotype is associated with nicotine dependence. *Psychiatry Research, 196*(2-3), 285-289.

Waa, A., Edwards, R., Newcombe, R., Zhang, J., Weerasekera, D., Peace, J., & McDuff, I. (2011). Parental behaviours, but not parental smoking, influence current smoking and smoking susceptibility among 14 and 15 year-old children. *Australian and New Zealand Journal of Public Health, 35*(6), 530-536.

Wand, G., Levine, M., Zweifel, L., Schwindinger, W., & Abel, T. (2001). The cAMP-protein kinase: A signal transduction pathway modulates ethanol consumption and sedative effects of ethanol. *The Journal of Neuroscience, 21*(14), 5297-5303.

Wang, M. Q., Fitzhugh, E. C., Trucks, J., Cowdery, J., & Perko, M. (1995). Physiological sensations of initial smoking in the development of regular smoking behavior. *Perceptual and Motor Skills, 80*(3), 1131-1134.

Wang, M. P., Ho, S. Y., Lo, W. S., & Lam, T. H. (2012). Smoking family, secondhand smoke exposure at home, and nicotine addiction among adolescent smokers. *Addictive Behaviors*, *37*, 743-746.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070.

West, R., Hajek, P., Stead, L., & Stapleton, J. (2005). Outcome criteria in smoking cessation trials: Proposal for a common standard. *Addiction, 100*(3), 299-303.

West, R., & Sohal, T. (2006). "Catastrophic" pathways to smoking cessation: Findings from national survey. *British Medical Journal, 332*(7539), 458-460.

Wei J., Chu C., Wang Y., Yang Y., Wang Q., Li., et al., (2012). Association study of 45 candidate genes in nicotine dependence in Han Chinese. *Addictive Behaviors, 37*(5), 622-626.

Wheeler, K. C., Fletcher, K. E., Wellman, R. J., & DiFranza, J. R. (2004). Screening adolescents for nicotine dependence: The hooked on nicotine checklist. *Journal of Adolescent Health, 35,* 225−230.

World Health Organization (1999). The world health report 1999 - Making a difference. Retrieved from http://www.who.int/whr/1999/en/

World Health Organization (2005). International Health Regulations (2005). Retrieved from http://www.who.int/ihr/9789241596664/en/

World Health Organization (2010). World health statistics 2010. Retrieved from http://www.who.int/whosis/whostat/2010/en/

World Health Organization (2011). World health statistics 2011. Retrieved from http://www.who.int/whosis/whostat/2011/en/

World Health Organization (2013). World health statistics 2013. Retrieved from http://www.who.int/gho/publications/world_health_statistics/2013/en/

Wileyto, P., O'Loughlin, J., Lagerlund, M., Meshefedjian, G., Dugas, E., & Gervais, A. (2009). Distinguishing risk factors for the onset of cravings, withdrawal symptoms and tolerance in novice adolescent smokers. *Tobacco Control, 18*(5), 387-392.

Willemsen, M. C. (2005). The new EU cigarette health warnings benefit smokers who want to quit the habit: Results from the Dutch continuous survey of smoking habits. *European Journal of Public Health,* 15, 398-392.

Willemsen, M. C., Kiselinova, M., Nagelhout, G. E., Joossens, L., & Knibbe, R. A (2012). Concern about passive smoking and tobacco control policies in European countries: An ecological study. *BMC Public Health*, *12*, 876.

Willemsen, M. C., Segaar, D., & van Schayck, C. P. (2013). Population impact of reimbursement for smoking cessation: a natural experiment in The Netherlands. *Addiction, 108*(3), 602-604.

Willemsen, M. C., van de Meer, R. M., & Bot, S. (2008). Description, effectiveness and client satisfaction of 9 European Quitlines: Results of the European Smoking Cessation Helplines Evaluation Project (ESCHER). Retrieved from http://www.quit.org.uk/enq/ESCHERFinalReport.pdf.

Willers, S., & Skarping, G., Dalene, M., & Skerfvng, S. (1995). Urinary cotinine in children and adults during and after semiexperimental exposure to environmental tobacco smoke. *Archives of Environmental Health, 50,* 130-138.

Winickoff, J. P., Healey, E. A., Regan, S., Park, E. R., Cole, C., Friebely, J., et al. (2010). Using the postpartum hospital stay to address mothers' and fathers' smoking: the NEWS study. *Pediatrics, 125*(3), 518-525.

Winickoff, J. P., Hillis, V. J., Palfrey, J. S., Perrin, J. M., & Rigotti, N. A. (2003). A smoking cessation intervention for parents of children who are hospitalized for respiratory illness: The stop tobacco outreach program. *Pediatrics, 111*(1), 140-145.

Winickoff, J. P., McMillen, R. C., Carroll, B. C., Klein, J. D., Rigotti, N. A, Tanski, S. E., et al. (2003). Addressing parental smoking in pediatrics and family practice: A national survey of parents. *Pediatrics, 112*(5) , 1146-1151.

Winickoff, J. P., Tanski, S. E., McMillen, R. C., Hipple, B. J., Friebely, J., & Healey, E. A. (2006). A national survey of the acceptability of quitlines to help parents quit smoking. *Pediatrics, 117*(4), e695-700.

Wolitzky-Taylor, K. B., Arch, J. J., Rosenfield, D., & Craske, M. G. (2012). Moderators and non-specific predictors of treatment outcome for anxiety disorders: A comparison of cognitive behavioral therapy to acceptance and commitment therapy. *Journal of Consulting and Clinical Psychology, 80*(5), 786-799.

Wright, A. J., French, D. P., Weinman J., & Marteau, T. M. (2006). Can genetic risk information enhance motivation for smoking cessation? An analogue study. *Health Psychology, 25*(6), 740-752.

Wyszynski, C. M., Bricker, J. B., & Comstock, B. A. (2011). Parental smoking cessation and child daily smoking: A 9-year longitudinal study of mediation by child cognitions about smoking. *Health Psychology, 30,* 171-176.

Yamada, H., Bishnoi, M., Keijzers, K. F. M., van Tuijl, I. A., Small, E., Shah, H. P., et al. (2010). Preadolescent tobacco smoke exposure leads to acute nicotine dependence but does not affect the rewarding effects of nicotine or nicotine withdrawal in adulthood in rats. *Pharmacology, Biochemistry and Behavior, 95,* 401-409.

Zhang, Y., Wang, D., Johnson, A. D., Papp, A. C., & Sadee, W. (2005). Allelic expression imbalance of human mu opioid receptor (OPRM1) caused by variant A118G. *The Journal of Biological Chemistry, 280*(38), 32618-32624.

Zhu, S. H., Anderson, C. M., Tedeschi, G. J., Rosbrook, B., Johnson, C. E., & Byrd M. (2002). Evidence of real-world effectiveness of a telephone quitline for smokers. *The New England Journal of Medicine, 347*(14), 1087-1093.

Dutch summary

(Nederlandse samenvatting)

Nederlandse samenvatting

Roken vormt wereldwijd één van de grootste bedreigingen voor de volksgezondheid. Het is één van de belangrijkste risicofactoren voor een groot aantal chronische en dodelijke ziekten, zoals hart- en vaatziekten, longziekten en kanker. Jaarlijks sterven vijf miljoen mensen ten gevolge van roken. De rookprevalentie in Nederland is hoog. In 2012 rookte 26% van de volwassenen en 18% van de jongeren (Stivoro, 2012). Om rookgerelateerde ziekten, zoals kanker, te voorkomen is het belangrijk om kennis te hebben van factoren die een rol spelen bij de initiatie van rookgedrag, factoren die rookgedrag in stand houden of bevorderen en factoren die een rol spelen bij het stoppen met roken. Vervolgens kunnen interventie- en preventieprogramma's ingezet worden die zich richten op deze risicofactoren om het beginnen met roken onder jongeren te voorkomen en het stoppen met roken onder rokers te bevorderen.

Hoofdstuk 1 is een algemene introductie en geeft informatie over beginnen met roken en factoren die hierbij een rol spelen. In dit hoofdstuk wordt ingegaan op de rol van ouderlijk rookgedrag bij het beginnen met roken. Kinderen van rokende ouders worden vaak blootgesteld aan tabaksrook en hebben een verhoogd risico om zelf te beginnen met roken. Een aantal processen liggen mogelijk ten grondslag aan de effecten van ouderlijk rookgedrag op kinderen (bv. genetische kwetsbaarheid om te roken, psychosociale processen en/of leerprocessen, fysiologische processen). Het is mogelijk dat rokende ouders extra gemotiveerd zijn om te stoppen met roken. Wanneer ouders stoppen met roken heeft dit mogelijk preventieve effecten op hun kinderen (bijvoorbeeld minder risico op gezondheidsproblemen en minder risico om zelf te beginnen met roken). Daarom is het belangrijk om rokende ouders ondersteuning aan te bieden bij het stoppen met roken. *Deel 1* van dit proefschrift beschrijft studies die ingaan op factoren die gerelateerd zijn aan de vatbaarheid voor roken bij kinderen en adolescenten. In deze studies is gekeken naar relaties tussen rookgedrag in de sociale omgeving, rookgerelateerde cognities, psychologische en gedragsmatige symptomen na blootstelling aan omgevingsrook, vatbaarheid om te beginnen met roken (bij kinderen die nog nooit gerookt hebben) en reacties op het eerste trekje van een sigaret en intensiteit van roken (bij adolescenten die recent zijn begonnen met roken). *Deel 2* van dit proefschrift beschrijft een reeks studies die voortkomen uit een gerandomiseerd, gecontroleerd onderzoek naar de effectiviteit van telefonische coaching in vergelijking met een zelfhulpbrochure bij rokende ouders die geworven zijn via de basisscholen van hun kinderen. In deze studies is onder meer gekeken naar het bereik van een schoolgebaseerde benadering om ouders in contact te brengen met stoppen-met-roken interventies en het gebruik en beoordeling van telefonische coaching en een zelfhulpbrochure door rokende ouders. Ook zijn de effecten van telefonische coaching om te stoppen met roken in vergelijking met de zelfhulpbrochure geëvalueerd bij rokende ouders en hun kinderen.

Deel 1: Effecten van rookgedrag in de omgeving op jongeren

Hoofdstuk 2 beschrijft de samenhang tussen rookgedrag in de omgeving en rookgerelateerde cognities en de vatbaarheid om te beginnen met roken bij 9-12 jarige kinderen die nog nooit gerookt hebben. De resultaten lieten zien dat kinderen met rokende ouders, broers, zussen en vrienden meer voordelen van roken zien dan kinderen bij wie rookgedrag in de omgeving minder of niet voorkomt. Daarnaast schatten kinderen van rokende ouders de gevaren van roken minder hoog in en gaven ze aan dat ze meer verlangen (*craving*) hadden om te roken wanneer ze met rookgerelateerde stimuli in aanraking kwamen (bijv. anderen zien roken). Kinderen die roken als veiliger waarnamen en meer verlangen om te roken rapporteerden waren meer vatbaar om in de toekomst te beginnen met roken.

Hoofdstuk 3 beschrijft het verband tussen rookgedrag in de omgeving en psychologische en gedragsmatige symptomen kenmerkend voor nicotineafhankelijkheid bij 9-12 jarige kinderen die nog nooit gerookt hebben. De symptomen gerapporteerd door kinderen die nog nooit gerookt hebben werden vergeleken met die van kinderen die al wel geëxperimenteerd hadden met roken. Zes procent van de kinderen die nog nooit gerookt hadden rapporteerden een verlangen om te roken (*craving*), 8% rapporteerde een verlangen om te roken na blootstelling aan rookgerelateerde stimuli (*cue-triggered craving*) en 20% rapporteerde subjectieve symptomen na blootstelling aan omgevingsrook (zoals moeite met concentreren, irritatie). Kinderen die nog nooit gerookt hebben maar een groot aantal rokers in de omgeving hebben gaven aan meer cue-triggered verlangen en meer subjectieve symptomen te ervaren. Er waren geen significante verschillen tussen kinderen die nooit gerookt hebben en kinderen die al wel geëxperimenteerd hebben met roken met betrekking tot subjectieve symptomen na blootstelling aan omgevingsrook, maar kinderen die geëxperimenteerd hebben met roken rapporteerden vaker een verlangen om te roken en cue-triggered verlangen om te roken dan kinderen die nooit gerookt hebben.

Hoofdstuk 4 beschrijft verbanden tussen rookgedrag in de omgeving (rookgedrag van ouders, broer(s)/zus(sen), vrienden), genetische polymorfismen (OPRM1 A118G, DRD2 TaqIA, DRD4 bp VNTR) en reacties op de eerste rookervaringen van adolescenten. De resultaten lieten zien dat naarmate adolescenten vaker blootgesteld werden aan rookgedrag van vrienden, ze het eerste trekje van een sigaret fijner vonden en dat ze meer aangename reacties ervoeren (bv. een relaxed, opgewonden of opgewekt gevoel). Naarmate adolescenten vaker blootgesteld werden aan rookgedrag van moeder rapporteerden ze minder onaangename reacties op het eerste trekje van een sigaret (bv. misselijkheid of hoesten). Adolescenten met de G-variant van de OPRM1 polymorfisme rapporteerden vaker dat ze het eerste trekje van een sigaret fijn vonden en adolescenten met de C-variant van de DRD2 polymorfisme rapporteerden minder onaangename reacties op het eerste trekje van een sigaret. Er werden geen hoofdeffecten van het DRD4 polymorfisme gevonden, noch werd er ondersteuning gevonden voor interacties tussen de genetische polymorfisme en rookgedrag in de omgeving.

Hoofdstuk 5 beschrijft associaties tussen rookgedrag van familieleden door middel van een longitudinaal *full-family* design (vijf metingen bij vier familieleden: vader, moeder, twee adolescente kinderen). De resultaten lieten een aantal verbanden tussen rookintensiteit van de familieleden over tijd heen zien. De resultaten suggereren dat associaties van rookgedrag tussen familieleden *bidirectioneel* kunnen zijn. Dat wil zeggen, ouders beïnvloeden niet alleen het rookgedrag van hun kinderen, maar kinderen beïnvloeden ook het rookgedrag van hun ouders. Zo kunnen ouders meer gaan roken wanneer hun kind ook meer rookt en vice versa.

Deel 2: Een stoppen-met-roken interventie voor ouders: Resultaten uit een gerandomiseerd, gecontroleerd onderzoek

Hoofdstuk 6 beschrijft het studieprotocol van de gerandomiseerde, gecontroleerde trial naar de effecten van telefonische coaching bij rokende ouders en hun kinderen. Het telefonische coachingstraject (maximaal zeven gesprekken verspreid over een periode van drie maanden) biedt rokers ondersteuning bij het stoppen met roken en werd uitgevoerd door de nationale Nederlandse hulplijn. De controlegroep ontving een standaard zelfhulpbrochure ter ondersteuning van het stoppen met roken. In totaal werden 512 rokende ouders en hun kinderen via basisscholen in Nederland geworven voor deelname aan het onderzoek. In dit hoofdstuk wordt de opzet van het onderzoek, de onderzoeksdoelen en de onderzoeksvragen beschreven.

Hoofdstuk 7 beschrijft het bereik, de beoordeling en de mate van gebruik van telefonische coaching en zelfhulpmateriaal onder rokende ouders die geworven zijn via de basisscholen van hun kinderen. De gebruikte schoolgebaseerde benadering van rokende ouders resulteerde in een response van ongeveer 5%. Zowel telefonische coaching als de zelfhulpbrochure werden door ouders in hoge mate gebruikt en positief beoordeeld. Ouders waren duidelijk meer positief over de telefonische coaching dan over de zelfhulpbrochure.

Hoofdstuk 8 evalueerde de effecten van telefonische coaching om te stoppen met roken bij rokende ouders. Ouders die deelnamen aan telefonische coaching hadden een grotere kans om te stoppen met roken in vergelijking tot ouders die de zelfhulpbrochure ontvingen (gestopt na 12-maanden: 34.0% vs. 18.0%). Daarnaast waren ouders die deelnamen aan telefonische coaching meer geneigd om nicotinevervangers te gebruiken (48.4% vs. 20.9%), rookten ze minder sigaretten per dag als ze niet stopten met roken (11.1 vs. 13.3 sigaretten) en waren ze meer geneigd om naar aanleiding van de interventie een volledig rookverbod in huis in te stellen (39.5% vs. 26.1%).

Hoofdstuk 9 evalueerde de rol van verschillende persoonskenmerken bij de effectiviteit van telefonische coaching om te stoppen met roken. Een aantal persoonskenmerken waren non-specifieke voorspellers (voorspellers in beide behandelcondities) van langdurige rookabstinentie op de 12-maanden follow-up meting, namelijk mannelijk geslacht, hogere werkstatus, minder gerookte sigaretten per dag, meer vertrouwen om te kunnen stoppen met roken, aanwezigheid van een rookgerelateerde ziekte bij het

kind (bijvoorbeeld astma) en willen stoppen voor de gezondheid van het kind. Twee kenmerken waren eveneens van invloed op het effect van behandelcondite op stoppen met roken, namelijk de intentie om te stoppen en het opleidingsniveau. Intentie om te stoppen en opleidingsniveau waren niet gerelateerd aan stoppen met roken in de telefonische coaching conditie, maar een hogere intentie om te stoppen en een hoger opleidingsniveau waren voorspellers van stoppen met roken in de zelfhulpconditie.

Hoofdstuk 10 beschrijft de psychologische processen die ten grondslag liggen aan de effectiviteit van telefonische coaching om te stoppen met roken. Ouders die deelnamen aan telefonische coaching rapporteerden minder waargenomen voordelen van roken, een hogere zelfeffectiviteit, minder negatieve gevoelens, meer vermijding van rookgerelateerde stimuli en meer bereidheid (acceptatie) tot het ervaren van craving naar een sigaret in vergelijking met ouders die de zelfhulpbrochure ontvingen. Twee psychologische processen bleken een significant mediërende rol te spelen in het effect van telefonische coaching op stoppen met roken, namelijk een toegenomen zelfeffectiviteit en een toegenomen bereidheid tot het ervaren van craving.

In **Hoofdstuk 11** worden de effecten van telefonische coaching om te stoppen met roken voor ouders en daadwerkelijk stoppen met roken van ouders op hun kinderen geëvalueerd. Er werd geen bewijs gevonden dat deelname van ouders aan telefonische coaching of stoppen met roken van ouders preventieve effecten heeft op rookgerelateerde cognities en rookinitiatie bij hun kinderen. Het aantal kinderen dat begon met roken (rookinitiatie: het nemen van het eerste trekje van een sigaret) in de groep ouders die gestopt was met roken verschilde niet significant van het aantal kinderen in de groep ouders die niet gestopt was met roken op geen van de metingen.

In **Hoofdstuk 12** worden de bevindingen uit alle studies uit het huidige proefschrift samengevat en in het kader van de bestaande literatuur nader besproken. De resultaten worden bediscussieerd en er worden aanbevelingen gegeven voor praktijk, beleid, en toekomstig onderzoek. De belangrijkste bevindingen die voortkomen uit *Deel 1* van het huidige proefschrift zijn: Rookgedrag in de omgeving heeft invloed op de vorming van rookgerelateerde cognities, de vatbaarheid om te beginnen met roken bij pre-adolescenten en invloed op de eerste rookervaring en rookgedrag van adolescenten. De bevindingen bevatten belangrijke implicaties voor de praktijk. Ten eerste kunnen de bevindingen invloed hebben op het tabaksbeleid door argumenten aan te leveren voor beleidsmakers en rokende ouders voor een rookvrije omgeving van kinderen (bijvoorbeeld huishouden en auto's). Tevens geven de bevindingen meer inzicht in risicofactoren van roken onder jongeren. Inzicht in deze factoren kan helpen bij een meer gerichte preventie van roken onder jongeren. Door vroege identificatie van risicofactoren kunnen interventies gericht op het voorkomen van roken onder jongeren gericht worden aangeboden aan risicogroepen.

De belangrijkste bevindingen die voortkomen uit *Deel 2* van het huidige proefschrift zijn: Basisscholen kunnen een goede ingang vormen om rokende ouders te bereiken. Wanneer ouders via basisscholen worden benaderd zijn ze mogelijk meer geneigd om gebruik te maken van stoppen-met-roken interventies (bijvoorbeeld omdat ze aangesproken worden op hun rol als ouder). Telefonische coaching in combinatie met op maat gemaakte materialen is effectief in het bevorderen van stoppen met roken onder rokende ouders. Zelfs onder de ouders die niet gestopt waren met roken had telefonische coaching belangrijke positieve effecten. Er is geen bewijs gevonden dat stoppen met roken van ouders preventieve effecten heeft op rookgerelateerde cognities of rookinitiatie bij hun kinderen. De bevindingen bevatten belangrijke implicaties voor de praktijk. Ten eerste suggereren de bevindingen dat de populatie van rokende ouders ontvankelijk is voor ondersteuning bij het stoppen met roken en dat een schoolgebaseerde benadering van ouders en het gebruik van op maat ontwikkeld aanvullend materiaal mogelijk het bereik en de effectiviteit van beschikbare interventies kan bevorderen. Ten tweede toont dit onderzoek aan dat telefonische coaching een grote impact kan hebben op rokende ouders en mogelijk ook op de algemene populatie van rokers. Ten derde hebben de bevindingen de potentie om het tabaksbeleid te beïnvloeden door een model te schetsen van een effectieve manier om rokende ouders in contact te brengen met hulpmiddelen bij het stoppen met roken. Indien de kosteneffectiviteit van deze benadering aangetoond kan worden, dan zou een schoolgebaseerde benadering van rokende ouders systematisch geïntegreerd kunnen worden in het zorgsysteem. Hierdoor zou een groot deel van rokende ouders bereikt kunnen worden.

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Publications

Publications in peer-reviewed international journals

Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. (2014). Connecting smoking parents to cessation support: Effects on smoking-related cognitions and smoking behaviour in their children. *Manuscript submitted for publication.*

Schuck, K., Bricker, J. B., Otten, R., Kleinjan, M., & Engels, R. C. M. E. (2014). Longitudinal treatment mediation of quitline counselling and self-help material for smoking cessation among parents. *Manuscript submitted for publication.*

Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. (2014). Moderators and non-specific predictors of cessation treatment outcome among smoking parents: A comparison of quitline counseling to self-help material. *Manuscript submitted for publication.*

Schuck, K., Bricker, J. B., Otten, R., Kleinjan, M., Brandon, T., & Engels, R. C. M. E. (in press). Effectiveness of proactive quitline counselling in smoking parents recruited through primary schools: Results of a randomized controlled trial. *Manuscript accepted for publication in Addiction.*

Schuck, K., Otten, R., Engels, R. C. M. E., & Kleinjan, M. (in press). Initial responses to the first dose of nicotine in novel smokers: The role of exposure to environmental smoking and genetic predisposition. *Manuscript accepted for publication in Psychology and Health.*

Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. (2013). School-based promotion of cessation support: reach of proactive mailings and acceptability of treatment in smoking parents recruited into cessation support through primary schools. *BMC Public Health, 13,* 381.

Schuck, K., Kleinjan, M., Otten, R., Engels, R. C. M. E., & DiFranza, J. R. (2013). Responses to environmental smoking in never-smoking children: Can symptoms of nicotine addiction develop in response to environmental tobacco smoke exposure? *Journal of Psychopharmacology, 27, 533-540.*

Schuck, K., Otten, R., Kleinjan, M., Barker, E. D., & Engels, R. C. M. E. (2013). Bidirectional influences between parents and children in smoking behaviour: A longitudinal full family model. *Nicotine and Tobacco Research, 15,* 44-51

Schuck, K., Keijsers, G. P. J., & Rinck, M. (2012). Implicit processes in pathological skin picking: Responses to skin irregularities predict symptom severity and treatment susceptibility. *Journal of Behavior Therapy and Experimental Psychiatry, 43,* 685-691.

Schuck, K., Otten, R., Kleinjan, M., & Engels, R. C. M. E. (2012). The role of environmental smoking in smoking-related cognitions and susceptibility to initiate smoking in never-smoking 9-12 year-old children. *Addictive Behaviors, 37,* 1400-1405.

Schuck, K., Otten, R., Kleinjan, M., Bricker, J. B., & Engels, R. C. M. E. (2011). Effectiveness of proactive telephone counseling for smoking cessation in parents. Study protocol of a randomized controlled trial. *BMC Public Health, 11,* 732-737.

Schuck, K., Otten, R., Engels, R., & Kleinjan, M. (2011). The relative role of nicotine dependence and smoking-related cognitions in adolescents' process of smoking cessation. *Psychology and Health, 26,* 1310-1326.

Schuck, K., Keijsers, G. P. J., & Rinck, M. (2011). The effects of brief cognitive-behaviour therapy for pathological skin picking: A randomized comparison to wait-list control. *Behaviour Research and Therapy,* 49, 11-17.

Van der Vorst, H., **Schuck, K.**, Hermans, R. C. J., & Engels, R. C. M. E. (in press). Children's responses towards alcohol in virtual reality: Associations between parental alcohol use, drinking selections and intentions to drink. *Manuscript accepted for publication in Journal of Substance Use.*

Kindt, K., Scholte, R., **Schuck, K.**, & Janssen, J. (2014). Negative cognitive styles and depression, a vicious cycle in early adolescence? *Manuscript submitted for publication.*

Lochbuehler, K., **Schuck, K.**, Otten, R., Ringlever, L., & Hiemstra, M. (2014). Parental smoking and adolescent's smoking cognitions: A systematic review of the literature. *Manuscript submitted for publication.*

Otten, R., Lojowska; M., Sanfey, A., Van de Hei, M., **Schuck, K.**, & Kleinjan, M. (2014). Striatal activity in response to cigarette smoke in former smokers, current smokers and never smokers: A pilot study. *Manuscript submitted for publication.*

Publications in peer-reviewed national journals

Schuck, K., Bricker, J. B., Otten, R., Kleinjan, M., Brandon, T., & Engels, R. C. M. E. (2014). Effectiviteit van telefonische coaching bij rokende ouders. *Manuscript resubmitted for publication.*

Schuck, K., Kleinjan, M., Otten, R., Engels, R. C. M. E., & DiFranza, J. R. (2014). Het effect van omgevingsrook op kinderen die nooit gerookt hebben: Kunnen kinderen symptomen van nicotineafhankelijk ontwikkelen nadat zij blootgesteld zijn aan een rokende omgeving? *Manuscript resubmitted for publication.*

Curriculum vitae

Curriculum vitae

Kathrin Schuck was born on May 23, 1983 in Oberhausen (Germany). After completing her secondary education (Abitur) at the Bertha-von-Suttner Gymnasium in Oberhausen in 2002, she spend a year in the United States as an au-pair. Here, she gained work experience and took college courses (Forensic Psychology, Physical Activity and Nutrition) at the Prince George's Community College (MD, USA). In 2004, Kathrin moved to the Netherlands to start the bachelor's program (Clinical Psychology) at Radboud University Nijmegen. Subsequently, during the master's program (Clinical Psychology and Behavioural Science), she completed a one-year clinical internship at a psychotherapeutic ambulatory care institution (Ambulatorium, Academic Center Social Sciences, Nijmegen). For her master's thesis, she conducted research on the treatment of dermatillomania (pathological skin picking) and the role of implicit (automatic) processes in symptom severity and treatment outcome. In 2009, Kathrin obtained her master's degree in Clinical Psychology and Behavioural Science from Radboud University Nijmegen. After receiving her master's degree (with honors), Kathrin continued to stay at Radboud University Nijmegen as a PhD-student within the department of Developmental Psychopathology to conduct research on smoking cessation interventions for smoking parents. Most of her studies have been presented at national and international conferences (e.g., *Meetings of the Society for Research on Nicotine and Tobacco, Forum Alcohol and Drugs Onderzoek [Dutch Research Forum for Alcohol and Drugs], Deutsche Konferenz für Tabakkontrolle [German Conference on Tobacco Control], Deutscher Suchtkongress [German Conference on Addiction]*) and published in international peer-reviewed journal (e.g., *Addiction, Behaviour Research and Therapy, Journal of Psychopharmacology*). To participate in international conference visits and summer schools, Kathrin received grants from the Society for Research on Nicotine and Tobacco (SRNT), the European Association for Research on Adolescence (EARA), Radboud University Nijmegen, and the International Research Universities Network (IRUN). Also, Kathrin had the opportunity to review for several journals such as *Addiction, Preventive Medicine, American Journal of Epidemiology, Pediatrics, Nicotine and Tobacco Research, Addictive Behaviors, BMC Public Health,* and *International Journal of Behavioral Medicine*. During the PhD program, Kathrin collaborated with dr. Jonathan Bricker (Fred Hutchinson Cancer Research Center & University of Washington, WA, USA) and dr. Edward Barker (King's College London, UK) on joint publications. Also, she spend several weeks working at the University of Massachusetts Medical School (MA, USA) and the Moffitt Cancer Research Centre (FL, USA) to collaborate with prof. Joseph DiFranza and prof. Thomas Brandon on joint publications and ongoing research projects. Throughout the PhD program, she supervised several graduate students in writing their master's theses and taught several academic courses (e.g., Multivariate statistics, Basic skills in psychological and educational counselling). In her free time, Kathrin likes to spend time with her friends and family and enjoys travelling, cycling, and hiking.