Childhood Asthma

Parents' role in smoking prevention and asthma perception

Linda Ringlever

Colofon

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General introduction

Part I

Asthma is the most common chronic disease in childhood (Mallol et al., 2013; Sennhauser, Braun-Fahrländer, & Wildhaber, 2005). In the Netherlands, it is estimated that 119.000 children aged under 15 are diagnosed with asthma (Gommer & Poos, 2011). In a large epidemiological study, 7% of 12-14 year-old Dutch adolescents reported asthma symptoms and 13% reported to have received a asthma diagnosis by a physician (Van De Ven, Van Den Eijnden, & Engels, 2006a). Asthma is a chronic inflammatory condition of the lungs, and one irritant that may provoke or aggravate asthma symptoms is tobacco smoke. As such, one might expect that young people with asthma would not engage in a health risk behaviour such as smoking. However, empirical studies reveal the contrary. The literature comparing the smoking habits of adults and adolescents with and without asthma show that adolescents with asthma are as likely, or even more likely, to smoke compared to their peers without asthma (Mcleish & Zvolensky, 2010). Additional health risks for youth with asthma include less responsiveness to asthma medication, higher asthma morbidity, and the risk of developing obstructive pulmonary disease (COPD) (Thomson, Chaudhuri, & Livingston, 2004).

Despite the health risks of smoking for adolescents, in general, and for adolescents with asthma in particular, it is disturbing that young people in the Netherlands still smoke at substantial numbers. In 2013, 9% of Dutch adolescents aged 10 to 19 indicated that they smoked daily (Verdurmen, Monshouwer, & Van Laar, 2014). Since 2004, a decline in smoking has been seen, yet in 2013, 24% of 14-17 year olds indicated that they had smoked in the past 4 weeks. For young adults aged 18-19, these numbers increased to 34%.

First attempts to smoke begin around 10 years old, with 3% indicating having ever smoked; however, none indicated that they smoked daily (Verdurmen et al., 2014). These numbers suggest that when aiming to prevent smoking uptake, an effective strategy might be to focus on children as young as 10 years old, as these children may not have experience with smoking, but some are likely to experiment in the near future. Preventing early smoking uptake is important as studies have shown that early initiators are at a greater risk of smoking as adults, smoking more cigarettes per day (e.g., Chassin, Clark, Pitts, & Sherman, 2000), and less likely to quit smoking (Breslau & Peterson, 1996) compared to late initiators. In addition, even low levels of exposure to smoking can lead to symptoms of nicotine dependence (DiFranza et al., 2000). It is important to prevent the first active smoking experience as this may represent the beginning of a process that leads to nicotine dependence in young smokers, even before they progress to daily smoking (DiFranza et al., 2000; Gervais, O'Loughlin, Meshefedjian, Bancej, & Tremblay, 2006). Therefore, effective strategies to prevent early smoking initiation are needed.

Tobacco control and prevention among youth can be reached via several intervention strategies, mass media campaigns, and governmental policies (e.g., Lantz et al., 2000). Effective international and national strategies to reduce smoking include increasing taxes on cigarettes, encouraging smoke-free public places, and restricting access to cigarettes (WHO, 2013). Increasing the price of cigarettes is especially effective to prevent youth from initiating smoking (WHO, 2013). Also, pictures to warn smokers of the detrimental effects of smoking placed on cigarette packages are effective among youth and can form a tobacco control policy to prevent youth from smoking initiation (Hammond, 2011).

Substantial numbers of prevention strategies and interventions are designed to reach children and adolescents via schools (e.g., Tobler et al., 2000). School-based interventions have reported short-term effects (Wiehe, Garrison, Christakis, Ebel, & Rivara, 2005). The use of peers to educate children has been found effective in several school-based interventions (e.g., Mellanby, Rees, & Tripp, 2000). However, school-based approaches that include peers and other classroom teaching methods are time consuming and difficult to implement. A new range of internet and computerised school-based interventions, which have the potential to reduce intentions to initiate smoking, overcome these difficulties, as they are easier to implement at low costs (Champion, Newton, Barrett, & Teesson, 2013).

In addition to government policies and strategies via schools, smoking prevention can also be achieved at the family level. Petrie et al. (2007) reviewed controlled studies of parenting programs and reported significant reductions in tobacco use or intention to use in 9 out of 13 studies that concentrated on tobacco; however, three interventions reported increased tobacco use. Thomas et al. (2007) identified 22 randomised controlled trial (RCT) studies of family-based prevention programs. They concluded that the high-quality RCTs supported the role of the family in interventions. However, less well-conducted RCTs yielded mostly neutral or negative findings. One component in prevention that appears to work is an interactive approach with children to provide opportunities to share ideas with one another (Petrie et al., 2007; Sandler et al., 2014; Tobler et al., 2000).

The present thesis

This thesis focuses on an interactive prevention program to encourage parents, amongst others strategies, to actively discuss and share ideas about smoking with their children. Part I of this thesis deals with the setup and findings of a study that involves a strategy to prevent smoking among children with and without asthma by involving parents. The Smoke-Free Kids program aimed to prevent smoking using mechanisms of constructive communication on smoking

topics, setting and keeping strict household rules, and implementing other relevant smoking-specific parenting strategies. These parenting strategies are hypothesised to affect children's smoking-related cognitions, such as attitudes, self-efficacy, and social norms, and subsequent smoking initiation.[1]

Smoke-Free Kids is translated and adapted from a successful home-based prevention program originally designed for smoking parents in the United States (Jackson & Dickinson, 2003, 2006). In the United States, children of smoking parents who followed the intervention program had half the odds for initiating smoking than those in the control condition. More precisely, 3 years after baseline, 12% of intervention children reported initiation of smoking versus 19% of children in the control condition (Jackson & Dickinson, 2006). In a different sample that included non-smoking parents, Jackson and Dickinson (2011) showed that high engagement in the program enhanced recall of parental efforts in anti-smoking socialisation by their children after 3 years.

For the evaluation of the Smoke-Free Kids program in the Netherlands, a RCT design was used. A sample of Dutch families both with children with and without asthma were randomly allocated to two conditions: one intervention condition receiving activity guides at home once a month for 5 months in a row, and one control condition receiving booklets as well. The control booklets included basic smoking information directed toward parents only, whereas parents in the intervention condition were explicitly encouraged to discuss the content with the child. Intervention activity guides also included assignments intended for children. This program was not especially designed for parents of asthmatic children. However, findings suggest that parents of children with asthma do not engage as much in smoking-specific parenting (Otten, Engels, & Van den Eijnden, 2007). In combination with high smoking rates among adolescents with asthma (Mcleish & Zvolensky, 2000) and additional health risks associated with smoking for this at-risk group (e.g., Thomson et al., 2004), we hypothesised that the program would be especially appealing and effective for parents of children with asthma. Chapter 2 of this thesis describes the study protocol of the Dutch Smoke-Free Kids study in detail. This chapter functions as the background information for the trial

1 The main results of Smoke-Free Kids concerning smoking prevention in general are published in Hiemstra (2013). Hiemstra focused on studies that examined factors associated with smoking onset and prevention and smoking-related cognitions during (pre)adolescence among the sample of Smoke-Free Kids assumed to represent the Dutch adolescent population. In the current thesis, in chapters concerning smoking prevention and behaviour, the focus is always on adolescents with asthma compared to peers without asthma. Both dissertations include the publications describing the study protocol (Chapter 2) and the main study outcome of smoking initiation of Smoke-Free Kids (Chapter 3). Relevant results described by Hiemstra (2013) and not included in the current thesis involve the short-term effects of Smoke-Free Kids (Hiemstra, Ringlever, Otten, Van Schayck, & Engels, 2013) and results on smoking-related cognitions in the general population (Hiemstra, Engels, Van Schayck, & Otten, submitted). The short-term results will be mentioned in the discussion section of the current thesis.

registration of this RCT and includes detailed information of the recruitment strategy (via schools, leaflets in waiting rooms at GPs and pharmacies, short announcements in local newspapers, and websites). Also included is information of the study sample (1,478 mother-child dyads of which 220 children had self-reported physician-diagnosed lifetime asthma) and the study variables (e.g., child smoking, child asthma symptoms, child's strengths and weaknesses, and smoking-specific parenting strategies). When performing a RCT design, the trial registration requires the researcher to record the primary and secondary study outcomes on which the prevention will be evaluated for effectiveness.

In Chapter 3, the effectiveness on the primary outcome of ever smoking (i.e., having ever smoked -a puff of- a cigarette: yes, no) by children with and without asthma is discussed. With a 36-month follow-up assessment, we could answer the question whether children in the intervention condition were less likely to initiate smoking compared to those in the control condition. Additionally, we tested whether the effect of Smoke-Free Kids on smoking initiation differed for children with and without asthma.

In Chapter 4, we concentrate on one of the secondary outcomes: smoking-specific parenting. Specifically, we focus on a possible differential development between parents with and without a child with asthma concerning their parenting strategies. We addressed the following research question: Are parents of asthmatic children more likely to engage in effective anti-smoking parenting strategies because of the Smoke-Free Kids intervention program compared to parents of children without asthma?

Following these three chapters, we attempt to gain additional insight into the relation between asthma and smoking. Although the literature indicates that adults and adolescents with asthma smoke at similar—or even higher—rates than do those without asthma (Mcleish & Zvolensky, 2010), less is known about rates for the first stage of active smoking (i.e., first puff). The few studies that have focused on the early stages of smoking onset and experimentation used retrospective study designs (e.g., Breslau & Peterson, 1996; Hublet et al., 2007; Precht, Keiding, & Madsen, 2003; Van de Ven, Engels, Kerstjens, & Van den Eijnden, 2007) (e.g., by including items such as 'At what age did you smoke your first cigarette?'). Inquiring adult or adolescent smokers about the age of first initiation is likely to lead to recall bias (Engels, Knibbe, & Drop, 1997). To avoid recall bias, researchers should measure the age of onset as close to the actual age of onset as possible.

In Chapter 5, we examine the first puff of a cigarette among children with and without asthma. The Smoke-Free Kids baseline data lends itself to answer the question of whether children with asthma are, as the literature indicates on advanced stages of smoking among adults and adolescents, as likely or more

likely to have smoked (a puff) of a cigarette. Currently, no such literature is available and only few studies have focused on risk factors for smoking among youth with asthma. Further, these studies largely focused on the period of late adolescence (15-18 years old) (e.g., Zbikowksi et al., 2002). To rule out the possibility that youth with asthma are found to smoke more often because of underlying risk factors shared by both smoking and asthma, we controlled for these possible risk factors (i.e., parental smoking, socioeconomic status, child problem behaviours). For instance, parental smoking is found to be associated with the incidence and progression of asthma symptoms (Baena-Cagnani, Gomez, Baena-Cagnani, & Canonica, 2009) as well as offspring smoking (Leonardi-Bee, Jere, & Britton, 2011). Furthermore, research has found that childhood behavioural problems are risk factors for smoking (Upadhyaya, Deas, Brady, & Kruesi, 2002). Research also suggests that children with asthma have elevated levels of internalising and externalising behaviours (McQuaid, Kopel, & Nassau, 2001). Therefore, in Chapter 5, child problem behaviours include both externalising (e.g., conduct problems) and internalising (e.g., emotional problems) behaviours.

In Chapter 6, we further elaborate on the role of child problem behaviour in smoking among children with asthma. In this chapter, we investigated depressive feelings as a possible underlying mechanism in the link between asthma and smoking. Consistent evidence suggests that depressive feelings in adolescence are associated with higher risks for smoking (Chaiton, Cohen, O'Loughlin, & Rehm, 2009). Depressive feelings are also associated with smoking via self-efficacy to refrain from smoking (Minnix et al., 2001).

Youth with asthma are more willing to accept offers by friends to fit in with the peer group and avoid stigmatization because of their chronic health condition (Zbikowski et al., 2002). Furthermore, adolescents with asthma often show elevated levels of depression (McQuaid et al., 2001) and a stronger association between self-efficacy and smoking (Van de Ven, Van den Eijnden, & Engels, 2006b). Therefore, we tested whether asthma status could be a risk factor in instigating an indirect process that leads to smoking via depressive feelings and low self-efficacy to refrain from smoking. This model was tested in two samples. First, it was examined in our Smoke-Free Kids baseline data, which was a cross-sectional sample that includes pre-adolescents. Second, it was tested in a longitudinal sample that includes adolescents. By including two samples in one study, we strived for better recommendations for the type and timing of prevention efforts.

Part II

Parents play an important role in both preventing their asthmatic offspring from taking up smoking and in facilitating their children to handle their condition effectively. The latter implies that parents have insight into their children's emotional well-being and physical functioning. In the literature, these two concepts are referred to as quality of life. It seems, however, that children and their parents often differ in their ideas of quality of life (Annett, Bender, DuHamel, & Lapidus, 2003). One might assume that when parents lack accurate knowledge of their children's wellbeing, they are less efficient in dealing with potentially risky situations that their children encounter. This is worrisome, as children having asthma *and* impaired emotional well-being are at a special risk for smoking. For instance, children with asthma who scored high on depressive and/or anxiety disorder measures were over three times more likely to be smokers than were their peers without asthma (Katon et al., 2007). Youth with asthma who smoked also reported more asthma symptoms than did nonsmoking adolescents with asthma (Bush et al., 2007). They also reported less use of controller medications, and more use of rescue medications and, in general, reduced functioning because of their asthma (Bush et al., 2007). Finally, smoking was a determinant of impaired quality of life among asthmatics (Leander et al., 2012).

Individuals with asthma build certain representations of the asthma for themselves. This seems logical as patients (and their parents) spend little time with health care professionals who provide them objective medical information. Therefore, parents and children have ample opportunity to build subjective cognitive and emotional representations concerning the causes, course, consequences, timeline, and identities of their illness. These so-called illness perceptions are associated with several health outcomes, including self-management and asthma control (e.g., Kaptein et al., 2008; Kaptein, Klok, Moss-Morris, & Brand, 2010). The common sense model (also referred to as the self-regulation theory) is a theoretical framework in which illness perceptions are believed to affect illness and emotional problems via patient coping strategies (Leventhal, Meyer, & Nerenz, 1980). One characteristic of asthma is that is has an unpredictable and variable course of symptoms (Fuhlbrigge, Guilbert, Spahn, Peden, & Davis, 2006). This unpredictability results in asthma outcomes being highly dependent on illness representations (Kaptein et al., 2010).

Most studies on illness perceptions have applied cross-sectional designs and have focused on adult populations (Hagger & Orbell, 2003). Recently, the common sense model was examined in childhood asthma (Tiggelman, Van de Ven, Van Schayck, Kleinjan, & Engels, 2014). The researchers found that, on a cross-sectional

level, child asthma perceptions were associated with child asthma control and emotional problems. Illness perceptions did not influence asthma control over time; however, perceptions of ineffective treatment and perceiving more concern of the asthma increased emotional problems at follow-up (Tiggelman et al., 2014). Childhood asthma is a condition that affects not only the child, but also the whole family. Therefore, parents will also form their own perceptions about childhood asthma.

The present thesis

In Part II, we focus on these asthma illness perceptions of parents (mothers) and discuss their relation to childhood quality of life 1 year later. This examination is based on the sub-sample of children with asthma who participated in the Smoke-Free Kids study. We were able to replicate and extend our research question in the Tiggelman et al. (2014) sample, which comprises a substantial number of parents and children with asthma (see Table 1).

To summarise, Part I of this thesis deals with strategies to prevent smoking among children with asthma, as these children in particular should not jeopardise their health with such a behaviour as smoking. Engaging in this behaviour will not only harm their physical health, but also their emotional well-being, or to put them together, their quality of life. In Part II of this thesis, we focus on the quality of life of children with asthma. Again, we are interested in parental involvement. We concentrate on parental views on asthma and their relation to children's quality of life. Gaining insight into which parental perceptions of their asthmatic children are related to quality of life and how much these perceptions are congruent with those of children themselves might help to develop prevention programs that specifically target parents of asthmatic children. This is important, as few interventions have been developed and evaluated to support children with asthma management, especially when intervening during pre- and early-adolescence (Bruzesse, Unikel, Gallagher, Evans, & Colland, 2008).

Overview

Chapter 2 comprises the study protocol of Smoke-Free Kids, which formed the Trial Registration for our RCT. All details regarding the setup, recruitment, method, sample, and expected outcomes of Smoke-Free Kids are described. *Chapter 3* directly reports the primary study outcome of Smoke-Free Kids, smoking initiation at final follow-up. Specifically, do children in the intervention condition initiate

Table 1 Study and population characteristics

Sample name/description and method	Chapters	Number of participants in data set	Age of children	Data collection points
Smoke-Free Kids sample				
Questionnaires and telephone interviews [1]	2, 3, 4 5, 6	1,478 mothers and children	10.1 years old	Baseline (2,5) [2] Baseline, 12 months (6) Baseline, 36 months (3,4)
Home visit questionnaire data	7	87 mothers and 89 children	10.1 years old	Baseline, 12 months
Other samples				
Class-room questionnaire data (Otten et al., 2007; Van de Ven et al., 2007)	6	4,531 adolescents	12.8 years old	Baseline, 4, 24 months
Home visit questionnaire data (Tiggelman et al., 2014)	8	261 mothers and children	11.9 years old	Baseline , 12 months

[1] Baseline data of Smoke-Free Kids was obtained before randomisation.

[2] Numbers between the parentheses refer to the chapters that use these data collection points.

smoking less than children in the control condition 3-years post-baseline? Is Smoke-Free Kids effective in preventing children with asthma from smoking? The Smoke-Free Kids program is hypothesised to be effective via mechanisms of smoking-specific parenting. *Chapter 4* focuses on parenting and deals with the question of whether Smoke-Free Kids is more effective for families with a child with asthma then for families without asthmatic children because of effects of the program on parenting skills.

In *Chapter 5,* the Smoke-Free Kids baseline data–obtained before randomisation–was suited to examine the prevalence of the first active smoking experience among children with and without asthma. *Chapter 6* focuses on an underlying process that may explain the asthma-smoking association. In two separate samples of different age ranges, a model concentrating on the psychosocial factors of depressive feelings and self-efficacy to refrain from smoking is tested. Chapters 2-6 contribute to the field of smoking prevention. While one specific home-based prevention program was tested on effectiveness, the results of Chapter 5 can contribute to determining the timing of smoking prevention programs for children with asthma. The underlying mechanism discussed in Chapter 6 provides suggestions to focus attention on other domains in the asthmatic child's life during smoking prevention efforts.

Following these chapters concerning smoking behaviour, prevention, and parenting among children with asthma, *Chapters 7* and *8* in Part II deal with another important aspect of asthmatic children's life's. Both chapters concentrate on children's quality of life and the role of maternal illness perceptions, which may influence experienced quality of life. In Chapter 8, children's perceptions are compared to maternal perceptions and are related to quality of life. With the results of Chapters 7 and 8, we hope to contribute to suggestions for family-based psychosocial intervention programs, which are currently scarce.

Part I

Smoking and smoking prevention in childhood asthma

2

Efficacy of smoking prevention programme 'Smoke-Free Kids': study protocol of a randomised controlled trial

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Abstract

A strong increase in smoking is noted especially among adolescents. In the Netherlands, about 5% of all 10-year olds, 25% of all 13-year olds and 62% of all 17-year olds report ever smoking. In the U.S., an intervention program called 'Smoke-Free Kids' was developed to prevent children from smoking. The present study aims to assess the effects of this home-based smoking prevention program in the Netherlands. A randomised controlled trial is conducted among 9 to 11-year old children of primary schools. Participants are randomly assigned to the intervention and control conditions. The intervention programme consists of five printed activity modules designed to improve parenting skills specific to smoking prevention and parent-child communication regarding smoking. These modules will include additional sheets with communication tips. The modules for the control condition will include solely information on smoking and tobacco use. Initiation of cigarette smoking (first instance of puffing on a lighted cigarette), susceptibility to cigarette smoking, smoking-related cognitions, and anti-smoking socialisation will be the outcome measures. To collect the data, telephone interviews with mothers as well as with their child will be conducted at baseline. Only the children will be examined at post-intervention follow-ups (6, 12, 24, and 36 months after the baseline). This study protocol describes the design of a randomised controlled trial that will evaluate the effectiveness of a home-based smoking prevention programme. We expect that a significantly lower number of children will start smoking in the intervention condition compared to control condition as a direct result of this intervention. If the programme is effective, it is applicable in daily live, which will facilitate implementation of the prevention protocol.

Introduction

A strong increase in smoking is noted especially among adolescents. Between 80,000 and 100,000 of young adolescents worldwide start smoking each day (WHO, 2005). In the Netherlands, 40% of youths between the ages of 10 and 19 reports ever smoking (Stivoro, 2009a). Findings on early onset and later cigarette use suggest that those who initiate smoking in childhood are more likely to report advanced levels of smoking and nicotine dependence in late adolescence and (early) adulthood (Chassin, Presson, Pitts, & Sherman, 2000; Fergusson, Lynskey, & Horwood, 1995; Jackson & Dickinson, 2004; Prokhorov, Pallonen, Fava, Ding, & Niaura, 1996). The consistency of findings regarding the effects of early initiation on future smoking has led investigators to advocate for a delay in the age of onset as an important strategy for preventing tobacco use.

One potential powerful tool to lower the prevalence of youth smoking and to delay the age of onset is the implementation of effective prevention programmes. In the past decade, various prevention programmes have been implemented primarily at secondary schools (e.g., Bruvold, 1993). Programmes targeting on early adolescents need to be improved to be more effective (Cuijpers, Jonkers, De Weerdt, & De Jong, 2002; Jackson, Henriksen, Dickinson, Messer, & Robertson, 1998). One of the reasons that current school-based prevention programmes have had little sustained effect on smoking rates is - in our opinion - the general disregard of the role of parents in preventing youth smoking onset.

Recent studies have shown that parental smoking (Otten, Engels, Van de Ven, & Bricker, 2007), general parenting style, and parental anti-smoking socialisation (e.g., Harakeh, Scholte, Vermulst, De Vries, & Engels, 2004; Harakeh, Scholte, De Vries, & Engels, 2005; Otten, Harakeh, Vemulst, Van den Eijnden, & Engels, 2007; Otten, Engels, & Van den Eijnden, 2008) predict smoking experimentation, progression to advanced stages of smoking, and even smoking cessation (Bricker, Otten, Liu, & Peterson, 2009). In the last five years, prospective studies have extensively studied the influence of parents on child smoking in the Netherlands. These studies generally show that parents are the primary socialising agents. Parents affect the norms of children with respect to smoking by communicating constructively about smoking-related issues, setting household rules against smoking, acquiring additional smoking-related knowledge, and monitoring their children's activities. In turn, this lowers the odds of children experimenting with smoking (Harakeh et al., 2005; Den Exter Blokland, Hale III, Meeus, & Engels, 2006; Huver, Engels, Vermulst, & De Vries, 2007; Huver, Engels, & De Vries, 2006; Otten et al., 2007). In addition to the direct influence of parents on adolescent smoking initiation, parents can also influence their children indirectly through cognitions. Anti-smoking specific parenting practices have been found to be related to

adolescents' smoking-specific cognitions (i.e., social norm, self-efficacy, and attitudes (Engels & Willemsen, 2004; Otten et al., 2007), and these smoking-specific cognitions have been found to mediate the relation between parental smoking and initiation of smoking (Harakeh et al., 2005; Huver et al., 2006). Considering these findings, we expect that smoking-specific cognitions will mediate the association between parenting practices and smoking initiation.

There is overwhelming empirical evidence that parents can prevent their children from smoking by engaging in anti-smoking socialisation. However, no effective prevention programme for parents of children aged 9-11 years old has been tested and implemented in the Netherlands. In the U.S., Jackson and Dickinson (2003; 2006) have developed a highly innovative and successful prevention programme for smoking parents of primary school children named 'Smoke-Free Kids.' Smoke-Free Kids is a structured programme focused on anti-smoking socialisation that can be conducted at home, which means that parents and children can go through these activities in their own time.

Using communication, rule setting, monitoring, guided experience, and other methods of child socialisation, parents can influence children's perceptions regarding the prevalence of smoking, the acceptability of smoking, and the personal and social consequences of smoking (Henriksen, & Jackson, 1998).

A randomised controlled trial conducted over a period of 24 and 36 months has provided strong evidence for the preventive effects of the Smoke-Free Kids programme on child smoking initiation (Jackson & Dickinson, 2006). Specifically, analyses showed that exposure to the programme reduced the likelihood of children's smoking initiation at follow-up (24-months later). While 19% of children in the control condition initiated smoking by grade 6, only 12% of children in the intervention condition had done so (OR = 2.16; *95% CI* = 1.39 - 3.37, $p < .001$).

Asthma

Health effects of smoking initiation are more profound on adolescents with asthma compared to adolescents without asthma. People with asthma who smoke are more likely to develop lung diseases and COPD (George, 1999) over time compared to those who do not smoke. Worldwide, the prevalence of asthma varies across countries and age groups. The prevalence of asthma among children aged 7-9 years old ranges from 0% to 20.3% and among 13-14 year olds from 0.1% to 16% (ISAAC study: Lai et al., 2009). Our institute is one of the participating collaborating parties in the ISAAC study, the worldwide epidemiological project on the prevalence of asthma and asthmatic symptoms. According to Dutch data collected from 10,087 adolescents aged 12-14 years old, 13% of the participants reported lifetime asthma and 7% reported asthmatic symptoms in the last 12 months (Van de Ven, Van den Eijnden, & Engels, 2006a). Although one might expect that- due

to the long-term negative consequences of cigarette use - adolescents with asthma would be less likely to start smoking, the contrary seems to be true (see also Precht, Keiding, & Madsen, 2003; Zbikowski, Klesges, Robinson, & Alfano, 2002). The prevalence of regular smoking among adolescents with asthma is as high as among their non-asthmatic peers (Van de Ven, Engels, Kerstjens, & Van den Eijnden, 2007). In addition, adolescents with asthma are more likely to have parents who smoke than adolescents without asthma (Otten, Engels, & Van den Eijnden, 2005). Smoking parents are less involved in anti-smoking socialisation than non-smoking parents (Henriksen & Jackson, 1998). Therefore, it is important to involve this vulnerable group in smoking prevention and to examine whether the effects of the Smoke-Free Kids programme are different for children with and without asthma.

Aim and hypotheses

The primary aim of the study Smoke-Free Kids is to assess the effectiveness of this prevention programme among children aged 9-11 years old in the Netherlands. Both short-term (after 6 months) and long-term (12, 24, 36 months) effects of the intervention will be tested. Two hypotheses will be tested. First, in line with the U.S. findings, we expect that the programme will lead to lower likelihood of children's smoking initiation. Specifically, we expect that children in the intervention condition, relative to controls, will be less likely to engage in smoking at follow-up based on the findings of Smoke-Free Kids in the U.S. We will test whether the effects of the intervention programme are different for children with asthma. Second, we expect that the programme will lead to significant increases in anti-smoking socialisation of children. Specifically, we expect that parents included in the intervention programme (as compared to controls) (a) will be more engaged in constructive communication on smoking topics, (b) will have more confidence in discussing smoking matters and greater self-efficacy to prevent their children from smoking, (c) will set and keep stricter household rules against smoking and establish a non-smoking contract with their children, and (e) will be more likely to monitor children's and peers' smoking-related activities.
Methods/Design

Study design

The programme Smoke-Free Kids is a 3-year randomised controlled trial with two arms, an intervention and a control condition, testing the effects of an intervention programme consisting of five activity modules. Participants consist of 1479 mothers (and their children): 729 in the intervention and 750 in the control condition. To select the eligible sample, randomization takes place at school level, to avoid contamination between conditions, after the initial recruitment and

participant selection. After informed consent, enrolment in the trial, and baseline assessment, families will receive one of the five programme modules every four weeks by mail. The modules for the intervention condition will consist of activities (such as games, scripted role-plays, contests, and interviews) designed to increase communication between mother and child. Mothers will be instructed to read the modules and to perform these activities together with their child. The intervention condition will also receive a booster module 12 months after the baseline to reinforce the skills learned from the earlier modules. Families in the control condition will receive modules containing only of factual information about smoking. Hence, these mothers will not be explicitly encouraged to communicate about the modules with their child. Assessments in both intervention and control condition will be conducted at baseline, after six months (after completing the intervention), 12, 24, and 36 months (see Figure 1). After 36 months of follow-up, each family will receive €10 for participation in all measurements, and five traveler's cheques of €1000 will be raffled among these families. Children will receive little gifts after different measurement (e.g., pen & memo pad, magnet stickers, frisbees) to thank them for participating in the study.

Recruitment

Families are recruited from primary schools, media, and health professionals. Specifically, primary school boards are asked to distribute letters to all children aged 9-11 years old and to request that children give this letter to their parents. This letter includes information about the study and inquires whether parents want to be involved in our study. If parents agree to participate, they can provide their contact information by filling out a short screening self-administered questionnaire (that includes items assessing parental smoking status and possible asthmatic symptoms of the child) and return it in the enclosed envelope. It is also possible to register online via a secured webpage. To recruit children with asthmatic symptoms, several local and national newspapers, a local television station, and different health related prevention websites (e.g., Dutch Asthma Foundation, Dutch Institute for Smoking Prevention) agreed to assist in announcing the study on a population level. Furthermore, health professionals (i.e., general practitioners, pharmacist, and lung specialists) are requested to place posters with accompanying flyers in their waiting rooms.

Eligibility criteria

Eligibility is determined in two steps; first based on a short screening self-administered questionnaire completed by the parents, and second based on the baseline telephone interview. Inclusion criteria for the present study are; children have to

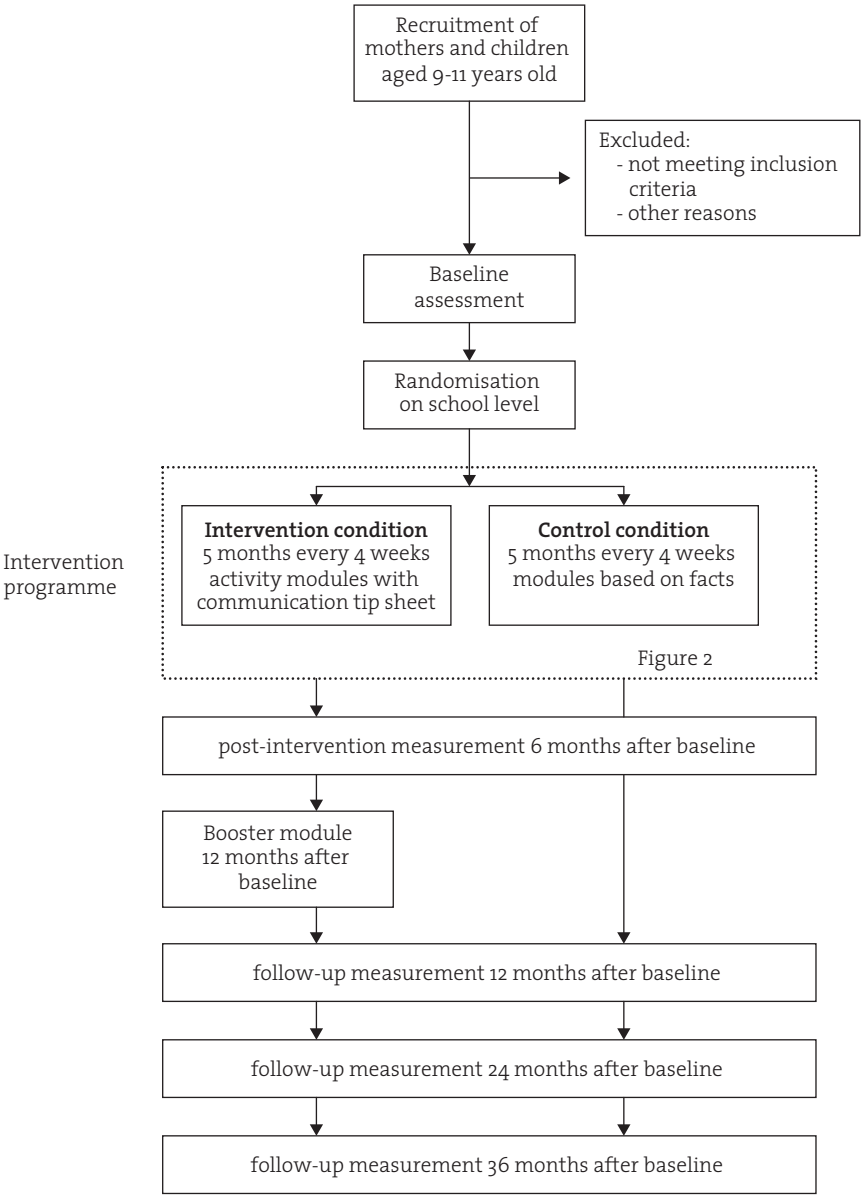

Figure 1 Study design

be aged between 9-11 years old and should not have initiated smoking yet, participating adults have to be the mother or a female guardian, and both adult and child need to be competent in reading and speaking Dutch. Furthermore, only one child per household is eligible to participate. To test the moderating effect of asthma, we also needed a subsample (n = 200) of children with asthmatic symptoms. Written informed consent from participating families will be obtained upon enrolment. The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen approved the study's protocol.

In this study, we will focus on 9 to 11 year old children because at this age, children start to become increasingly interested in smoking issues (see Dalton et al., 2006), but generally do not smoke yet. The prevalence of lifetime smoking among this age group is low (< 2%) (Monshouwer, Van Dorsselaer, Gorter, Verdurmen, & Vollebergh, 2004) making it an important target group for primary prevention. Furthermore, this age group consists of children prior to the phase in which they enter pre-puberty. This is a period characterised by increasing conflicts with parents, particularly with mothers (Granic & Hollenstein, 2003), leading to less conformity and openness, although children are still responsive to the influence of parents (Jackson & Dickinson, 2006).

We have decided to target mothers rather than fathers for the following reasons; (a) if parents are divorced, children live mostly with their mothers (Centraal Bureau voor de Statistiek, 2005), (b) on an average, children spend more time with their mothers than with their fathers, which gives mothers the practical advantage of having more time to deliver the anti-smoking socialisation programme to their children (Renk et al., 2003), (c) women are generally more likely than men to enrol in health-related programmes, (d) the U.S. trial also included only mothers, so including mothers would increase comparability of findings (Jackson & Dickinson, 2003; 2006), and (e) given the plausibility that programme effects would differ by parent's gender, including fathers would substantially increase the size and costs of the proposed trial.

Randomisation

Randomisation occurs at the school level to avoid contamination between conditions. Thus, clusters of children from one school are allocated to either the intervention or the control condition. An independent statistician performed the allocation and stratified participants by school and number of children with asthma after the baseline assessment.

Sample size calculation

Based on the findings from the U.S. trial, we expect a 10% difference in smoking initiation rates between the intervention and control conditions. Equal cell sizes

are assumed for study cells and power of .80 was targeted. The primary hypothesis will be tested at an overall two-sided significance level of 0.05. We used the general-purpose statistical software package Stata to calculate the estimated sample sizes for two-sample comparison of proportions. Based on the U.S. data and the prevalence of smoking in 12 to 14 year olds (age of the children at 36-months follow-up), which is around 30%, we would need 428 children per condition. In these power analyses, we corrected for the fact that data are clustered (children are nested within schools) and the fact that we will apply multiple imputation in the case of missing data. Thus, 856 children (and mothers) would be included to test the effectiveness of Smoke-Free Kids. A subgoal of the study is to examine whether there is any difference between the children with and without asthma or asthmatic symptoms. To test the moderating effect of asthma or asthmatic symptoms, we will include a subsample of 200 children with asthma or asthmatic symptoms. This allows us to test whether the effect of the intervention is different for children with asthma. Eventually, the study is over-enrolled. Overall, a total of 1479 children (and mothers) will participate in the study: 1399 never smokers and 80 ever smokers. The asthmatic subsample includes approximately 239 children whose mothers reported their child to have had an asthmatic period at least once in their lives. This allows us to test whether the effect of the intervention is different for children with asthma. Moreover, having 623 additional participants allows us to do complex analyses and to test several other moderators and mediators. In accordance with the intention-to-treat philosophy, all children randomised to one of the conditions are included in analyses to test the study hypotheses.

Theoretical basis of the intervention

Social Cognitive Theory (Bandura, 1986) and models of persuasive communication for attitude and behavioural change (Petty & Cacioppo, 1986) were used to structure the programme to meet the intervention objectives. Bandura's Social Cognitive Theory (1986) has been broadly applied in public health intervention, and it has been used here to identify the critical elements of child socialisation regarding cigarette smoking. Specifically, these elements include a) perception, where a child perceives the expressed thoughts and actions of parents or other socialising agents, b) cognitive rehearsal, where a child recalls and assigns meaning to what has been perceived, c) behavioural rehearsal, where a child communicates or acts in a manner consistent with what has been learned and receives feedback regarding those thoughts and behaviours, and d) motivation, where a child experiences positive (or negative) reinforcements for specific communications or actions. Each element of the programme was designed to address one or more of these child socialisation processes.

Communication models, particularly the Elaboration Likelihood Model (Petty & Cacioppo, 1986), offer substantive input as regards the design of persuasive communications. Of particular importance is that participants vary with respect to the perceived relevance and salience of health communications, and the intervention design should take this variability into account. For example, we expect some parents to engage in argument-based processing of programme content (where message content most affects parental response to programme recommendations), and others to engage in cue-based processing (where peripheral cues such as print design most affect parental response to programme recommendations). The programme information has been structured to address both modes of information processing.

Intervention condition

Parents and children in the intervention condition will receive five printed activity modules by mail at four-week intervals. The aim of the modules is to achieve progressive development of parent-child socialisation activities. Activities have been designed to gradually increase parental skills and comfort level in communicating with children about smoking, addiction, and expectations regarding abstinence. Each activity module includes a high concentration of structured interactions that engages parent and child simultaneously, such as games, scripted role-plays, contests, and interviews. These structured interactions are a key technique for facilitating parent-child engagement in the intervention (Jackson & Dickinson, 2009).

Each module aims to modify different socialisation variables, module 1 targets general communication about smoking and makes parents and child comfortable with communicating about smoking, module 2 concentrates on influence of smoking messages (i.e., influence of media, sport events, and people around us), module 3 focuses on setting rules about smoking to protect their child from experimentation with tobacco. Module 4 is an extension of module 3 and involves creating a smoke-free house and -environment to keep the child away from second hand smoking. The last module, number 5, increases children's awareness regarding the influence of smoking classmates and friends and increases their ability to handle peer pressure. All five modules contain a communication sheet for parents. These sheets provide additional background information about the subjects discussed in the modules and communication tips for parents. Finally, a booster module will be delivered 12-months post-baseline.

Between the activity modules, parents will receive a series of digital newsletters in their email box. These newsletters will be sent after modules two, three, and five. The newsletters aim to maintain commitment to the programme. The newsletters will inform parents about the background of Smoke-Free Kids, review

the activity modules that parents and child receive in the mail, and announce the winners of different programme contests (e.g., 'drawing an anti-smoke message,' 'compose the longest sentence with magnet stickers,' and 'writing a story including an anti-smoking message').

Evaluations of smoking prevention programmes for adolescents indicate that repeated exposure to the key elements of the intervention programme can strengthen programme effects. A booster module will be developed with the theme 'Staying smoke-free.' This module includes a self-assessment component; i.e., parents and children will evaluate which anti-smoking skills they have practiced well, and which ones they could improve. Additionally, motivational information to stay smoke free throughout the high school years will be provided.

Control condition

For the families in the control condition, a fact-based programme has been developed. An alternative program will be provided for controls because we assume it is unethical to recruit them for an intervention programme while not offering them a programme afterwards. Providing alternative materials for controls also helps maintain comparable response rates when follow-up data are collected from the two arms of the study. The factsheets provide information on youth smoking and focuses parents' attention on macro-level variables relevant to youth smoking, but not targeted by the intervention version of the programme (for example, smoking prevalence among youths, ingredients of cigarettes, tobacco legislation). The criterion for selecting factsheets information was that the same information would be available in local, state, or national print or broadcast media. Although the information provided could increase control condition parents' knowledge regarding tobacco issues, this awareness is not expected to affect anti-smoking socialisation processes. Moreover, it is difficult to retain parents in the study without providing them anything of a programme. Both factsheets and modules will be mailed at the same time to participants in the control and intervention condition (Figure 2). Similar to the children in the intervention condition, the children in the control condition will also receive incentives (magnet stickers & Frisbees) to thank them for participating.

All the U.S. materials were translated and adapted to the Dutch language. This was done in collaboration with STIVORO (Dutch Institute for Smoking Prevention), the Trimbos Institute (Netherlands Institute of Mental Health and Addiction), and professional translators. The following adaptations were made for the Dutch intervention. For instance, some assignments were not suitable for the Dutch intervention because they were too culturally specific or they concerned issues that have changed since the U.S. programme started. For instance, the U.S. intervention included assignments that referred to tobacco advertising, which is

prohibited nowadays. Moreover, while the original programme targeted smoking mothers, the Dutch programme was made accessible to both smoking and non-smoking mothers; therefore, the focus of some modules needed to be changed. Finally, the layout of the modules has been modernised and adapted (i.e., cartoons).

Data collection

An overview of all measurements is given in Table 1. All questions will be administered during a 20-minutes telephone interview by one of the trained interviewers. At baseline, mothers will be interviewed first to check the eligibility of the family. Children will be interviewed few days later. Because of practical reasons, the over-enrolled families will be asked to answer the questions by questionnaire which will be sent to their homes. Only the children will be examined at post-intervention and follow-ups. We considered collecting data from parents at each follow-up, but we opted not to because (a) such data are not needed to test the study hypotheses and (b) our perspective is that children's perceptions of anti-smoking socialisation are more reliable (less biassed) and will

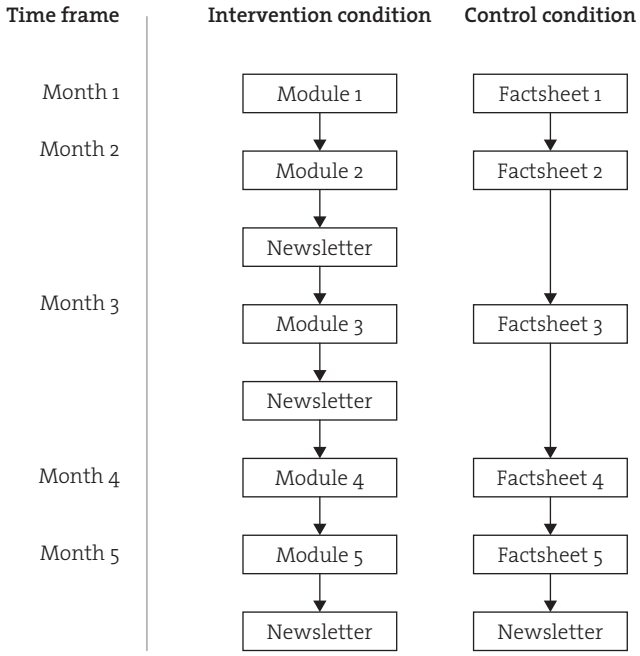

Figure 2 An overview and time frame of the intervention programme

explain their smoking status better than parental reports of anti-smoking socialisation (see also Darling & Cumsille, 2003; Engels, Finkenauer, Meeus, & Dekovic, 2001; Harakeh, Engels, De Vries, & Scholte, 2006).

During the intervention programme, 10% of the participants in the intervention condition will receive a telephone call from a trained interviewer about the procedure of the programme. They will be asked if they received the activity modules and which modules they did utilise so far. The answers will give us an indication about programme exposure among intervention condition families.

The post-intervention measurement (after 6 months) will collect more detailed information on program utilisation. The three follow-up measurements will be at 12, 24, and 36 months after baseline. We have decided to follow the children for 36 months, indicating that at the final wave, children will be 12 to 14 years old. The national prevalence data on smoking in adolescents have shown an increase in ever smoking of 5% among 10-year olds, 7% among 11-year olds, 17% among 12-year olds, and of 25% among 13-year olds (Stivoro, 2009a).

Outcomes

The primary outcome, initiation of cigarette smoking, has been defined as puffing on a lighted cigarette for the first time.

Secondary outcome measures are general parenting dimensions like monitoring, psychological control, manipulative control, support, and responsiveness (e.g., Finkenauer, Engels, & Baumeister, 2005; Kerr & Stattin, 2000; Scholte, Engels, Overbeek, De Kemp, & Haselager, 2007; Steinberg, Mounts, Lamborn, & Dornbusch, 1991), as well as smoking-specific parenting, such as house rules on smoking, non-smoking agreement, warnings about consequences of smoking, frequency and quality of communication on smoking matters, and reactions on experimentation with smoking (e.g., (Engels, Noom, Hale III, & De Vries, 2005; Engels & Willemsen, 2004; Ennett, Bauman, Foshee, Pemberton, & Hicks, 2001; Harakeh et al., 2005; Huver et al., 2006; Otten, Engels, & Van den Eijden, 2007).

Other outcomes are susceptibility to cigarette smoking, defined as the lack of a firm commitment against cigarette smoking (Jackson et al., 1998; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996), child smoking-related cognitions, such as expectancies concerning self-efficacy (De Vries, Dijkstra, & Kuhlman, 1988), and social norms (Otten et al., 2007) which have been shown to be related to smoking initiation (Harakeh et al., 2004; Van de Ven et al., 2007) and attitude (Otten et al, 2007.

Asthma symptoms will be identified using an extended version of ISAAC's asthma questionnaire (Asher et al., 1995). In addition, children with asthmatic symptoms will be phenotyped using lung function measurement.

The Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) will be used as a behavioural screening instrument for early detection of psychological

Table 1 Overview of measurements

Measurement Concept	Baseline		6 months (Post-intervention)	12 months	24 months	36 months
	Mother	Child	Child	Child	Child	Child
Demographic characteristics	*					
Smoking behaviour parents (De Vries et al., 2003)	*	*	*	*	*	*
Smoking behaviour child (De Vries et al., 2003)	*	*	*	*	*	*
Anti smoking socialisation:						
Communication about smoking (Ennett et al., 2001)	*	*	*	*	*	*
Monitoring (Engels et al., 2004)	*		*	*	*	*
Availabiltiy of cigarettes at home (Engels et al., 2004)	*	*	*	*	*	*
Parental norms (Engels et al., 2004)	*		*	*	*	*
Parental influence on offspring smoking (Engels et al., 2004)	*	*	*	*	*	*
House rules (Engels et al., 2004)	*	*	*	*	*	*
Perceptions of parents' reaction (Engels et al., 2004)		*	*	*	*	*
Intention to smoke (Kremers, 2002)		*	*	*	*	*
Self-efficacy (De Vries et al., 1998; Engels, Knibbe, & Drop, 1999)		*	*	*	*	*
Attitude (Dijkstra, De Vries, & Bakker, 1996)		*	*	*	*	*
Social norm (De Vries, Backbier, Kok, & Dijkstra, 1995)		*	*	*	*	*
General parenting style (Jackson, Henriksen, & Foshee, 1998)	*	*	*	*	*	*

Table 1 Continued

Measurement Concept	Baseline		6 months (Post-intervention)	12 months	24 months	36 months
	Mother	Child	Child	Child	Child	Child
Smoking behaviour peers (Engels, Knibbe, De Vries, Drop, & Van Breukelen, 1999)	*	*	*	*	*	*
Parent-child relationship (NRI) (Furman & Buhrmester, 1985)	*	*	*	*	*	*
Alcohol use		*	*	*	*	*
Strength and Difficulty Questionnaire (SDQ) (Goodman, 1997)	*	*		*	*	*
Asthmatic symptoms (ISAAC) (Asher et al., 1995)	*	*		*	*	*
Programme evaluation and utilisation (Jackson & Dickinson, 2003, 2006)			*			

problems. Psychological problems are associated with problem behaviours like smoking (e.g., Crone & Reijneveld, 2007).

Statistical analyses

The main comparisons of study conditions with respect to the distribution of time until first instance of smoking will be based on survival analysis methods. All available data for participants who are randomised but lost to follow-up will be used in the survival analysis. This way, if a participant is not able to be located after the first year, for example, the data collected from the participant up to one year will be used in estimating the intervention effect and will contribute to the time trend estimates up to a year. Survival analysis is selected as the primary analysis in part because it easily incorporates censored observations. Logistic regression models will also be used to test how the intervention is related to susceptibility of smoking in originally abstinent children. Mplus analyses will be used to deal with missing data at the subsequent waves and to control for the clustered data (e.g., the fact that we randomise on school level) (see Kuntsche, Knibbe, Gmel, & Engels, 2005).

Time frame

The recruitment, inclusion, randomization of participants started at the end of 2008. The final follow-up measurement is planned for mid-2012. All data will be continuously collected, entered, and cleaned. Short-term results will be reported before the completion of the 36 months follow-up

Discussion

The present study protocol presents the design of a randomised controlled trial evaluating the effectiveness of a smoking prevention programme for 9 to 11 years old children. The intervention programme called 'Smoke-Free Kids' aims to prevent children from initiating smoking. It is hypothesised that, after three years of follow-up, children in the intervention condition will be less likely to initiate smoking, and that maternal communication about smoking topics, confidence in discussing smoking, and efficacy to prevent their children from smoking will increase compared to the control condition.

Strengths and limitations

An important first strength of Smoke-Free Kids programme is that the programme is theory-driven. Social Cognitive Theory (Bandura, 1986) and models of persuasive communication for attitude and behaviour change (Petty & Cacioppo, 1986) have been used to structure the intervention. Second, the programme is a home-based prevention programme, which means that parents and children can go through the activities on their own, in their leisure time, and are not obligated to engage in a complex, time-consuming programme. Third, this program focuses on children who have not initiated smoking yet. Strength of the study design is that it includes follow-up measurements at 6, 12, 24, and 36 months, which allows us to test the short and long-term effects of the intervention programme. Second, regarding the generalisability of the study results, if Smoke-Free Kids is effective, the programme can be easily implemented in the home setting and disseminated, for example, by primary schools, general practitioners, and school doctors. A limitation of the study is that the behaviour of the children and parents is based on self-reports. However, studies have shown that self-reported data of adolescents about their own smoking are generally reliable (Dolcini, Adler, & Ginsberg, 1996; Dolcini, Adler, Lee, & Bauman, 2003; Hunter, Webber, & Berenson, 1980).

Implications for practice

If the Smoke-Free Kids intervention programme is effective, it could be easily applied to daily life, which will facilitate implementation of the prevention

protocol. The programme's modular, self-help format allows flexibility as regards where, when, and how it is implemented. Although the present study will measure effects on individual children after delivering the modules to households, in the future, the programme could also be delivered to multiple families at the group-level using an alternative approach (e.g., at school), or it could be self-administered on a website that provides sequential access to the intervention modules. This is the reason that STIVORO (Dutch Institute for Smoking Prevention) and the Trimbos Institute (Netherlands Institute of Mental Health and Addiction) are actively involved. This all implies a strong potential of the programme to reach large populations. In addition, if the home-based prevention programme is effective, it can be developed for other risk taking behaviour like alcohol and drugs.

Conclusion

This study will evaluate a protocol for preventing smoking initiation in children. The results of this study will provide insights into the effectiveness of the Smoke-Free Kids intervention programme and the precursors of smoking initiation among children aged 9 to 11 year olds.

3

Long-term effects of a home-based smoking prevention programme on smoking initiation: A cluster randomised controlled trial

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Abstract

The aim of the study was to evaluate the long-term effects (i.e., 36 months) of the home-based smoking prevention programme 'Smoke-free Kids' on smoking initiation and test the potential moderating role of parental smoking, socioeconomic status (SES), and asthma. A cluster randomised controlled trial in 9-11 years old children and their mothers was used. Families were recruited from 418 elementary schools in the Netherlands. In 2008, 1,478 children and their mothers enrolled into the study. Inclusion criteria were a) mothers and children needed to read and speak Dutch and b) one child per household could participate. An independent statistician randomly allocated schools to the intervention or control condition using a 1:1 ratio (single blind): 728 children in the intervention and 750 in the control condition. Intention-to-treat analysis was performed on 1,398 non-smoking children at baseline (intervention: 684 and control: 714). In the intervention condition, mothers and children received five activity modules, including a communication sheet for mothers, by mail at four-week intervals and one booster module one year after baseline. The programme deals with anti-smoking socialisation strategies to assist parents in preventing their children from smoking. The control condition received a fact-based intervention only. Smoking initiation at 36 months follow-up (i.e., first instance of puffing on a cigarette) was the main study outcome. Results showed that in the intervention 10.8% of the children started smoking compared to 12.0% in the control condition. The difference between the two conditions was not significant (odds ratio = 0.90, 95% confidence interval = 0.63 - 1.27). No moderating effects of SES, parental smoking, and asthma were found. In conclusion no effects on the prevention of smoking initiation after 36 months were found. Perhaps, the programme was implemented with children that were too young. Programmes closer to the age of smoking onset should be tested.

Introduction

Smoking is the leading cause of preventable death, killing more than six million people each year (WHO, 2012). A major increase in smoking rates can be observed during adolescence. Therefore, preventing tobacco use among children is important, particularly because delaying the age of the first puff decreases risk of developing long, enduring smoking patterns (Chassin, Presson, Pitts, & Sherman, 2000).

Most smoking prevention programmes take place at school. The majority of these programmes show positive short-term effects while evidence on the long-term effects is not yet convincing (Flay, 2009; Thomas & Perera, 2006). A possible explanation is that most programmes take place during secondary school years. Previous research showed that particularly children who are transitioning from primary to secondary school (in the Netherlands children at age 12) are vulnerable to factors leading to smoking (Côté, Godin, & Gagné, 2004). Therefore, it is important to intervene with children before they form attitudes and beliefs about smoking and before they have to deal with smoking-related situations with peers.

Another explanation could be that school programmes generally disregard the role of parents (Glyn, 1989). Involving parents in smoking prevention may be crucial, as parents can affect their children's risk of smoking through parenting practices specifically aimed at smoking (Chassin et al., 2005). Parental anti-smoking socialisation consists of discussing smoking-related topics, setting rules not to smoke at home, establishing a non-smoking agreement, limiting the availability of cigarettes at home, and providing appropriate reactions regarding their child's smoking (Engels & Willemsen, 2004).

The 'Smoke-free Kids' programme developed in the U.S. is a successful smoking prevention program targeting parenting practices (Jackson & Dickinson, 2003; 2006). This home-based smoking intervention programme for parents and elementary school-aged children deals with anti-smoking socialisation strategies to assist parents in preventing their children from smoking (Jackson & Dickinson, 2003). In the U.S., this programme showed significant effects on smoking initiation after 36 months for children of smoking parents. In the intervention condition, 12% of children tried smoking compared to 19% in the control condition (odds ratio for smoking initiation in control condition 2.16, 95% confidence interval 1.39 to 3.37) (Jackson & Dickinson, 2006). In a later trial for children of non-smoking parents, no programme effects were found (Jackson & Dickinson, 2011).

It is important to replicate the U.S. trial (Jackson & Dickinson, 2003; 2006) in other Western countries before implementing the Smoke-free Kids intervention programme. The present study evaluated the long-term effects (i.e., 36 months) of an adapted intervention on smoking initiation using a cluster randomised controlled trial. We also tested whether the programme effects would differ by

parental smoking and socioeconomic status (SES) as well as for children with asthmatic symptoms. Previous research showed that children of smoking parents are more likely to start smoking compared to children of non-smoking parents (Leonardi-Bee, Jere, & Britton, 2010). Children from low SES families are more likely to start smoking compared to children from higher SES (Hanson & Chen, 2007), and children with asthmatic symptoms are more likely to start smoking compared to their non-asthmatic peers (Mcleish & Zvolensky, 2010).

Methods

Procedure and participants

Baseline to 36 months data were used. The programme is based on the U.S. version (Jackson & Dickinson, 2003; 2006) and has the same objective, although the content and layout of the Dutch version were modified (for more information: trial protocol in Hiemstra et al., 2009). Families were recruited predominantly via primary schools (i.e., active informed consent) in the Netherlands. Specifically, school boards were asked to distribute letters to parents via their children. Participation was possible if the following inclusion criteria were met: children had to be 9 to 11 years old, adults had to be mothers or female guardians, both mother and child had to be able to read and speak Dutch, and only one child per household was eligible to participate. A total of 1,478 mothers and children were eligible, including a subsample of approximately 200 children with asthmatic symptoms (Hiemstra et al., 2009).

The data were collected using telephone interviews or questionnaires at all waves. Trained Master students administered the telephone interviews with mother and child. Prior to the interview, mothers and children were assured privacy and confidentiality. Questionnaires were sent to mothers and children by mail and returned in enclosed envelopes. The baseline assessment of mother and child were conducted between December 2008 and June 2009. From February 2008 to September 2009, the intervention was mailed to participants in both conditions at four-week intervals. The follow-up measures with children were conducted at 6, 12, 24, and 36 months after baseline via telephone or mail. The 36 months assessment was conducted between December 2011 and June 2012. Each family received €10 for completing all measurements. In addition, five travellers' checks of €1000 were raffled among these families. The ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen approved the trial protocol registered in the Dutch Trial Register (NTR1465) (www.trialregister.nl).

Sample size

A power calculation indicated that 428 children were needed per condition to detect a 10% difference between the control and intervention condition in smoking initiation among 12 to 14 years old adolescents (i.e., 36-month follow-up) using a two-tailed test with $\alpha = 0.05$ and power $(1-\beta) = 0.80$. We accounted for data clustering and imputations in case of missing data. Therefore, a minimum of 856 children and mothers were needed to detect significant differences in smoking initiation.

Randomisation and masking

An independent statistician randomly allocated schools to the intervention or control condition (allocation ratio (1:1)). To avoid contamination between the two conditions, all children from one school were allocated to the same condition. Based on the baseline assessment, children were stratified by the number of asthmatic children. Participants were blind to randomization (i.e., single-blind trial).

Intervention

In the intervention condition, families received five printed activity modules by mail at four-week intervals. These modules included different assignments to gradually increase parental skills and comfort in communicating with children about smoking, addiction, and expectations regarding abstinence. Each module included structured interactions, such as games and scripted role-plays, to engage mother and child simultaneously. Each module intervened on different socialisation constructs (for more details see Hiemstra et al, 2009). All five activity modules included a communication sheet for mothers, providing background information about the subjects discussed in the modules and communication tips for mothers. Finally, a booster module was delivered 12-months post-baseline.

A fact-based programme was developed for the control condition because it would be unethical to recruit families for an intervention programme while not offering them a program afterwards. The fact sheets provided information on youth smoking and directed parents' attention towards macro-level variables relevant to youth smoking but not targeted by the intervention version (e.g., smoking prevalence among youths, ingredients of cigarettes, tobacco legislation). Mothers received the programme along with the intervention condition but did not receive a booster.

Outcome measures

Smoking initiation Smoking behaviour of children was assessed at each wave using a well-established measure (Kremers, Mudde, & De Vries, 2001). Children were asked to report, on a nine-point scale, which stage of smoking applied to

them. Response categories ranged from 1 = I have never smoked, not even one puff to 9 = I smoke at least once a day. This was recoded to 0 = never smoker and 1 = smoker (i.e., any experience with lifetime smoking) (Harakeh, Scholte, De Vries, & Engels, 2005). If children reported irregular smoking behaviour over time and tried smoking at one of the different time points, we indicated them as smoker. The percentage of children with irregular smoking responses was 0% at 6 months, 0.4% at 12 months, 1.2% at 24 months, and 2.3% at 36 months.

Parental smoking was assessed on an eight-point scale ranging from 1 = never smoked, not even a puff to 8 = I smoked at least once a day by asking mothers about their and their partners' smoking at baseline (Harakeh et al., 2005). Based on their lifetime smoking status, both parents were classified to three groups, never, former, and current smoker. Six levels were constructed by combining responses of both parents.

Socioeconomic status (SES) was measured using the educational level of the parents at baseline. Educational level was assessed on a 9-point scale ranging from 1 = primary school to 9 = university. Parents were allocated to lower, middle, or higher education. The educational level of parents was combined to 0 = both parents follow lower education or one lower and one middle education; 1 = both parents followed middle education or one followed lower and one followed higher education; 2 = both parents followed higher education or one followed middle and one followed higher education (Ringlever, Otten, Van Schayck, & Engels, 2011).

Asthma. Children were categorised as having asthma if mothers responded 'yes' to the two following questions at baseline: 'Does your child ever have had asthma?' and 'Did a physician confirm that your child has asthma' (Ringlever et al., 2011).

Statistical analyses

We examined the differences between the intervention and control conditions in covariates (i.e., gender, age, ethnicity child and mother, smoking behaviour parents, SES, and asthma) and smoking initiation to determine whether randomisation was successful. Loss to follow-up was examined with logistic attrition analyses using 36 months follow-up as outcome and covariates, smoking initiation, and condition as predictors.

Programme effects were analysed (SPSS version 19) according to the intention-to-treat principle (n = 1398) and the completers-only framework (n = 1238). For the intention-to-treat analysis, missing data were handled using multiple imputations implemented in SPSS. To impute the missing values, all model variables were used as predictors. In addition, smoking-related cognitions (i.e., attitude, self-efficacy, social norm of mother and friends) at baseline were used as additional predictors of smoking initiation because they are strongly related to smoking initiation (e.g.,

Theory of Planned Behaviour). Using more related predictor variables and a larger number of imputations allows more accurate standard errors to be computed (Donders, Van der Heijden, Stijnen, & Moons, 2006). The predictive mean matching method (a variant of linear regression that matches imputed values computed by regression model to the closest observed value) was used to impute continuous variables and logistic regression was used for categorical variables. In total, 20 datasets were imputed, and the results were combined by averaging these effects (i.e., pooling).

Examining the effects of the programme on smoking initiation, we first looked univariately using χ^2 tests to examine mean differences between conditions. Second, multiple regression analyses were used to look at differences between the two conditions controlling for covariates. In the first step, we controlled for asthma and gender because we found significant differences at baseline. In the second step, we tested for the effects of the Smoke-free Kids programme. In the third step, we tested the moderating role of parental smoking, SES, and asthma on the association between the programme and smoking initiation separately.

Since children from the same schools may share common attitudes and behaviours (i.e., clustering), intraclass correlations (ICC) were calculated to determine the effects of school clustering. The ICC for smoking initiation was zero, indicating that the variance could not be explained by a school effect. Therefore, we ran the analyses without adjustment.

Results

Figure 1 shows the trial profile. To recruit participants, we sent a request to 1,347 schools to distribute a recruitment letter to all children aged 9 to 11. After calling the schools, 630 (47%) agreed to participate, 497 (37%) declined to participate, 220 (16%) did not need to be contacted as we already had enough participants. From 630 participating schools, 1490 children and mothers were recruited. Of these, 12 families provided baseline measurements only for mothers, thus they were excluded. Overall, 728 children were randomised in the intervention condition and 750 children in the control condition. Children who had already puffed a cigarette at baseline (n = 80, 5.4%) were included in the programme but excluded from analysis, leaving 1398 never-smoking children eligible for the analyses. The retention rates were high, with 1328 children (95%) completing the 6 month, 1284 children (91.8%) the 12 month, 1255 children (89.8%) the 24 month, and 1238 children (88.6%) the 36 month follow-up. Attrition from baseline to 36 month follow-up was 11.4%. Logistic regression showed that children in the intervention condition (15.4%) were more likely to drop out compared with children in the

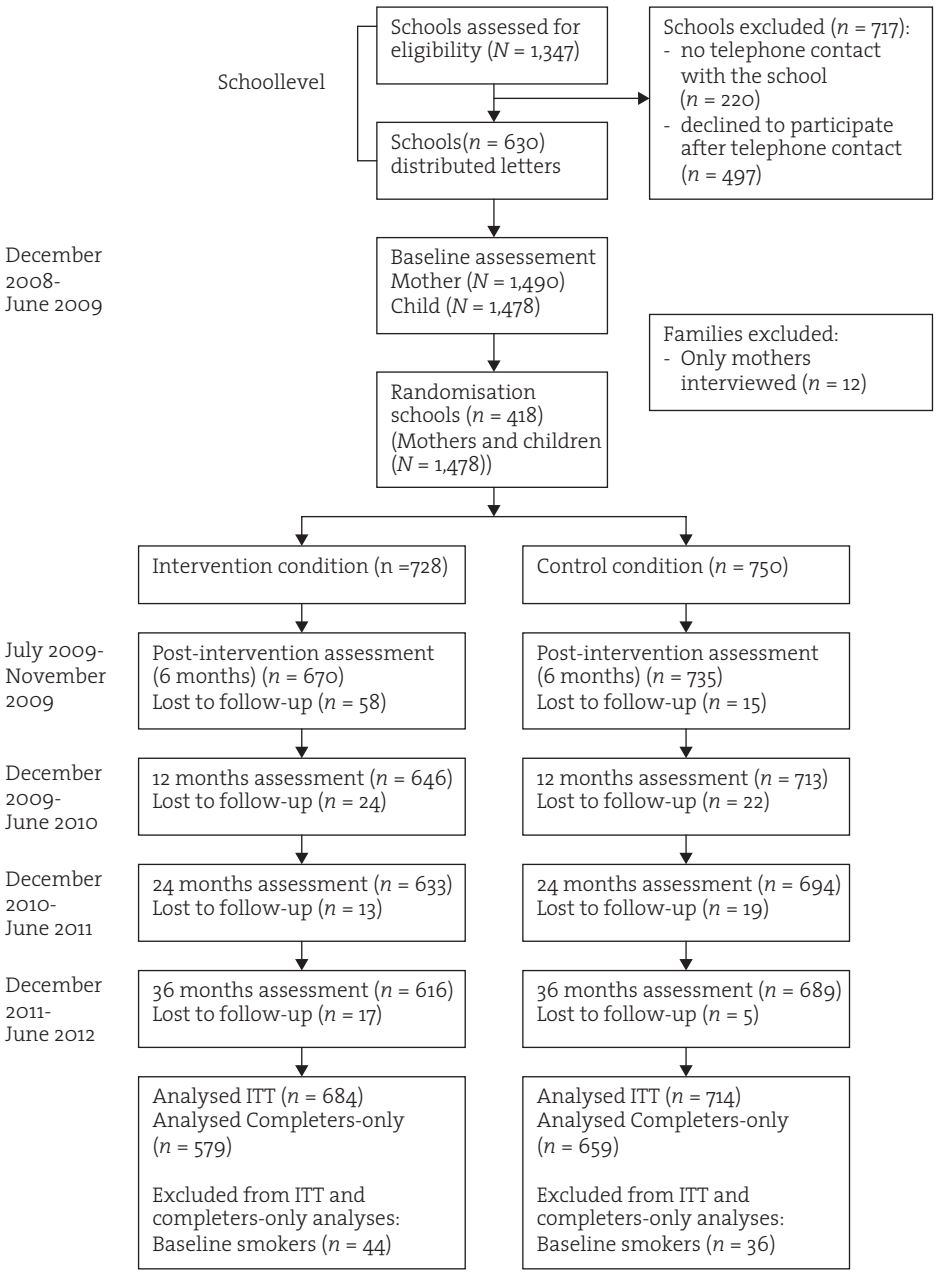

Figure 1 Flow of participants. ITT = Intention-to-treat analysis

Table 1 Baseline characteristics of Smoke-free Kids. Values are numbers (percentages) unless stated otherwise

Characteristics	Intervention (n = 684)	Control (n = 714)	Total (N = 1,398)	Sign. diff. I and C[+]
Age child (mean (SD))	10.13 (0.78)	10.08 (0.77)	10.10 (0.78)	n.s.
Gender				
Male	297 (43.4)	366 (51.3)	663 (47.4)	p = 0.002
Female	387 (56.6)	348 (48.7)	735 (52.6)	
Smoking status parents				
Both never smokers	150 (22.3)	167 (23.9)	317 (23.1)	n.s.
One former and one never smoker	173 (25.7)	160 (22.9)	333 (24.3)	
Both former smokers	112 (16.6)	117 (16.7)	229 (16.7)	
One current and one never smoker	83 (12.3)	93 (13.3)	176 (12.8)	
One current and one former smoker	78 (11.6)	81 (11.6)	159 (11.6)	
Both current smoker	77 (11.4)	81 (11.6)	158 (11.5)	
Ethnicity mother				
Dutch	673 (98.4)	701 (98.2)	1374 (98.3)	n.s.
Other	11 (1.6)	13 (1.8)	24 (1.7)	
Ethnicity child				
Dutch	675 (98.7)	697 (97.8)	1372 (98.2)	n.s.
Other	9 (1.3)	16 (2.2)	25 (1.8)	
Socioeconomic status				n.s.
Low	165 (24.9)	177 (25.5)	342 (25.2)	
Middle	176 (26.5)	185 (26.7)	361 (26.6)	
High	322 (48.6)	332 (47.8)	654 (48.2)	
Asthma				
No	573 (83.9)	624 (87.8)	1197 (85.9)	p = 0.02
Yes	110 (16.1)	87 (12.2)	197 (14.1)	

Note. n.s. = $p > .05$. [+]Logistic regression analyses were used to compare the intervention (I) with the control condition (C).

control condition (7.7%) (*OR* = 2.56, *95% CI* = 1.77 - 3.70, $p < .001$). Children of one current and one former smoking parent were more likely to drop out compared to children from two never smoking parents (*OR* = 1.80, *95% CI* = 1.02 - 3.20, $p = .04$).

Table 1 shows the baseline characteristics of the children and mothers by study condition. Significant differences between the intervention and control condition were found for gender (*OR* = 1.42, *95% CI* = 1.14 - 1.77, $p = .002$) and asthma (*OR* = 1.46, *95% CI* = 1.06 - 2.01, $p = .02$)

At 36 months, 10.8% (63/583) in the intervention condition and 12.0% (79/661) in the control condition tried smoking (Table 2). Chi-square difference test did not show a significant mean difference between the two conditions.

Table 2 Smoking initiators from 6 months to 36 months follow-up measurement. Values are numbers (percentage) unless stated otherwise

	Intervention condition	Control Condition	Total	P value*
6 months follow-up	5 (0.8)	13 (1.8)	18 (1.4)	0.10
12 months follow-up	10 (1.6)	18 (2.7)	28 (2.2)	0.22
24 months follow-up	24 (4.0)	37 (5.6)	61 (4.8)	0.20
36 months follow-up	63 (10.8)	79 (12.0)	142 (11.4)	0.53

Note. * Chi-square differences test was used to examine the significant difference between the intervention and control condition

Table 3 shows the results of the intervention effect controlling for asthma and gender. No significant effects of condition were found for smoking initiation (*OR* = 0.90, *95% CI* = 0.63 - 1.27, $p = .54$) for the intention-to-treat analysis. The results were replicated in the completers-only analysis (*OR* = 0.90, *95% CI* = 0.64 - 1.29, $p = .58$). No significant interaction effects were found when controlling for parental smoking behaviour, SES, and asthma, indicating that the associations between the condition and smoking initiation were the same (univariate results are available on request from the first author). To assess implementation integrity of the programme, children completed participation records at 6-month follow-up. Of the families participating in the intervention, 81% (495/613) of the children read and completed at least 3 of 5 activity modules. Of the control families, 73% (485/666) read and completed 3 of 5 fact sheets.

Table 3 Logistic regression analyses of the effect of the intervention on smoking initiation at 36 months follow-up

	Variable	Odds ratio (95% CI)	P value
Intention-to-treat (*n* = 1,398)			
	Condition	0.90 (0.63 - 1.27)	0.54
	Asthma	0.93 (0.56 - 1.54)	0.78
	Gender	0.90 (0.62 - 1.27)	0.52
Completers only (*n* = 1,238)			
	Condition	0.90 (0.64 - 1.29)	0.58
	Asthma	0.90 (0.54 - 1.51)	0.69
	Gender	0.88 (0.62 - 1.26)	0.49

Note. Condition: 0 = control condition and 1 = intervention condition, CI = Confidence Interval.

Discussion

The present study evaluated the long-term effects (i.e., 36 months) of a home-based smoking prevention programme called 'Smoke-free Kids' on smoking initiation of children using a cluster randomised controlled trial. Contrary to the original trial for smoking parents (Jackson & Dickinson, 2003;2006), we found non-significant effects of the programme on the smoking initiation rates of children in the intervention versus the control condition (10.8% vs. 12.0%). Our results are comparable with a later trial conducted with non-smoking parents, which also reported no programme effects (Jackson & Dickinson, 2011). Although, we tested the moderating role of parental smoking, we did not find difference in effects between smoking and non-smoking parents or moderating role of socioeconomic status (SES) and asthma.

There are different explanations for the absence of programme effects on smoking initiation. First, it could be that the prevention program for the children was too early. The program targeted young, 9-11 years old, children, while most children start smoking halfway through secondary school (i.e., age 14-16). Prevention in elementary aged children was too far from the actual age of onset. Recent studies on smoking prevention during elementary school showed similar results, showing no effects on smoking onset by prevention at elementary age (Crone, Spruijt, Dijkstra, Willemsen, & Paulussen, 2011; Elek, Wagstaff, & Hecht, 2010; Hopfer et al., 2010; Marsiglia, Kulis, Yabiku, Niere, & Coleman, 2011; Wang et

al., 2011). More specifically, a Cochrane review on the effectiveness of family based programme in children was published in 2007 (Thomas, Baker, & Lorenzetti, 2007). From this review no firm conclusions could be drawn because of various quality levels of the executed RCT's. More additional research is needed (Thomas, Baker, & Lorenzetti, 2007). On the other hand, different elementary school-based prevention programmes are performed. Another Cochrane review examined the effects of school-based smoking prevention programmes on children and adolescents, however no distinction between prevention at elementary and secondary school was made. Therefore, no conclusion could be drawn either (Thomas & Perera, 2006). In 2010, Hopfer and colleagues (2010) reviewed substance use prevention in elementary schools. They found that substance use programmes had no effect on the prevention of initiation of alcohol, tobacco, and other drugs during elementary school (Hopfer et al., 2010). Although, initiation was reported only in 4 of the 24 studies, and no distinction between different substance uses could be made. Recently, more studies examined the effectiveness of smoking prevention programmes during elementary school. Most of these studies found no effects (Crone et al., 2011; Marsiglia et al., 2011; Wang et al., 2011) or negative effects (Elek et al., 2010) on smoking initiation. Marsiglia et al. (2011) found no effect of substance use programmes conducted during elementary school on smoking, but they found a positive effect of the programmes implemented during middle school. Crone et al. (2011) found a delayed effect during secondary school. Nevertheless, one study found a protective effect on smoking initiation during elementary school (O'neill, Clark, & Jones, 2010). In summary, above-mentioned studies indicated that it might be too early to conduct smoking prevention during elementary school age, as it is unlikely to prevent children from smoking later in life. More research closer to the age of onset is necessary.

A second explanation could be that the intervention programme may have a delayed effect. At the last wave, the absolute difference in smoking between intervention and control condition was 1.2%. This difference could increase and give a delayed effect later during secondary school when more children start smoking (Crone et al., 2011). Third, a robust placebo effect could be present. Mothers and children in the control condition also elaborated on smoking matters after receiving the fact-sheets. The high implementation rates in the control condition (73%) relative to the intervention condition (81%) support this assumption. Therefore, in future studies, it would be better to use a passive control condition (i.e., standard care condition) next to an active control condition (Kinnunen et al., 2008). Fourth, low smoking rates could have affected the programme effects. A reason for the low smoking rates overall could be the recent national decline in youth smoking (Stivoro, 2012). Another reason could be a measurement effect, implying that answering questions about attitude, intentions, and smoking

regularly leads to self-monitoring and subsequent behavioural regulation. Completing questionnaire items increases the acquisition of smoking-related cognitions, which might increase the likelihood of children to act in line with these cognitions (Morwits & Fitzsimons, 2004). Future research could test this by varying the number of assessments during a study. Fifth, the intervention programme should be better monitored in families. During the intervention, parents and children completed the programme independently. Thomas and colleagues (2007) showed in a review that the adherence of implementation related to the positive outcomes of a family-based programme. Minimal intensity programmes could not be strong enough to obtain behaviour change.

Despite the strengths of this study, such as the large sample size, low attrition rates, and relatively large time interval, the present study has some limitations. First, data were collected through self-reports. Participants may have provided socially desirable responses or may have answered erroneously. Previous research has shown that self-report data about smoking are generally reliable (Dolcini, Adler, Lee, & Bauman, 2003). Further, for practical reasons, the programme focused on mothers instead of both parents. In future research, fathers should be considered when investigating the effect of the programme. Lastly, generalisability to the larger population is limited since we used a volunteer sample. The findings are mainly generalisable to participants who are interested in anti-smoking socialisation.

Conclusion and implications

The present study showed no effects of the home-based smoking prevention programme 'Smoke-free Kids' on smoking initiation during preadolescence. The findings indicate the relevance of smoking prevention programmes closer to the age of onset. Future studies should test prevention efforts in an older sample, just before children start smoking. So far, smoking prevention during elementary age is not recommended

4

Engaging parents of children with and without asthma in smoking-specific parenting: results from a three year – Randomised Controlled Trial evaluation

Submitted as:
Ringlever, L., Hiemstra, M., Otten, R., Van Schayck, O. C. P., & Engels, R. C. M. E. (2015). Engaging parents of children with and without asthma in smoking-specific parenting: results from a three year – Randomised Controlled Trial evaluation.

Abstract

The present study evaluated long-term effects of a home-based smoking prevention programme targeting smoking-specific parenting in Dutch families with children with and without asthma. This special focus on asthma is warranted because adolescents with asthma smoke as much, or even more, as their peers without asthma. Smoking-specific parenting has been found to prevent offspring smoking. In this study, we aimed to test whether the effects of a prevention programme on smoking-specific parenting were different in families with and without a child with asthma. In total, 1,398 non-smoking children with a mean age of 10.1 participated, of which 197 (14.1%) were diagnosed with asthma. During randomization into an intervention and control condition we stratified for asthma. Families were blinded to group assignment. The intervention group (n = 684) received booklets with assignments that actively encouraged parents to engage in smoking-specific parenting strategies, such as maintaining a smoke-free home. Control families (n = 714) received booklets containing basic information about youth smoking. Latent growth curve modelling was used to calculate intercepts and slopes to examine whether there was change in the different parenting aspects over the study period. Regression analyses were used to examine whether a possible change was different for intervention and control condition families with and without a child with asthma. Baseline engagement in smoking-specific parenting appeared to be high. For those smoking-specific parenting aspects that changed over time, families in the intervention and control condition increased similarly. Also, no interaction effects with child asthma status were found; families with a child with asthma did not engage in parenting at higher levels due to the intervention programme than parents of non-asthmatic children. This prevention programme did not affect smoking-specific parenting in the Netherlands and did not work differently for families with and without a child with asthma. As there are hardly any effective smoking prevention programmes available for adolescents with asthma, future prevention research could focus on other risk factors (e.g., peer smoking) for smoking initiation among adolescents with asthma.

Introduction

There is substantial evidence showing that adolescents with asthma are as likely or even more likely to engage in smoking, as compared to their peers without asthma (Mcleish & Zvolensky, 2010). For adolescents with asthma, specific health consequences associated with smoking include less responsiveness to asthma medication, and the potential to develop chronic obstructive pulmonary disease (COPD) in the long run (Thomson, Chaudhuri, & Livingston, 2004). To prevent youth from ever smoking, it is essential to intervene with risk factors that are related to the onset of smoking. Risk factors for smoking onset among young children have been studied widely and involve demographic, peer, family, and intrapersonal influences (e.g., Best, Thomson, Santi, Smith & Brown, 1998; Conrad, Flay, & Hill, 1992; Tyas & Pederson, 1998). Research specifically focussing on risk factors for youth with asthma showed that adolescents with asthma share similar risk factors for smoking (Zbikowski, Klesges, Robinson, & Alfano, 2002), among which family smoking and parental approval of smoking. Prevention programmes could target these parental factors as the involvement of parents in smoking prevention programmes for children has been suggested as an effective strategy (Thomas, Baker, & Lorenzetti, 2007; Petrie, Bunn, & Byrne, 2007). The present study examined the effectiveness of a smoking prevention programme targeting smoking-specific parenting strategies used by parents of non-smoking children with and without asthma.

Smoking-specific parenting

Smoking-specific parenting -- interchangeably also referred to as antismoking socialisation -- concerns all parenting strategies and interactions influencing the development of children's cognitions and norms against smoking (Jackson & Dickinson, 2003). In the last decade the concept of smoking-specific parenting has received more attention in the literature [e.g., Chassin, Presson, Todd, Rose, & Sherman, 1998; Ennett, Bauman, Foshee, Pemberton, & Hicks, 2001; Jackson & Dickinson, 2006; Jackson & Henriksen, 1997; Harakeh, Scholte, De Vries, & Engels, 2005; Otten, Engels, & Van den Eijnden, 2007) as specific parenting involves practices by parents that are most observable (Jackson & Dickinson, 2009) and therefore might be easier to modify than the more general parenting style or goals. Examples of smoking-specific parenting include communicating about smoking, setting house rules, monitoring, and carrying out norms about smoking. Associations between antismoking socialisation and adolescent smoking have been frequently found (e.g., Harakeh et al., 2005; Jackson & Henriksen, 1997). However, hardly any studies concentrated on smoking-specific parenting in families with a child with asthma. Otten et al. (2007) examined five different

aspects of smoking-specific parenting and found one of these strategies to differ between the asthma and non-asthma subgroups; adolescents with asthma reported their parents to talk more often about non-smoking. Other studies found no difference between families with and without a child with asthma for parental approval of smoking (Vázquez-Rodríguez et al., 2012; Zbikowski et al., 2002), another aspect of smoking-specific parenting. Although smoking rates were somewhat higher in adolescents with asthma, the association between parental disapproval and adolescent smoking was similar for both adolescents with and without asthma (Vázquez-Rodríguez, et al., 2012).

Keeping in mind that only few studies focussed on smoking-specific parenting and asthma, generally the level of smoking-specific parenting was similar in families with or without a child with asthma. Further, it is unknown whether it is effective to encourage parents of children with asthma to engage in smoking-specific parenting. It is conceivable that parents who have children with asthma are more willing to complete a family-based smoking prevention programme when offered in order to prevent their offspring smoking. Therefore, the aim of the present study is to evaluate whether the Randomised Controlled Trial (RCT) 'Smoke-Free Kids' activated parents' antismoking socialisation efforts. The Dutch Smoke-Free Kids is based on the original version found to be effective among smoking parents in the United States (Jackson & Dickinson, 2006). Although we did not find long-term effects after 24 and 36 months on smoking onset (Hiemstra et al., 2014), short-term results on hypothesised mechanisms were found in the Netherlands as well (Hiemstra, Ringlever, Otten, Van Schayck, & Engels, 2013). Therefore, we aim to test what the effects of the programme are on the development of smoking-specific parenting practices over the course of three years. More specifically, we aim to test whether the effects of the programme differs between families with and without a child with asthma. Smoke-Free Kids is not in particular designed for parents of children with asthma, however, because of the troubling finding that children with asthma often engage in smoking irrespective of the increased associated health risks, it is important to evaluate this family-based smoking prevention programme by comparing the effectiveness on parenting between families with and without a child with asthma.

Method

Procedure

Inclusion criteria for the Smoke-Free Kids trial in the Netherlands were (a) only one child per household, aged between 9 and 11 years old (b) the participating parent had to be the mother or the female guardian and (c) both mother and child

had to be able to read and speak Dutch. The main recruitment strategy was the distribution of recruitment letters via primary schools. For the remaining, health professionals were asked to place information posters and flyers in their waiting rooms and announcements were placed in local newspapers and health related websites. After baseline assessment participants were randomised. To avoid contamination between the intervention and the control conditions, randomization took place at school level. An independent statistician performed the randomization and stratified for school and asthma. For more details about the recruitment, see our RCT-registration (Dutch Trial Register NTR1465) and Hiemstra et al. (2009). The study was approved by the ethical committee of the Faculty of Social Sciences at Radboud University Nijmegen.

Intervention

The primary goal of the Smoke-Free Kids intervention was to prevent – or postpone- the first puff of a cigarette. The results on adolescent smoking behaviour after three years were reported elsewhere (Hiemstra et al., 2014). It was hypothesised that prevention of initiation would be achieved via mechanisms of increasing quality and/or frequency of smoking-specific parenting practices. The Smoke-Free Kids programme consisted of five activity guides, mailed to the families every month, beginning one month after baseline assessment. These activity guides were designed to increase involvement of mothers in smoking-specific parenting by actively discussing the assignments with their child. Also, specific assignments for children were included and for mothers every guide included a communication tip-sheet with information how to communicate in a constructive manner with the child in general, as well as how to communicate about smoking-specific topics. Families in the control condition received booklets per post as well. These booklets had the same graphic design, but they contained no explicit encouragements to actively go through the booklets together with the child. Merely, the booklets contained basic information about smoking with no parenting or communication tips or whatsoever. Six months after the baseline measurement, a post-intervention measurement took place. On the post-intervention follow-up children reported moderate to high intervention compliances in both conditions: in the intervention condition 81 % had seen and read at least 3 out of 5 booklets, in the control condition this was 73 %. One year after baseline, the families in the intervention condition received a booster module to reinforce the most important skills of the intervention programme. Remaining follow-ups were at 12, 24, and 36 months after baseline and all follow-up measurements only involved child reports. Figure 1 provides the completion rates for each measurement. As a reward, each family received 10 euro's and five traveler's cheques were raffled. In between measurements, all children received little presents to thank them for participating.

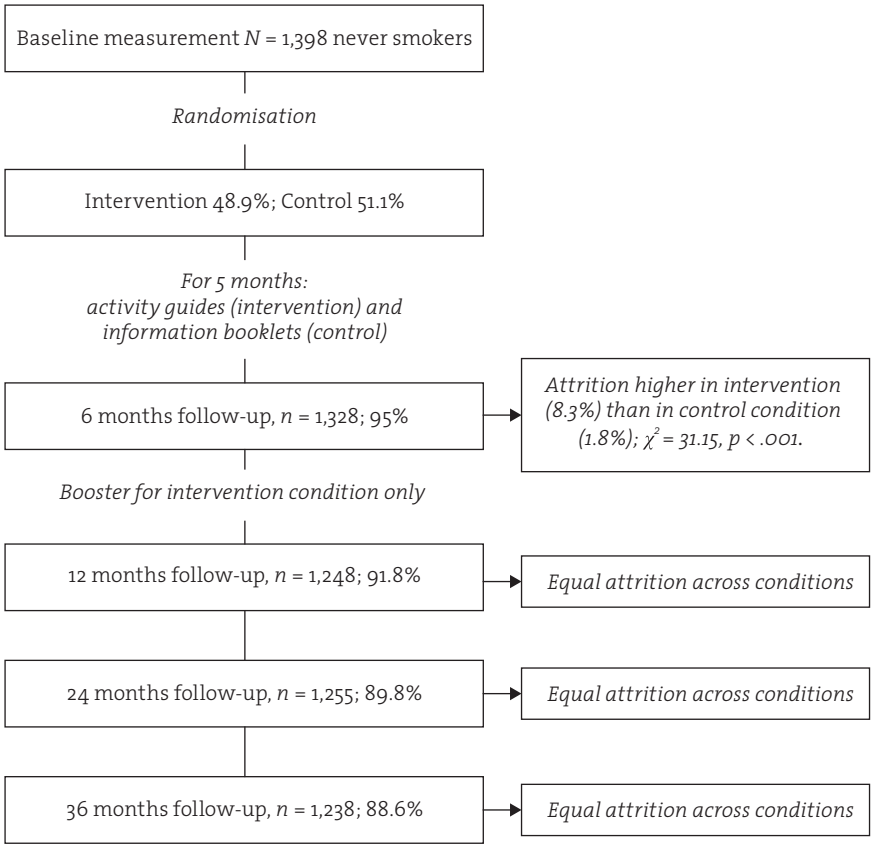

Figure 1 Flow chart with number and percentage of children providing data during each data collection point

Participants

Power calculations indicated that a minimum of 856 families was necessary to evaluate the Smoke-Free Kids trial in the Netherlands (Hiemstra et al., 2009). To examine whether the effects of Smoke-Free Kids were different for children with asthma as compared to children without asthma, a required minimum of 200 children with asthma or asthma symptoms was estimated. Eventually, the study was over-enrolled with 1,478 mothers and children providing baseline data. At baseline 80 children (5.4 %) reported to have ever smoked a puff of a cigarette and this percentage was higher among children with asthma (Ringlever, Otten, Van Schayck, & Engels, 2012a). As smoking initiation was the primary outcome of

Smoke-Free Kids to prevent, these children did participate in the programme and follow-ups but they were excluded from all analyses evaluating the effectiveness of Smoke-Free Kids. Therefore, 1,398 mothers and their children participated in this study. The intervention condition comprised of more girls (52.7%) than the control condition (47.3%, $\chi^2(1,1398) = 8.61$, $p = .003$) and also included more children with asthma (16.1%) than the control condition (12.2%, $\chi^2(1,1394) = 4.30$, $p = .04$). Children were aged between 8 and 12 years old at baseline measurement ($M = 10.11$, $SD = .79$).

Measures

Covariates were child's age and gender, socio-economic status (SES) and parental smoking. SES was measured with baseline reports of mother about the educational levels of father and mother separately (lower-, middle-, higher-educated). For parental smoking, children reported at baseline whether their father or mother currently smoked. A combined variable was created with three categories (both parents non-daily smokers; one parent daily smoker; both parents daily smokers) (Otten, Engels, & Van den Eijnden, 2007).

Asthma Items from the parent version of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire were used to screen for asthma (Asher et al., 1995; Jenkins et al., 1996). Mothers indicated whether their child ever had asthma and whether asthma was ever diagnosed by a physician. Only if both answers were positive, these children were categorised as having asthma. Four mothers indicated their child to have asthma, but did not indicate that asthma was diagnosed by a physician. Therefore, these 4 families were not included in the analyses.

Smoking-specific parenting strategies

Frequency of communication Frequency of smoking-specific communication between mother and child was measured with seven items (e.g., during the last 12 months, how often did your mother talk to you about how to resist peer pressure to use tobacco use?) (Ennett et al., 2001; Harakeh et al., 2005). Response options were 1= never, 2 = sometimes, or 3 = a lot. Higher mean scores on this scale represent a higher frequency of communication between mother and child. Alpha's were .79, .77, .82, .81 and .79 respectively.

Quality of communication Quality of smoking-specific communication between mother and child was measured with six items [11]. An example item is "My mother and I are interested in each other's opinion about smoking". Children could respond whether these statements were 1 = not true, 2 = sometimes true, or 3 = true. Higher mean scores on this scale represent a higher quality of communication between mother and child. Cronbach's alpha's were .64, .65, .68, .66 and .71 for the subsequent time points.

The following smoking-specific parenting concepts concern different rules and perceptions involving strategies that parents can use to prevent their children from smoking. All are measured by separate items.

Agreement assessed whether children had a non-smoking agreement with their parents (1 = no, 2 = yes).

Availability assessed how often cigarettes were available for children in their homes (1 = all the time, 2 = sometimes, 3 = never).

Influence inquired whether the child thinks his/her mother can have influence on their smoking behaviour (1 = totally disagree, 2 = disagree, 3 = agree, 4 = totally agree).

House rule inside concerns the rule that only adults are allowed to smoke at home, not children (1 = not true, 2 = sometimes true, 3 = true).

House rule outside assessed whether smoking is only allowed outside (1 = not true, 2 = sometimes true, 3 = true).

Conflict measured the child's perception that his/her mother would be angry as a reaction to smoking behaviour by the child (1 = not true, 2 = maybe, 3 = true).

Disappointment measured the child's perception that his/her mother would be disappointed as a reaction to smoking behaviour by the child (1 = not true, 2 = maybe, 3 = true).

Withdrawal measured the child's perception that his/her mother would have no difficulty with his/her smoking when she found out her child would be smoking (1 = not true, 2 = maybe, 3 = true).

Statistical analysis

First, descriptive and attrition findings are provided. Second, development of the different anti-smoking parenting concepts was modelled by estimating separate latent growth curves. Latent growth curve modeling permits to capture not only the initial levels of individuals at the beginning of a developmental period, but also individual changes over a developmental period (Muthén & Muthén, 1998-2006). In the present study, intercepts represented initial levels of a specific parenting construct while the slopes represented the rates of change in the same constructs. Mplus provides both the means and the variances of the intercept and the slope. If the slope growth factor mean is significant, this means that it is significantly different from zero, which indicates development over time on average. If the slope growth factor variance is significant, this indicates that not all individuals grow at the same rate, but that there is significant variability in their growth rates. For the purpose of this study, we aimed to establish whether there was change over time, and whether this change could be predicted by condition or asthma. Those parenting concepts that showed significant growth over time were included in the next step. In that step, we tested whether the

different growth curves could be predicted by regressing the intercepts and the slopes one by one on the condition (i.e., intervention, control) and on asthma status, while controlling for the aforementioned set of covariates. In a final step, we examined whether the effects were different for adolescents with and without asthma by including an interaction term. As we tested many interactions, we took a more conservative approach and used a significance level of $p < .01$. The Satorra-Bentler Scaled Chi-Square difference test was used to test model comparisons (Satorra & Bentler, 2001). To determine model fit we used the comparative fit index (CFI, critical value ffl .90) (Bentler & Bonett, 1980), the Tucker Lewis Index (TLI, critical value ffl .90) (Bentler, 1990) and the root mean squared estimate of approximation (RMSEA, critical value ffi .08) (Browne & Cudeck, 1993).

Results

Descriptive analyses

The attrition rate at final follow-up was 11.4 % (Figure 1). Dropouts did not differ from those still participating after 36 months on age, gender or asthma status. Dropouts were more often children from lower SES families (dropout increased from 8.0 % among higher-educated mothers to 16.7% among lower educated mothers, $\chi^2(1,1470) = 14.39$, $p < .001$, and from 9.2 % to 13.6 % for paternal education, $\chi^2(1,1437) = 5.65$, $p = .059$). Less children dropped out who had two non-smoking parents (9.7%) than children with one (14.3 %) or two smoking parents (18.1 %, $\chi^2(1,1478) = 12.26$, $p = .002$). Finally, more children from the intervention condition than from the control condition dropped out (15.4% versus 8.1%, $\chi^2(1,1478) = 18.80$, $p < .001$). More detailed analyses showed that this difference appeared directly after offering the intervention material to the families (Figure 1).

More boys (17.6 %) than girls (11.0 %) ever had asthma ($\chi^2(1,1394) = 12.25$, $p < .001$) and children with asthma were slightly older than their peers without asthma (*mean age* 10.2 versus 10.1 years, (t (1390) = -2.236, $p = .04$). There were no differences in SES or parental smoking.

Table 1 provides the means (SD) for all smoking-specific parenting measures at baseline. Children with asthma only differed in their reports on parenting with regard to a higher reported frequency of communication than their peers without asthma.

Table 1 Baseline means for smoking-specific parenting measures, displayed by asthma status and total sample

	No Asthma (*n* =1,197)	**Asthma (*n*=197)**	**Total (*N*=1,394)**	**Significant difference No asthma/asthma**
	Mean (SD)	Mean (SD)	Mean (SD)	*p*-value
Agreement	1.21 (.41)	1.22 (.42)	1.21 (.41)	.66
Availability	2.53 (.75)	2.62 (.69)	2.55 (.74)	.09
Influence	3.32 (.74)	3.24 (.80)	3.31 (.75)	.22
House rule inside	2.08 (.90)	2.01 (.94)	2.07 (.91)	.34
House rule outside	2.43 (.83)	2.43 (.83)	2.43 (.83)	.96
Conflict	2.41 (.78)	2.43 (.77)	2.41 (.78)	.69
Disappointment	2.77 (.53)	2.81 (.50)	2.78 (.53)	.43
Withdrawal	2.83 (.48)	2.80 (.53)	2.82 (.49)	.39
Frequency communication	1.75 (.45)	1.83 (.47)	1.76 (.45)	.02
Quality communication	2.67 (.35)	2.67 (.33)	2.67 (.34)	.91

Latent growth curves

Latent growth curves were estimated for each of the anti-smoking socialisation constructs using Mplus 6.0 (Muthén & Muthén, 1998-2006). Model fit indices (i.e., CFI, TLI, RMSEA) for all latent growth models were good (for CFI and TLI > .90; for RMSEA < .07). Expected influence ($Mean_{slope}$ =.25, p = .00), house rules outside ($Mean_{slope}$ =.65, p = .00), and disappointment ($Mean_{slope}$ = .41, p = .01) did show an increase over time. For house rules inside, frequency and quality of communication descriptive statistics as well as the Chi-Square Difference Test (Satorra & Bentler, 2001) indicated a non-linear trend. Specifically, for house rules inside ("adults are allowed to smoking inside, not children": 1 = not true, 2 = sometimes true, 3 = true), an initial increase is followed by decrease ($Mean_{slope}$ = .12; $Mean_{quadratic\ trend}$ = -.21). Regarding frequency of communication, statistics showed that communication about smoking occurred more frequently during the intervention than before and after the intervention ($Mean_{slope}$ = .78; $Mean_{quadratic\ trend}$ = -.57). Quality of communication was rated higher during the intervention than before and after the intervention ($Mean_{slope}$ = .86; $Mean_{quadratic\ trend}$ = -.61). No significant overall change over time (slope) was found for agreement ($Mean_{slope}$ = .13, p = .14), availability ($Mean_{slope}$ = -.22, p = .12), conflict ($Mean_{slope}$ = -.02, p = .76), and

Table 2 Programme effects on intercepts and slopes of different smoking-specific parenting concepts

Aspects of smoking-specific parenting		Independent variables	*Intercept*				*Slope*			
			B	b	SE	*p*	B	b	SE	*p*
Influence	Step 1	Condition	-.04	-.04	.05	.43	.01	.00	.02	.89
		Asthma	-.06	-.09	.07	.24	.11	.05	.03	.10
	Step 2	Interaction	-.30	.22	.16	.16	-.36	-.08	.06	.19
Houserule outside	Step 1	Condition	-.04	-.08	.06	.21	.10	.00	.02	.86
		Asthma	.05	.14	.09	.10	-.07	-.04	.02	.07
	Step 2	Interaction	-.11	-.14	.18	.43	-.05	-.01	.05	.84
Disappointment	Step 1	Condition	.04	.06	.07	.41	-.03	-.01	.02	.74
		Asthma	.09	.18	.10	.08	-.18	-.08	.03	.02
	Step 2	Interaction	-.04	-.03	.19	.87	-.20	-.04	.06	.53

Note. Standardised and unstandardised estimates, standard errors, and *p*-values of the program effects are shown. In all analyses we controlled for age, sex, education level father, education level mother, and parental smoking. Condition: 1 = intervention condition and 2 = control condition; Asthma: 1 = no asthma, 2 = asthma.

withdrawal ($Mean_{slope}$ = -.11, p = .58), so these parenting concepts were not included in the regression analyses in the next step.

Tables 2 and 3 show the results of six separate regressions in which we tested the effects of asthma, the intervention versus control condition, and the interaction (asthma * condition) on the intercepts and slopes fore the aforementioned significant anti-smoking socialisation concepts, while controlling for the covariates[2]. In some of the regressions there was an effect of asthma or the condition on the intercept or the slope, although effects of condition on the intercept could only be subscribed to coincidence. The slope of disappointment *was* significant, showing an overall tendency for children to expect their mothers to react more disappointed if they would find out smoking. Having asthma was predictive of a less steeper increase in expected disappointment over time (B_{slope} = -.18). Regarding frequency and quality of communication, we found support for a quadratic trend, indicating an increase followed by a decrease. Being in the control condition was associated with lower rates of frequency of communication (B_{slope} = -.10). In families with a child with asthma the decrease in frequency of communication was less steep ($B_{quadratic}$ = -.10). Finally, being in the control condition was associated with a less steep increase in quality of communication over time (B_{slope} = -.23) and with a stronger decrease after the intervention ($B_{quadratic}$ = .17). However, what stands out are the overall non-significant interactions of asthma on the relationship between condition and changes in smoking-specific parenting, indicating that the effects of the intervention on smoking-specific parenting aspects were similar for adolescents with and without asthma.[3]

2 In order to save space we did not show the results of the covariates. Findings can be obtained from the first author.

3 We also took a less conservative approach by running the regression models with those parenting concepts that had not shown a significant change over time as outcome, but with significant variance. However, then also no significant effects could be identified for condition, asthma, or the interplay between these two.

Table 3 Programme effects on intercepts, slopes, and quadratic trends of smoking-specific parenting.

Smoking-specific parenting		Independent Variables	Intercept				Slope				Quadratic trend			
			B	b	SE	p	B	b	SE	p	B	b	SE	p
House rule inside	Step 1	Condition	.08	.01	.07	.88	-.01	.02	.09	.85	.01	.00	.02	.85
		Asthma	-.08	-.15	.09	.11	.02	.04	.013	.77	-.01	.00	.03	.99
	Step 2	Interaction	-a	-	-	-	-	-	-	-	-	-	-	-
Frequency of communication	Step 1	Condition	-.10	-.05	.02	.03	-.08	-.03	.02	.14	.05	.01	.01	.30
		Asthma	.06	.05	.04	.18	.08	.05	.03	.12	-.10	-.02	.01	.03
	Step 2	Interaction	-.34	-.12	.07	.09	.17	.05	.07	.46	-.06	-.01	.01	.77
Quality of communication	Step 1	Condition	.05	.02	.02	.25	-.23	-.04	.02	.03	.17	.01	.00	.03
		Asthma	.04	.02	.03	.37	.01	.00	.02	.95	.04	.00	.01	.57
	Step 2	Interaction	.15	.04	.05	.45	-.37	-.04	.05	.42	.16	.01	.01	.64

Note. Standardised and unstandardised estimates, standard errors, and P-values of the program effects are shown. In all analyses we controlled for age, sex, education level father, education level mother, and parental smoking. Condition: 1 = intervention condition and 2 = control condition, 1 = no asthma, 2 = asthma.
[a] a model with an interaction term did not convert.

Discussion

The present study evaluated the long-term effects of a home-based smoking prevention programme on smoking-specific parenting in a sample including both families with children with and without asthma. This special focus on asthma is warranted because it is consistently found in the literature that adolescents with asthma smoke as much, or even more, than peers without asthma (Mcleish & Zvolensky, 2010). Hardly any attention has been paid to smoking prevention efforts for this subgroup of adolescents (Tyc & Throckmorton-Belzer, 2006) despite the risk for negative respiratory consequences of smoking (Thomson et al., 2004).

In general, no differential intervention effects on smoking-specific parenting were found in this three-year Randomised Controlled Trial (RCT) for families with and without a child with asthma. What we did find for the total sample (i.e., both families with and without asthma) is an effect of the programme on quality of smoking communication. Being in the control condition was associated with less increase of quality of this communication over time and a stronger decrease after the intervention. The original study of Smoke-Free Kids also found some significant effects on parenting (Jackson & Dickinson, 2003) among a sample including solely smoking parents. They found that enrolment in the programme increased anti-smoking socialisation efforts among parents in the intervention condition. Also, children in the intervention condition were less likely to have initiated smoking. In the Netherlands, the steeper increase in quality of communication currently found for children in the intervention condition did not translate into less smoking behaviour three-years post-baseline (Hiemstra et al., 2014). When the Smoke-Free Kids programme was replicated in the U.S. among a non-smoking parent sample, the authors found similar effects as we did. They showed that high engagement in the programme did enhance recall of parental efforts in anti-smoking socialisation by the children after three years (Jackson & Dickinson, 2011). However, they also did not replicate their effects on smoking initiation prevention. They postulate the young age of the children at final follow-up as one reason for the differential intervention effects among smoking ((Jackson & Dickinson, 2003) and non-smoking parents (Jackson & Dickinson, 2011). Children of smoking parents are more likely to early initiate smoking relative to children with non-smoking parents (Leonardi-Bee, Jere & Britton, 2011) and a differentiated risk for initiation could therefore have been detected in the smoking parents sample only in which children were 7-8 years old at baseline. In our study, children's mean age at baseline was 10.1 and at final follow-up 13.1 years old. A longer follow-up period including the age of 14 and 15, in which children in the Netherlands show a strong uptake in ever smoking as compared to 12- and 13 year-olds (Stivoro, 2011), could be required to evoke parents' engagement in

anti-smoking socialisation. When parents of 14 and 15 year olds notice that their offspring get interested in smoking or, for instance, some of their friends start smoking, this may require them to engage actively in smoking-specific parenting on that moment. We can only speculate whether there might be such a delayed effect on parenting for this programme. Another intervention evaluation including children aged 10-14 also faced with low baseline and growth rates of substance use and conclude that this may have suppressed detection of interventions effects (Spoth, Redmond, Trudeau, & Shin, 2002). Furthermore, one study found that adolescents of parents who smoked reported similar levels of anti-smoking practices measured at 7th grade, however, when these adolescents became older they reported lower levels of punishment for smoking and less smoking rules at home than children of non-smoking parents (Pennanen, Vartiainen, & Haukkala, 2012). Finally, a school-based intervention offered at elementary schools did not show effects during the elementary school years, arguably due to low smoking rates and experimentation in both the intervention and control condition (Crone, Spruijt, Willemsen, & Paulussen, 2011). However, an effect appeared during secondary school, in favour for children in the intervention condition (Crone et al., 2011). Maybe parents in our intervention and control condition show similar smoking-specific parenting practices during the age range currently examined, but families in the control condition have more difficulty to maintain these practices when their children become older and get more challenged by smoking in their social environment. A study design including substantial years of follow-up assessments is therefore preferable. Also, motivating parents to uphold their learned smoke-free parenting efforts may be an effective strategy (Pennanen et al., 2012). We offered the intervention families one booster module. As a stronger increase in quality of communication in the intervention condition compared to the control condition was found followed by an overall decrease as revealed by the quadratic trend, additional booster modules can possibly help parents to uphold their learned communication skills.

We reported some short-term effects of the intervention on parenting (Hiemstra et al., 2013), while current analyses do not support long-term effects on smoking-specific parenting. As shortly discussed by Wiehe et al. (2005), short-term effects may be a by-product of the intervention period. Respondents may be currently primed with the topics and therefore pay extra attention to it within the family. Also, we found higher frequencies of a non-smoking agreement in the intervention condition after 6 months (Hiemstra et al., 2013), while this non-smoking agreement was one of the assignments in the intervention booklets. When asked at the 6 months follow-up answers can be more positive due to higher retention of the learned material than at three year follow-up. This argument does not mean that short-term effects do not count as an intervention effect when

not replicated on the long-term. Rather, it might question the timing of the intervention, which could arguably be closer to the likelihood the prevented behaviour will first occur. We offered this intervention to families with a child with a mean age of 10. National figures (Stivoro, 2011) indicate very low smoking rates among 10 year olds. One possibility is that we were too early offering Smoke-Free Kids, and programmes supporting parents might better be offered a few years later.

We expected that offering help to parents in their smoking-specific parenting practices in a non-intensive manner, with minimal efforts for parents, would appeal to parents. However, perhaps a more intensive approach might be preferable. For instance, involving health educators or trainers, or using a motivational approach may be warranted to inquire whether parents are aware of the importance to keep their child smoke-free. On the other hand, there was a differential dropout just after offering the intervention, with more intervention families dropping out. One reason often mentioned by these mothers was that they currently had no time to actively go through the booklets with their children, as was instructed by the researchers.

No differential effect of the programme was found on the development of smoking-specific parenting strategies by parents with and without a child with asthma. It has been suggested that interventions that aim at encouraging smoking-specific parenting strategies may benefit from emphasis on the health dangers (Fearnow, Chassin, & Presson, 1998). Parents who view smoking as less dangerous to health are less likely to take action by means of smoking-specific parenting than parents who view smoking as more dangerous to health (Fearnow et al., 1998). In general, parents often tend to underestimate their offspring's engagement in smoking (Harakeh, Engels, De Vries, & Scholte, 2006). Due to respiratory problems, parents of a child with asthma might underestimate child smoking to a larger extend than parents of children without asthma and might not see necessity for smoking rules. Information is available that indicates that parents of smoke-exposed children with asthma believe that exposure to smoke has limited or no negative effect on their child's asthma (Farber et al., 2008). Given the voluntary nature of subscribing to this smoking prevention programme, the high baseline levels on our smoking-specific parenting measures, and the non-significant increases in development of this parenting, it seems that those parents most motivated to prevent their children from smoking actually enrolled in this study. It is amendable that parents who do not believe smoking will have negative effects on their child's asthma, or parents who believe their child with asthma would not engage in smoking, are not participating in this study. Explicitly trying to encourage smoking-specific parenting could have had less of an effect as would have been the case when these parents would have subscribed.

This is a great challenge for health campaigns: strategies to get underrepresented individuals or families involved in health promotion programmes are warranted (e.g., Uybico, Pavel, & Gross, 2007).

Specific parenting practices such as communicating about smoking take place in the context of a general parenting style. The general parenting style may alter the effectiveness of specific parenting practices on child's development (Darling & Steinberg, 1993). While two parents may have the same policy towards smoking (e.g., communicating non-smoking rules), in the one family this may happen in a context of warmth and responsiveness, while the other context may be more authoritarian. The present study exclusively focused on smoking-specific parenting, while, for instance, a general parenting style of low control or strictness has also been linked to adolescent smoking initiation (Chassin et al., 2005; Den Exter-Blokland, Hale, Meeus, & Engels, 2007; Otten, Engels, & Van den Eijnden, 2007). When smoking-specific parenting was examined along with general parenting style, although they were related, they also appeared to be unique predictors of adolescent smoking (Chassin et al., 2005). Concerning asthma, adolescents with asthma are found to perceive their parents as stricter and more involved than adolescents without asthma (Otten, Engels, & Van den Eijnden, 2007). Although from a prevention perspective it may be more feasible to tailor a programme on smoking-specific parenting practices, as we did in the current study, programmes targeting only at smoking-specific practices and not general parenting may not be sufficient (Chassin et al., 2005).

Some limitations of the current study should be acknowledged. First, the sample consisted of relatively high-educated parents. Socio-economic status is associated with different styles of smoking-specific parenting. Higher-educated parents are, for instance, less permissive about smoking at home and place higher value on their child staying smoke-free (Fearnow et al., 1998). Although we included parental education as a covariate, including a sample consisting of mainly higher-educated mothers might have underestimated the strengths of relationships examined. Second, we only included child self-reports. Child reports of parenting may differ from parental reports (Harakeh et al., 2006). On the other hand, efforts by parents to keep offspring smoke-free may only be effective when children perceive these efforts, providing support for the use of children's reports. Also risk of common shared variances might have occurred, although we assume this risk to be similar for both intervention and control condition and therefore of less influence for the evaluation of intervention effectiveness. Third, as stated elsewhere (Chassin et al., 1998; Fearnow et al., 1998), we were limited to abbreviated measures of some parenting strategies (i.e., 1 item measures or few answer options) due to the large survey and young age of the participants. This might have underestimated the strength of detecting parenting effects, although

on the other hand, Jackson and Dickinson (2006) did find results among similar aged children with simplified smoking-specific parenting measures. Fourth, only maternal and not paternal parenting was evaluated. Evidence for similar associations with adolescent smoking is found for maternal and paternal reports of their smoking-specific parenting behaviour (Harakeh et al., 2005). Fifth, we did not differentiate between families who engaged in the whole programme (i.e., all 5 booklets) or had only gone through a few of them. On the other hand, programme compliance in this sample seemed high in both conditions.

Conclusion

This prevention programme did not affect parental smoking-specific parenting strategies in the Netherlands. In addition, results do not support a differential effect of the programme on anti-smoking strategies held by parents with and without a child with asthma. Substantial smoking rates are consistently found for adolescents with asthma (Mcleish & Zvolensky, 2010). Parents of a child with asthma might underestimate this risk. Therefore, active engagement in anti-smoking socialisation by parents of adolescents with asthma should still be encouraged. As there are hardly any effective prevention programmes available for adolescents with asthma, future prevention research could focus also on other risk factors for smoking initiation, such as peers or interpersonal factors (e.g., peer smoking, refusal self-efficacy skills).

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Early smoking in school-aged children with and without asthma

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Abstract

Research has shown that adolescents with asthma are as likely and sometimes even more likely to smoke than their peers without asthma. The current study examined whether the prevalence of the first active smoking experience differs for children (9-12 years of age) diagnosed with asthma compared with children who do not have asthma. The association between asthma and smoking was evaluated with logistic regression analysis, controlling for socio-economic status, parental smoking and child's internalising and externalising behaviours. A nation-wide sample of 1,476 mother and child dyads participated, of which 220 children (14.9%) had been diagnosed with childhood asthma. Children diagnosed with asthma were 2.45 times more likely to have taken a puff of a cigarette compared with children without asthma. In addition, the association between asthma and early smoking remained significant after including potential confounders in the regression equation. Suggestions are provided for preventing school-aged children, especially youths with asthma, from smoking. Additional research is needed to gain further insights into the mechanisms underlying the higher likelihood of early smoking among children with asthma.

Introduction

Cigarette smoking has serious detrimental effects on individuals' health. For individuals with asthma, smoking causes even greater adverse health consequences. In addition to long-term health consequences, noticeable short-term effects include increased respiratory symptoms, airway inflammation, reduced lung function and impaired response to asthma medication (Thomson, Chaudhuri, & Livingston, 2004). One might expect that children and adolescents with asthma would be less likely to jeopardise their health by taking up smoking than their peers without asthma. However, research has indicated that—particularly during adolescence—individuals with asthma are more likely to smoke than their peers without asthma (Mcleish & Zvolensky, 2010). These findings require more insights into the developmental process of regular smoking habits, especially regarding this at-risk group. In developing such insights, it is important to control for factors that relate to both childhood asthma and children's smoking. For instance, it has been well established that parental smoking increases the odds for children's smoking (e.g., Otten, Engels, Van den Eijnden, 2005); it also increases the likelihood of incidence and progression of asthmatic symptoms in children (Baena-Cagnani, Gómez, Baena-Cagnani, & Canonica, 2009). Socio-economic status (SES) is also associated with both smoking (Hanson & Chen, 2007) and asthma (Subbarao, Mandhane, & Sears, 2009), although the direction of the relationship between SES and asthma might depend on the status of asthma (i.e., prevalence vs. hospitalisations; Subbarao et al., 2009). Finally, researchers have found that childhood behavioural problems are risk factors for smoking (Upadhyaya, Deas, Brady, & Kruesi, 2002), and evidence also suggests that children with asthma have elevated levels of internalising and externalising behaviours (McQuaid, Kopel, & Nassau, 2001). Therefore, the present study will control for these factors while examining early smoking behaviours among children with and without asthma.

Previous research comparing smoking among adolescents with and without asthma has focused primarily on regular smoking habits. Such research has determined that the development of smoking progresses through different stages (Mayhew, Flay, & Mott, 2000). Young people begin experimenting with smoking at approximately 10 years of age (Stivoro, 2008); however, scholars have not yet adequately investigated early smoking experiences among children with asthma. Rather, most studies have included older samples and measured early smoking retrospectively (Hublet et al., 2007; Precht, Keiding, & Madsen, 2003; Van de Ven, Engels, Kerstjens, & Van den Eijnden, 2007) which could lead to biassed recall responses (Engels, Knibbe, & Drop, 1997). To avoid recall biases, researchers should measure the age of onset as close to the actual age of onset as possible. The present study examined early smoking (i.e., taking a puff of a cigarette) among a sample

of 9- to 12-year-old children, with and without asthma. Including children of this age provides the opportunity to examine the stage during which the first puff of a cigarette occurs. As a consequence, this minimises the possibility that asthma is a consequence of active smoking.

Information is required about the earliest stage of active smoking in this at-risk group in order to develop effective programmes targeting at preventing smoking among children with asthma. The present study is the first to focus on differences between children with and without asthma in their first experience of active smoking. Whereas most studies concentrate on children in adolescence, we examined an age group that starts to become interested in smoking, but generally do not engage in regular smoking yet. Since this is the first study to focus on this younger age group, it has an explorative character.

Method

Procedure and participants

Baseline data were obtained from a randomised controlled trial that evaluated a home-based smoking prevention programme in the Netherlands entitled Smoke-free Kids (Jackson & Dickinson, 2006; see Hiemstra et al. 2009). Baseline data were collected prior to randomization. Primary schools in central and southern parts of the country were approached in order to contact parents. Parents could enrol in the programme by returning a recruitment letter. Inclusion criteria included (a) participation of the mother or female guardian and one 9- to 12-year-old child per family and (b) both participants were competent in reading and speaking Dutch. Information of mothers and children was obtained via telephone interviews and questionnaires. Children could only answer closed-ended questions to protect against parents who–against our instructions–listened to their child during the telephone interview. For the paper questionnaires, two envelopes were included so children and mothers were able to return their own questionnaires without seeing each other's answers.

Measures

Socio-economic status SES was measured using the educational level of both parents. This variable was assessed using a 9-point scale covering all education levels. Participants were allocated to lower, middle or higher education groups and then the educational levels of the father and mother were combined: 0 = both parents lower or one lower and one middle; 1 = both middle or one lower and one higher; and 2 = both parents higher or one middle and one higher.

Parental smoking To assess parents' smoking status, a 9-point scale was used with options ranging from 'I have never smoked, not even a puff' to 'I smoke at

least once a day' (see also De Vries, Engels, Kremers, Wetzels, & Mudde, 2003). Mothers indicated which option applied to themselves as well as to the biological father of the child. The variable was coded as 0 = both parents are non-daily smokers; 1 = one parent is a daily smoker and 2 = both parents are daily smokers.

Child problem behaviours Problem behaviours were measured with the problem scales (i.e., emotional problems, hyperactivity, conduct problems, and peer relationships) of the Dutch parent version of the Strength and Difficulties Questionnaire (SDQ) (Goodman, 1997; Stone, Otten, Engels, Vermulst, & Janssens, 2010), a screening tool for clinical assessment of mental disorders and epidemiological research. Subscales consisted of 5 items with response options 0 = not at all; 1 = a little, sometimes and 2 = very much, all the time. A sum score was calculated for each subscale, with higher scores implying more problems.

Asthma: diagnosed asthma Asthma was indicated if mothers responded 'yes' to the questions: 'Does your child have had asthma?' and 'Did a physician confirm that your child has asthma?' McGill et al. (1998) confirmed the validity of parental reports of physician-diagnosed asthma in a random subsample with a 98.5% conformation rate of physicians' reports.

Asthma: current symptoms The parent version of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire was used to screen for asthma (Asher et al., 1995; Jenkins et al., 1996). Mothers indicated how often symptoms were present in their children in the 12 months prior to the study. They were also asked to indicate the most recent time their children experienced asthma symptoms. All children with diagnosed asthma were divided into two groups: 0 = past asthma (last symptoms longer than 12 months before measurement) or 1 = current asthma (symptoms at present or within the 12 months preceding the measurement).

Children's early smoking Children were asked a 'yes' or 'no' question concerning whether they had ever smoked (a cigarette), even if it was only a puff (Jackson & Dickinson, 2006).

Statistical analyses

First, differences between children with and without asthma were assessed with Pearson's chi-square for the categorical variables (children's gender, ses and parental smoking); means and mean differences (with 95% confidence interval (95% CI)) are shown for continuous variables (age and problem behaviours), assessed using *t*-tests. Second, logistic regression was used. Results are reported as odds ratios (OR's with 95% CI) for early smoking for children with and without asthma. These logistic regressions were adjusted for the effects of age, gender, parental factors and children's problem behaviours. This procedure was replicated within the subsample of children with asthma to examine whether children

with current asthma were more at risk for early smoking compared with children with past symptoms of asthma. All analyses were performed using SPSS version 15.0.

Results

In total, 1,476 mothers and their children participated. Children's mean age was 10.12 years (*SD* = 0.78); 47.8% were boys. In 98.6% of the families, the biological mother participated and almost all mothers and children were of Dutch nationality (98.2%).

Almost 15% of the children had been diagnosed with asthma by a physician (table 1). Children with diagnosed asthma were slightly older and comprised of significantly more boys than those not diagnosed. Moreover, children with asthma demonstrated higher scores on emotional problems (*mean difference* = 0.49, 95% CI = 0.18 -0.79, $t(1474) = -3.13$, $p = 0.002$). Total scores for hyperactivity and conduct problems were only marginally different whereas peer relationships, ses and parental smoking behaviour were similarly distributed within the non-asthmatic and asthmatic groups.

Early smoking and asthma

Of the total sample, 5.4% of children reported having puffed on a cigarette. The unadjusted OR's for early smoking indicated that children with asthma were 2.45 times more likely to have smoked than children without asthma (95% CI = 1.48 - 4.07, table 2). Within the asthmatic and non-asthmatic groups, 10.5% and 4.5% reported having smoked a puff of a cigarette, respectively. Children with two smoking parents were most at risk to have smoked, followed by children with one smoking parent. Furthermore, higher rates of hyperactivity and conduct problems were associated with early smoking behaviours. Including these confounders in the regression equation lowered the odds for early smoking among asthmatic children; however, the association of asthma with early smoking remained significant (OR = 2.09, 95% CI = 1.18- 3.70). While predicting early smoking with asthma status at step 1 accounted for 2% of the variance in early smoking, adding all study variables at step 2 explained 15% of the variance of early smoking.

Current versus past asthma

In total, 97 mothers (43.9%) reported that their child had experienced wheezing in the chest within the 12 months preceding the study. For 18 of these children, wheezing was so severe that they were limited in their ability to speak to only one or two words at a time between breaths. Furthermore, 85 children (38.5%) had

Table 1 The study population displayed by number of participants (percentage) for child's gender, parental SES and parental smoking and by means (SDs) for child's age and problem behaviour

	Non-asthmatics ***n*= 1256**	**Diagnosed asthma** ***n*= 220**	***p-value***
Gender: male, *n* (%)	574 (45.7%)	131 (59.5%)	<0.001
SES [a] *n* (%)			0.56
Low	314 (25.8%)	62 (29.2%)	
Middle	323 (26.5%)	55 (25.9%)	
High	580 (47.7%)	95 (44.8%)	
Parental smoking [b] *n* (%)			0.62
Both non-smoker	861 (68.8%)	148 (67.6%)	
One smoker	269 (21.5%)	45 (20.5%)	
Both smoker	121 (9.7%)	26 (11.9%)	
Problem behaviour (mean ± SD)			
Hyperactivity	2.99 ± 2.71	3.40 ± 2.98	0.06
Emotional problems	2.28 ± 2.10	2.76 ± 2.26	0.002
Conduct problems	1.00 ± 1.28	1.19 ± 1.56	0.07
Peer relationships	1.20 ± 1.53	1.34 ± 1.63	0.19
Age (mean ± SD)	10.10 ± .77	10.22 ± .84	0.04

[a] Does not add up to 1,476 due to 6 missing values on mother's educational level; 39 missing values on father's educational level (among which 12 cases in which no father figure was present); 2 cases with missing values on both educational levels.

[b] 28 cases in which no father figure was available were considered as non-smoker, interpreted as lacking a smoking father as a model figure. Further, 3 missing values on mother's smoking and 3 missing values on father's smoking.

experienced a dry cough at night within the 12 months preceding the study. Based on mothers' indication of time since the most recent episode of asthma symptoms, the subsample was divided into two groups: (a) having had symptoms in the past (42.5%) and (b) currently experiencing asthma symptoms (48.9%). Some mothers (n = 19, 8.6%) could not accurately indicate whether asthma symptoms were present during the 1 year before baseline; reasons included co-morbidities such as hay fever and eczema, amongst others. These children were not included in the analysis predicting early smoking. Of note, none of the 19 children excluded had ever puffed on a cigarette.

For children with past symptom asthma, 34.0% of the parents belonged to the lower SES group, 20.9% belonged to the middle SES group, and 45.1% belonged to the higher SES group, compared to 26.0%, 27.9%, and 46.1%, respectively, for the

Table 2 Logistic regression analysis predicting early smoking by asthma, while adjusting for age, gender, SES, parental smoking, hyperactivity, emotional problems and conduct problems

Variable	OR	(95% CI)
Unadjusted: *Step 1*		
Asthma		
No asthma (Ref.)	1	
Asthma	2.45**	(1.48 - 4.07)
Adjusted: *Step 2*		
Age	1.24	(0.92 – 1.69)
Gender		
Girls (Ref.)	1	
Boys	1.13	(0.68 – 1.90)
SES		
High (Ref.)	1	
Middle	1.04	(0.53 - 2.04)
Low	1.53	(0.83 - 2.80)
Parental smoking		
Both non-smokers (Ref.)	1	
One smoker	2.86**	(1.42 - 5.76)
Both smokers	3.28***	(1.86 - 5.77)
Child problem behaviour		
Hyperactivity	1.13** [a]	(1.03- 1.24)
Emotional problems	1.06	(0.95- 1.19)
Conduct problems	1.19* [a]	(1.01- 1.40)
Peer relationships	1.01	(0.86- 1.18)
Asthma		
No asthma (Ref.)	1	
Asthma	2.09*	(1.18- 3.70)

n = 1,421 in the adjusted model. Ref.= Reference category. *p <0.05, **p <0.01, ***p <0.001.
[a] OR's for child health behaviour represent the increase in the risk of early smoking per unit increase of the variables

current symptom group. For parental smoking behaviour, 61.3% of children with past symptom asthma had non-smoking parents, 23.7% had one smoking parent, and 15.0% had two smoking parents, compared to 71.3%, 19.4%, and 9.3%, respectively, in the current symptom group. Neither SES (p = 0.36) nor parental smoking (p = 0.32) distributions significantly differed between past and current asthma symptom children.

Table 3 Logistic regression analysis predicting early smoking by current asthma status, while adjusting for age, gender, SES, parental smoking, hyperactivity, emotional problems and conduct problems within the subsample of children with diagnosed asthma

Variable	OR	(95% CI)
Unadjusted: *Step 1*		
Current Asthma		
Past symptoms (Ref.)	1	
Current symptoms	0.91	(0.40 - 2.27)
Adjusted: *Step 2*		
Age	0.87	(0.47 – 1.59)
Gender		
Girls (Ref.)	1	
Boys	1.78	(0.54 – 5.88)
SES		
High (Ref.)	1	
Middle	1.03	(0.20 - 5.32)
Low	1.81	(0.49 - 7.22)
Parental smoking		
Both non-smokers (Ref.)	1	
One smoker	3.40	(0.76 - 15.13)
Both smokers	6.13**	(1.59 - 23.94)
Child problem behaviour		
Hyperactivity	0.97	(0.79 - 1.18)
Emotional problems	1.18	(0.90 - 1.56)
Conduct problems	1.71**[a]	(1.18 - 2.48)
Peer relationships	1.06	(0.73 - 1.54)
Current Asthma		
Past symptoms (Ref.)	1	
Current symptoms	0.83	(0.28 - 2.47)

n = 192 in the adjusted model. Ref.= Reference category. ** p <0.01

[a] OR for child health behaviour represents the increase in the risk of early smoking per unit increase of this variable

For hyperactive behaviour, children with current asthma had marginally higher scores than symptom-free children (*mean difference* = -0.81, 95% CI = -1.64 – 0.01, $t(199) = -1.95$, $p = 0.052$). No differences in mean scores were observed for emotional problems ($p = 0.48$), conduct problems ($p = 0.67$), or peer relationships ($p = 0.53$). A regression equation including these confounders revealed similar odds for early smoking among children with current or past asthma (table 3).

Solely including asthma severity status did not explain any of the variance in predicting early smoking; however, including all study variables at step 2 explained 36% of the variance of early smoking.

Discussion

The present study aimed to scrutinise the association between asthma and the first phase of active smoking in primary school children while controlling for confounding factors related to asthma and smoking. In line with literature indicating higher rates of regular smoking among adolescents with asthma (Mcleish & Zvolensky, 2010), we found that 9- to 12-year-old children with physician-diagnosed asthma were more than twice as likely to have had a smoking experience compared to their peers without asthma. Not all studies concentrating on stages prior to regular smoking found an increased risk of smoking among adolescents with asthma. Concerning the age at which children smoked their first cigarette, based on self-reports of 15-year-olds with and without asthma, Hublet et al. (2007) found no difference in onset. Precht et al. (2003) also concluded, in a sample of 15- to 20-year-old adolescents, that adolescents with and without asthma started smoking regularly at the same time (14.6 vs. 14.8 years of age); however, more boys with than without asthma smoked regularly before the age of 14 years. Finally, Van de Ven et al. (2007) concluded that adolescents with asthma were less likely to have experimented with smoking between the age of 12.9 and 14.8, although once they began smoking, they progressed to regular smoking more quickly.

The focus of the present study was to measure the very first experience of active smoking in a younger sample than usually. Most researchers asses the age of onset during middle or late adolescence, which can cause recall bias. The present sample of 9- to 12-year-old children is believed to minimise recall bias. As described by Engels and colleagues (1997), recall bias in smoking assessment increases as the interval between smoking onset and the time of recall is longer. For instance, in their 5-year longitudinal study (Engels et al., 1997), respondents aged 12.4 years at baseline estimated their age of smoking onset during all 3 waves. At the first wave, mean reported age of smoking onset was 10.52 years; at the third wave the same respondents reported a mean age of onset of 12.42. Thus, inconsistencies in smoking behaviour preceding regular smoking may be caused by recall bias due to the age of the study cohort at which this behaviour was retrospectively assessed. Furthermore, both Hublet et al. (2007) and Precht et al. (2003) included only those adolescents who had already smoked whereas the present study also included children that may not progress to regular smoking.

The relationship between asthma and smoking remained significant after controlling for important confounders. With respect to gender, we did not find significant effects. One reason may be that our study only had few girls with asthma who reported having ever smoked a puff. Another reason may be that our sample was too young: gender differences in any tobacco use were also not found at age 12/13 years in Hedman et al. (2007), but were present in 14- to 15-year-olds. Parental smoking was similarly distributed within the asthmatic and non-asthmatic groups. This may indicate that parents of children with asthma do not adjust their smoking behaviours to their children's health condition, which was also found elsewhere (Hublet et al., 2007; Otten et al., 2005). In addition to the heightened risk for early smoking among children with smoking parents, parental smoking is especially harmful for children with asthma via second-hand smoke, which can worsen asthma by accelerating the decline of lung functioning, increasing asthma severity, lowering quality of life, and diminishing response to medication (Baena-Cagnani et al., 2009).

The final confounder was childhood problem behaviour. Children with diagnosed asthma demonstrated more emotional problems and marginally significantly more hyperactivity and conduct problems than children without asthma. Although smoking is associated with internalising and externalising behaviours (Upadhyaya et al., 2002), findings did not support the relationship of asthma and early smoking to be explained by these behaviours. Generally, the SDQ is a reliable tool in screening childhood psychological well-being (Goodman 1997; Stone et al., 2010). However, Stone et al. (2010) also noted the need for caution when using a single informant report on the SDQ as the report may not generalise to outside the parents' home. Therefore, we suggest that the present study be replicated in a clinical sample to examine whether children with asthma with more pronounced internalising or externalising problems will engage more in early smoking.

Asthma was measured through self-reported diagnosis, which has been found to be reliable (Jenkins et al., 1996; McGill et al., 1998). The changeable pattern of symptoms characteristic of asthma (Stein & Martinez, 2004) might require a more detailed, in-depth subdivision to reveal more precisely which children are most at risk for smoking. We attempted to do so by examining current asthma symptoms. One might expect children who experience respiratory difficulties to refrain from engagement in behaviours, which could harm their health. However, our findings do not support this idea. In fact, they indicate that children currently experiencing asthma symptoms experiment with cigarette smoking by taking a puff of a cigarette as often as symptom-free asthmatic children.

In addition to examining whether current symptoms play a role, the specific factors that trigger a child's asthma may also be of importance to smoking onset, especially when controlling for psychological problems.

Strengths, limitations and implications

This study had several strengths. In addition to a large sample size, the time of measuring early smoking is of great importance. Almost all scholars have investigated the first stages of smoking retrospectively (Breslau et al., 1996; Hublet et al., 2007; Mcleish & Zvolensky, 2010; Precht et al., 2003; Van de Ven et al., 2007). The current study examined early smoking at an age at which it was most likely to occur. However, some limitations should be noted. First, our study was cross-sectional, providing the first step in examining early smoking behaviour in children with asthma. However, smoking develops in different stages, and empirical evidence supports different risk factors of the various stages of smoking Mayhew et al., 2000). Longitudinal designs provide greater insights into the development and risk factors of smoking in both asthmatic and non-asthmatic children. Adolescents with asthma have been found to accelerate to regular cigarette use after trying cigarettes (Van de Ven et al., 2007) and to eventually smoke more cigarettes per day, but with more quit attempts (Precht et al., 2003) than adolescents without asthma.

Second, our recruitment of families via schools may have had implications for several study variables. First, most diagnosed children reported experiencing mild asthma. It would be interesting for future research to focus on distinct groups of children with asthma, to examine exactly which children are at a higher risk to start smoking since this atopic disease varies in phenotype, with great individual variability over time (Stein & Martinez, 2004). In addition, our sample included mostly families with relatively high SES levels. The total number of children who had smoked a (puff of a) cigarette could potentially have been higher when including lower SES families. Although our data do not show an increased risk of SES in early smoking, lower SES generally is associated with higher smoking rates (Hanson & Chen., 2007). Also, SES can be associated with the other study variables as described in the introduction section. For instance, parents in lower SES families are more likely to smoke and children in lower SES families may be more at risk to have asthma. Moreover, low SES has also been linked to psychopathology, which has been shown to affect smoking.

Finally, existing studies suggest that smokers react differently to questionnaire surveys, with smokers being late- or non-responders (Rönmark et al., 2009). Therefore, smoking parents may be underrepresented in the current sample, in which we approached parents to participate only once. However, parental smoking rates are similar to national statistics (Stivoro, 2009b). As is often the case with surveys, we do not have data on non-responders and it is therefore hard to speculate about whether or not smoking parents with or without a child with asthma were more reluctant to respond. However, an underestimation might

have occurred, with smoking parents of children with asthma being less willing to enrol in the study (e.g., because of feelings of quilt, Harakeh, 2006).

The finding that 9- to 12-year-old children with asthma do engage in smoking can be very important for the treatment of asthma. Physicians should be aware of the risks of taking up smoking in children and adolescents with asthma, even when asthma symptoms are present and substantial. As such, active smoking should be discussed during consults with this age group. Smoking prevention can be accomplished at the family level. Special programmes could be developed to help parents prevent their child from smoking (Jackson & Dickinson, 2006), possibly through educational programs and increasing awareness of available prevention programmes (e.g., via general practitioners or school doctors).

Conclusion

This study investigated early engagement in active smoking among children with and without a diagnosis of asthma. The disturbing finding that children with asthma were twice as likely to have smoked (a puff of) a cigarette requires more research in the near future.

6

The link between asthma and smoking explained by depressive feelings and self-efficacy

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Abstract

Adolescents with asthma consistently smoke at higher or similar rates as non-asthmatic peers, although smoking might involve more health risks. This study examined possible mechanisms (i.e., depressive feelings and self-efficacy to refrain from smoking) explaining the association between asthma and smoking initiation. An indirect path from asthma to self-efficacy through depressive feelings was examined in two independent samples. Sample 1 consisted of 4,531 adolescents (mean age 12.8) and sample 2 consisted of 1,289 children (late childhood, mean age 10.1). Data were gathered from maternal and self-report. In the adolescent sample, whether the relationship between depressive feelings at baseline and smoking initiation two years post-baseline runs via self-efficacy was also examined. Higher amounts of depressive feelings decreased adolescents' self-efficacy to refrain from smoking, which subsequently increased the risk to initiate smoking. A diagnosis of asthma was also associated with higher levels of depressive feelings which in turn decreased self-efficacy. A marginal significant indirect effect was found in the childhood sample. Smoking prevention efforts should start as early as mid to late childhood. The results indicate that focus should be placed on preventing depressive feelings with the aim of increasing children's self-efficacy to refrain from smoking. This is especially important for children and adolescents with asthma.

Introduction

Smoking continues to be a worldwide health problem and is associated with serious health consequences (WHO, 2011). For people with asthma, the health consequences of smoking are even more serious and include elevated risks of increased respiratory morbidity, less responsiveness to asthma medication, and potential to develop chronic obstructive pulmonary disease (COPD) (Thomson, Chaudhuri, & Livingston, 2004). Despite the heightened health consequences of smoking, young people with asthma consistently show similar or higher smoking rates as their peers without asthma (Mcleish & Zvolensky, 2010). Specifically, researchers have reported that adolescents with asthma are more often daily smokers (Hublet et al., 2007; Precht, Keiding, & Madsen, 2003) and smoke more cigarettes per day (Precht et al., 2003), although others have found similar rates of reported cigarettes per week (Hublet et al., 2007). Moreover, even in stages that precede regular smoking (i.e., initiation, experimentation), adolescents with asthma are at higher risk (Ringlever, Otten, Van Schayck, & Engels, 2012a). It is essential to acknowledge the risks to prevent youth with asthma from smoking uptake. One way to move forward is to examine factors that mediate the link between asthma and smoking to develop and implement smoking prevention programmes that are specifically suited for this focus group. The present study examined adolescents' depressive feelings and perceived self-efficacy to refrain from smoking. Other studies have demonstrated that adolescents with asthma are likely to show elevated levels of depressive feelings (McQuaid, Kopel, & Nassau, 2001). However, few studies have focused on differences in smoking-cognitions between adolescents with and without asthma (Mcleish & Zvolensky, 2010), while cognitions are assumed to precede behaviour. For instance, researchers have used influential theories such as the Theory of Planned Behaviour (TPB) (Azjen, 1991) and the Attitude-Social influence–self-Efficacy (ASE) model (De Vries, Backbier, Kok, & Dijkstra, 1995) to describe cognitions such as attitudes and beliefs, and ones refusal skills (i.e., self-efficacy) to precede smoking onset. One study found support for a stronger association between perceived self-efficacy and smoking progression for adolescents with asthma (Van de Ven, Van den Eijnden, & Engels, 2006b). The present study elaborates on this self-efficacy-smoking association and examined whether a proposed model that includes depressive feelings and self-efficacy could provide more insight into the link between asthma and smoking.

Depression, self-efficacy and smoking

Adolescents with elevated levels of depressive feelings are at a higher risk for smoking than are those with lower levels of depressive feelings (Chaiton, Cohen, O'Loughlin, & Rehm, 2009; Engels, Halle III, Noom, & De Vries, 2005; Otten, Van de

Ven, Engels, & Van den Eijnden, 2009). Studies have also found evidence for the reverse: smoking might precede depressive feelings (Chaiton et al., 2009) or the association might be bi-directional (Audrain-McGovern, Rodriquez, & Kassel, 2009; Chaiton et al., 2009). One mechanism by which depressive symptoms increase adolescents' odds for smoking initiation is increased vulnerability to the influence of peer smoking (Patton et al., 1998), thereby putting pressure on adolescents' cigarette refusal skills. Similarly, Audrain-McGovern et al. (2009) found that higher levels of depressive symptoms precede an increase in the number of smoking friends, which in turn predicted smoking progression. This finding might imply that depressed youth have more difficulty refraining from smoking when affiliating with smoking peers.

Ample evidence underscores that perceived ability to refrain from smoking is associated with smoking: adolescents who report higher self-efficacy have shown lower rates of smoking intention and behaviour than have peers who are less confident in refusing a cigarette (Engels et al., 2005; Hiemstra, Otten, De Leeuw, Van Schayck, & Engels, 2011). If self-efficacy to refrain from smoking decreases because of adolescents' levels of depressive feelings, it is likely that these adolescents are particularly at risk to smoke. Minnix et al. (2001) reported partial mediation between depressive feelings and smoking susceptibility through self-efficacy based on their study of 1,093 high-school students. However, our study differs from Minnix et al. (2001) in several respects: we concentrated on younger age groups (10.1 and 12.8 years versus 15.6 years). Moreover, Minnix et al. (2001) used an outcome measure referred to as 'susceptible for initiation,' which is a product of three items, one of which assesses smoking status, one assesses the intention to smoke, and the other measures the ability to refuse a cigarette. One could argue that the latter susceptibility item shows some overlap with the construct of self-efficacy, which is a mediating variable. Moreover, this outcome measure (i.e., susceptible for initiation) might be more of a reflection of the intention to smoke than of the actual behaviour. In contrast, we included adolescent smoking initiation as the smoking outcome measure.

The present study

The suggested indirect pathway between depression and smoking via self-efficacy found by Minnix et al. (2001) was used as the basis of the current study. The fact that adolescents with asthma often show elevated levels of depression (McQuaid et al., 2001) and the assumption that adolescents with asthma show a stronger association between self-efficacy and smoking (Van de Ven et al., 2006b) led us to propose a model with asthma status as the first concept of instigating this indirect process. The model (see Figure 1) was tested in two separate, independent samples; an adolescent sample (*mean age* 12.8 years) and a mid to late childhood

sample (*mean age* 10.1 years). The assumption that depressive feelings decrease one's self-efficacy and subsequently increase the risk of smoking uptake was investigated in the adolescent sample. Asthma was then added to the model as the first factor to instigate this process. The children in the childhood sample were in the first stage of smoking development (i.e., the non-smoking contemplation stage in which children form their own attitudes about smoking, while already being susceptible to peer pressure; Mayhew, Flay, & Mott, 2000). Therefore, the assumed process that precedes smoking initiation was examined in the childhood sample. It was hypothesised that asthma would be associated with a decrease in self-efficacy through higher amounts of depressive feelings. Thus, the childhood sample provided insight into a (modifiable) mechanism that could prevent subsequent smoking behaviours. This is essential information for the prevention of smoking. One effective strategy could be to postpone the age of smoking onset, because early initiation of smoking has been found to increase the likelihood of progression to regular smoking (Everett et al., 1999). Therefore, including both samples in one study allowed us to provide better recommendations for the type *and* timing of prevention efforts.

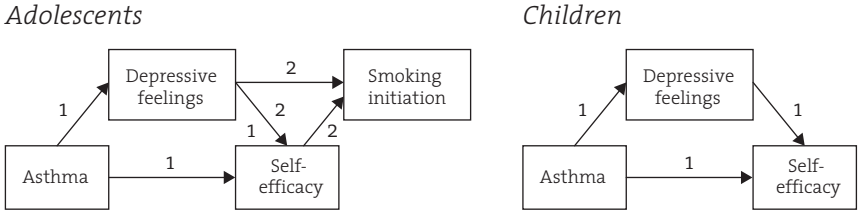

Figure 1 Hypothesised model examining an indirect path (1) from asthma to self-efficacy via depressive feelings, in both the adolescent and childhood sample. An indirect path (2) from depressive feelings to smoking initiation via self-efficacy was examined among adolescents exclusively.

Method

Procedure

Adolescent sample

The first sample consisted of adolescents who participated in a longitudinal study approved by the Central Committee on Research Involving Human Subjects that examined precursors of smoking (Otten et al., 2009; Van de Ven, Engels, & Sawyer, 2009; Van de Ven et al., 2006b). Data were collected via questionnaires filled out by the adolescents at schools located in four regions in the Netherlands. There

were three data collection points. The first wave was in January 2003 (*N* = 10,087); of these adolescents, 9,008 (89.3%) provided data during the second wave 4 months later. The final wave was 22-24 months later (*n* = 6,769, 67.1%). Attrition was mainly due to being absent on the day of data collection; no explicit refusal was reported. In the present study, only baseline never smokers were included (*n* = 4,531, 66.9%). Adolescents were aged between 11 and 16 years old (*mean age* 12.8; *SD* = .75). The majority were of Dutch nationality (95.8%).

Childhood sample

For the childhood sample, data came from a longitudinal study in the Netherlands that started in 2008 and approved by the ethical committee of the Faculty of Social Sciences at Radboud University Nijmegen (Hiemstra et al., 2009). Families responded to an invitation letter provided via schools that were mostly located in the central and southern parts of the Netherlands. Data were obtained via telephone interviews and questionnaires. In the present study, information from baseline and 12-month follow-up was used. At baseline, 1,478 mothers and children participated. Children who reported at baseline to have ever smoked (a puff) of a cigarette (5.4%) and children who did not provide data for all three waves (7.7%) were excluded. The final total sample was *N* = 1,289. The children were aged between 8 and 12 (*mean age* = 10.1; *SD* = .78) and 98.2% were of Dutch nationality. The sample was part of a randomised controlled trial. Half of the families received intervention booklets aimed at increasing the quality of smoking-specific communication between the children and their mothers. The other half received control booklets that contained basic smoking information (Hiemstra et al., 2009). The smoking prevention condition (control vs. Intervention) was included as a covariate in the present analyses, a strategy also used elsewhere (Minnix et al., 2001).

Measures

Asthma status was based on self-report by adolescents and measured at baseline. Adolescents were classified as 'asthma' if they answered yes to both the questions 'Did you ever have asthma?' and 'Did a physician confirm that you have asthma?' In the childhood sample, mothers indicated whether their children ever had asthma and whether asthma had been diagnosed by a physician. Self-reported diagnosis of asthma for inclusion into an 'asthma' or 'non-asthma' group has also been used by other researchers, both when reported by individuals themselves (Hublet et al., 2007; Precht et al., 2003) as well as by parents (e.g., Ortega, Huertas, Canino, Ramirez, & Rubio-Stipec, 2002).

Depressive feelings were measured at baseline with the Depressive Mood List (Kandel & Davies, 1982) in the adolescent sample and with the subscale 'emotional problems' from the Strengths and Difficulties Questionnaire (Goodman, 1997) in

the childhood sample. The Depressive Mood List consists of 6 items reported by the adolescent (i.e., feeling too tired to do things; having trouble going to sleep; having trouble staying asleep; feeling unhappy, sad, or depressed; feeling hopeless about the future; and worrying too much). The Depressive Mood List is widely used in adolescent surveys (Compas, Ey, & Grant, 1993) to measure depressive mood compared to depressive syndromes or disorders. Response options ranged from 1 = never to 5 = always. Higher scores imply higher levels of depressive feelings, and Cronbach's alpha = .76. In the childhood sample, mothers reported on 5 items from the subscale that measures emotional problems (i.e., often complains of headaches, stomach-aches or sickness; many worries, often seems worried; often unhappy, downhearted or tearful; nervous in new situations, easily loses confidence; many fears, easily scared) (Goodman, 1997). Response options were 0 = not at all; 1 = a little, sometimes; and 2 = very much, all the time. A sum score was calculated and higher scores imply more problems. Alpha = .71. Although a multi-informant approach might be recommendable when using the SDQ (Stone, Otten, Engels, Vermulst, & Janssens, 2010), parental reports on this subscale have been found within an acceptable range of internal consistency (Stone et al., 2010; Van Widenfelt, Goedhart, Treffers, & Goodman, 2003).

Self-efficacy was measured at 4-month (for adolescents) and 12-month follow-ups (for children) with the same scale for both samples (6 items) (De Vries, Dijkstra, & Kuhlman, 1988). Examples from the scale include, "Not to smoke when my friends smoke is [difficult/easy] for me" and "To explain why I do not want to smoke is [difficult/easy] for me." Response options for adolescents ranged from 1 to 5 (1= very easy to 5 = very difficult). Response options for children ranged from 1 to 6 (1 = very easy to 6 = very difficult). Cronbach's alpha was .80 in the adolescent sample and .79 in the childhood sample.

Smoking status was assessed by self-report of a single item with 9 response options (Kremers, Mudde, & De Vries, 2001) and used only in the adolescent sample. Adolescents could choose between the following response options: 1 = I have never smoked, not even a puff; 2 = I tried, but I quit; 3 = I quit after smoking less than once a week; 4 = I quit after smoking at least once a week; 5 = I tried smoking once in a while; 6 = I smoke less than once a month; 7 = I smoke at least once a month; 8 = I smoke at least once a week; 9 = I smoke every day. Smoking initiation among baseline never smokers was categorised as 1 = never smoker (i.e., category 'never smoked, not even a puff') and 2 = lifetime smoker (all other categories) at the 24-month follow-up.

Parental smoking status was included as covariates in both samples and assessed by asking both adolescents and children whether their mother or father smoked (yes or no). Harakeh, Engels, De Vries, & Scholte (2006) found that adolescents aged 13-17 were a reliable source to assess the current smoking status

of their parents. Whether this reliability also applied to our childhood sample is unclear, as Harakeh et al. (2006) did not report about children aged 8 to 12. Fortunately, we checked this information within our childhood sample, as maternal reports about mothers' smoking status were available as well. A Chi-square test revealed that proxy reports by children corresponded highly with those of their mothers (98.3% overlap in response, χ^2 (1, 1287) = 1124.26, $p < .001$).

Statistical Analyses

Demographic characteristics were calculated and mean score differences between those with and without asthma were examined using *t*-tests for depressive feelings and self-efficacy in both adolescents and children and a χ^2 test for lifetime smoking was conducted for adolescents only. These statistics were calculated with SPSS 15.0. For both adolescents and children, regression estimates were calculated for direct effects of asthma on depressive feelings and self-efficacy, as well as the direct effect of depressive feelings on self-efficacy. Direct effect variables for smoking were calculated for adolescents only. Next, two indirect paths were tested in the adolescent sample: (a) the link between asthma and self-efficacy running via depressive feelings and (b) depressive feelings and lifetime smoking via self-efficacy. In the childhood sample, only the indirect path from asthma to self-efficacy through depressive feelings was tested.

The weighted least square parameter (WLSMV) estimator was used to estimate the direct and indirect parameters in M-Plus (Muthén & Muthén, 1998-2006). The indirect estimates were calculated using the bootstrapping procedure with 500 times a pseudo-sample (with replacement), which provided 95% confidence intervals for the indirect parameters. In all analyses, adolescents' and children's age and gender and maternal/paternal smoking were included as covariates. In addition, in the childhood sample, the intervention condition was included as a covariate. The full information maximum likelihood method was used to handle missing values on the study variables.

Results

Adolescent sample

In total, 11.3% of the adolescents reported a diagnosis of asthma. Almost half of them were boys (47.4%); within the asthma sub-sample the percentage of boys was slightly higher (53.8%) than among adolescents without asthma (46.6%, χ^2 (1, 4516[4]) = 9.482, $p = .002$). There were no age differences (t (4518) = -.301, $p = .76$).

4 We have some missing values on model variables. In the final model examining indirect paths, the full information maximum likelihood method was used to handle missing values on all variables.

Adolescents with asthma were more likely than adolescents without asthma to have a smoking father (37.4% versus 29.6%, χ^2 (1, 4318) = 12.409, p < .001) or a smoking mother (27.7% versus 23.7%, χ^2 (1, 4390) = 3.798, p =.05). Mean scores for adolescents with and without asthma on depressive feelings and self-efficacy can be found in Table 1. T-tests for independent samples confirmed that adolescents with asthma had higher scores on depressive feelings than adolescents without asthma (p = .001). Furthermore, adolescents with asthma perceived themselves as more efficacious to refrain from smoking than their peers without asthma (p = .001). At follow-up, 29.9% of all adolescents initiated smoking. Adolescents with and without asthma reported similar rates of initiation (27.8% and 30.1%, respectively, χ^2 (1, 4491) = 1.117, p = .29).

Results for the indirect model can be found in Figure 2. In this model, the covariates age, gender, maternal smoking, and paternal smoking were included in the analyses (estimates not shown). Concerning the direct estimates, positive associations were found for the relationships between asthma and both depressive feelings

Table 1 Demographic characteristics and mean differences for depressive feelings and self-efficacy for adolescents and children with and without asthma

	Adolescents (N = 4,531)		**Children (N = 1,289)**	
	%	M (SD) range	%	M (SD) range
Gender, boy	47.4		47.1	
Smoking mother	23.7		19.4	
Smoking father	30.2		26.0	
Age		12.8 (.75) 11-16		10.1(.78) 8-12
Depressive feelings [a]				
No asthma		**2.13** (.65) 1-5		**2.26** (2.1) 0-10
Asthma		**2.23** (.69) 1-5		**2.74** (2.2) 0-10
Self-efficacy [b]				
No asthma		**4.28** (.59) 1-5		5.10 (.91) 1-6
Asthma		**4.37** (.55) 1-5		5.21 (.85) 1-6

Note. Bold mean scores differ significantly (p < .05) within the samples between adolescents/children with and without asthma. [a] Measured with different instruments: Depressive Mood List for adolescents' reports and Strength and Difficulties Questionnaire with maternal reports in the childhood sample. [b] Self-efficacy was measured with identical items, but number of response options differed with 5 response options in the adolescent sample and 6 response options in the child-sample.

(Beta = .07, p = .003) and self-efficacy (Beta = .10, p < .001). Furthermore, higher amounts of depressive feelings were associated with lower levels of self-efficacy (Beta = -.17, p < .001), but the relationship between depressive feelings and smoking initiation was not significant. Finally, a higher perceived self-efficacy to refrain from smoking was associated with lower levels of initiation (Beta = -.18, p < .001).

Regarding the indirect effects, bootstrap procedures revealed that the relationship between asthma and self-efficacy runs via depressive feelings (bootstrap $B_{indirect}$ = -.01, z = -2.695, p = .007; *95% CI* between -.02 and -.01). It also revealed that the relationship between depressive feelings and smoking initiation runs via self-efficacy (bootstrap $B_{indirect}$ = .03, z = 6.104, p < .001; *95% CI* between .02 and .04). A total of 4.7% of the variance in self-efficacy could be explained by asthma, depressive symptoms and the covariates. For smoking initiation, these same variables plus self-efficacy explained 6% of the variance.

Childhood sample

Among the children, 14.3% ever had a diagnosis of asthma. Gender was not equally divided between children with and without asthma; the percentage of boys was higher among children with asthma (58.7%) than among children without asthma (45.2%, χ^2 (1, 1289) = 11.60, p = .001). Children with asthma were slightly older (M = 10.2, SD = .85) than were children without asthma (M = 10.1, SD = .77, t (1285) = -2.277, p = .023). There were no differences for maternal and paternal smoking (χ^2 (1, 1289) = .033, p = .85 and χ^2 (1, 1255) = .046, p = .83 respectively). Higher scores for depressive feelings were reported by mothers of children with asthma than by mothers of children without asthma (see Table 1: p = .003). Children with asthma reported similarly on self-efficacy as children without asthma (p = .10).

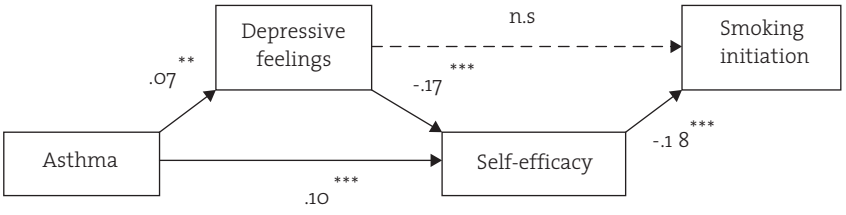

Figure 2 Standardised regression coefficients for the direct effects of the study variables tested among **adolescents.** The results are controlled for age, gender, maternal smoking, and paternal smoking. N = 4,531; CFI = 1.000; TLI = 0.995; RMSEA = 0.007; $^{*}p$ < .05, $^{**}p$ < .01, $^{***}p$ < .001, n.s. = non significant.

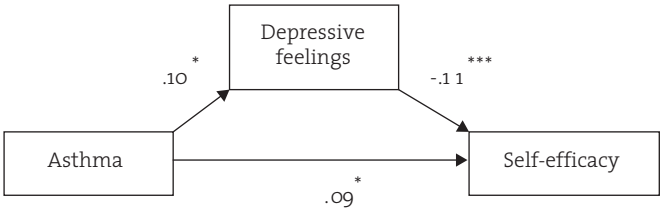

Figure 3 Standardised regression coefficients for the direct effects of the study variables tested among **children.** The results are controlled for age, gender, maternal smoking, paternal smoking, and intervention condition. N = 1,289; CFI = 1.000; TLI = 1.000; RMSEA = 0.000; $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

The model estimates are displayed in Figure 3. Asthma status was associated with higher amounts of depressive feelings (Beta = .10, p = .02). Additionally, asthma status was associated with higher self-efficacy to refrain from smoking (Beta = .09, p = .05). Higher amounts of depressive feelings were associated with lower self-efficacy (Beta = - .11, $p < .001$). The model examining whether depressive feelings form an indirect path between asthma status and self-efficacy was marginally significant (bootstrap $B_{indirect}$ = -.01, z = -1.805, p = .07; *95% CI* between -.02 and .001). Together with the covariates, these variables explained 2.3% of the variance in self-efficacy.

Discussion

Young people with asthma engage in smoking behaviour as frequently as do peers without asthma (Mcleish & Zvolensky, 2010). The present study examined two possible mechanisms that explain the association between asthma and smoking initiation in two independent samples that covered the age ranges of late and middle childhood and adolescence. Results indicated that more depressive feelings decreased adolescents' self-efficacy to refrain from smoking, which subsequently increased the risk to initiate smoking two years post-baseline among the adolescent sample. Because both adolescents and children with asthma showed higher amounts of depressive feelings than did peers without asthma, this finding may instigate another indirect path. Specifically, asthma status is associated with higher amounts of depressive feelings, which subsequently are associated with lower self-efficacy. This was found for adolescents and a trend for this indirect path was found in the childhood sample.

In total, this study presumed that the link between asthma and smoking could be explained by depressive feelings and subsequent lower levels of self-efficacy.

The present study extends current knowledge in several ways. First, although direct effects between depression and self-efficacy (Engels et al., 2005), and self-efficacy and smoking (Hiemstra et al., 2011) have been investigated regularly, to our knowledge, only one study (Minnix et al., 2001) examined the indirect path from depression to smoking through self-efficacy. We replicated their findings of partial mediation by self-efficacy between depression and a smoking related outcome measure. However, Minnix et al. (2001) focused on smoking susceptibility, and the current study examined smoking initiation in an adolescent sample.

Second, we contribute to current knowledge by providing insight into the mechanisms that may underlie the increased or similar risk for smoking among adolescents and children with asthma. Associations between asthma and depression have been documented (e.g., McQuaid et al., 2001). In addition, this association has been linked to smoking behaviour, with adolescents with asthma and co-morbid disorders including depression being more likely to be smokers than are adolescents with asthma but without co-morbid disorders (Bush et al., 2007). The current results add to the finding of increased risk due to co-morbidity of depressive feelings forming an indirect path in the relationship between asthma and smoking, and that self-efficacy to refrain from smoking plays a role in this process. These mechanisms provide specific advice for tailored smoking prevention.

Implications for smoking prevention are twofold. First, our results indicate that targeting depressive symptoms are associated with higher self-efficacy to refrain from smoking and, subsequently, might help to prevent smoking in adolescents with *and* without asthma. This finding implies a broader approach in which one can focus on depressive feelings and, thereby, decrease the odds for substance abuse. For instance, this strategy was used in a study that targeted aggressive classroom behaviour as the problem behaviour, which reduced the risk for smoking initiation in adolescent boys (Kellam & Anthony, 1998). As Munoz, Cuijpers, Smit, Barrera, and Leykin (2010) underscored in their review, depression is among the most preventable mental disorders. School-based programmes are now available that target preventing the increase of depressive symptoms during adolescence (e.g., Tak et al., 2012). The current study found support for the notion that a decrease in smoking can be accomplished by the prevention of depression, which might affect perceived self-efficacy to refrain from smoking. This finding also means that, in addition to depressive symptoms, once this risk group of young people are reached, extra attention can be paid to the mechanism of self-efficacy. Incorporating an additional module within a depression prevention programme could be one way to accomplish this goal. A second option could be to

offer adolescents with elevated levels of depression a specific smoking prevention program that focuses on refusal skills. One such programme could apply the European Smoking Prevention Framework Approach (ESFA), a large-scale prevention project evaluated in six European countries with a substantial focus on smoking cognitions and training in refusal skills (De Vries et al., 2006).

Second, the present study highlighted that, especially for children and adolescents with asthma, the indirect pathway from depressive feelings to smoking via lower self-efficacy may be an important explanatory mechanism. Although adolescents with asthma generally believe that they are more capable to refrain from smoking, our results suggest that once these adolescents feel depressed, their self-efficacy can decrease because of the influence of the depressive feelings. This occurrence places these children and adolescents at a higher risk for smoking initiation. A selected prevention approach is warranted, with the specific objective to reach children and adolescents with asthma. Interventions adapted to the specific needs of children and adolescents with asthma and depressive feelings can then be offered. Unfortunately, to date no asthma-specific psychological interventions with well-conducted randomised controlled trial designs within adolescent samples are available (Yorke, Fleming, & Shuldham, 2007). Recently, a peer-led randomised controlled trial was conducted among adolescents with asthma in Jordan and was successful in increasing self-efficacy levels to refrain from smoking (Al-sheyab, Gallagher, Crisp, & Shah, 2012). The present study underscores the prevention approach through self-efficacy and the short-term results by Al-sheyab et al. (2012) look promising. Therefore, replication of this prevention programme in other countries is advisable, including long-term follow-ups to assess smoking behaviours.

Additionally, this study provides insight into the timing of smoking prevention efforts. It argues that undertaking smoking prevention among children at age 10 might be useful because results suggest that the first mechanism (i.e., association of asthma with self-efficacy through depressive feelings) already exists in this younger sample. Other researchers have also suggested that smoking prevention should start in grade 4 (8, 9, or 10 years old) (Khuder, Price, Jordan, Khuder, & Silvestri, 2008).

Some aspects of this study should be noted. The administration strategies classroom assessments in the adolescent sample and at-home telephone and questionnaire assessments in the childhood sample might have affected the model findings. With the inclusion of two independent samples, we did not aim to make a direct comparison. Rather we intended to test a model in two age groups and open doors to prevention strategies by examining whether the association differs across cohorts. It can be considered a strength and an indication of the integrity of results that support for the main model was found in the two age

groups. The concept of self-efficacy was measured with the same questionnaire in both samples, and depressive feelings were measured with different questionnaires and different informants (self versus mother report). Similar results in both samples support our hypotheses and underscore the robustness of the findings.

We did not consider the severity of asthma. All children and adolescents who, at some time in their lives, had received an asthma diagnosis were assigned to the 'asthma' group. However, concerning asthma severity and smoking, no large differences in smoking rates have been found among those who currently experienced asthma symptoms and those who did not (Precht et al., 2003; Zbikowski, Klesges, Robinson, & Alfano, 2002). For prevention efforts that focus on depressive feelings (and subsequent self-efficacy), it is important to be aware that adolescents with more asthma symptoms have been found to report higher levels of depressive symptoms (Richardson et al., 2006).

Conclusions

To date, no smoking prevention programme exists that works across all environmental settings for all individuals. Therefore, "[r]esearch should address which interventions produce which specific results in which people under which environmental circumstances" (Johnson et al., 2007, p. 1048). The present study adds to our understanding of smoking initiation in children and adolescents with asthma by suggesting that one strategy to prevent smoking uptake is to target the underlying mechanisms of depressive feelings and self-efficacy. Among adolescents with asthma, this suggestion is especially important as they often show elevated levels of depression, which can instigate the process that leads to smoking.

Part II

Perceptions and Quality of Life in childhood asthma

7

The role of maternal illness perceptions in perceived asthma symptoms in school-aged children

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Abstract

The objective was to examine the unique contribution of perceptions held by mothers about their children's asthma in relation to symptoms as reported by their children. Families with a child diagnosed with asthma participating in a larger smoking prevention study were invited to participate. For all, 89 children (mean age 10.1 years) and 87 mothers questionnaire and lung function data during home visits were provided. The main outcome of this study involved asthma symptoms as measured by the Paediatric Quality of Life Inventory. Mothers' and children's reports of symptoms, as well as the lung function parameter of percentage of predicted Forced Expiratory Volume in one second (% of predicted FEV_1), were analysed in relation to maternal illness perceptions.

Mothers' perceptions of illness were not associated with % of predicted FEV_1. However, while controlling for gender and children's baseline asthma symptoms, four out of eight mothers' perceptions of illness (i.e., identity, consequences, concern, and emotional influence) were associated with children's asthma symptoms. Additional analyses controlling for % of predicted FEV_1 in the models with subjective asthma symptoms reports of mother and child did not change the study findings. This pilot study provides evidence that, in addition to children's lung function and baseline symptoms, maternal perception of illness contributes to symptom-related quality of life (QoL) of children. More research on underlying mechanisms, which addresses the linking of mothers' perceptions of concern and emotion to the QoL symptoms as reported by children is necessary.

Introduction

Asthma, characterised by symptoms such as coughing, wheezing, breathlessness, and/or chest tightness, is a common chronic disease in childhood in the Netherlands (Van de Ven, Van den Eijden, & Engels, 2006a) and worldwide (e.g., Williams et al., 1999). Objective physical measures (as measured in lung function testing) cannot always verify the intensity of these symptoms (e.g., Rietveld, Prins, & Colland, 2001; Stahl, 2000). Patients with similar severity levels of asthma symptoms, as established with objective measures, may have different perceptions of quality of life (QoL) (Guyatt, Feeny, & Patrick, 1993). It is important to understand the perception of both symptoms and factors that may affect perception of asthma severity, because both under- and overperception of symptoms can result in serious medical consequences and asthma management errors (Lane, 2006).

A review by Hagger and Orbell (2003) offered convincing evidence of the importance of illness perception as a psychological construct that contributes to illness outcome. Studies described in this review focused primarily on adult populations, utilised cross-sectional methods, and included only one informant, increasing the risk for shared method variance. Parents are the important socialising agents during childhood in terms of health behaviours and attitudes (Lau, Quadrel, & Hartman, 1990; Tinsley, 1992). Several familial psychological factors, such as family conflict, stress, and caregivers' psychological dysfunctioning (Kaugars, Klinnert, & Bender, 2004), family routines (Fiese, Wamboldt, & Anbar, 2005), and parental support (Rhee, Belyea, & Brasch, 2010), have been associated with childhood asthma outcomes. For example, in families whose adolescents perceived significant parental support, adolescents reported higher QoL than adolescents in families in which parents were perceived as less supportive (Rhee et al., 2010). In the present study, we aimed to examine the association between mothers' perceptions of their children's asthma and the children's perceived symptoms 1 year later.

Illness perceptions and illness outcomes

In general, patients with asthma spend limited time with health care professionals, who provide them with objective information (McWilliam, 2009). Consequently, they have many opportunities to create and develop subjective mental representations about the causes, consequences, duration, identity, emotional influence, and controllability of asthma. These so-called "illness perceptions" reflect cognitive and emotional components and are believed to affect illness outcomes via coping strategies (Leventhal, Meyer, & Nerenz, 1980). Particularly in the case of asthma's unpredictable course, illness outcomes are hypothesised to be highly dependent on patients' illness perceptions (Kaptein, Klok, Moss-Morris,

& Brand, 2010). Studies have demonstrated the importance of familial factors in children's illness outcomes (e.g., Anthony, Gil, & Schanberg, 2003; Conn et al., 2005; Kaugars et al., 2004; Rhee et al., 2010; Spurrier et al., 2000). More specifically, concerning parental perceptions, Spurrier et al. (2000) showed that parents who perceived their child as more vulnerable were more likely to (a) visit a general practitioner, (b) keep their child home from school, and (c) give their child regular preventive medication. Children of parents, who perceived their child as more vulnerable also, had higher levels of social anxiety (Anthony et al., 2003). Furthermore, most parents had strong beliefs of necessity for their children's asthma medication in the study of Conn et al. (2005), but parental perception of concern about controller medication had a greater impact on children's adherence. These findings suggest that parental perceptions of illness might influence the way in which a child manages, copes, and lives with asthma.

In summary, this study aims to examine the unique contribution of maternal perceptions of asthma to the QoL of children, as reported by both the mother and the child. We expect that mothers' perceptions of their child's illness will contribute to their reports of their child's asthma symptoms 1 year later (intrapersonal hypothesis). In addition, we expect that maternal perceptions of illness will contribute to children's subjective reports of asthma symptoms 1 year later (interpersonal hypothesis), above and beyond the objective severity.

Method

Procedure

Data were collected from a subsample of mother-child dyads participating in a larger study evaluating a home-based smoking prevention programme (see Hiemstra et al., 2009). At the baseline of the prevention study, 220 mothers (15%) out of 1478 participating mothers indicated that their children ever had asthma and/or that the children had ever received a diagnosis of asthma. If they answered both questions positively and their family participated in the prevention study of 15 months post-baseline (n = 214), they were considered to be candidates for an additional home visit to conduct a spirometer lung function test and for a more in-depth study on asthma-related topics. The Dutch translation of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire (Asher et al., 1995) was used to verify the present asthma symptoms via a phone call. In 108 cases, mothers indicated that their child was not presently on asthma medication or had not experienced asthma symptoms in the past 12 months, leading to 106 eligible families. Fourteen families were not willing to participate and three families did not respond. Chi-square tests and the t-test did not reveal any

demographic differences for age, nationality of the child, or maternal education between participating and non-participating families. A marginally significant difference was found for gender, with boys being slightly overrepresented in the participating families (65.2% in the participating families and 41.2% in the non-participating families, χ^2 (1,106) = 3,464, p = .063). Furthermore, two mothers appeared not to be at home during the home visit and did not return the questionnaire, which was left at the home. Therefore, data used in this study are from 87 mothers and 89 children. The children's mean age at baseline was 10.1 years (range = 8-12 years, SD = .87) and 96.6% had Dutch nationality. Most of the children lived with both of their biological parents (78.7%); the remaining children lived with their mothers or were in a situation of co-parenting. Almost all children presently used asthma medication (97%); 21% used short-acting ß-agonists exclusively and the remaining used long-acting ß-agonists (in combination with or without a short-acting ß-agonist). Mothers generally had a high educational level; 12% obtained up to preparatory secondary school for vocational education, 43% obtained intermediate vocational education and pre-university education, and 43% followed higher professional education and university education. Before visiting the families at home, the questionnaires were piloted to check their readability and length. During the home visits, the mother and child were asked to fill in their questionnaires individually. All the children attended regular primary schools, except one girl who attended special education. During the home visit, this one child could not read all the questions within the 1 hour of the home visit and the researcher helped this child by reading the questions aloud. Five families refused a home visit but agreed to fill in questionnaires by post. To maintain confidentiality of family members, these families received two separate return envelopes, one for the mother and one for the child. In addition, the families received a gift coupon after participating and completing the questionnaires. The study was approved by the ethics committee of the Faculty of Social Sciences at the Radboud University Nijmegen.

Measures

Maternal illness perceptions were measured at baseline of the prevention study using an adapted version of the Brief Illness Perception Questionnaire (B-IPQ) (Broadbent, Petrie, Main, & Weinman, 2006). Five cognitive perceptions (i.e., identity, time line, personal control, treatment control, and consequences), two emotional perceptions (i.e., concern and emotion), and one item measuring 'understanding' were modified to allow mothers to report their child's asthma by phone (see Appendix). For example, the original item assessing consequences ('How much does your illness affect your life?') was changed to 'How much does the asthma of your child affect his/her life?' Similar adaptations of the original

Illness Perception Questionnaire-Revised (Moss-Morris et al., 2002) were made by Law (2002), who adapted the original items to measure mothers' perception of their child's diabetes. Furthermore, to enable telephone interviewing, the original 10-point response format was transformed into a format with four response options, with higher scores indicating greater belief in that specific perception.

Child asthma symptoms at follow-up (henceforth referred to as QoL symptoms) were measured during home visits, using the symptom sub-scale of the Paediatric Quality of Life Inventory (PedsQL, asthma module) (Varni, Burwinkle, Rapoff, Kamps, & Olson, 2004), which has showed high levels of reliability, validity, and responsiveness required in paediatric asthma care (Seid et al., 2010). Asthma symptoms were measured with items covering differential asthma symptoms in children aged 8-12 years, such as wheezing, coughing, and experiencing problems when playing outside or with pets. Mean scores of the 11 items measured on a five-point scale ranging from "almost never" to "almost always" were calculated, with higher scores indicating higher QoL at the asthma symptom level. The PedsQL has a child and a parent version. Both were assessed during the home visit. Cronbach's alpha was 0.85 for the mothers' version and 0.81 for the children's version.

Child lung functioning was measured with a spirometer during the home visits (Pt-medical, the Netherlands) to obtain an indication of the child's physical lung function. To conform to American Thoracic Society standards, all spirometry tests were performed at least 4 h after using short-acting ß-agonists and 12 h after long-acting ß-agonists. For each child, the manoeuvre with the highest sum of FEV_1 and the Forced Vital Capacity (FVC) was chosen after the child performed three reproducible manoeuvres, which was the case for 84 children (94%). The percentage of the predicted FEV_1 value was used as an indicator of lung functioning.

Covariates

We controlled for gender and child baseline asthma symptoms which were measured during the baseline assessment of the prevention study using the Dutch version of an asthma screening tool for children aged 7-13 developed by the American College of Allergy, Asthma, and Immunology (ACAAI) (Redline et al., 2004). Children had to indicate whether they experienced any of the seven asthma symptoms using the responses "never", "sometimes", or "a lot". A "sometimes" or an "a lot" answer was scored as 1, "never" as 0. A score of 3 or more indicated that the child should consult a general practitioner (26). The scores were dichotomised, with 0 = no risk and 1 = above the risk score for asthma consultation. This screening score served as a control measure for symptoms that a child experiences at baseline. α was 0.74.

Statistical analyses

In the first step of the analyses, descriptive statistics were provided. In the second step, separate linear regression analyses were performed for each illness perception (eight) to test associations between illness perceptions and the objective lung function measure %FEV_1 (regression model 1), between illness perceptions and maternal report of children's symptoms (regression model 2), and between illness perceptions and children's own reports of symptoms (regression model 3). Finally, the regression analyses with the subjective QoL symptoms reports (i.e., models 2 and 3) were conducted once more with %FEV_1 added as an additional covariate to examine whether this would change the findings.

Results

Sample characteristics

At follow-up, children reported a mixture of symptoms on the QoL symptoms scale (M = 3.75, SD =.62). Mothers had similar scores (M = 3.77, SD =.67) on this same scale (r = 0.50, p < .001). As shown in Table 1, mothers of boys reported higher QoL for their children. Children who scored above the threshold for asthma referral on the asthma screening list at baseline (68.5%) reported a lower QoL 1 year later. Furthermore, the mean percentage of predicted FEV_1 was 93.82 (SD = 10.49), indicating good lung function in general. Six children had a value of ffi 80% FEV_1, indicating seriously affected lung function (National Institutes of Health, 1997).

Parental illness perceptions predicting QoL symptoms

As seen in Table 2, column 1 depicts that none of the maternal illness perceptions was related to the lung function indicator %FEV_1. In contrast, as depicted in columns 2 and 3, when including the subjective indicator of symptoms, four maternal illness perceptions were associated with children's disease outcome as reported by the mother (intrapersonal perspective), and when children reported their own asthma symptoms (interpersonal perspective). Specifically, a stronger belief that asthma would affect the child's life (perception: consequences), a conviction that the child experienced more symptoms (perception: identity), a greater concern (perception: concern), and more emotional responses to the child's asthma (perception: emotional response) were associated with lower scores on the child's QoL, as reported by both mothers and children 1 year later.

Table 1 Sample characteristics (*number of participants (%)*), and the subjective measure of QoL symptoms (*Means (SD)*), reported by mother and by child

	N (%)	QoL-symptoms	
		Mother report Mean (SD)	Child report Mean (SD)
Gender			
Boy	58 (65.2%)	**3.90 (.59)**	3.79 (.58)
Girl	31 (34.8%)	**3.52 (.74)** *	3.67 (.69)
Age			
8-9	22 (24.7%)	3.63 (.67) [a]	3.60 (.65)
10	40 (44.9%)	3.95 (.63)	3.88 (.58)
11-12	27 (30.3%)	3.60 (.66)	3.65 (.62)
Education mother [b]			
Low	11 (12.4 %)	**3.40 (.80)** * [c]	3.54 (.53)
Middle	38 (43.0 %)	**3.58 (.61)** **[c]	3.63 (.58)
High	38 (43.0 %)	**4.05 (.60)**	3.90 (.64)
Baseline asthma screening score [b]			
No risk	24 (27.0%)	**3.99 (.57)**	**4.22 (.52)**
Risk score	61 (68.5%)	**3.67 (.70)** *	**3.54 (.55)** ***

* $p < .05$; ** $p < .01$, *** $p < .001$ (two-tailed),

[a] p-value for the Analysis of Variance (ANOVA) for age and mother report is marginal significant ($p = .065$).

[b] Does not add up to 100% because of two missing values for education mother and four missing values for asthma screening score.

[c] Bonferroni *ad-hoc* tests show that lower- and higher-educated, and middle- and higher-educated mothers differ significantly.

Table 2 Linear regression coefficients for the eight illness perceptions predicting %FEV_1 and QoL-symptoms. Adjusted for gender and child's reported baseline symptoms (screening risk)

	% FEV_1				QoL-symptom scale (mother report)				QoL-symptom scale (child report)			
	ß	B	95%CI B	*p*	*ß*	B	95%CI B	*p*	*ß*	B	95%CI B	*p*
Step 1												
Gender [a]	0.14	3.09	-2.12 /8.30	.24	**-0.22**	**-0.31**	**-0.61 /-0.01**	**.04**	0.01	0.02	-0.25 /0.28	.90
Screening risk [b]	-0.15	-3.63	-9.12 /1.89	.20	-0.21	-0.31	-0.62 /0.01	.06	**-0.50**	**-0.69**	**-0.97 /-0.42**	**<.001**
Steps 2 Perceptions [c]												
1: Consequences	-0.15	-2.74	-6.85 /1.38	.19	**-0.34**	**-0.38**	**-0.61 /-0.14**	**.002**	**-0.24**	**-0.24**	**-0.45 /-0.04**	**.02**
2: Time Line	-0.01	-0.17	-3.74 /3.39	.92	-0.14	-0.14	-0.35 /0.08	.21	0.01	0.01	-0.18 /0.19	.96
3: Personal control	-0.05	-0.74	-4.18 /2.70	.67	-0.07	-0.06	-0.27 /0.14	.54	-0.04	-0.03	-0.20 /0.14	.70
4: Treatment control	0.11	1.69	-1.20 /5.37	.37	0.09	0.09	-0.14 /0.31	.45	0.01	0.01	-0.18 /0.20	.93
5: Identity symptoms	-0.17	-3.04	-7.11 /1.04	.14	**-0.35**	**-0.40**	**-0.65 /-0.15**	**.002**	**-0.22**	**-0.22**	**-0.43 /-0.02**	**.03**
6: Concern	-0.02	-0.26	-3.40 /2.87	.87	**-0.29**	**-0.27**	**-0.46 /-0.08**	**.007**	**-0.27**	**-0.21**	**-0.37 /-0.06**	**.007**
7: Understanding	0.07	1.31	-2.77 /5.39	.52	0.10	0.12	-0.13 /0.36	.35	0.03	0.04	-0.17 /0.24	.74
8: Emotional Response	-0.10	-1.23	-4.28 /1.82	.42	**-0.31**	**-0.26**	**-0.44 /-0.08**	**.006**	**-0.25**	**-0.19**	**-0.34 /-0.04**	**.01**

[a] Boys are reference category. [b] Children scoring under the cut off score for risk for asthma are reference category. [c] This table reflects eight separate linear regressions: step 1 is the same for all regressions but step 2 constitutes of one perception per linear regression which is replaced by another perception each time.

Discussion

The way in which patients perceive their illness is known to affect their disease outcomes (Leventhal et al., 1980). In addition, several familial influences (e.g., family stress) have been found to relate to a child's asthma outcomes (Kaugars et al., 2004). However, little is known about whether and how parental illness perceptions of asthma affect children's asthma outcomes. The present study aimed to extend the current literature on parental involvement in childhood illness by examining the unique contribution of eight separate perceptions of mothers regarding their children's asthma and asthma symptoms as reported by their children (i.e., QoL). The results indicated that some maternal illness perceptions (depending on the content) indeed contribute to asthma outcome measures reported by both mother and child.

Maternal perceptions of child asthma were not associated with physical lung functioning (indicated by $\%FEV_1$). Limited accuracy in the relationship between perceptions and objective measures has also been found in a number of studies including adult populations (e.g., Kendrick, Higgs, Whitfield, & Laszlo, 1993; Nguyen, Wilson, & German, 1996; Stahl, 2000) and childhood asthma samples (Rietveld et al., 2001; Stahl, 2000; Yoos, Kitzman, McMullen, & Sidora, 2003). However, moderately strong associations between parental perception of changes in severity of children's symptoms with physiological measures were found for children aged 7-10, but these correlations were low in children aged 11-17 (Juniper, 1997), which is within the age range of our present sample. On an average, children in this sample showed high values of $\%FEV_1$, indicating relatively adequate lung functioning. Perhaps larger sample sizes or more diversity in the sample are needed to find significant associations between objective lung function indicators and maternal perception of asthma.

However, when examining whether maternal perceptions of child asthma were associated with future *subjective* symptom outcome measures (i.e., child asthma symptoms), we found associations with four perceptions. These associations were found longitudinally when symptoms were reported by mothers 1 year later. More specifically, when mothers (a) attributed more consequences to asthma of their children, (b) perceived more frequent asthma symptoms, (c) were more concerned about asthma, or (d) perceived asthma as having higher emotional effects; mothers and children were more likely to report a lower QoL 1 year later. Therefore, the results show that illness perceptions, although presently not concerning the mothers' own illness but rather the child's illness, are associated with disease outcome (i.e., subjective physical functioning, defined by QoL symptoms).

In a second step, as stated in the endnote,[5] this analysis was repeated with the inclusion of $\%FEV_1$. Above and beyond this indicator of lung function, results show that perceptions of the mother predicted QoL. Although the present study is exploratory, we found primary support for the idea that maternal perceptions of children's asthma affect children's symptoms reported 1 year later. We recommend that future studies examine the role of parents' illness perceptions in child illness outcomes, to examine more closely any confounding factors. We mention maternal education as a confounding variable in our results, but other factors may also play a role. For example, parenting strategies, parents' own asthma history, asthma knowledge, and child factors such as coping behaviour or personality but also concurrent allergies and other child health conditions, may affect caregivers' perceptions. Our results remained similar after inclusion of maternal education in the model, except for perceptions of the consequences and symptoms identity, which became non-significant in the analyses with child QoL outcome report. Maternal perceptions of concern and emotional impact of her child's asthma were consistently associated with mothers' and children's Qol reports in all analyses. The latter is in line with Kaugars et al. (2004), who demonstrated that caregivers' psychological characteristics affect child asthma outcomes. Furthermore, positive caregiver expectations (defined as expectations about the ability to manage the child's asthma) were associated with better child functional status measured by sleeping, eating, energy level, and mood (Wade, Holden, Lynn, Mitchell, & Ewart, 2000). Thus, it may be interesting to examine how parents with different psychological characteristics think of, and perceive the asthma of their child, because when parents are more concerned and emotional, they and their children are likely to report more symptoms. Consequently, this may result in an overattribution of symptoms on which the child may act, leading to consequences such as inadequate asthma management or overuse of medications (Lane, 2006). From a prevention perspective, it is important to gain insight into the coping mechanisms of mothers who are more concerned or emotional about their child's asthma, as researchers have argued that these perceptions affect disease outcomes through coping mechanisms (Kaptein et al., 2010).

Similar to our main findings, Hagger and Orbell (2003) showed in their meta-analysis that particular perceptions of identity (i.e., the attribution of symptoms to one's illness) and consequences (i.e., the consequences of one's illness) were

5 As mentioned in the "methods" section, we also tested whether results would change if we included the $\%FEV_1$ value as a covariate, but this was not the case. Furthermore, we tested the model with maternal education as an additional covariate at step 1. Results for perceptions 1, 5, 6, and 8 for mothers' report of QoL remained similar, while for children's report of Qol, perceptions 6 and 8 remained significant.

negatively related to physical functioning (amongst other outcomes). Although in Hagger and Orbell's meta-analysis perceptions of control were also related to more adaptive outcomes, the present study did not reveal such relationships with asthma symptoms.

Regardless of the question of who is the best provider of information about the child's QoL (e.g., Guyatt, Juniper, Griffith, Feeny, & Ferrie, 1997; Le Coq, Boeke, Bezemer, Colland, & Van Eijk, 2000; Rutishauser, Sawyer, & Bowes, 1998), which is frequently mentioned in the literature, we suggest that it is preferable to discuss asthma with *both* parents and children, especially when the child is approximately 11 years old or younger. The present results revealed that a child's asthma symptom report is not free of parental influences, although at first sight it may seem independent. This presents challenges associated with clinical practice that may focus too strongly on the physical status of the child, underestimating other psychosocial aspects such as parental concern.

Study limitations and strengths

Some limitations of this study should be mentioned. In this study, we used an adapted version of the B-IPQ (Broadbent et al., 2006), giving the study an exploratory character. Although we found support for the effect of parental illness perceptions on asthma symptoms reported by children while controlling for important variables, replication with other perception questionnaires is absolutely warranted. In addition, it may be interesting to consider the child's own perceptions using the B-IPQ or, when possible, a questionnaire that is disease specific (e.g., the Asthma Illness Representation Scale; Sidora-Arcoleo, Feldman, Serebrisky, & Spray, 2010) and that may cover more specific beliefs about asthma and medication use. Also, more measurement points throughout the year may complement insight into the relationship between illness perceptions and outcome variables. Data collection of the follow-up wave took place in March and April, which is just before the peak of the Dutch pollen season. This may have created interference with seasonality for our outcome measures, as asthma is found to be related with seasonality with respect to, for instance, asthma hospitalisations (Crighton, Mamdani, & Upshur, 2001). On the other hand, responses to questions about lifetime prevalence and 12-month-period prevalence of symptoms of asthma generally did not reach statistical significance when evaluating the effect of season-of-responses in questions of the ISAAC (Stewart et al., 1997). Still, seasonal asthma and other concurrent allergies of the child may influence mother's perceptions of asthma as well. Future research might benefit from testing seasonal influences on associations between theory-driven predictor variables and asthma outcomes. Finally, replication including children's asthma severity and asthma control is warranted, as the relationship between psychosocial

factors of maternal perceptions and child symptom report may differ depending on severity and controlled versus uncontrolled asthma (Meijer, Griffioen, Van Nierop, & Oppenheimer, 1995).

One of the strengths of this study is that we used a subjective as well an objective indicator of asthma severity when predicting QoL. Although it would have been more accurate to control for baseline QoL symptoms when predicting specific QoL symptoms 1 year later, we controlled the baseline asthma severity by including an asthma screening list (core symptoms characteristic of childhood asthma such as wheezing, coughing, and exercise-induced breathlessness) and a lung function test. Second, we included the perspectives of mothers and children. Hence, the present study included information from multiple informants with respect to the main study outcome variable and the baseline control variable of asthma symptoms measured from the children's point of view as well.

Conclusions

In summary, this pilot study suggests that maternal illness perceptions might contribute to a lower symptom-related QoL in children. In childhood asthma, clinicians may obtain a more complete picture of different disease-related aspects by means of the perception of asthma held by mothers (e.g., by asking mothers to complete a B-IPQ (Broadbent et al., 2006) prior to consultation). Nevertheless, more research is necessary to understand the underlying mechanisms. For instance, it may be that maternal perceptions lead to adapted asthma management skills or certain coping styles of parents and children. Insight into the mechanisms may contribute to more effective education and intervention programmes which, in turn, could result in better disease outcomes and QoL. In addition to the perception of mothers, children's own perceptions of asthma could be valuable, since they may or may not overlap with their parents' point of view and may exert a different influence on the disease outcomes.

Appendix

Original items of the Brief Illness Perception Questionnaire (Broadbent et al., 2006)

1. How much does your illness affect your life?
2. How long do you think your illness will continue?
3. How much control do you feel you have over your illness?
4. How much do you think your treatment can help your illness?
5. How much do you experience symptoms from your illness?
6. How concerned are you about your illness?
7. How well do you feel you understand your illness?
8. How much does your illness affect you emotionally?

The items of the Brief Illness Perception Questionnaire, transformed to mother's perception concerning the children's asthma. Items were asked in Dutch.

1. How much does the asthma affect your child's life?
2. How long do you think the asthma of your child will continue?
3. How much control do you feel you have over your child's asthma?
4. How much do you think your child's treatment helps your child's asthma?
5. How much does your child experience the symptoms of his/her asthma?
6. How concerned are you about your child's asthma?
7. How well do you feel you understand your child's asthma?
8. How much does your child's asthma affect you emotionally?

8

The role of mother's and children's asthma perceptions in child Quality of Life: a longitudinal study

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Abstract

The literature indicates that quality of life (QoL) of children with asthma is affected by familial factors such as parental perceptions of child vulnerability. Maternal perceptions of childhood asthma are associated with child symptom-related QoL. This study examined the role of maternal perceptions in relation to broader child health-related QoL. Also, children's own perceptions were analysed. Dutch families (N = 261) with a child (10-15 years) with self-reported asthma were recruited via schools. Questionnaire data and lung function tests were obtained during home visits over two consecutive years. Most maternal and child perceptions were weakly correlated. Concerning the predictive value of perceptions, both maternal and child perceptions of 'identity' and 'consequences' predicted decreased levels of QoL at follow-up. Furthermore, children's baseline concern predicted a reduction in QoL in all subdomains. Finally, maternal perceptions reflecting the time line, treatment control and coherence predicted changes in children's QoL over time. Child's QoL is related to both the child's and the mother's perceptions of asthma. Health care providers should include both children and parents as informants to inquire about children's QoL and understand that within this age range (10-15 years), children's reports are not free of maternal influence. Current results also contribute to home-based asthma education interventions, which can start with assignments to encourage discussions between parents and children about asthma. In particular, children's concerns should be discussed, as their concerns about asthma were related to decreases in their QoL while maternal concern was not.

Introduction

Asthma is among the most common chronic diseases in childhood and adolescence, with recent numbers of the International Study of Asthma and Allergies in Childhood (ISAAC) indicating that worldwide 14% of 13- to 14-year-olds reported current asthma (Mallol et al., 2013). In the Netherlands, 7% of Dutch adolescents self-reported asthma symptoms and 13% self-reported an asthma diagnosis (Van De Ven, Van Den Eijnden, & Engels, 2006a). Generally, the literature and asthma interventions have focussed on asthma management through reductions in asthma symptoms or increases in medication adherence to enhance asthma control. However, health problems associated with asthma during adolescence also involve denial of the disease, underreporting of symptoms and increased risks for developing depressive and anxiety symptoms (Sadof & Kaslovsky, 2011; Towns & Van Asperen, 2009). Health-related quality of life (QoL) is often used as a subjective outcome measure to reflect the impact asthma has on a person's daily functioning and emotional well-being (Rutishauser et al., 2001). For children and adolescents, QoL is partly affected by ideas and routines within the family (Fiese, Wamboldt, & Anbar, 2005). Children and their parents often differ in their ideas about asthma and the child's asthma-related QoL (Annett, Bender, DuHamel, & Lapidus, 2003). The present study focussed on asthma illness perceptions held by children and their mothers and how they predict children's QoL reports over time.

Illness perceptions reflect cognitive as well as emotional representations about one's illness and are believed to affect illness outcomes via coping strategies (Leventhal, Meyer, & Nerenz, 1980). Particularly in the case of a condition with an unpredictable and variable course such as asthma (Fuhlbrigge, Guilbert, Spahn, Peden, & Davis, 2006), illness outcomes may depend partially on illness perceptions (Kaptein, Klok, Moss-Morris, & Brand, 2010). Indeed, Hagger and Orbell (2003) underscored the importance of illness perceptions in asthma, but not many studies have reported on childhood asthma; the empirical studies described in this review primarily focussed on adult populations. In addition, most studies have utilised cross-sectional methods and included only one informant, increasing the risk for shared method variance. Nonetheless, several studies have revealed that parents' perceptions, ideas and beliefs about a child's characteristics influence child asthma outcomes. In a qualitative study, Mansour and colleagues (2000) focussed on barriers to asthma care and concluded that parental attitudes and health beliefs modify how parents respond to caring for their child with asthma. Other studies have associated parental views of child vulnerability to several asthma outcomes and child behaviour, including medication adherence and social anxiety levels (Anthony, Gil, & Schanberg, 2003; Spurrier et al., 2000).

Recently, we reported on maternal asthma perceptions in another sample that included 87 mothers and 89 children. We examined whether maternal perceptions of their child's asthma were associated with child reports of asthma symptoms on a symptom-related subscale of QoL one year later (Ringlever, Otten, Van Schayck, & Engels, 2012b). We found that mothers who (a) attributed more consequences to their child's asthma, (b) perceived their child to experience more frequent asthma symptoms, (c) were more concerned and/or (d) perceived asthma as having a higher emotional impact reported a lower symptom-related quality of life for their children than mothers who gave lower scores to these perceptions. In addition, the children themselves also reported a lower symptom-related quality of life (Ringlever et al., 2012b). These results were found longitudinally, but we solely focussed on the symptom-related quality of life. In the present study, we were interested in the broader health-related quality of life (i.e. concerning medication, physical activities, symptoms, emotions and social interaction). In addition, while the former sample included children during late childhood (*mean age:* 10 years old), the present study examined maternal perceptions in a sample with families with early adolescents (*mean age:* 12 years old). A slightly older sample can provide new insights as child age is associated with several asthma outcomes, such as responsibility for asthma management and adherence to asthma medication (McQuaid, Kopel, Klein, & Fritz, 2003). It is of interest to examine the role of maternal perceptions in early adolescence as adolescents feel more responsibility for their own condition and can therefore be assumed to be less influenced by their mothers. Finally, the present study not only focussed on maternal asthma perceptions of the child's asthma, but it also concentrated on children's own asthma perceptions. Comparisons between parent and child reports concerning asthma-related outcomes are documented in the literature, including comparing visions on child quality of life (Annett et al., 2003). Agreement between parent-child illness perceptions is also documented for food-allergic adolescents who showed high comorbidity with asthma (Van der Velde, 2011), but, as far as we know, no studies are yet available indicating the agreement in illness perceptions between mother and child concerning childhood asthma. An abbreviated measure was used to examine illness perceptions. Consistent with the Brief Illness Perception Questionnaire (Brief-IPQ) published instructions (Broadbent, Petrie, Main, & Weinman, 2006), the eight items of the questionnaire were treated as individual items, similar to studies using the Brief-IPQ with adult patients (e.g., Sofianou et al., 2012) and adolescents with asthma (e.g., McGrady et al., 2010). As only a few studies have used the Brief-IPQ to measure *parental* perceptions of child disease, including childhood cancer (Michel, Taylor, Absolom, & Eiser, 2010), food allergy (Van der Velde et al., 2011) and recently asthma (Ringlever et al., 2012b), replication is warranted.

To summarise, while we have focussed on maternal illness perceptions in relation to child symptom-related QoL (Ringlever et al., 2012b), currently we have also concentrated on the child's own illness perceptions. To what extent are these perceptions consistent with maternal perceptions? Furthermore, while we only had the opportunity to examine maternal perceptions in relation to symptom-related QoL in the former study (Ringlever et al., 2012b), this time we examined whether both maternal and child asthma perceptions also influence other domains of child QoL.

Method

Procedure

A selection of primary and secondary schools in the Netherlands received a letter describing the purpose and procedure of the study. After school boards were approached by telephone to ask whether they were interested in participating, research assistants delivered letters to the interested schools, which subsequently distributed them to the children. Pupils were asked to hand this letter to their parents. In addition to an invitation for pupils with asthma and their parents to sign up, the letter included information about asthma in general and the purpose and procedure of the study. Moreover, to recruit participants, an announcement of the study was printed in the magazine of the Netherlands Lung Foundation. Families that were interested could register using a digital or paper application form. Families were included if the child met the following criteria: (1) aged between 10 and 15 years old, (2) diagnosed with asthma by a physician, (3) using asthma medication or experiencing asthma-related complaints at least once in the last 12 months and (4) adequate Dutch language skills. Of the 311 families that signed up, 261 (83.9%) met the inclusion criteria; 46 (14.8%) did not meet the criteria and 4 families (1.2%) cancelled for various reasons. At follow-up one year later, 257 (98.5%) families participated. All the participating families were visited at home by trained research assistants. After brief instructions and the guarantee of anonymity, the children and at least one of their parents completed questionnaires. In addition, the children performed a spirometry lung function test, assessed using Spida 5 software (e.g., Ringlever et al., 2012b). The present study used questionnaire data provided by the children and their mothers at baseline and at one year follow-up. The children's mean age at baseline was 11.9 years (*SD* = 1.0, *range* 10-15 years) and 59.4% was boys. The visits took between 1 and 1,5 hours and families received a voucher of 20 euros for participation at each visit.

Measures

Illness perceptions were measured using the Brief-IPQ (Broadbent et al., 2006). This generic questionnaire can be used to inquire about perceptions of several illnesses just by replacing the word 'illness' with the specific condition of interest. Children and mothers individually reported on six cognitive perceptions (i.e. identity, time line, personal and treatment control, consequences and coherence) and two emotional perceptions (i.e. concern and emotion). This means that for children the original eight items of the Brief-IPQ were included, while for mothers most items concerned 'the asthma of your child.' For instance, the original item assessing consequences, 'How much do you experience symptoms of your asthma?' was changed to 'How frequently does your child experience the symptoms of his/her asthma?' (see appendix). For each perception, respondents could indicate on a 10-point scale the extent to which the item applied to them.

Quality of life was measured with the Adolescent Asthma Quality of Life Questionnaire (AAQOL), which has been validated for adolescents aged 12-17 (Rutishauser et al. 2001). This scale comprised six domains (symptoms, medication, physical activities, emotion, social interaction and positive effects) with 32 items. A total score can be calculated from all subscales except the 'positive effects' subscale (Rutishauser et al. 2001). Internal consistencies for this scale at baseline (alphas at follow-up are displayed in parentheses) were: total score α = .94 (.93), medication subscale α = .87 (.71), symptom scale α = .88 (.87), physical activities α = .80 (.80), emotion α = .85 (.86) and social interaction α = .67 (.65). Higher scores indicate a better QoL.

Covariates include *QoL scores at baseline*, *age* and *gender* of the children. Furthermore, the following factors were examined for their possible confounding influence:

Socio-economic status (SES) was measured at baseline using 1 item for maternal education and recoded into 3 categories: 1 = lower-educated (18.5%), representing educational levels up to preparatory secondary school for vocational education; 2 = middle-educated (40.9%), representing intermediate vocational education and pre-university education; 3 = higher-educated (40.5 %), representing a higher professional or university education.

Asthma status of mother As maternal asthma may influence the mother's perceptions of asthma illness, the asthma status of the mother was measured using 1 item at the second wave. Most mothers (n = 168, 67%) indicated they had never had asthma themselves; 33 (13%) mothers indicated to have once had asthma and 51 (20%) of the mothers indicated that they currently had asthma. We recoded mothers who had asthma currently and in the past into one category, thereby creating a dichotomous variable with 0 = never had asthma and 1 = past or current asthma.

Asthma control was included as a confounder, as asthma control is associated with QoL (Vollmer et al., 1999) and is likely to influence asthma perceptions. Asthma control was measured at baseline using the Asthma Control Questionnaire (ACQ) (Juniper, O'byrne, Guyatt, Ferrie, & King, 1999), which contains five symptom items (i.e. wake due to night-time symptoms, wake in the morning with symptoms, limit daily activities, experience shortness of breath and wheezing), one item indicating the predicted percentage of pre-bronchodilator FEV1 and one item measuring the frequency of using a daily bronchodilator. All items were measured on a 7-point scale and equally weighted; therefore, mean scores between 1 (totally controlled) and 7 (severely uncontrolled) could be calculated. Cronbach's alpha was .77.

Statistical analyses

Mean scores (and standard deviations) for maternal and child illness perceptions about the child's asthma were calculated. Paired-samples t-tests compared dyadic differences between maternal and child reports of child asthma perceptions. Furthermore, intra-class correlations focussed on a dyadic similarity between adolescent and maternal reports of asthma perceptions (e.g., Burk & Laursen, 2010). Next, all proposed covariates (i.e. baseline QoL score, child's age, gender and asthma control and maternal education and asthma status) were tested for their predictive value for the QoL subscales. Only the covariates significantly contributing to one of the QoL subscales were included in step 1 of the final analyses. At step 2, one specific illness perception was included, resulting in eight separate regression analyses per quality of life subscale. All analyses were performed using SPSS 20.

Results

Children in this sample generally reported high levels of QoL with a total mean score of M = 6.00 (Sd = 0.78) on a scale from 1 to 7. Mean scores for the specific subscale ranged from M = 5.46, Sd = 1.14 (i.e. the symptom subscale) to M = 6.52, Sd = 0.66 (i.e. the medicine subscale). Table 1 provides the mean scores of the eight perceptions for children and mothers. Children reported their asthma to have a higher impact on their life (i.e. perception identity) and to experience fewer symptoms (i.e. perception consequences) than their mothers reported. In addition, children felt they had more personal control, but less treatment control than their mothers reported. Interestingly, mothers reported being more concerned about their child's asthma than the children themselves, but mothers and children did not differ regarding the emotional aspects of asthma. Finally, mothers reported to better understand childhood asthma than their children reported (i.e. perception

coherence). Intra-class correlations revealed that, except for the perception of personal control, perceptions held by the mother and child were related. However, all correlations between mother and child concerning childhood asthma were weak. For cognitive perceptions, the correlation was weakest for coherence (understanding asthma). Correlations concerning the two emotional perceptions (i.e. concern and emotion) were weakly correlated as well.

Table 1 Means (standard deviations), paired-samples T-values, and between-reporter correlations for the eight illness perceptions concerning childhood asthma reported by children and their mothers

	Child report ***Mean (Sd)***	**Mother report** ***Mean (Sd)***	**T-score (df), *p* value**	**Intra-class correlation**
1. Identity	4.28 (2.17)	3.69 (2.09)	T(257) = 3.46, $p = .001$	.21**
2. Time line	7.15 (2.53)	7.24 (2.70)	T(252) = - .49, $p = .622$	.26***
3. Personal control	7.32 (2.12)	6.51 (2.36)	T(257) = 4.20, $p < .001$	-.01
4. Treatment control	7.14 (2.16)	8.15 (1.78)	T(251) = -6.47, $p < .001$	.22***
5. Consequences	3.61 (2.24)	4.46 (2.13)	T(257) = -5.05, $p < .001$	.25***
6. Concern	2.86 (2.15)	4.45 (2.35)	T(257) = -9.02, $p < .001$	.23***
7. Coherence	7.33 (2.06)	7.86 (1.82)	T(257) = -3.32, $p = .001$	.12*
8. Emotion	3.01 (2.26)	3.07 (2.03)	T(258) = - .25, $p = .803$	.19**

Note: Range for each perception is 0-10, * $p < .05$, ** $p < .01$, *** $p < .001$.

Tables 2 and 3 provide the results for the predictive value of the illness perceptions on children's QoL. Children who reported more symptoms as being part of their asthma (i.e. perception identity) at baseline reported a lower QoL at follow-up (Table 2). This was found for all subscales, except for symptom-related QoL, and a marginal effect was found for the total QoL score ($p = .063$). In addition, when children perceived asthma to have fewer consequences in their lives, they reported a higher medicine-related and physical activities-related QoL. Children who were more concerned about their asthma reported a lower QoL in all domains. Finally, the perception of being emotionally affected by asthma was associated with a lower medicine-related QoL and marginally associated with the emotion subscale of QoL ($p = .067$).

For maternal perceptions (Table 3), the perception of identity predicted changes in most of the subscales of child QoL. A stronger maternal belief that asthma had an impact on the mother's life predicted lower medicine, physical activities, social interaction and total QoL scores reported by her child one year

Table 2 Quality of Life predicted by asthma illness perceptions reported by **children**

Predictor	Medicine	Physical activities	Symptoms	Emotion	Social interaction	Total
Step 1	R^2	R^2	R^2	R^2	R^2	R^2
Covariates [a]	.159	.428	.345	.396	.348	.460
Step 2 [b]						
Child perceptions	β / ΔR2	β / ΔR2	β / ΔR2	β / ΔR2	β / ΔR2	β / ΔR2
1. Identity	**- .16*/ .022**	**-.12*/ .012**	-.07 / .004	**-.11*/ .010**	**- .11*/ .011**	-.10 [d] / .008
2. Time line	-.08 / .007	-.08 / .005	-.07 / .004	-.01 / .000	-.10 [c] / .011	-.07 / .005
3. Personal control	-.01 / .000	.01 / .000	-.06 / .003	.02 / .001	-.01 / .000	-.03 / .001
4. Treatment control	.04 / .002	.04 / .001	.07 / .005	-.04 / .001	.06 / .003	.04 / .001
5. Consequences	-.14*/ .015	- .16**/ .021	-. 07 / .003	-.07 / .004	- .07 / .005	- .09 / .006
6. Concern	**- .22**/ .038**	**- .24***/ .043**	**- .14*/ .016**	**- .28***/.054**	**- .22***/ .053**	**-.23***/.036**
7. Coherence	-.02 / .001	.05 / .002	. 03 / .001	-.02 / .000	-.06 / .004	-. 01 / .001
8. Emotion	**-.16*/ .021**	- .06 / .004	.00 / .000	-.11 [d] / .008	- .08 / .004	-.04 / .002

Note: [a] Covariates include baseline QoL for the specific subscale being predicted, gender, asthma control and SES. [b] Step 2 comprised of one specific illness perception at the time, meaning that this table reflects eight separate linear regression analyses with adjusted estimates for each subscale when the child reported the illness perceptions. * $p < .05$, ** $p < .01$, *** $p < .001$, [c] $p = .05$, [d] $p < .07$.

Table 3 Quality of Life predicted by asthma illness perceptions reported by **mother**

Predictor	Medicine	Physical activities	Symptoms	Emotion	Social interaction	Total
Step 1	R^2	R^2	R^2	R^2	R^2	R^2
Covariates [a]	.158	.427	.345	.395	.351	.461
Step 2 [b]						
Child perceptions	β / ΔR2	β / ΔR2	β / ΔR2	β / ΔR2	β / ΔR2	β / ΔR2
1. Identity	**- .23***/.051**	**- .12*/.013**	- .01 / .000	-. 06 / .003	- .11 / .010	**-.10*/ .009**
2. Time line	.05 /.002	.07 / .005	**.12*/.014**	.04 / .002	.02 / .000	.05 / .003
3. Personal control	.03 / .000	.02 / .000	-.02 / .000	-.01 / .000	.08 / .007	.03 / .001
4. Treatment control	-.01 / .000	**.10*/.010**	.03 / .001	.03 / .000	**. 15**/.021**	.07 / .005
5. Consequences	**- .16*/ .021**	**- .14**/.016**	- .10 [d] / .009	- .10 [d] / .009	**- .14**/.019**	**-.13**/.015**
6. Concern	-.07 / .004	- .03 / .000	- .03 / .001	**- .11*/ .010**	- .09 / .007	- .06 / .004
7. Coherence	.04 / .001	. 08 / .006	**.19***/.036**	.05 / .003	.01 / .000	**.11*/ .012**
8. Emotion	-.10 / .010	- .08 / .006	-. 04 / .001	- .09 [d] / .008	- .11 / .011	- .09 [d] / .007

Note: [a] Covariates include baseline QoL for the specific subscale being predicted, gender, asthma control and SES. [b] Step 2 comprised of one specific illness perception at the time, meaning that this table reflects eight separate linear regression analyses with adjusted estimates for each subscale when the child reported the illness perceptions. * $p < .05$, ** $p < .01$, *** $p < .001$, [d] $p < .07$.

later. In addition, maternal perception of consequences was associated with the child's QoL in several domains, indicating that the more symptoms the mother attributed to her child, the lower the reported QoL by the child one year later. What differs with child perceptions is that perceptions reflecting understanding and knowledge of asthma (i.e. perceptions of time line, treatment control and coherence) also related to child QoL, while for children themselves these perceptions did not relate to their QoL reports. More precisely, children of mothers who indicated a better understanding of childhood asthma (i.e. coherence) at baseline reported a higher symptom and total QoL score at follow-up. Children of mothers who perceived asthma to last longer (i.e. time line) reported a higher symptom QoL as well. Children of mothers who perceived more treatment control for asthma reported a higher quality of life concerning physical activities. Finally, while the child's perception of concern about asthma was reflected in lower QoL scores in all domains, maternal concern about her child's asthma only predicted the emotion subscale of child QoL.

Discussion

This study examined the impact of illness perceptions on children's QoL by examining the illness perceptions held by children themselves and by their mothers. First, mean scores for these perceptions revealed that children reported their asthma to have a higher impact on their life, they reported experiencing fewer symptoms than their mothers reported and they perceived that they had more personal control but less treatment control than their mothers did. Mothers, on the other hand, reported to better understand childhood asthma (i.e. perception coherence). Mothers also reported being more concerned about their child's asthma than the children themselves, but mothers and children did not differ regarding the emotional aspects of asthma. The maternal and child perceptions were only weakly correlated, except for the perception of personal control, which was not correlated. Perceptions reflecting the severity of asthma (i.e. perceptions of identity and symptoms) held by both mothers and children were predictive of a lower child QoL. We also found that maternal perceptions, but not child perceptions, reflecting knowledge (i.e. perceptions of time line, treatment control and coherence) of asthma were predictive of lower child quality of life in some QoL domains. Finally, the perception in children of feeling emotionally affected by asthma was predictive of a lower medicine-related QoL. In addition, children's perceiving asthma as more of a concern was predictive of a lower child QoL in all domains, while for mothers being more concerned about child asthma was only related to a lower emotional QoL reported by her child.

To begin with this latter result, children's concerns about their asthma and mothers' concerns regarding their children's asthma were related in the present study, but this correlation was weak (r = .25). Children were less concerned about their asthma than their mothers were. Weak correlations between maternal and child perceptions may be the result of mothers being asked to think for another person and the other person´s illness while children report all items about themselves (see the appendix). Also, a mother may not be adept at noticing what her child's asthma means to the child and how it interferes with his/her life in physical, social, emotional and medicational aspects. The finding of a weak correlation between maternal and child worrying about asthma corresponds with the literature. Differences in perceptions of QoL between parents and children were most prominent in subjective attributes of QoL such as emotions (Janse, Sinnema, Uiterwaal, Kimpen, & Gemke, 2008). Likewise, the degree of agreement between parents and adolescents was low for the QoL domains of asthma treatment, worry and communication in Rayens and colleagues (2011). Mothers reported more worries in the present study then their children, but these worries were only related to the emotional subdomain of child QoL. Children reported fewer worries than their mothers, but these worries were predictive of all subdomains of QoL. Mothers are believed to be more accurate in noticing overt externalising problem behaviour than the less salient internalising behaviour of children (Burk & Laursen, 2010; Karver, 2006). Likewise, mothers may not be accurate in noticing their child's concerns about asthma although the child's worries may significantly interfere with his or her daily life. This may result in dysfunctional parenting behaviour and additionally to a lower health-related QoL for children as their concerns and poor quality of life may place higher demands on parenting tasks. More asthma behaviour problems in the areas of anxiety, aggression, hyperactivity and oppositional behaviour are associated with higher levels of parenting difficulty and lower parental confidence in dealing with the child's behaviour and parenting tasks (Morawska, Stelzer, & Burgess, 2008). As parents may restrict a child's activities to control asthma (Fuhlbrigge et al., 2006), they may inaccurately act on their own perceptions because they worry more about the childhood asthma than their children may do. These restrictions may hinder youth's ability to manage their asthma adequately and impede achieving desirable levels of child quality of life.

It may also be that mothers are more concerned and these concerns are not resulting in decreased QoL because they have more knowledge about asthma than their children do. Due to more knowledge and life experience, mothers may be more aware of the potential risks associated with asthma and develop more confidence in dealing with asthma. Indeed, maternal perceptions reflecting knowledge and faith in asthma management (i.e. perceptions of time line,

treatment control and coherence) predicted several subscales of child QoL. This is consistent with the literature indicating that parental self-efficacy in managing childhood asthma is associated with higher child treatment adherence and lower morbidity (Chen et al., 2003). Furthermore, positive parental expectations regarding asthma management were associated with parents' reports of better child functional status (Wade, Holden et al. 2000). A lack of faith and parental belief in medication treatment and quality of life issues were important barriers to asthma treatment in Mansour and colleagues (2000). Therefore, enhancing parental knowledge and faith may increase parents' ability to engage in parental behaviours that increase their children's confidence in dealing with asthma, thereby increasing their quality of life.

The current results also suggest that both maternal and child perceptions of the severity and impact of asthma (i.e. perceptions identity and consequences) predict child reports in several QoL domains one year later. Note that in general parents and children tend to overestimate the child's asthma control (Fuhlbrigge et al., 2006; Wildhaber, Carroll, & Brand, 2012) and underestimate the child's asthma severity (Wildhaber, Carroll, & Brand, 2012). Both under- and overestimation of asthma symptoms can result in less favourable asthma outcomes (Lane, 2006). It is essential that maternal and child perceptions of symptoms and consequences match the more objective state of the asthma, as these perceptions are associated with decreased QoL. One way to reach this goal is to visit practice nurses who can measure the child´s lung functioning. During these visits, practise nurses can provide feedback to families about the objective lung functioning as well as the experienced symptoms.

Implications

Several scholars have examined whether parents or children are the best providers of childhood asthma information (e.g., Everhart & Fiese, 2009; Guyatt, Juniper, Griffith, Feeny, & Ferrie, 1997; Le Coq, Boeke, Bezemer, Colland, & Van Eijk, 2000). They indicated that by the time the children are 11 years old, parents provide little additional information beyond the information provided by the children themselves (Guyatt et al., 1997). Although children aged 11 and older are reaching puberty and are therefore assumed to be increasingly responsible for their asthma management (McQuaid et al., 2003), our study suggests that the way in which children in this age group (10-15 years old) deal with asthma and how they experience their asthma as reflected in their quality of life is still affected by their mothers´ perceptions of asthma.

The current results also contribute to the field of prevention and intervention research, especially since our results are found longitudinally, indicating that adapting certain perceptions can influence child QoL at later time points. The

present results suggest that families can be helped when an intervention starts with discussing parental and child perceptions of asthma, as we found that these perceptions are only weakly correlated. It is found that simply offering information in education intervention programmes is ineffective in adult asthma care (Gibson et al., 2002) and transferring knowledge between a patient and a health care professional should begin with acknowledging current knowledge and beliefs (Yoos et al., 2007). This approach should also be applied to home-based interventions, which can start with discussion of parents' and children's current knowledge and beliefs about asthma and then move on to the content of the intervention material. When parents are aware of their children's perceptions and that their children's perceptions may differ from their own, they can better adapt their parenting behaviour and become involved in effective asthma management. Next, the intervention's content can include efforts to enhance maternal knowledge and confidence in asthma treatment, as these maternal perceptions (i.e. time line, treatment control, coherence) can increase the child's QoL. An individualised intervention that assigns mentors who educate parents in the intervention families increased parental self-efficacy and reduced - amongst other outcomes - child wheezing and asthma exacerbations (Flores et al., 2009). One specific programme that focussed on both children and parents, including an evaluation of quality of life, showed that after 10 months children who followed the programme displayed fewer asthma symptoms and increased levels of asthma knowledge and self-efficacy (Butz et al., 2005). Quality of life, however, was not increased by the education programme (Butz et al., 2005). A review of 32 studies evaluating asthma education programmes for children concluded that programmes focussing on self-management strategies can help improve child lung function, decrease asthma morbidity, improve self-perception and limit days of restricted activities (Wolf, Guevara, Grum, Clark, & Cates, 2002). The results we found for perceptions of 'identity' and 'consequences' support the use of these types of programmes. Intervention content focussing on the child's worries can be added, as being more concerned decreased the child's QoL, not only within the emotional QoL domain, but also in other domains, including medication. Interventions in this area are warranted as, particularly for asthma, interventions mainly focussed on disease management with less attention paid to the psychosocial effects of living with asthma (Barlow & Ellard, 2004). When offering family-based programmes, one assignment in such a programme could be to supplement sentences (e.g. "I think last week you had most trouble with your asthma during..."). This conforms to a programme designed for smoking prevention (e.g., Hiemstra et al., 2009) in which the parent fills out what counts for the child and the child fills it out for the parent. Such assignments encourage parents and children to think for one another and learn more about each other's troubles and worries.

Strengths and limitations

Strengths of the current study involve the large sample of mother-child dyads, with low attrition at follow-up. In addition, as we first exclusively examined maternal asthma perceptions in childhood symptom-related QoL (Ringlever et al., 2012b), we were now able to provide a more detailed overview of illness perceptions influencing other health-related QoL domains. Also, the literature indicates that parental reports of child asthma severity were associated with child QoL when it was the parents who also reported on their child's QoL (Everhart & Fiese, 2009). The current study adds to this literature suggesting that maternal perceptions reflecting several cognitive and emotional aspects are associated with other health-related QoL domains reported by children as well, thereby avoiding a shared rater bias.

However, this study also has limitations. First, we used a brief version of an illness perception questionnaire to measure parental illness perceptions (Broadbent et al., 2006). Although this questionnaire is intended for use among patients with different types of illnesses, including asthma, it was not specifically designed for use among the parents of these patients. However, it has been applied for that purpose in other studies as well (e.g., Michel et al., 2010; Van der Velde et al., 2011). Nonetheless, examination of the psychometric properties for parent versions of this questionnaire is advisable. Second, the magnitude of the findings was small. This is not surprising: Children with asthma form a heterogeneous group that includes children with different times of asthma onset, variable courses of asthma and specific triggers of asthma symptoms. It is unlikely that one specific psychosocial factor like an illness perception accounts for a large portion of explained variance in QoL, as similarly mentioned in the discussion section by Wade and colleagues (2000). Still, when possible, an asthma-specific questionnaire covering more items (e.g. the Asthma Illness Representation Scale; Rutishauser, Sawyer, & Bowes, 1998) may better capture specific asthma beliefs and may account for more explained variance. Another limitation is that we focussed on maternal perceptions, ignoring the role of fathers. A more holistic family approach may have provided more specific information, as fathers and mothers do not always agree on asthma severity and subsequent asthma management for their child (Eiser, Eiser, Town, & Tripp, 1991). In addition, variables associated with perceptions are yet to be examined in this field. We controlled for some relevant factors in asthma research, among which was asthma control, including a lung function test. We did not specifically concentrate on factors that could have influenced maternal and child illness perceptions. However, this may be important if we want to intervene and increase beliefs in certain perceptions, such as maternal confidence in asthma management skills, as described above. We also note that by including asthma control as a covariate along with baseline

scores of symptom-related QoL in step 1 of the regression analyses, we controlled for two variables that share similar items (e.g. frequency of wheezing). By controlling for both variables there is a risk of collinearity in the analyses. However, all analyses concerning the symptom-related subscale of QoL remained the same with and without the inclusion of asthma control as a covariate. In addition, statistical differences might have occurred for the total QoL score. Therefore, we also conducted the analyses without the symptom subscale of the AAQOL in the total QoL score. Significant and non-significant βs in Tables 2 and 3 remained similar, except for maternal perception of emotion and child perception of identity, whose marginally significant results became significant. Maternal perception of coherence became non-significant. As symptom-related QoL and asthma control differ conceptually (Vollmer et al., 1999), we decided to provide results in the current study including the symptom subscale and to provide this additional information in the discussion section. Finally, this study comprised a community-based asthma sample, recruited via schools. As in most large nationwide surveys (Wildhaber et al., 2012) children in this study reported their asthma to be mild, although the impact of asthma on their daily lives may be substantial. In addition, as most studies on asthma severity and QoL have found a suppressed level of QoL when asthma severity increases (Everhart & Fiese, 2009), focussing on the asthma status of children and including children with more severe asthma may contribute to more and better knowledge about how to prevent interference from asthma in QoL.

Conclusions

Childhood asthma perceptions of mothers and children are weakly correlated. Health-related QoL of children aged 10 to 15 is predicted by maternal and child illness perceptions. Perceptions reflecting the severity and impact of asthma held by both mothers and their children were associated with a lower child QoL. Specifically, for the perception of asthma concerns, children who perceived asthma as more of a concern showed decreased levels of QoL. Finally, increasing the mother's knowledge and confidence in her asthma management and parenting behaviour might increase the child's QoL. Our study underscores that parent and child assessment of illness perceptions should be considered to obtain a complete picture of perceptions and QoL in childhood asthma. In addition, given the low agreement in maternal and child asthma perceptions, asthma education interventions may profit from starting with discussion of perceptions and beliefs about asthma between the parent and child before moving on to the content of the intervention material.

Appendix

Items of the Brief Illness Perception Questionnaire (Broadbent et al., 2006) asked to the children (asked in Dutch):

1. Identity: How much does your asthma affect your life?
2. Time line : How long do you think your asthma will continue?
3. Personal control: How much control do you feel you have over your asthma?
4. Treatment control: How much do you think your treatment can help your asthma?
5. Consequences: How much do you experience symptoms of your asthma?
6. Concern: How concerned are you about your asthma?
7. Coherence: How well do you feel you understand your asthma?
8. Emotion: How much does your asthma affect you emotionally?

Items of the Brief Illness Perception Questionnaire transformed to mother's perception concerning the children's asthma.

1. Identity: How much does the asthma affect your life?
2. Time Line: How long do you think the asthma of your child will continue?
3. Personal control: How much control do you feel you have over your child's asthma?
4. Treatment control: How much do you think your child's treatment helps your child's asthma?
5. Consequences: How much does your child experience the symptoms of his/her asthma?
6. Concern: How concerned are you about your child's asthma?
7. Coherence: How well do you feel you understand your child's asthma?
8. Emotion: How much does your child's asthma affect you emotionally?

9

General Discussion

References

Dutch Summary | *Nederlandse samenvatting*

Publications

Curriculum Vitae

Acknowledgements | *Dankwoord*

General discussion

The present thesis focused on the effectiveness of a smoking prevention program designed for parents of children with and without asthma (Part I). Furthermore, we focused on the health beliefs and quality of life within a group of children diagnosed with asthma (Part II).

Part I

First, we evaluated the effectiveness of the home-based programme Smoke-Free Kids in preventing children with and without asthma from initiating smoking. This program was believed to work via hypothesised mechanisms of parenting and child smoking-related cognitions. This section addresses the contribution of knowledge and possibilities to prevent smoking uptake for children. More specifically, this section addresses special efforts that can be made to prevent asthmatic children from initiating smoking.

Summary

Adolescents and adults with asthma are consistently found to smoke at similar or even higher rates as individuals without asthma (Mcleish & Zvolensky, 2010). Furthermore, adolescents with asthma are less likely to have experimented with smoking between the age of 12.9 and 14.8; however, once they started smoking, they progress to regular smoking more quickly (Van de Ven et al., 2007). Absent in the literature is whether this finding also accounts for the very first experience with a cigarette (i.e., the first puff). Some scholars have inquired about smoking the first puff; however, this variable has been assessed retrospectively, which increases the risk of recall bias.

In Chapter 5 we were able to avoid recall biases, as we measured the age of onset as close to the actual age of onset as possible. We found that, among children with a mean age of 10.1 years old, children with asthma more frequently reported to have ever smoked a puff of a cigarette compared to children without asthma. This finding indicates that prevention efforts for these young children with asthma (and for those without asthma) are warranted. We examined a universal home-based smoking prevention program for parents of children aged 9-11 years old (Chapters 2, 3, and 4). Children of families that followed the program did not initiate smoking less frequently than did children in the control condition (Chapter 3). Moreover, no intervention effects on smoking-specific parenting were found in this 3-year RCT for families with or without asthmatic children (Chapter 4).

Chapter 6 revealed that depressive feelings and self-efficacy to refrain from smoking were factors involved in smoking among youth. This was especially the case for asthmatic children, as this diagnosis is associated with higher levels of depressive feelings and may instigate smoking. When depressive feelings are suspected, especially among children with asthma, a selected prevention approach targeting these at-risk adolescents may be an effective strategy to reduce risk for smoking.

Several factors may explain the findings of Smoke-Free Kids in the Netherlands. The discussion sections in Chapters 3 and 4 provide an overview of reasons why the program might not have worked in the Netherlands. These assumptions form the basis of this discussion and can best be summarised into the following categories:

- Timing of the program: Were the children too young?
- Timing of the program: Some short-term effects were observed; however, the findings revealed no sustained long-term effects. Does Smoke-Free Kids need to be offered more closely to the expected smoking behaviour? Are adaptations to the program delivery necessary to up-hold the short-term effects (e.g., more follow-up booster magazines, updates via social media)?
- Mechanism: We focussed exclusively on smoking-specific parenting; no attention was paid to general parenting or parenting goals as a context.
- Recruitment bias: The voluntary nature of participation in the prevention program might have resulted in the most motivated and relatively higher-educated parents agreeing to participate. Were smoking parents and parents of children with asthma as willing to participate as were other parents?
- Format: We offered a low-intensity program, sent by post once a month. Was this the best approach? We offered the control group written material. Is it possible that these control sheets formed an intervention as well? Also, Smoke-Free Kids is a universal prevention program. Is such a universal program suited for families with children with asthma or should it contain asthma-specific content?
- Measures: Only maternal parenting was included, the role of father was not taken into account. The focus on the very first puff of a cigarette in our study might have ignored effects of the program at other stages of smoking.
- Prevention strategy: Smoke-Free Kids targeted one specific behaviour. Are programs that target multiple risk behaviours better suited for children with asthma? We focused on parental prevention; perhaps complex prevention programs that include the school or peers may have more effect. Finally, we offered Smoke-Free Kids to all families, but selecting or indicating prevention strategies for at-risk families may have greater potential for families with asthmatic children.

· National changes: During our intervention, national law concerning smoke-free public places was introduced in the Netherlands, which might have affected our smoking rates in general.

This general discussion further elaborates on these statements from a broader perspective. In Parts I and II, future directions will be provided as well as general study limitations and strengths.

Timing of the program: child's age

Contrary to the original trial of Smoke-Free Kids developed for smoking parents (Jackson & Dickinson, 2003, 2006), we found no significant effects of the program on smoking initiation rates of children in the intervention (10.8%) versus the control condition (12.0%) within our Dutch sample. However, our results are comparable with a later trial conducted with non-smoking parents in the United States, which also reported no program effects (Jackson & Dickinson, 2011). Jackson and Dickinson postulated that the young age of the children at final follow-up was one reason for the differential intervention effects for children of smoking and non-smoking parents. Indeed, research has found that children of smoking parents are more likely to initiate smoking early relative to children of non-smoking parents (Leonardi-Bee et al., 2011).

In their sample with smoking parents, Jackson and Dickinson (2003, 2006) included children who were 7-8 years old at baseline. Although in our study, the mean age at baseline was 10.1 and 13.1 years at final follow-up, a longer follow-up period including the age categories of 14 and 15 would be needed to detect an effect, as in the Netherlands, children aged 14-15 show a strong increase in lifetime smoking compared to 12- and 13 year-olds (Stivoro, 2012). Other intervention researchers have also mentioned the young age and subsequent low initiation and growth rates of substance use as a factor that may have suppressed the detection of interventions effects (Spoth, Redmond, Trudeau, & Shin, 2002). For example, a school-based intervention offered at elementary schools did not show effects during these formative years; however, an effect appeared in secondary school. Specifically, children in the intervention condition perceived less social pressure, had higher intentions not to smoke, and had smoked less than children in the control condition (Crone, Spruijt, Willemsen, & Paulussen, 2011).

A delayed effect could also occur for Smoke-Free Kids. It is possible that parents wait to engage in smoking-specific parenting actively until they notice that their offspring have become interested in smoking (e.g., age 14 or 15), or when some of their friends have initiated smoking. We can only speculate whether such a delayed effect on parenting may exist in our program. We do not have the data to test what efforts parents in the intervention and control conditions undertake

when their children do become involved in smoking because our last measurement was at mean age 13.1, and few children had initiated smoking at that time.

On the other hand, some intervention studies support this assumption. Pennanen, Vartiainen, and Haukkala (2012) found that adolescents of parents who smoked reported similar levels of anti-smoking practices measured in seventh grade; however, when these adolescents became older, they reported lower levels of punishment for smoking and less smoking rules at home than did children of non-smoking parents. Related to this delayed parenting effect are the results by Fleming and colleagues (2010), who found that levels of positive family relationships at Grades 5 and 9 were predictive of substance use at age 19. Therefore, a study design that includes substantial years of follow-up assessments is preferable. Meanwhile, motivating parents to uphold their learned smoke-free parenting efforts may be an effective strategy (Pennanen et al., 2012).

Timing of the program: short-term vs. long-term results

As mentioned above, we did not find significant main effects of the Smoke-Free Kids program 3 years post-baseline on smoking and smoking-specific parenting. However, this study did yield some potentially promising short-term results that are worth mentioning. It was found that immediately after offering the program, children in the intervention condition reported more frequent discussions about smoking, they were more likely to have a non-smoking agreement with their parents, and they were more convinced that their mothers could prevent them from smoking than children in the control condition (Hiemstra, Ringlever, Otten, Van Schayck, & Engels, 2013). These results did not translate into less smoking (Chapter 3) or to improvements in smoking-specific parenting strategies (Chapter 4) in the long-term.

Wiehe et al. (2005) offered an explanation for significant short-term, but no long-term, effects that could also apply to our intervention study. They state that a possibility of finding short-term effects, as opposed to long-term effects, is that short-term effects may be a by-product of the intervention period. Specifically, on the short-term, a priming effect may occur related to the questions asked during or shortly following the intervention. Such effect may result in children and parents paying more attention to these topics. However, answers may diverge more if the topics involved in the intervention are asked at a later time point with more time between the intervention and the questions.

This notion also seemed true for a home-based prevention program aimed to improve communication about smoking and alcohol in Australia (Beatty, Cross, & Shaw, 2008); this study was quite similar to our Smoke-Free Kids program. These researchers conclude that their program is promising in enhancing parent-child communication on alcohol and smoking among families with 10- and 11-year-old

children. However, here communication was measured 4 to 5 weeks following the last intervention communication sheet. Beatty and colleagues (2008) stated that their results may relate to short-term outcomes and the improved communication could be an immediate effect of the intervention itself.

In our study, a non-smoking agreement was one assignment in the Smoke-Free Kids intervention booklet. When asked at the 6-month follow-up, answers might be more positive because of better memory recall of the items than at the 3-year follow-up. This finding might question the timing of the intervention, which could arguably be offered closer to the likelihood that the behaviour will first occur. When offering the intervention, on average, children were 10.1 years old. National monitoring studies (Stivoro, 2012; Verdurmen et al., 2014) indicate very low smoking rates among 10 year olds. Therefore, it is possible that we offered the Smoke-Free Kids program to early.

Significant short-term effects may also require additional efforts after the initial program is offered to reinforce and expand current intentions to avoid tobacco (Wiehe et al., 2005). We offered the intervention group one booster module. Perhaps more boosters or other strategies could be offered to those parents and children who were open to the program. Smart phone use is increasing and more apps are available that offer information concerning smoking cessation (e.g., Choi, Noh, & Park, 2014). Using special apps that include reminders of parenting practices, can be an easy, low-cost opportunity to remind parents of the learned Smoke-Free Kids material after the initial program has finished. Furthermore, several prevention strategies via the internet have shown promising results for smoking prevention among children and adolescents when delivered in a school environment (e.g., Buller et al., 2008; De Jong, Candel, Segaar, Cremers, & De Vries, 2014, Prokhorov et al., 2008). This suggests that incorporating internet booster modules for children participating in Smoke-Free Kids could be another strategy. Future research should investigate the effectiveness of these apps and other e-health strategies in a home-based setting.

Mechanisms: specific parenting versus general parenting and parenting goals

In Chapter 4, we focused on the specific parenting measures involved in Smoke-Free Kids. Smoking-specific parenting practices formed the aimed parenting involvement practices that Smoke-Free Kids was believed to be able to modify. In contrast to our expectations, we found no effects of the program on the development of smoking-specific parenting. Additionally, we found no differential effects of Smoke-Free Kids for families with and without asthmatic children.

Specific parenting practices, such as setting house rules about smoking, take place in the context of a more general parenting style. A general parenting style,

characterised by low levels of control or strictness, has been linked to adolescent smoking initiation (Chassin et al., 2005; Den Exter Blokland, Hale, Meeus, & Engels, 2007; Otten , Engels, & Van den Eijnden, 2007). Moreover, the general parenting style may alter the effectiveness of specific parenting practices on children's development (Darling & Steinberg, 1993). Indeed, researchers have found that supportive parents are more likely to engage in high quality communications about smoking with their children, which, in turn, lower the likelihood of smoking (Harakeh, Scholte, Vermulst, De Vries, & Engels, 2010).

An example of maladaptive parenting was found as well. Parents who exerted psychological control were more likely to talk more frequently about smoking with their children, which, in turn, was related to a higher likelihood of smoking (Harakeh et al., 2010). Finally, Chassin et al. (2005) examined parenting as a predictor of adolescent smoking, and found that both general parenting and smoking-specific parenting uniquely predicted smoking. Therefore, it would also be interesting to focus on general parenting. The present thesis exclusively focused on smoking-specific parenting practices, such as communication about smoking and setting house rules. From a prevention perspective, it seemed more feasible to tailor a programme that taps into specific parenting practices as we did with Smoke-Free Kids. Nonetheless, programmes that target only smoking-specific practices and not general parenting may not be sufficient to establish an effect (Chassin et al., 2005), at least in this age group.

In Chapter 4 we were particularly interested in the possible differential effects of Smoke-Free Kids within families with and without a child with asthma. We examined whether Smoke-Free Kids could 'gain' more within families who had a child with asthma. However, we found no support for the idea that, among these families, Smoke-Free Kids would be more effective than in families with non-asthmatic children.

Although little research is available on smoking-specific parenting within families with asthmatic children, general parenting differences have been found between parents of children with and without asthma (Otten, Engels, & Van den Eijnden, 2007). For instance, adolescents with asthma perceived their parents as stricter and more involved than did adolescents without asthma (Otten, Engels, & Van den Eijnden, 2007). On the other hand, specific parental disapproval of smoking was similarly related to smoking behaviour among children with and without asthma (Vázquez-Rodríguez et al., 2012). This literature indicates that some differences in parenting exist that merely point in the direction of general parenting differences between asthma and non-asthma families. A broader approach on parenting within the prevention research might be warranted. An approach not specified to modify one parenting behaviour, but a set of behaviours (e.g., teaching parents general parenting skills) might also be warranted.

In addition to general and specific parenting, parents also have certain parenting goals (Jackson & Dickinson, 2009). If parents do not have the goal of keeping their children smoke-free, specific parenting practices are less likely to be performed. A lack of focus on parenting goals can also explain why we found no differential effect of Smoke-Free Kids between families with and without asthma. Research indicates that parents of smoke-exposed children with asthma believe that exposure to smoke has limited or no negative effect on their children's asthma (Farber et al., 2008). If parents do not set a smoke-free future for their children as a goal, explicitly trying to encourage smoking-specific parenting is likely to have less of an effect.

Indeed, parents who view smoking as less dangerous to health are also less likely to take action by means of smoking-specific parenting than are parents who view smoking as more dangerous to health (Fearnow, Chassin, & Presson, 1998). We did not inquire about participants' parenting goals, although the high baseline scores on our smoking-specific parenting measures indicate that most parents were eager to keep their children smoke-free. As interventions that encourage smoking-specific parenting strategies may benefit from emphasising health dangers (Fearnow et al., 1998), more education about the detrimental effects of smoking might be particularly beneficial for parents of asthmatic children.

Possible recruitment bias? Factors associated with voluntary subscribing

Subscribing to the Smoke-Free Kids programme was voluntary. The voluntary nature could have led to differences in which parents responded to our recruitment letter. Existing studies suggest that smokers respond differently to questionnaire surveys, with smokers being late- or non-responders (Rönmark et al., 2009). Smoking parents may have been non-responders in our study and, therefore, underrepresented in the current sample, especially as we approached parents only once by letters distributed via schools and waiting rooms of general practitioners. On the other hand, parental smoking rates in this dissertation were similar to national figures (Stivoro, 2009b).

It is possible that parents who do not believe smoking has negative effects on their children's asthma, or parents who believe their asthmatic child would not engage in smoking, did not participate. The high baseline levels on our smoking-specific parenting measures point in the direction that, indeed, parents who are most willing to raise their children in a non-smoking environment subscribe to a home-based smoking prevention programme such as Smoke-Free Kids. Parents' willingness to participate in interventions is based, amongst other factors, on parental self-efficacy in dealing with their children's behaviours and

with their beliefs in the effectiveness of the interventions (Morawska, Stelzer, & Burgess, 2008). Therefore, if a programme such as Smoke-Free Kids attracts motivated parents, efforts should be made to reach those parents who are less confident that they can make a difference. Counselling parents or using a motivational approach may be warranted first to inquire whether parents are aware of the importance of keeping their children smoke-free and in feeling self-efficacious and self-confident to become involved in preventing offspring smoking.

In addition, parents tend to underestimate their offspring's engagement in smoking (Harakeh, Engels, De Vries, & Scholte, 2006). Because of respiratory problems, parents of children with asthma might underestimate them smoking to a larger extent than parents of children without asthma; therefore, they might not see the necessity for smoking rules. Overall, children with asthma did not report more involvement of their parents in attempts to keep them smoke-free than do peers without asthma in both the intervention and control condition (Chapter 4).

Finally, our voluntary sample consisted mostly of middle- and higher-educated parents. Parental education is related to child smoking (e.g., Kestilä et al, 2006; Ringlever et al, 2011), with offspring from lower-educated parents showing a higher prevalence of daily smoking (Kestilä et al., 2006). Parental education is also associated with different styles of smoking-specific parenting (Fearnow et al., 1998). Overall, higher-educated parents are less permissive about smoking at home, and they place higher value on their children staying smoke-free (Fearnow et al., 1998). Although we controlled for education in all analyses, it may have been harder to find significant programme effects as lower-educated parents were underrepresented in the data. Most reviews that focus on family-based interventions to prevent children's problem behaviours conclude that, amongst others, parenting training is mostly effective when applied as a prevention strategy with high-risk youth (Kumpfer & Alvarado, 2003). Our study comprised of few high-risk families. It is a great challenge, yet highly necessary for health campaigns to find strategies to involve underrepresented individuals or families in health promotion programmes (e.g., Uybico, Pavel, & Gross, 2007).

Format: minimal effort, universal content

We expected that offering help that was non-intensive and required minimal efforts for parents would appeal to parents. For prevention programmes to work, the dosage should be sufficient, as participants should be well exposed to the intervention for it to be effective. The length, number of booklets, spacing between the booklets sent to families, and the duration of the total programme were similar to the U.S. Smoke-Free Kids. In the United States, the programme did work

for smoking parents (Jackson & Dickinson, 2003, 2006) but not for non-smoking parents (Jackson & Dickinson, 2011). It could be that the indicated intensity needs for non-smoking parents, or other specific groups, are different. Possibly, parents of children with asthma also need a different intensity of home-sent material, as the risk faced by children with asthma to early initiate smoking is higher (Chapter 5). Smoke-Free Kids consists of five activity guides and one booster sent home to the families. We thought this approach might be appealing for parents, as both parents spend more time working and less time parenting (Kumpfer & Alvarado, 2003). Parents were free to discuss the programme with their children any time during the month and as much time as they needed. Our attrition rates (see for exact details, Figure 1 in Chapter 4) suggest that parents might still find this approach too demanding, as the largest dropout was registered in the intervention group right after the 5-months during which we offered the programme. Thereafter, attrition was equally divided between the intervention and control groups for all subsequent measurement points.

A large number of interventions lack the ability to compare results with a true non-intervention control group, which may underestimate the intervention effect (Wiehe et al., 2005). For Smoke-Free Kids, we also provided the control condition with information sheets, as it was not possible to postpone offering the intervention to the control group after the study was finished. Specifically, children would have been too old at that point for the intervention. We tried to ensure that the content offered to the control group was as simple as possible without explicit encouragement to discuss the information with children. Nonetheless, the control programme looked similar in style and colour to the intervention and might have affected child outcomes in this condition as well.

Concerning asthma, we offered parents of asthmatic children the same universal programme at similar time intervals, as we did for parents without asthmatic children. By offering the same universal content, which solely focused on smoking, we assumed that parents were aware that smoking rates are similar for children with and without asthma and that smoking increases asthma morbidity. Additional information and activities targeting issues concerning asthma within the Smoke-Free Kids programme could have better captured the needs of families with children with asthma. For instance, in the very first activity guide of Smoke-Free Kids, it might be useful to make parents of asthmatic children aware that they are at similar risk to initiate smoking as are their non-asthmatic peers. Then, parents of children with asthma might be less likely to underestimate the risk for their children becoming involved in smoking behaviour. Additional topics could include information that smoking is associated with less responsiveness to asthma medication and with an increased potential of developing chronic obstructive pulmonary disease (COPD) (Thomson et al., 2004).

Measures: focus only on mother and strictness of outcome measure

Similar to the original Smoke-Free Kids study (Jackson & Dickinson, 2003, 2006), this programme focused on mothers instead of both parents. Research indicates similar associations for maternal and paternal reports of smoking-specific parenting with adolescent smoking (Harakeh, Scholte, De Vries, & Engels, 2005). However, evidence for differences between father's and mother's communications about substance use have been found as well, depending on the substance and gender of the child (Luk, Farhat, Iannotti, & Simons-Morton, 2010). Specifically, Luk and colleagues (2010) found that for sons, paternal communication was protective against marijuana, and maternal communication was protective against smoking. For daughters, neither paternal nor maternal communications were protective against substance use. Based on these findings, it might be worthwhile to include fathers' contributions to smoking-specific parenting and to examine fathers' roles in prevention research.

Concerning our main outcome measure, we focused on the prevention of the first puff of a cigarette. However, this definition might have been too rigid to assess the precise onset of smoking in such young children. Not every child who experiments with smoking one or a few times progresses to regular smoking. Therefore, another prevention strategy could be to prevent all children (never-smokers, ever-smokers, irregular smokers) from becoming daily smokers (e.g., O'Loughlin, Karp, Koulis, Paradis, & DiFranza, 2009). For example, O'Loughlin et al. (2009) examined a range of risk factors for smoking initiation and for daily smoking longitudinally, while most research has examined associations on a cross-sectional level. They found multiple diverse factors associated with initiation. However, only a subset of these factors were predictive for the progression to daily smoking. They concluded that prevention programmes targeting single risk factors might be less or not effective.

Prevention strategy: multiple risk behaviours, multiple domains, and type of approach

Adolescent risk behaviours are often clustered, and these behaviours may share the same underlying risk factors (Jackson, Geddes, Haw, & Frank, 2011). In Chapter 6, we investigated depressive feelings as a possible underlying mechanism in the link between asthma and smoking. We were also interested in children's self-efficacy to refrain from smoking. We found that higher levels of depressive feelings decreased adolescents' self-efficacy to refrain from smoking, which subsequently increased the risk to initiate smoking. These two psychosocial factors can form important points of attention in the prevention of smoking.

Self-efficacy is a factor associated with smoking that is assumed to be changeable during prevention strategies (i.e., as compared to other risk/protective factors for

smoking as the child's gender) (Spear & Kulbok, 2001). Munoz and colleagues (2010) underscored that depression is among the most preventable mental disorders. In Chapter 6, we found support for the idea that a decrease in smoking could be accomplished with the prevention of depression, which might affect perceived self-efficacy to refrain from smoking. Universal school-based prevention programmes are now available that target preventing an increase of depressive symptoms during adolescence (e.g., Tak et al., 2011).

The results presented in Chapter 6 also support a selected, indicated prevention approach. In other words, only when adolescents show elevated levels of depressive feelings would they be offered a prevention programme with the aim of decreasing and preventing these feelings. Wijnhoven, Creemers, Vermulst, Scholte, and Engels (2014) found that an indicated programme based on cognitive behavioural therapy was effective in reducing depressive symptoms in adolescent girls. In addition to efforts for preventing depressive symptoms, once this at-risk group of adolescents is reached, extra attention can be paid to the mechanism of self-efficacy. Incorporating an additional module within a depression prevention programme could be one way to accomplish this goal. A final option is to offer adolescents with elevated levels of depression a specific smoking prevention programme that focuses on refusal skills; for instance, the European Smoking Prevention Framework Approach (ESFA), which has a substantial focus on smoking cognition and training in refusal skills (De Vries et al., 2006).

Most important to the asthma-smoking association is that a diagnosis of asthma is associated with higher levels of depressive feelings, which, in turn, decrease self-efficacy. This finding supports the choice for selected and indicated prevention approaches for children with asthma. A selected approach would mean that additional efforts are performed to reach all asthmatic children in a classroom to offer a prevention programme. An indicated approach seems essential when health care practitioners consult a child with asthma and suspect elevated levels of depression. Therefore, a prevention strategy that focuses on depressive feelings may be especially important for children and adolescents with asthma.

Smoking and depression may also be targeted together to accomplish an optimal gain in health behaviour. Some reviews suggest that promising interventions exist to address a set of behaviours rather than one specific behaviour (e.g., smoking or drug abuse). For instance, Jackson, Geddes, Haw, and Frank (2011) examined intervention programmes to prevent alcohol, tobacco, and drug use along with risky sexual behaviours. They found that the most effective results were obtained for programmes that addressed multiple domains. Similar underlying risk factors may exist and one behaviour might reinforce the risk for becoming involved in other risk behaviours or situations. For instance, alcohol is a risk factor for smoking (e.g., O'Loughlin et al., 2009), which supports this combined approach.

In addition, prevention strategies can be more effective when they involve multiple domains within a child's life. Wu et al. (2003) found that parental monitoring at home was effective in reducing smoking in combination with a non-school based social influence programme, while the social influence programme alone did not reduce smoking. According to Jackson and Dickinson (2011), the most promising interventions include active parental involvement and focus on developing social skills and self-regulation and parenting. Indeed, a longitudinal study on parenting behaviours, smoking, and alcohol use found that parents not only influenced child smoking directly via their parenting behaviours, but these behaviours were also precursors to the vulnerability of peer pressure (Cohen, Richardson, & LaBree, 1994; De Leeuw, 2011).

We did not find lower initiation rates in our Smoke-Free Kids sample, but parental involvement in smoking prevention might still be important. Nevertheless, a focus on parents alone is not enough. Although rather outdated, a study that reviewed over 100 prevention programmes yielded several key characteristics associated with successful programmes focussing on substance abuse (Dryfoos, 1990, as cited in Nation et al., 2003). Among these characteristics, effective strategies included engagement of peers and parents in the programme and training in social skills, but also focussing on early identification of problem behaviours and intervention in several domains of the child's life. Such strategies are presumably more expensive, time consuming, and complex to implement than solely home-based prevention programmes, such as Smoke-Free Kids. Cost-effectiveness analyses are necessary to determine which strategies are possible when preventing youth in the Netherlands from smoking.

Finally, individualised interventions in paediatric asthma are found effective (e.g., Bonner et al., 2002; Flores et al., 2009). In particular, Flores and colleagues (2009) evaluated an intervention and found it effective in increasing asthma outcomes in minority children using parent mentors. Parental self-efficacy in identifying serious breathing problems at home also increased with this intervention. Further, the intervention reduced child wheezing, asthma exacerbations, emergency department visits, and missed parental workdays. Cost-effectiveness analyses showed that the effects were achieved at a reasonable cost (Flores et al., 2009). A future direction in the development and evaluation of interventions could be to focus on individualised approaches to increase parental self-efficacy in dealing with psychosocial factors involved in asthma, including smoking among asthmatic children.

Changes on national level: smoke-free law

During the time we ran our evaluation of Smoke-Free Kids, much attention had been paid to smoking in general in the Netherlands, including changes in national laws. For example, a smoking ban in restaurants and pubs was introduced in

2008. In addition, many efforts were directed toward smoke-free schoolyards. The effect of changes in smoking legislation is not yet fully understood. For the Smoke-Free Kids RCT evaluation, we can assume that these adaptations in the law have affected parents and children in the intervention and control conditions and for families with and without a child with asthma equally. However, this factor might account for a small effect in the initiation rates we found among our participants aged 13.8 at the final follow-up in 2012 (i.e., 10.8% in the intervention and 12.0% in the control condition). National figures provided in the same year as our final measurement provide rates of ever smoking of 11% (12 year olds), 14% (13 year olds), and 35% for 14 year olds (Stivoro, 2012). These rates were higher in 2008 when we conducted our baseline measurement; 17%, 27%, and 41% for 12, 13, and 14 year olds, respectively (Stivoro, 2008).

Strengths, limitations and future directions

First, in most chapters, severity and control of asthma were not considered. Asthma is a chronic condition that is characterised by a changeable pattern of symptoms (Stein & Martinez, 2004). This means that, when aiming to provide the best advice for asthma prevention, gaining an in depth picture of *which* asthmatic children are at risk of engaging in dysfunctional behaviours such as smoking, future research should focus more on subgroups. For example, one might expect that children who currently experience respiratory difficulties will refrain from engagement in behaviours that could harm their health more than children who are currently symptom-free.

Our attempt in Chapter 5, in which we divided the asthma group in a 'past asthma' and 'current asthma' group (i.e., no symptoms in the past 12 months vs. symptoms at present or within the 12 months preceding the measurement), did not show an additional withdrawal in smoking for the current asthma group. This result indicates that children currently experiencing asthma symptoms experimented with smoking by taking a puff of a cigarette as often as did symptom-free asthmatic children. Concerning asthma severity and smoking in the literature, no large differences in smoking rates have been found between those currently experiencing asthma symptoms and those not currently experiencing symptoms (Precht et al., 2003; Zbikowski, Klesges, Robinson, & Alfano, 2002). On the other hand, Brook and Shiloh (1993) found that adolescents who were currently healthy but had asthma in the past, were more positive about smoking and indicated more intention to smoke in the future compared to current asthma and no-asthma adolescents. For prevention efforts that focus on depressive feelings (and subsequent self-efficacy), it is important to be aware that adolescents who report more severe asthma symptoms also report higher levels of depressive symptoms (Richardson et al., 2006).

Strengths of this dissertation are the samples and data we analysed. We had a rich set of data at our disposal in the Smoke-Free Kids sample that consisted of over 1,300 families, and we had low attrition rates at final follow-up. Furthermore, five of the six peer-reviewed articles in this thesis involved a longitudinal design. In addition, in Chapter 6, we had the opportunity to test one model to gain additional insight into the asthma and smoking link using two independent samples. We did not aim to make a direct comparison; rather, we intended to test a model in two age groups, which could be considered an indication of reliability of the outcomes.

Part II

Summary

Studies have demonstrated the importance of parental factors in children's illness outcomes (e.g., Anthony, Gil, & Schanberg, 2003; Kaugars, Klinnert, & Bender, 2004; Rhee, Belyea, & Brasch, 2010; Spurrier et al., 2000). In Part II, we were interested in parental perceptions related to the quality of life of their asthmatic children. Additionally, we examined the extent to which these perceptions were congruent with those of children. In Chapter 7, we found that maternal illness perceptions contribute to symptom-related quality of life of children. Maternal perceptions of asthma were not associated with an objective lung function measure (i.e., percentage of predicted Forced Expiratory Volume in one second [FEV_1]). However, while controlling for gender and children's baseline symptoms, four of eight maternal perceptions of illness (i.e., identity, consequences, concern, and emotional influence) were associated with children's asthma symptoms. These results were found within the subsample of children with a diagnosis of asthma in the Smoke-Free Kids sample who were reported experiencing asthma symptoms and who were willing to participate in a home visit (n = 89, mean age at baseline 10.1 years old). In that sample, we assessed childhood asthma perceptions held by mothers, not the children themselves, using the Brief Illness Perception Questionnaire (Broadbent, Petrie, Main, & Weinman, 2006).

In Chapter 8, we replicated and expanded this study in a different and larger sample of slightly older children (n = 261, mean age 11.9 years old). We focused on both children's and maternal perceptions on the total health-related quality of life. Several domains were affected by children's and mother's asthma perceptions. The results suggest that both maternal and child perceptions reflecting the effect and severity of children's asthma (i.e., perceptions of consequences and identity) affected children reports in several quality of life domains. Differential effects for maternal and child perceptions were found. Specifically, for children's perception

of concern, an association with suppressed child quality of life on all domains was found, while maternal worries for childhood asthma were related only to children's emotional quality of life. Finally, maternal perceptions of timeline, treatment control, and coherence were also related to several childhood quality of life domains, while these perceptions held by children did not predict quality of life.

The findings that maternal perceptions of their children's asthma are related to child symptom-related quality of life (Chapter 7) and children's broader health-related quality of life (Chapter 8) are in line with other research that has underscored the importance of parental perceptions for several facets of childhood asthma. For instance, parental perceptions are also related to treatment adherence (Drotar & Bonner, 2009; Spurrier et al., 2000), school attendance (Spurrier et al., 2000), and child social anxiety (Anthony et al., 2003). Furthermore, in Chapter 8 we found that mother's concern of their children's asthma was related (although not strongly) to child concern. Conversely, only higher levels of child concern were related to lower quality of life on all subdomains of this construct.

As childhood asthma affects the whole family (Fiese & Wamboldt, 2003), it may be expected that children and mothers are in line with each other when it comes to their perceptions of asthma. Although weak correlations between these perceptions were found in Chapter 8, this finding may be because mothers needed to answer questions for another person's illness (i.e., the child). Weak correlations between psychosocial concepts in the literature are not rare. For instance, Rayens, Svavarsdottir, and Burkart (2011) found low parent-child agreement in quality of life domains of worrying, communication, and asthma treatment. When parents lack accurate knowledge of their child's perceptions and ideas, situations can arise in which parents deal less efficiently with potentially risky situations for their children. As is discussed next, efforts should be made to increase agreement between parents and children concerning their perceptions of asthma.

Implications

The results found in Chapters 7 and 8 can contribute to the development and implementation of effective parenting programmes for paediatric asthma. A gap exists in the available interventions for children with asthma that concentrates on the psychosocial developmental issues that these children may encounter (Barlow & Ellard, 2004), including interventions aimed to increase quality of life. It is essential that psychoeducational programmes for children, adolescents, and their parents are developed and embedded in health care to empower paediatric self-care and management (Barlow & Ellard, 2004).

Our current results indicate that, when offering parents intervention programmes designed for asthmatic children to enhance health behaviours and

prevent problem behaviours (such as depression, anxiety, and substance use including smoking), parental beliefs and goals should be acknowledged. As stated in Part I, parental goals should clearly underscore the necessity of an intervention. Parental beliefs could be acknowledged before offering information in a home-based setting because only offering information may not be effective (Gibson et al., 2002). In fact, simply offering information in educational programmes has been found ineffective in adult asthma care (Gibson et al., 2002). Communication between parent and child could also follow the same advice made for these adult patients and their health care practitioners. Specifically, transferring knowledge between a patient or parent and a health care professional should begin with acknowledging current knowledge and beliefs, which constitute important components to improving asthma management (Yoos et al., 2007).

Ineffective transmission from the intervention content communicated from the parent to the child may arise if parents do not accurately know their children's perceptions and beliefs about their asthma. Therefore, successful educational programmes for a home-based setting could begin with eliciting parents' and children's perceptions and needs and identifying parent-child differences. For instance, in Chapter 8, we found a mismatch between mother's and children's concerns about asthma. Children's concerns were associated with decreased levels on all quality of life domains, whereas maternal concern was only associated with the emotional subscale of quality of life. When parents know about their children's concerns, they can first communicate about these concerns and be aware of specific risk situations. Then they can communicate about what to do and not to do when in those risky situations.

Intervention content can include efforts to enhance maternal knowledge and confidence in asthma treatment, as maternal perceptions (i.e., timeline, treatment control, and coherence) can increase children's quality of life (Chapter 8). Indeed the literature indicates that parental self-efficacy in managing childhood asthma is associated with higher child treatment adherence and lower morbidity (Chen, Bloomberg, Fisher, & Strunk, 2003). Additionally, positive parental expectations regarding asthma management are associated with parents' reports of better children's functional status (Wade, Holden, Lynn, Mitchell, & Ewart, 2000), a concept that resembles certain domains of childhood quality of life.

Our results also suggest that accurate perceptions of the impact and severity of asthma by mothers and children (i.e., perceptions of consequences and identity) are essential. Inaccurate interpretations of asthma symptoms can result in less favourable asthma outcomes (Lane, 2006), including the childhood symptom-related quality of life domain (Chapter 7), as well as the broader quality of life domains (Chapter 8). In the Netherlands, more general practitioners are working with practice nurses who are skilled at measuring children's lung functioning.

During these visits, practice nurses can provide families with feedback about objective lung functioning and experienced symptoms.

Strengths and limitations

One of the strengths in Part II is the fact that we were able to investigate the research question in Chapter 7, which had the character of a pilot study, more in depth in Chapter 8. While we found that maternal illness perceptions were associated with child symptom-related quality of life in Chapter 7, in Chapter 8 we examined perceptions on more quality of life domains. Furthermore, while we only had the opportunity to examine mothers' perceptions in the pilot study, it is a strength that children's perceptions were included in Chapter 8. Chapter 8 also included a rich data set with a large number of families participating and almost no drop out at follow-up (98.5% provided data at follow-up). Finally, in both Chapters 7 and 8, we controlled for a measurement of child lung functioning in all analyses. Therefore, the results considered the assessment of objective lung functioning.

Limitations include the focus on mothers only, leaving the role of fathers behind, although the literature indicates that fathers and mothers do not always agree on asthma severity and subsequent asthma management of their children (Eiser, Eiser, Town, & Tripp, 1991). Also, the magnitude of these findings was small, which is not so surprising as it is unlikely that one specific psychosocial factor (e.g., illness perception) would account for a large portion of the explained variance in childhood quality of life in children, which is influenced by substantial other factors (e.g., Everhart & Fiese, 2009; Erickson et al., 2002; Silva, Crespo, Carona, Bullinger, & Canavarro, 2015). Finally, we used validated, reliable and age-appropriate questionnaires to measure quality of life with the Paediatric Quality of Life inventory in Chapter 7 (Seid et al., 2010; Varni, Burwinkle, Rapoff, Kamps, & Olson, 2004) and the Adolescent Asthma Quality of Life Questionnaire in Chapter 8 (Rutishauser, Sawyer, Bond, Coffey, & Bowes, 2001). A brief version of an illness perception questionnaire (Brief-IPQ) was used to measure parental illness perceptions (Broadbent et al., 2006). This Brief-IPQ was designed for use among patients with different types of illnesses, including asthma. It was not specifically designed for use among the parents of these patients. However, it has been applied for that purpose in other studies (e.g., Van der Velde et al., 2011), and it has good test-retest reliability. Nonetheless, associations between the Brief- IPQ with equivalent dimensions of a longer perception questionnaire (IPQ- revised) ranged from moderate to good (Broadbent et al., 2006). For a more in depth analyses on parental perceptions, original, longer versions of perception questionnaires can be used. As suggested in Part I, it might be important to examine for which group of children parental beliefs are influential. The literature suggests that the relationship

between psychosocial factors of maternal perceptions and reported child symptoms may differ depending on asthma severity and control (Meijer, Griffioen, Van Nierop, & Oppenheimer, 1995). In addition, children and families were mainly recruited via schools, which is likely to result in a sample with different characteristics than when recruited via hospitals. Indeed, children in our samples reported asthma to be mild. This is true for most large nationwide surveys examining asthma (Wildhaber, Carroll, & Brand, 2012). Results can differ when replicating the studies within clinical samples. On the other hand, although asthma generally was mild for children in the studies included in this thesis, the effect of asthma on their daily lives may still be substantial. Conducting research with large asthma samples may provide the best opportunity to examine exactly which asthmatic children are most in need for intervention. In addition, most studies on asthma severity and quality of life have found suppressed levels of quality of life when asthma was not well managed (Everhart & Fiese, 2009). Focusing on the asthma status of children may contribute to more and better knowledge on how preventing asthma from interfering with quality of life.

In addition to focussing on subgroups, future studies should include more measurement points throughout the year, which may complement insight into the relationship between illness perceptions and outcome variables. In this thesis, we had annual data collection points, which may have created interference with seasonality for the outcome measures. For instance, asthma is related with seasonality with respect to hospitalisations (Crighton, Mamdani, & Upshur, 2001). On the other hand, we used the ISAAC questionnaire to inquire about asthma status (Redline et al., 2004), which is well validated, and we formulated all questions in a 12-month format.

Overall summary Part I and II

Children with asthma might be at a greater risk for some inadequate health behaviours, including higher odds of developing depressive feelings, which could make them potentially more vulnerable to smoke. The present thesis focused on a smoking prevention programme that is universally offered to all parents of children recruited via participating schools. We found the programme to be ineffective for both children with and without asthma. More precisely, for children in the Netherlands with and without asthma, a home-based programme offered to families with a child in primary school aged 9-11 years old, offered for 5 months with one booster module, focusing on smoking-specific parenting skills, did not accomplish a reduction in smoking initiation.

Suggestions for prevention in asthma

Based on these findings, in combination with the current literature, some suggestions for prevention arise. First, it is worthwhile to examine whether materials sent home to families with children with asthma should include more asthma-specific information to underscore the importance of smoking prevention among these youth. Interviewing techniques among parents of asthmatic children can reveal what information is required for parenting smoking-specific issues among this specific group of children. Second, general parenting style can be incorporated into programmes that focus on smoking prevention instead of solely trying to increase smoking-specific parenting efforts. Third, strategies that meet the needs of the current generation of parents should be incorporated into home-based designs, including boosters and updates via internet, apps, and text messages. When control and experimental groups are compared, factors, such as dosage, timing, and content, should be evaluated as well. Fourth, an additional intervention group can be added to examine the functionality of discussing perceptions and ideas about childhood asthma between parents and children, before moving to the content of a programme. Results from Part II and the literature beg this question of whether, for successful educational messages in interventions to transfer from parent to child, parents and their children should first inquire whether they share the same perceptions and beliefs about asthma. This inquiry concerns perceptions regarding the identity-related aspects of asthma, such as symptom perception, and the emotional components among which the child is concerned about the asthma. Parents with accurate knowledge about how their children experience asthma can be a basic requirement before the start of an intervention or prevention programme.

Prevention strategies can also move from a focus on a single outcome (i.e., smoking) to prevention that focuses on multiple domains in a child's life (i.e., substance use as well as emotional wellbeing, depressive feelings, and quality of life). Results in Chapter 6 supported a selective and indicated approach when offering asthmatic children prevention materials, instead of a more universal approach offered to all children. When emotional difficulties are expected, programmes aimed to decrease these symptoms can have positive effects on associated behaviours (e.g., substance use, including smoking). In future research projects, pre- and post-test use of substances can be examined during interventions that aim to improve emotional well-being. An additional module in these programmes that focus on smoking can also be included and examined for their effectiveness compared to a programme that does not include additional attention to smoking.

Closing Statement

Children with asthma are likely to experience more challenges in certain domains in their lives than children without asthma. It is desirable for all asthmatic children to live in a functional and emotionally well state, meaning living with high quality of life standards. Currently, few effective intervention programmes are available to help children and their families deal with risky situations and prevent maladaptive behaviour; this includes preventing them from smoking. As the home-based program we evaluated did not accomplish its desired goals, development, evaluation and implementation of prevention programmes for children with asthma is warranted.

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Dutch summary | *Nederlandse samenvatting*

DEEL I

Nederlandse jongeren zijn de laatste jaren minder gaan roken. Desalniettemin komt roken en experimenteren met roken nog steeds veelvuldig voor: in 2013 gaf bijna een kwart van de jongeren tussen de 14 en 17 jaar aan dat zij gerookt hadden in de voorbije 4 weken. Voor een speciale groep kinderen en adolescenten, namelijk degenen met en astmatische klachten, zou men kunnen verwachten dat zij zich minder snel inlaten met gedrag dat directe gevolgen kan hebben op hun luchtwegen. Zo is bijvoorbeeld bekend dat sigarettenrook een verminderde werking van astmamedicatie tot gevolg heeft. Echter, uit de literatuur blijkt dat jongeren met astma net zo vaak roken als hun leeftijdsgenoten zonder astmatische klachten. Dit is een groot probleem voor de gezondheidszorg en uiteraard voor deze jongeren zelf. Dit proefschrift richt zich dan ook op een mogelijke preventiestrategie om het beginnen met roken onder Nederlands jongeren tegen te gaan, met speciale aandacht voor jongeren met astma.

Evaluatie van rookpreventieprogramma 'Rookvrije Kids'

In deel I onderzochten we een rookpreventieprogramma, 'Rookvrije Kids', gericht op ouders en kinderen. In totaal namen 1478 gezinnen deel aan ons onderzoek. Dit waren gezinnen met een kind tussen de 8 en 12 jaar oud. Een deel van hen had een astmadiagnose van een arts. Deze jongeren vielen in onze 'astma groep' welke we vergeleken met de 'niet-astma groep'. Een nauwkeurige omschrijving van deze steekproef en onze aanpak, is beschreven in *hoofdstuk 2*. Samengevat hebben we gedurende drie jaar alle jongeren geïnterviewd en vragen gesteld over hun rookgedrag. Ook informeerden we naar opvoeding en diverse eigenschappen van de jongeren.

De helft van de deelnemende gezinnen kwam terecht in de interventiegroep. Deze gezinnen ontvingen vijf maanden lang, éénmaal per maand, ons interventiemagazine thuis. Ouders en kinderen werden gestimuleerd om dit samen door te nemen. Deze magazines behandelden het onderwerp roken vanuit verschillende invalshoeken. Daarnaast bevatten ze ook speciale informatie voor ouders over goede communicatie met hun kind. De andere helft van de kinderen, de zogenoemde controlegroep, ontving ook informatie thuis in diezelfde periode, maar hier werd de communicatie tussen ouder en kind niet extra gestimuleerd. De inhoud bestond voornamelijk uit cijfers over roken in Nederland.

De resultaten uit *hoofdstuk 3* laten zien dat het preventieprogramma niet het beoogde effect heeft gehad: van alle kinderen in onze interventiegroep gaf 10.8% aan wel eens een trekje van een sigaret genomen te hebben, ten opzichte van 12.0% in de controle groep. Deze percentages verschillen niet significant van elkaar. Ook maakte het niet uit of een jongere astma had of niet: jongeren met astma hadden net zo vaak een trekje van een sigaret genomen als jongeren zonder astma. In de discussie van dit proefschrift zijn een aantal verklaringen aangedragen voor het feit dat ons preventieprogramma geen effect heeft gehad. De meest aannemelijke verklaringen hiervoor zijn allereerst dat in onze steekproef überhaupt weinig kinderen zijn gaan roken, wellicht lager dan de landelijke cijfers die weergegeven worden door diverse instanties, ook in de controlegroep. Mogelijk heeft deelname aan ons onderzoek ook in de controlegroep een effect gehad waardoor er geen verschil in de interventie en controlegroep waar te nemen was. Een mogelijk tweede verklaring kan de timing van aanbieding van het programma zijn. We zijn gestart met kinderen in groep 6 en 7 van de basisschool met de gedachte om alle vormen van rookgedrag voor te zijn, ook het eerste trekje. Wellicht is dit toch te vroeg en zou aanbieding van een programma dichter op het daadwerkelijke rookgedrag moeten plaatsvinden. Ten derde zijn er in de literatuur studies beschreven die geen korte termijn effecten vonden voor hun interventies, maar evengoed wel een beschermend effect op middelengebruik lieten zien een aantal jaren later. In ons geval betekent dit dat we nu geen effecten zouden vinden, maar dat wellicht wel minder kinderen gaan roken op latere leeftijd. In het ideale geval, wanneer geld en middelen beschikbaar zouden zijn, zou dit zogenaamde 'delayed effect' nog onderzocht kunnen worden in onze steekproef door extra nametingen.

In *hoofdstuk 4* zijn we nader ingegaan op één van de mechanismen waarop het programma gebaseerd is, te weten de rookspecifieke opvoeding van ouders. Onder rookspecifieke opvoeding verstaan we opvoeding gericht op het stellen van regels omtrent roken en de communicatie over roken. We onderzochten of ouders van jongeren met astma meer baat hadden bij onze magazines in de ondersteuning van deze specifieke opvoeding gericht op rookgedrag. Echter, ons preventieprogramma bleek geen blijvende verandering over tijd te bewerkstelligen in rookspecifieke opvoeding. Ook bleek het programma niet méér behulpzaam voor ouders van jongeren met astma dan voor ouders van jongeren zonder astma. Jongeren en ouders in onze steekproef gaven al voordat we onze interventie startten aan dat er actief aandacht werd besteed aan het onderwerp roken in de vorm van rookspecifieke opvoeding. Dit geeft aan dat het waarschijnlijk de meest gemotiveerde ouders zijn geweest die zich toentertijd hebben aangemeld om deel te nemen aan ons onderzoek. Ook bleken het voornamelijk hoogopgeleide ouders te zijn geweest die zich aanmeldden. Dit kan een vertekend beeld hebben gegeven.

In de literatuur is namelijk beschreven dat hoogopgeleide ouders meer waarde hechten aan het rookvrij opgroeien van hun kinderen en hier strenger in zijn dan lager opgeleide ouders. Deelname was op vrijwillige basis en het is een uitdaging om juist ook ouders te bereiken die nog niet zo betrokken zijn in hun opvoeding ten aanzien van roken. Vervolgonderzoek zou zich meer kunnen richten op het bereiken van bepaalde risicogezinnen om juist hen een interventie aan te bieden. Ook zou meer onderzoek gedaan kunnen worden naar de mogelijkheden van verandering in algemene opvoedstijl van ouders in plaats van de rookspecifieke opvoeding. Zo kan een algemene stijl van autoritair opvoeden of juist een toegeeflijke opvoedstijl een verschil maken. Ook zou nog onderzocht kunnen worden of het benadrukken van de gezondheidsrisico's van roken voor jongeren met astma door professionals uit de gezondheidszorg ouders meer bewust maakt hier aandacht aan te besteden in de opvoeding. Vervolgens kan na deze bewustwording als tweede stap een preventieprogramma aangeboden worden. Tot slot zou toekomstig onderzoek de focus kunnen verplaatsen van ouders naar bijvoorbeeld interventies gericht op leeftijdsgenoten van jongeren met astma.

Verdieping van de relatie roken en astma

De laatste twee hoofdstukken uit deel I trachtten meer inzicht te verschaffen in de relatie tussen astma en roken. Uit de literatuur blijkt dat dagelijks of frequent roken vaker, of minstens even vaak, voorkomt onder mensen met astma in vergelijking met mensen zonder astma. Echter, in deze studies werd aan de deelnemers gevraagd om terug te denken aan de leeftijd waarop zij zijn begonnen met roken. Dit retrospectief terugvragen naar een beginleeftijd brengt een risico van antwoord bias met zich mee: onderzoek heeft aangetoond dat hoe meer jaren er zitten tussen het daadwerkelijke eerste rookgedrag en de huidige leeftijd van de deelnemers aan een onderzoek, hoe groter de afwijkingen van die antwoorden kunnen zijn wat betreft die beginleeftijd. Daarom hebben we in *hoofdstuk 5* onderzocht of kinderen met astma in Nederland op zeer jonge leeftijd meer of minder vaak aangaven al eens een trekje van een sigaret te hebben genomen dan kinderen zonder astma. Inderdaad vonden we terug dat kinderen met astma met een gemiddelde leeftijd van 10 jaar oud vaker een trekje van een sigaret hadden genomen dan kinderen zonder astma. Deze resultaten geven aan dat om verder rookgedrag onder jongeren met astma te voorkomen, vroeg interveniëren zoals beoogd met het Rookvrije Kids programma gewenst kan zijn.

Wat kan er nu een oorzaak van zijn dat jongeren met astma en/of astmatische klachten gaan roken? In *hoofdstuk 6* werd getracht om een mogelijke verklaring te vinden. De aandacht lag hierbij op depressieve symptomen van jongeren en hun weerbaarheid om een aangeboden sigaret te kunnen weigeren. Deze twee factoren, depressieve gevoelens en zelf-weerbaarheid, zijn namelijk in relatie

gebracht met zowel astma als met rookgedrag. We konden gebruik maken van twee steekproeven om onze vraagstelling te toetsen. De eerste steekproef was onze eigen onderzoeksgroep van het Rookvrije Kids project: kinderen tussen de 8 en 12 jaar (gemiddelde leeftijd was 10.1 jaar) met en zonder astma werden met elkaar vergeleken. De andere steekproef bestond uit 4531 jongeren tussen de 11 en 16 jaar oud (gemiddelde leeftijd was 12.8 jaar). In deze grote steekproef vonden we dat een hogere rapportage van depressieve klachten samenhing met een lagere weerbaarheid van deze jongeren ten aanzien van het weigeren van een sigaret, hetgeen vervolgens het risico op beginnen met roken deed toenemen. Ook bleek de astma status van jongeren samen te hangen met dit proces: jongeren met astma scoorden hoger op de depressievragenlijst en dit was vervolgens gerelateerd aan een lagere weerbaarheid ten aanzien van roken. Ditzelfde werd teruggevonden in onze Rookvrije Kids steekproef. Daarom geven de resultaten weer dat voor preventie van rookgedrag ingezet kan worden op het verminderen of voorkomen van depressieve klachten onder jongeren. Dit zal daardoor ook zijn uitwerking kunnen hebben op rookgedrag. Deze aanpak zou in het bijzonder geschikt kunnen zijn voor jongeren met astma, omdat zij een verhoogd risico hebben op het ontwikkelen van depressieve klachten welke het proces naar rookgedrag in gang kunnen zetten. De resultaten geven ook aan dat, indien er een vermoeden is van depressieve klachten onder jongeren, het een effectieve preventiestrategie kan zijn om de zelfweerbaarheid ten aanzien van roken te verhogen

Deel II

Ouders spelen een belangrijke rol in het omgaan met astma door jongeren. Het laatste hoofdstuk van deel I gaf een indicatie dat psychosociaal welbevinden van jongeren met astma samen kan hangen met rookgedrag. Een maat die de subjectieve beleving van het astma op het dagelijks leven van jongeren weergeeft is Kwaliteit van Leven (KvL). Voor meer inzicht in KvL hebben we alle jongeren met astma van onze Rookvrije Kids steekproef thuis opgezocht en extra vragen gesteld over astma. Vervolgens hebben we in deel II van het proefschrift onderzocht hoe ouders tegen astma van hun kind aankijken, de zogenoemde astma percepties. Ook onderzochten we of deze percepties overeenkwamen met hoe jongeren zelf tegen astma aankeken.

In *hoofdstuk 7* hebben we ons gericht op de relatie tussen astmapercepties van moeder (gemeten bij aanvang) en KvL van het kind (gemeten een jaar later). Wat betreft percepties van moeders over het astma van het kind, is in hoofdstuk 7 gevonden dat moeders die a) meer consequenties aan astma verbonden, b) aangaven dat hun kind frequent astmasymptomen ervaarde, c) meer bezorgd waren, en

d) een hogere emotionele impact toekenden aan astma, een lagere KvL voor hun kind rapporteerden een jaar later. Hun kinderen zelf rapporteerden ook een lagere KvL.

In *hoofdstuk 8* hebben we bovenstaande vraagstelling herhaald binnen een andere steekproef, namelijk 261 gezinnen met een kind met astma met een gemiddelde leeftijd van 11.9 jaar. Ditmaal onderzochten we ook de percepties van de jongeren zelf over hun astma. Deze percepties hingen ook samen met hun KvL. De percepties over astma van moeder en van kind zijn met elkaar vergeleken. Deze percepties waren zwak gecorreleerd en er waren een aantal verschillen. Kinderen gaven bijvoorbeeld aan dat hun astma een hogere impact in hun leven had dan dat hun moeders voor hen inschatten. Ook gaven de kinderen aan minder symptomen te ervaren dan hun moeders voor hen rapporteerden. Moeders daarentegen, gaven aan het astma beter te begrijpen dan hun kinderen. Al deze verschillen geven aan dat ouders en kinderen niet op een lijn zitten wat betreft beeldvorming omtrent het astma en de impact van het astma op het leven van het kind. Ongelijke percepties ten aanzien van astma kunnen ervoor zorgen dat informatie tussen moeder en kind niet goed overkomt. Als interventie of preventie-programma's thuis samen worden doorgenomen maar ouders en kinderen al bij aanvang niet overeenkomen in hun ideeën over astma, dan kunnen deze programma's minder effect hebben. Een dergelijk fenomeen is gevonden aangaande informatie uitwisseling tussen gezondheidszorg specialist en patiënt, waarbij enkel informatie-overdracht niet effectief bleek. Als eerste stap zou het zinvol kunnen zijn om de percepties en gedachten van ouders in kaart te brengen alvorens te interveniëren om gedrag te veranderen. Vervolgonderzoek zou kunnen richten op methodes die daarbij ondersteunen.

Percepties van zowel moeder als kind zijn dus voorspellend gevonden voor KvL, hetgeen aangeeft dat interventies zich kunnen richten op beïnvloeding van deze percepties. Te denken valt aan het verlagen van bezorgdheid bij kinderen, of het verhogen van kennis van moeders omtrent astma, om een toename van KvL te bewerkstelligen. Percepties van moeders en kinderen aangaande de ernst van de astma hingen ook samen met KvL. Tijdens bezoeken aan huisartsen of praktijk-ondersteuners zou in kaart kunnen worden gebracht of longfunctietesten over-eenkomen met deze percepties. Indien deze van elkaar afwijken, kan de huisarts of praktijkondersteuner mogelijke onrust bij het kind en de ouder wegnemen.

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Curriculum Vitae

Linda was born in a small village in the Netherlands. After high school, which was in small village as well, she was very eager to study 'in the city'. After one year of following classes in Organisation studies at Tilburg University she switched to studying Pscychology in Nijmegen. Part of her master's degree in Neurological and Revalidation Psychology included a clinical internship at the Canisius Wilhelmina Hospital (CWZ) and a research internship at Nijmegen Institute for Cognition and Information (NICI). Thereafter she applied for the Smoke-free Kids project. During her years as a researcher she wrote several articles published in international journals. She presented her work at international conferences in Canada, Norway, and Great Brittain that focussed on research in the field of child development, adolescent health and smoking. She visited the United States to discuss the Smoke-free Kids program with the developpers of this program. In addtion she supervised more than 30 students when writing their master thesis.

She always combined her academic ambitions with riding roadbike races on the highest (inter)national level. Recently she worked for a few months in the education and research departmenent of an organisation involved in youth care.

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