

Parental factors and adolescents' smoking behavior: an extension of *The theory of planned behavior*

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Abstract

Background. The aim of the present study is to investigate whether general parenting factors (i.e., quality parent–child relationship, psychological control, strict control, parental knowledge) and parental smoking add to *The theory of planned behaviour* [Organ Behav. Hum. Dec. 50 (1991) 179] in predicting the onset of smoking. A mediation model is applied in which parental factors affect smoking behavior indirectly by affecting smoking cognitions (i.e., attitude, self-efficacy, and social norm).

Methods. The model was tested in a longitudinal study on 1,070 adolescents, aged 10–14 years old. Structural equation models (SEM) on current and on future smoking behavior were tested.

Results. The findings showed that the quality of the parent–child relationship and parental knowledge affected adolescents' smoking behavior indirectly, while parental smoking behavior had a direct effect. Strict control and psychological control were found to be unrelated to adolescents' smoking onset.

Conclusions. In prevention campaigns, parents should be informed of the extent to which they exert influence on their child's smoking behavior and should be given advice and information on how they can prevent their children from starting to smoke.

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Introduction

Adolescence is a period in which many youngsters begin to experiment with smoking. In most of the Western countries, there is an increase in the prevalence of smoking in the adolescence period [2,3]. In many of these countries, the prevalence of regular smoking for 13 year olds varies from 3.5% to 12.5% and increases to 17% to 24.5% for 15 year olds [4]. In the Netherlands, the highest increase of ever smoking among adolescents occurs in 12- to 14-year-old children [5].

It is relevant to focus attention on the first phases of smoking onset because experimenting with smoking by adolescents is not without risk. Because of the physiological dependence on nicotine, once adolescents start to smoke, it is

very hard for them to quit and as a consequence they are more likely to develop a regular smoking pattern [6–11]. Regular smoking has been found to be the annual cause of 540,000 deaths in the European Union, 461,000 deaths in the USA, and 457,000 deaths in the former USSR [12]. Because of this addictive and harmful nature of smoking, it is important to examine the precursors of the first phase of smoking onset in adolescents. The aim of the current study is to investigate whether parental factors add to *The theory of planned behavior* in predicting adolescents' smoking onset.

The theory of planned behavior is designed to predict and explain human behavior in specific contexts [1]. In terms of smoking, *The theory of planned behavior* postulates that smoking-related cognitions (i.e., attitude, self-efficacy, and social norm) predict intention to start smoking, and intention in its turn predict actual smoking onset. In addition, self-efficacy also directly predicts actual smoking onset. Various studies have found support for the predictive validity of *The theory of planned behavior* with respect to smoking ([13–18], see also reviews, [19,20]).

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For example, a study of De Vries et al. [21] among early adolescents showed that intention to smoke was the most powerful predictor in explaining adolescents' future smoking behavior.¹ Their findings also demonstrated that the impact of smoking-related cognitions (attitude, self-efficacy, and social influences) was largely exerted through intention. The cognitions also made small unique contributions in the prediction of adolescents' smoking behavior. A positive attitude toward smoking or adolescents' perception of the social influence to smoke predicted an increased risk for adolescents to smoke. Among the smoking-related cognitions, self-efficacy was the best predictor of adolescents' smoking behavior with a high self-efficacy being negatively related to adolescents' smoking behavior.

The theory of planned behavior only includes the role of proximal cognitive factors. Petraitis et al. [19] argued that it is important to include distal factors besides the proximal factors in *The theory of planned behavior* to adequately predict experimental substance use (e.g., tobacco, alcohol, and marijuana use). They suggested that distal factors affect experimental substance use through proximal, cognitive factors. Since several studies have showed the relevance of parental factors, Petraitis et al. [19] proposed to add them to a potential set of distal factors. *The theory of planned behavior*, however, does not take into account the influence of parents when predicting adolescents' smoking behavior, although studies have showed that parents do have an influence on the smoking behavior of adolescents [13,18,19,22–29]. To our knowledge, only a study of Flay et al. [18] investigated the mediating effects on adolescents' smoking behavior by extending *The theory of planned behavior* by including parental factors as distal factors, although the parental factors were limited to parental smoking behavior and they did not examine parenting.

Some researchers have argued that parenting can be divided into two dimensions: the warmth (affect) and control dimension [30,31]. The affect dimension of parenting encounters the quality of the parent–child relationship. The control dimension of parenting refers to manipulative, suppressing control (i.e., psychological control) or to more supervision and monitoring (i.e., strict control and parental knowledge). The present study is the first study to investigate the indirect influence of parenting factors (i.e., the quality of the parent–child relationship, psychological control, strict control, and parental knowledge) on adolescents' smoking onset through smoking-related cognitions. Most of the studies on parental factors looked mainly at the direct effects of these factors on adolescents' smoking onset. Therefore, the indirect effects as well as the direct effects of the quality of the

parent–child relationship, psychological control, strict control, parental knowledge, and parental smoking behavior on adolescents' smoking behavior will be examined. Studies have investigated the direct effects of these five parental factors before and the influence of each parental factor on adolescents' smoking onset will be briefly discussed below.

First, conflicts between the parent and child might result in a negative parent–child relationship, which in turn will increase adolescents' risk to smoke [25,26,29]. In contrast, if parents have a positive, supportive, and stimulating relationship with their child, it decreases adolescents' likelihood to smoke [27]. Second, the influence of psychological control on adolescents' smoking behavior has been barely investigated. A study by Engels et al. [32] is one of the few studies investigating the relation of manipulative, suppressing control and adolescents' smoking onset. Findings of this study showed that higher levels of psychological control were related to higher levels of smoking onset, but only for boys. Third, several studies have examined the relation between strict control and adolescents' smoking behavior, and mixed results were reported. Studies by Chassin et al. [22,23] indicated that higher levels of strict control were related to lower involvement in smoking. In contrast, a study of Engels et al. [32] among Dutch and Swedish adolescents demonstrated that strict control was not related to adolescents' smoking onset. Fourth, longitudinal studies have found that children of parents who have knowledge about their whereabouts and activities are less likely to start smoking [24,25,29]. Fifth, several longitudinal studies showed that parental smoking behavior is moderately to strongly related to smoking onset among adolescents [13,19]. A study of Flay et al. [18] indicated that parental smoking influences adolescents' smoking onset indirectly, through negative outcome expectation, perceived parental approval, and intention. In summary, there is some evidence that parental factors are related to smoking onset and therefore these factors might be a substantial contribution to the explanatory value of *The theory of planned behavior*.

The aim of the present study has been to explore an extension of *The theory of planned behavior* by including the quality of the parent–child relationship, psychological control, strict control, parental knowledge, and parental smoking behavior as distal factors in predicting smoking onset. We investigated to what extent parental factors influenced adolescents' smoking behavior indirectly through smoking-related cognitions (see Fig. 1). We used cross-sectional data to examine the associations among parental factors, smoking cognitions, and current smoking behavior. Furthermore, longitudinal data were used to examine whether these explanatory factors also predicted future smoking behavior. It should be mentioned that no assumptions are made about the magnitude of indirect effects of each of these parental factors on adolescents' smoking onset. Data

¹ De Vries et al. [21] tested a similar model of *The theory of planned behavior* named the ASE model. The smoking-related cognitions in this ASE model are attitude, self-efficacy, and social influence.

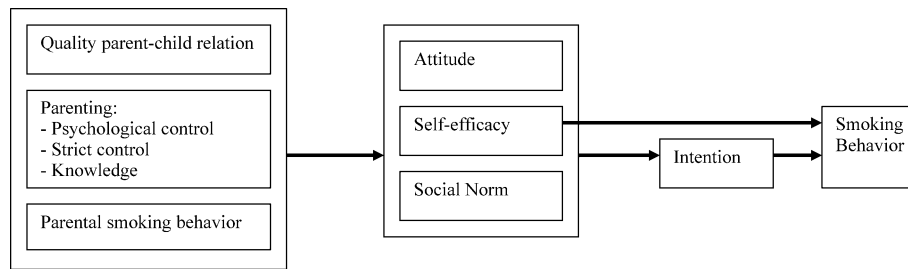


Fig. 1. The theory of planned behavior applied to adolescents' smoking behavior and extended with parental factors.

on a sample of 1,070 early adolescents were conducted to test our model.

Method

Participants

The present study was conducted in the Netherlands among six secondary schools in the area of Utrecht. From these schools, all first year students participated in this study. The students were approached in two waves: in the fall (November 2000) (T1) and spring (May 2001) (T2) of the first year of secondary education. A total of 1,173 secondary school children participated in both waves. However, 103 participants were excluded because of missing data on the variable "smoking behavior of their parents". Of the remaining 1,070 participants,² 50.7% of the participants were male. The age of participants ranged from 10 to 14 years old ($M = 12.30$; $SD = 0.52$). Most of the participants (96.4%) were of Dutch origin. The majority (90.6%) of the adolescents lived in a two-parent household, while most of the remaining adolescents lived with one parent. At the first wave, 73.3% adolescents never smoked and 26.7% smoked once or more. At the second wave, 65.8% adolescents never smoked and 34.1% smoked once or more. Of 55.8% of the adolescents, both parents did not smoke while 44.2% of the adolescents had one or both parents who smoked. A logistic regression analysis was used to test whether the 103 participants excluded from the analyses significantly differed from the 1,070 adolescents on the demographic variables (gender, age, ethnicity, and education) and smoking behavior at T1 and T2. Findings indicated that the dropouts did not differ on gender, age, education, and smoking at T1 and T2 ($P >$

0.05), but differed on ethnicity ($P = 0.02$). Of the included participants, 97% had a Dutch nationality as compared to 92% of the dropouts.

Procedure

Beforehand, a letter was sent to the students' parents informing them about the aims of the study. In this letter, parents were asked if they had any objection if their child would participate in this study. The content of the letter also assured parents that the collected data of their child, when participating in this study, would be handled confidentially and anonymously. If parents had an objection to the participation of their child, they could return a form in which it was clearly stated that their child would not participate in this study. None of the parents returned this form. Nonresponse of students was due to the absence of the student that day when the questionnaire was administered. Students filled out the questionnaire during school hours in presence of a teacher. In advance, teachers received instructions on how to administer the questionnaire in the class. Before students filled out the questionnaire, teachers ensured them that confidentiality and anonymity were rigorously respected and that teachers and their parents would never know what the student filled out. To motivate the students to participate in both waves, they were included in a lottery where CD-certificates could be won.

Measures

Parenting factors

Quality of the parent-child relationship. The quality of the parent-child relationship represented the affect dimension of parenting, and was assessed by the inventory of parent and peer attachment (IPPA) [33]. The psychometric properties of the IPPA showed high internal consistencies [33,34], high 3-week test-retest reliability, and convergent validity [33]. The IPPA distinguishes three subscales: communication, trust, and alienation. The response scales of these three subscales varied from 1 ("never") to 6 ("always"). Although adolescents completed the items separately for their mother and father, the scores were summed. The communication scale assessed the extent to which the child experiences having a high quality of communication with his or her

² Using the listwise deletion option, the original sample size of $N = 1,070$ would be reduced to $N = 999$. Because the mean percentage of missing values per variable equals 0.8% (varying from 0 to 3.0) and to prevent unnecessary deletion of almost complete cases, we decided to impute values using the EM algorithm [57] as is implemented in SPSS. Because the results of the SEM analyses with and without missing values did not show significant differences, we decided to present the SEM results based on the complete file of $N = 1070$ cases.

parents. This scale consisted of eight items: four items for father and four for mother (e.g., “I tell my mother/father about my problems and worries”). Cronbach’s alpha was 0.82. The trust scale assessed the extent to which the child trusts his or her parents to respect and accept his or her feelings and wishes. This scale was measured with eight items (e.g., “My mother/father respects my feelings”). Cronbach’s alpha was 0.82. The alienation scale assessed the degree to which the child experiences negative feelings toward his or her parents. This scale was measured with eight questions (e.g., “When I talk with my mother/father about my problems, I feel ashamed or stupid”). Cronbach’s alpha was 0.80.

Psychological control, strict control, and parental knowledge. Psychological control, strict control, and parental knowledge represented the control dimension of parenting. These three factors were assessed by a widely employed instrument of Steinberg et al. [35]. The psychometric properties of this scale showed internal consistency, external validity, and test–retest reliability of the three factors [36–38]. A Dutch translation of Beyers and Goossens [39] was used to measure these three factors. The response scales varied from 1 (“completely not true”) to 5 (“completely true”).

Psychological control is the extent to which adolescents perceive their parents to be using psychologically manipulative strategies to control the child’s behavior. In other words, the adolescents’ perception that their parents exert coercive, nondemocratic discipline discourage them to express individuality in the family. This scale consisted of nine items (e.g., “When I get a poor grade in school, my parents make me feel guilty”). Cronbach’s alpha was 0.72. Strict control is the extent to which adolescents perceive their parents to be placing control on their whereabouts and activities. This was assessed with four items (e.g., “My parents try to know what I do with my free time”). Cronbach’s alpha was 0.87. Parental knowledge is the adolescents’ perception of their parents’ knowledge about their whereabouts and activities. This scale consisted of four items (e.g., “My parents really know where I am most afternoons after school”). Cronbach’s alpha was 0.84.

Smoking behavior of parents. Adolescents were asked whether their mothers and fathers currently smoked, with two response categories consisting of 1 = “no” and 2 = “yes”. We recoded the response to 1 = “both parents do not smoke” versus 2 = “one or both parents smoke”.

Factors of The theory of planned behavior

Attitude. Attitude toward smoking refers to the degree of favorable evaluation or appraisal of smoking [40]. It was assessed with seven items on a seven-point-scale (e.g., “I think daily smoking is: healthy [1]/unhealthy [7], good [1]/bad [7], boring [1]/exciting [7]”). Cronbach’s alpha was 0.83.

Self-efficacy. Self-efficacy refers to adolescents’ confidence in their ability to become (or stay) nonsmokers and their confidence that they could refuse a cigarette when one was offered [14,16,41]. This was measured with six items (e.g., “To become (or to stay) a nonsmoker is...”) varying from 1 (“very difficult”) to 6 (“very easy”). Cronbach’s alpha was 0.86.

Social norm. The perceived social norm with respect to smoking was assessed by adolescents’ perception of the approval of friends to smoke [21]. It was measured with two items [e.g., “Do you think your friends would approve when you smoke (or would smoke)”) on a five-point scale. Response categories ranged from 1 = “definitely not” to 5 = “definitely yes”. Cronbach’s alpha was 0.84.

Intention. The adolescents’ intention to smoke was measured with five items [e.g., “Do you think you will ever start smoking (or if you already smoke, to stay a smoker)”) on a five-point scale. Response categories ranged from 1 = “absolutely not” to 5 = “absolutely yes”. Cronbach’s alpha was 0.86.

Adolescents’ smoking behavior. To assess adolescents’ smoking behavior, respondents were asked to fill out which stage of smoking applies to them (see Ref. [12]). On a seven-point scale, responses ranged from 1 = “I have never smoked, not even one puff” to 7 = “I smoke at least once a day”. Because of the skewness in the distribution of this variable, it was dichotomized into 1 = “never smoked” and 2 = “smoked once or more”.

Data analyses

To examine whether parental factors affect adolescents’ smoking behavior indirectly by affecting smoking cognitions, structural equation models (SEM) on current and on future smoking behavior were tested with the software package Mplus [42].³ Mplus allows the use of both continuous and categorical variables as independent and dependent variables. In our models, we had a mixture of both types of variables. The smoking behavior variables were categorical (binary) variables; the other variables were continuous. Mplus analyses the correlation matrix of these variables, and parameters in the models were estimated according to the weighted least square method with adjusted mean- and variance chi-square statistic (WLSMV estimator) ([42], p. 39). An initial model was estimated with only the set of a full mediation model. Nonsignificant paths were removed, and in a single case, an unexpected path was included only if it made sense and if the model fit improved

³ Strictly speaking, mediation could better be tested when all explanatory variables are assessed at different waves instead of one wave, such as was done in our study.

significantly. The model on current smoking behavior examined whether parental factors are related to adolescents’ smoking at T1 indirectly by affecting smoking-related cognitions. The model on future smoking behavior examined whether parental factors affected, through smoking-related cognitions, the onset of adolescents’ smoking at T2 by selecting those adolescents who reported to be never smokers at T1 (confer Ref. [16]).

Results

The input matrix of correlations used for Mplus is given in Table 1. To avoid complicated graphic presentations of the models, results of the analyses are given in two parts. The measurement part of the models (lambdas) and the significant correlations between latent variables are presented in Table 2. The structural parts of the models are given in Figs. 2 and 3.

The latent variable “quality of parent–child relationship” was linked to three indicators (i.e., communication, trust, and alienation); the other latent variables were measured by one indicator. Error variances of the latter indicators were estimated on beforehand using alpha and variance of these indicators and were calculated according to the recommendations of Bollen ([43], p. 168) and Jöreskog and Sörbom ([44], pp. 180–181). The error variances of the smoking behavior variables were set to 0. The factor loadings (lambdas) and the significant correlations between the latent variables were omitted from the graphic presentation and are presented in Table 2. Lambda coefficients showed that the links between the indicators and the latent variables had sufficiently high loadings for both models. Table 2 shows that the following distal factors were significantly correlated in the model on current smoking behavior and in the model on future smoking behavior. Adolescents who regarded the relationship with their parents to be satisfactory perceived their parents to be less psychologically manipulative and

having more knowledge about the whereabouts and activities of their children. Adolescents who perceived their parents to be using psychologically manipulative strategies also perceived their parents to exert more control over their whereabouts and activities. Adolescents who reported that their parents had knowledge about their whereabouts and activities were less likely to smoke. Table 2 shows that the following proximal factors or smoking-related cognitions were significantly correlated in the model on current smoking behavior and in the model on future smoking behavior. Adolescents with a more positive attitude toward smoking had a lower self-efficacy and perceived a high social norm to smoke. Adolescents with a high self-efficacy were less likely to perceive a high social norm to smoke.

Model on current smoking behavior: cross-sectional analyses

The model on current smoking behavior (Fig. 2) showed an acceptable fit (CFI and TLI were above 0.90 and RMSEA was below 0.05). Estimates of the regression coefficients were completely standardized. The distal factors and the smoking-related cognitions (proximal factors) included in the model explained 57% of the variance of adolescents’ smoking intention and 38% of the variance of adolescents’ smoking at T1, indicating a rather high percentage of explained variance.

Proximal factors

Fig. 2 shows the model on current smoking behavior with only the significant paths. There is strong support for *The theory of planned behavior* model. Adolescents’ intention to smoke was positively related with adolescents’ smoking behavior at T1. Adolescents with a high intention to smoke were more likely to engage in smoking. A positive attitude toward smoking, a low self-efficacy, and perceiving a high prosmoking social norm was related to a higher intention to smoke.

Table 1
Correlation matrix for the manifest variables in the models on current and future smoking behavior

	1	2	3	4	5	6	7	8	9	10	11	12
1. Communication		0.73	-0.57	-0.38	0.02	0.45	-0.02	-0.11	0.21	-0.14	-0.18	-0.19
2. Trust	0.72		-0.53	-0.41	0.03	0.40	0.01	-0.08	0.17	-0.08	-0.13	-0.10
3. Alienation	-0.56	-0.53		0.43	0.09	-0.33	-0.01	0.15	-0.26	0.07	0.18	0.05
4. Psychological control	-0.36	-0.40	0.42		0.19	-0.22	0.04	0.09	-0.10	-0.00	0.08	0.05
5. Strict control	0.03	0.01	0.11	0.23		0.03	-0.08	-0.04	-0.04	0.03	0.02	-0.15
6. Knowledge	0.43	0.38	-0.32	-0.20	0.04		-0.11	-0.17	0.21	-0.12	-0.13	-0.24
7. Smoking parents	-0.04	-0.03	0.03	0.07	-0.08	-0.10		0.19	-0.03	-0.02	0.18	0.21
8. Attitude	-0.13	-0.14	0.16	0.11	-0.03	-0.22	0.20		-0.25	0.18	0.30	0.16
9. Self-efficacy	0.21	0.22	-0.27	-0.16	-0.03	0.26	-0.08	-0.38		-0.18	-0.44	-0.10
10. Norm	-0.14	-0.12	0.11	0.05	0.01	-0.20	0.07	0.28	0.28		0.29	0.12
11. Intention	-0.18	-0.19	0.22	0.14	0.04	-0.25	0.23	0.49	-0.52	0.38		0.18
12. Smoke 1 (smoke 2)	-0.09	-0.17	0.16	0.15	0.02	-0.27	0.31	0.33	-0.28	0.36	0.44	

Note. Correlations, significance level for the model on current smoking behavior (smoke 1) below the diagonal: $P < 0.05$ if $0.06 < |r| < 0.07$; $P < 0.01$ if $0.07 < |r| < 0.10$; $P < 0.001$ if $|r| > 0.10$. Correlations for the model on future smoking behavior (smoke 2) above the diagonal: $P < 0.05$ if $0.07 < |r| < 0.09$; $P < 0.01$ if $0.10 < |r| < 0.12$; $P < 0.001$ if $|r| > 0.12$.

Table 2
Factor loadings (lambdas) and significant correlations between latent variables for the structural equation model on current and future smoking behavior

Manifest variables	Latent variables	Factor loadings (lambdas)	
		Current smoking behavior	Future smoking behavior
Communication	parent–child relation	0.79	0.85
Trust	parent–child relation	0.79	0.78
Alienation (–)	parent–child relation	0.73	0.71
Psychological control	psychological control	0.82	0.80
Strict control	strict control	0.93	0.92
Parental knowledge	knowledge	0.90	0.89
Parental smoking behavior	smoking parents	1.00	1.00
Attitude	attitude	0.90	0.87
Self-efficacy	self-efficacy	0.91	0.90
Norm	norm	0.93	0.92
Intention to smoking behavior	intention	0.92	0.87
Smoking behavior child T1	smoke 1	1.00	
Smoking behavior child T2	smoke 2		1.00
<i>Correlations between latent constructs^a</i>			
Parent–child relation × psychological control		–0.63	–0.64
Parent–child relation × knowledge		0.55	0.57
Psychological control × strict control		0.30	0.25
Psychological control × knowledge		–0.29	–0.30
Knowledge × smoking parents		–0.22	–0.32
Attitude × self-efficacy		–0.34	–0.25
Attitude × norm		0.25	0.19
Self-efficacy × norm		–0.23	–0.17

^a These are correlations between latent variables in the models on current and future smoking behavior ($P < 0.05$).

Distal factors

A good quality of the parent–child relationship was related to a negative attitude toward smoking of adolescents, while it was related to a high self-efficacy not to smoke. Psychological control was positively related to adolescents' smoking behavior at T1, but was not significantly related to one or more of the proximal factors. Strict control was not significantly related to the proximal factors or adolescents' smoking behavior. Greater parental knowledge was related to a negative attitude of adolescents toward smoking, while it was related to a high self-efficacy not to smoke. Adolescents with parents who had greater knowledge were less likely to

perceive a prosmoking social norm. Adolescents with one or both parents smoking were not only more likely to develop a positive attitude toward smoking, but were also more likely to engage in smoking.

Model on future smoking behavior: longitudinal analyses

The model on future smoking behavior (Fig. 3) showed an acceptable fit. In this model, we looked at adolescents' smoking onset and therefore only the 784 adolescents who did not smoke at T1 were included in the analyses. The distal factors and the smoking-related cognitions included in the model explained 44% of the variance of adolescents' smoking intention and 23% of the variance of adolescents' smoking onset.

Proximal factors

Fig. 3 shows the model on future smoking behavior with only the significant paths. In general, the paths in this model were similar to those found in the model on current smoking behavior. First, it appeared that adolescents with a high intention to smoke were more likely to start smoking. Adolescents with a positive attitude toward smoking and perceiving a prosmoking social norm were more likely to have a high intention to smoke, while adolescents with a high self-efficacy not to smoke were less likely to have high intention to smoke. In contrast to the model on current smoking behavior, social norm was not directly significantly related to adolescents' smoking behavior in the model on future smoking behavior.

Distal factors

The quality of the parent–child relationship was negatively related with adolescents' attitude toward smoking, while it was positively related with adolescents' self-efficacy not to smoke. The relation between psychological control with adolescents' smoking behavior at T1 (see Fig. 2) was nonsignificant in the model on future smoking behavior. Similar to the model on current smoking behavior, strict control was not significantly related to one or more of the proximal factors or adolescents' smoking onset. The relation between parental knowledge with adolescents' attitude toward smoking shown in the model on current smoking behavior was nonsignificant in the model on future smoking behavior. Parental knowledge was again positively related with adolescents' self-efficacy not to smoke, and negatively related with adolescents' perception of the social norm to smoke. Adolescents with one or both parents smoking turned out to be at higher risk to start smoking.

Additional analyses

Additional analyses were done to investigate if there was a difference in effects of parenting on adolescents' smoking onset when one or both parents smoked (smoking parents) compared to parents who both did not smoke (nonsmoking

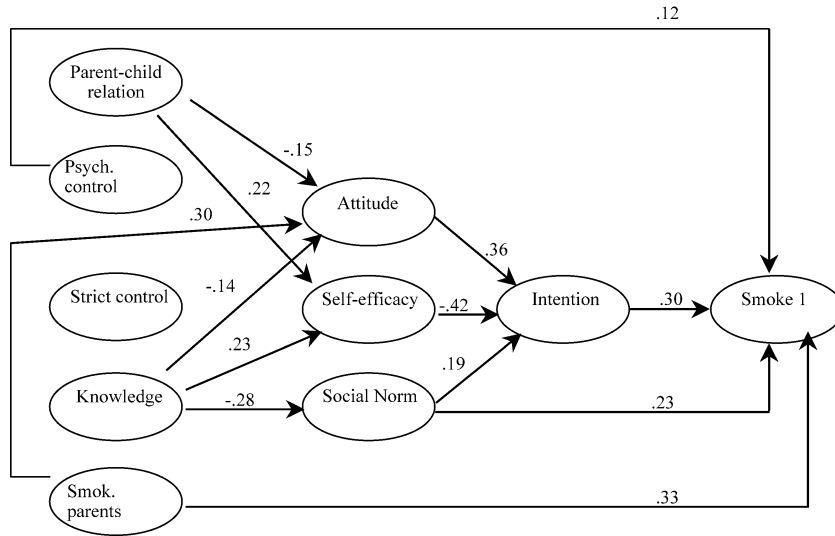


Fig. 2. Structural equation model of adolescents' smoking behavior at T1 (model on current smoking behavior): $N = 1,070$, $\chi^2 [19] = 57.78$, $P = 0.0000$, RMSEA = 0.04, CFI = 0.97, and TLI = 0.97. Only the significant paths are included in the model.

parents). In Mplus, it is possible to test an overall model that is applicable for both groups. But in our case (a model with a dependent categorical variable using the WLSMV estimator), it was impossible to test differences in path estimates between both groups with help of chi-square difference tests. To gain more insight into possible differences between the two groups, we decided to test the overall model. The overall model for smoking ($n = 302$) and nonsmoking parents ($n = 482$) showed an acceptable fit (CFI and TLI were both above 0.95 and RMSEA equaled 0.05). This result is an indication that the same model is applicable to both groups. Inspection of the nonstandardized structural path estimates did not reveal marked differences between the two groups. Regarding smoking parents, the distal factors and the smoking-related cognitions included in the model explained 40% of the variance of adolescents' smoking intention and 10% of the variance of adolescents' smoking onset. Regarding to the

nonsmoking parents, the distal factors and the smoking-related cognitions included in the model explained 55% of the variance of adolescents' smoking intention and 6% of the variance of adolescents' smoking onset. In general, the findings did not suggest significant differences in effects of parenting on adolescents' smoking onset between smoking and nonsmoking parents.

Discussion

In this study, we examined whether *The theory of planned behavior* [1] could be extended with parental factors (i.e., the quality of the parent–child relationship, psychological control, strict control, parental knowledge, and parental smoking behavior) as important distal factors in predicting adolescents' smoking onset.

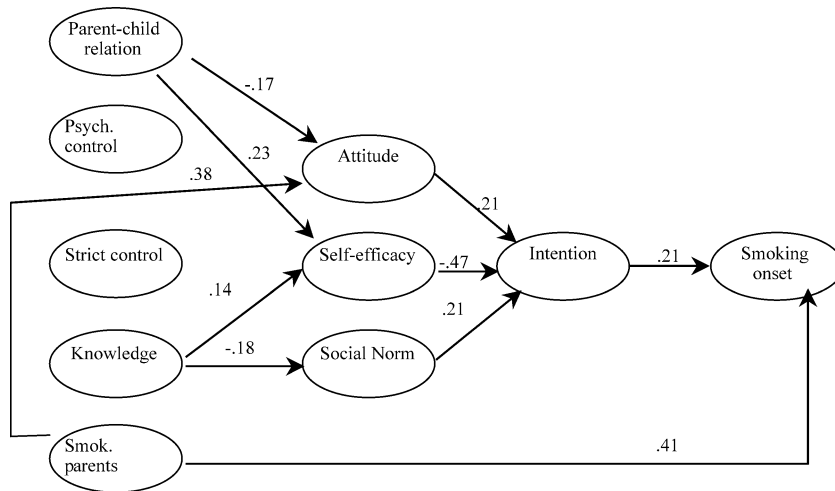


Fig. 3. Structural equation model of adolescents' smoking onset (model on future smoking behavior): $N = 784$, $\chi^2 [23] = 54.68$, $P = 0.0002$, RMSEA = 0.04, CFI = 0.97, and TLI = 0.96. Only the significant paths are included in the model.

First of all, the results of this study, like those of other studies on smoking initiation, are to a large extent in agreement with *The theory of planned behavior* [1]. The model on current smoking behavior in our study implies that smoking-related cognitions as proximal factors (attitude, self-efficacy and social norm) indirectly affect adolescents' smoking onset through intention [21]. Only in the model on current smoking, a direct path between social norm and smoking behavior has been found. For the results of the model on future smoking behavior, this direct effect of social norm is not observed and the indirect effect remains. Except for this difference, the results of the model on future smoking behavior are similar to the results of the model on current smoking behavior [18].

Our extension of *The theory of planned behavior* clearly shows that parental factors as distal factors contribute to the prediction of adolescents' smoking behavior. In most cases, it concerns indirect effects, implying that as expected, parental actions affect smoking-related cognitions (proximal factors) which in turn affect smoking behavior. The findings of the models on current and future smoking behavior imply that the quality of the parent–child relationship influences adolescents' smoking onset indirectly through attitude and self-efficacy. The effect of the quality of the parent–child relationship on attitude is, however, small. Although other studies reported that the quality of the parent–child relationship was directly associated to adolescents' smoking onset [27], we did not find any direct effects of the parent–child relationship on adolescents' smoking onset. It is likely that because these studies only looked at the direct effects of relations on smoking, they could not detect the indirect effects of quality of the parent–child relationship. Thus, it is possible that the quality of the parent–child relationship primarily affects adolescents' smoking onset indirectly through proximal factors, such as attitude and self-efficacy.

The control dimension of parenting was split up into manipulative, suppressing control (i.e., psychological control) on the one hand and more supervision and monitoring (i.e., strict control and parental knowledge) on the other hand. Psychological control of parents has a small direct effect on adolescents' smoking behavior at T1. This finding implies that psychological control is positively related to adolescents' smoking behavior. In contrast to the model on current smoking behavior, psychological control of parents in the model on future smoking behavior was shown to have no indirect and/or direct influence on adolescents' smoking onset. There is not much knowledge on how psychological control is related to adolescents' smoking onset. Only one study (longitudinal) showed that psychological control is positively related to adolescents' smoking onset in boys [32]. More studies are needed to be able to understand how psychological control of parents affects adolescents' smoking onset.

Strict control of parents is neither directly nor indirectly related to adolescents' smoking onset. Our findings are not in line with findings of some other studies [22] that

indicated that higher levels of strict control are related to lower involvement in smoking. A possible explanation why in our study and the study of Engels et al. [32] no significant effects were found could be related to the age of the participants. Reviews of the literature on the parent–child relationship showed that most conflicts and problems in the relationship between parents and children occur in the early adolescent years, when adolescents undergo several personal and social transitions. It is possible that in particular, in these years, the explicit activities of parents to control their offsprings' behavior are not successful and may even have counterproductive effects [23]. Therefore, it is important to examine whether similar mechanisms also exist in middle and late adolescence.

The findings of the model on current smoking behavior in our study indicate that parental knowledge influences adolescents' smoking behavior indirectly through attitude, self-efficacy, and social norm. In contrast to the model on current smoking behavior, parental knowledge in the model on future smoking behavior affect adolescents' smoking onset indirectly through self-efficacy and social norm. The effect of parental knowledge on self-efficacy and social norm is, however, small. In contrast to other studies that reported direct effects of parental knowledge [24,25,29], we did not find any direct effects. Nonetheless, because these studies exclusively looked at the direct effects of relations on smoking, they could not detect the indirect effects of parental knowledge. A possible explanation for the indirect effects is that adolescents who experience that their parents have little knowledge of offspring's whereabouts and activities have levels of lower self-efficacy, because of the underlying lack of interest of their parents. It can be assumed that when adolescents with a low self-efficacy come into contact with friends who smoke, they will be less resistant to the encouragement of these friends to start smoking (confer Ref. [45]). Although the indirect effect of parental knowledge on adolescents' smoking onset through social norm is small, a possible explanation is the following. When adolescents perceive that their parents have little knowledge about their whereabouts and activities, they are more likely to come in contact with friends who smoke, and therefore will feel more pressure to start smoking, resulting in actual smoking engagement.

In the present study, the findings of the models on current and future smoking show that parents' own smoking behavior is positively associated to adolescents' smoking onset indirectly through attitude, but also directly. Regarding the direct associations, several longitudinal studies showed that parental smoking behavior is moderately to strongly related to smoking onset among adolescents [13,19]. A possible explanation for this direct association may be that parents have an influence on adolescents' smoking onset through modeling effects of their own smoking. Adolescents may imitate parents' behavior including their parents' smoking behavior. A study of Flay et al. [18] was the only study investigating the mediating effect of parental smoking by

extending *The theory of planned behavior* with parental smoking as distal factor. In contrast to our study, Flay et al. found no direct effects of parental smoking on adolescents' smoking onset. Indirect effects were found through negative outcome expectation, perceived parental approval, and intention. In contrast to the study of Flay et al., however, we did not measure "perceived parental approval" as part of a social norm. An alternative possibility may be that the relationship between parental and adolescent smoking is mediated by parental approval of smoking. Because we did not include this in the present study, we may therefore have found also a direct association between parental and adolescent smoking.

Additional analyses indicated no differences in the models for adolescents with smoking and nonsmoking parents. This implies that the effect of parenting on adolescents' smoking onset does not depend on whether parents smoke or not. Until now, no studies compared the influence of parenting on adolescents' smoking onset between smoking and nonsmoking parents. A few studies however examined the role of antismoking socialization on adolescents' smoking behavior separately for smoking and nonsmoking parents. For example, the study by Jackson and Henriksen [46] showed that if parents smoke, antismoking socialization will still have effect on the smoking behavior of elementary school children, but the effect is smaller compared with nonsmoking parents. Nonetheless, when it concerns general parenting practices, no differences are observed in effectiveness of parenting between smoking and nonsmoking parents.

Limitations

Our study is based on adolescents' self-reports on their own smoking behavior as well as parenting styles and parents' smoking behavior. This leads to two potential problems. First, when people are asked to report their own smoking behavior, the possibility of underreporting or overreporting exists because of not remembering accurately or not telling the truth due to social desirability [47–49]. However, self-administered questionnaires are frequently used to measure smoking behavior among adolescents and have been found to be as reliable and valid as a more objective method such as biochemical verification of smoking [50,51]. Second, there is a lively debate concerning the validity of reports of parents and children on parenting styles and behaviors because reports of parents and children are both subjective and may provide a distorted view [45]. It is nevertheless reasonable to use adolescents' self-reports, because adolescents are probably more influenced by their perceptions than by the actual behavior of their parents [26,52].

Although our study focused (primarily) on parental factors as distal factors, the explained variance of adolescents' smoking onset in the model on future smoking behavior is lower compared with the explained variance of adolescents' smoking behavior in the model on current smoking behavior.

This implies that there are other factors besides parental factors and smoking-related cognitions, which explain adolescents' smoking onset. Since previous studies have indicated that friends and peer group members are also important predictors of adolescents' smoking onset, family factors may be studied in the context of peer influences [53]. Further, besides focusing attention on the role of general parenting factors and parental smoking behavior, future studies should concentrate on antismoking socialization efforts of parents [46]. Finally, we looked at the short-term effects of parental factors on adolescents' smoking onset. Future studies are needed to investigate the long-term effects of parental factors on adolescents' smoking onset.

Implications

Our study has some implications for primary prevention. In The Netherlands, little to no attention has been paid to involvement of parents in prevention campaigns [54,55]. The majority of these prevention campaigns are aimed at teaching adolescents peer refusal skills. In the present study, it is shown that parents have an influence on adolescents' smoking onset primarily through modeling effects of their own smoking and through parenting practices. Therefore, in prevention campaigns, parents should be informed that they play a role in their child's smoking career, and should be given advice and information on how they can prevent their children from starting to smoke. First, parents should have a good, secure, and strong or tight relationship with their child giving the child the feeling of being loved and cared for. An assumption is that this may contribute to adolescents developing a less positive attitude toward smoking, which can prevent them from smoking on the one hand, and contribute to a higher confidence of the child's ability to stay a nonsmoker on the other. Second, manipulative, suppressing control and strictness of parents toward their children do not have any effect when trying to prevent their children from taking up smoking. Third, our study suggests that when parents show interest in their child by knowing his or her whereabouts and activities, this might diminish the probability that their child will start to smoke because of its reflective effects in adolescents' smoking cognitions. Our final implication is that parents who smoke are far more likely to have children who also will smoke and therefore these parents should be advised to stop smoking [56].

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