Smoking among Dutch elementary schoolchildren: gender-specific predictors

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Abstract

Higher rates of smoking initiation and continuation by female compared with male adolescents, as found in many developed countries, may call for gender-specific prevention programs. Risk factors of smoking initiation and continuation were examined prospectively (1997–2002) among 3205 Dutch elementary schoolchildren (mean age 11.64) in an intervention trial using written questionnaires and multilevel logistic regression. At baseline, smoking prevalence was lower among girls than among boys; at follow-up, smoking initiation was lower among girls than among boys. Concerning smoking initiation, girls and boys shared the following risk factors: age, modeling from parents and siblings (‘modeling nuclear’), modeling from other members in the social circle (‘modeling diffuse’) and perceived pro-tobacco pressure to smoke. The only gender-specific predictor of smoking initiation was parent origin; girls with non-Dutch parents could be targeted for prevention programs. Concerning continuation, girls and boys shared the following risk factors: older age, more modeling nuclear and diffuse, fewer smoking disadvantages and lower self-efficacy to refrain from smoking. This study confirms that social modeling, smoking attitude and self-efficacy information to refrain from smoking deserve a prominent place in smoking prevention programs for schoolchildren. Besides booster sessions, family-directed programs are suggested. No gender-specific predictors of later smoking initiation were found, apart from parent origin, which is not amenable to intervention.

Introduction

Adolescent girls and boys who start smoking at an early age seem considerably more at risk of the disadvantageous health consequences of smoking than late starters. Youths reported symptoms of nicotine dependence after their first few cigarettes [1, 2]. Also, nicotine addiction among these early smokers appears more severe than that among late starters [3]. Smoking prevalence rises sharply after students’ transfer from elementary to secondary education. This finding does not apply exclusively to the Dutch situation, in which school transition occurs when students are 12 years old, but has also been identified by researchers in other countries [3]. In 2003, the lifetime smoking prevalence among 10- to 12-year old Dutch children was 8% for girls and 14% for boys. At the age of 15, lifetime smoking prevalence for girls (58%) overtook the prevalence for boys (51%). Almost 1% of 10- to 12-year old girls and almost 2% of 10- to 12-year old boys indicated having smoked in the past 4 weeks, while
at the age of 15, 31% of the girls and 24% of the boys reported having done so [4].

Sex differences in smoking cigarettes have changed. Were boys more likely to smoke cigarettes than girls in the past, in many countries sex differences have disappeared [5]. In several developed countries, even a higher rate of smoking initiation by female than male adolescents has been found [6–8] and is of great concern, in view of the implications of smoking for, e.g. reproductive functions [3] and a higher risk for lung cancer for girls who start smoking at young age [9]. So far we have only a limited understanding of the reasons behind these gender patterns [10]. Recent research suggests that reasons for smoking need further examination, with special attention to girls. It is recommended to fine-tune smoking prevention programs to specific gender-sensitive issues [11, 12]. The attitude–social influence–self-efficacy (ASE) model, part of the integrated model for exploring motivational and behavioral change (the I-Change model), served as the theoretical framework for this study [13–15]. Initially, the ASE model not only originated from the Theory of Planned Behavior [16] but also incorporated insights of various other theories, such as Social Cognitive Theory [17], the Health Belief Model [18] and the Transtheoretical Model [19]. According to the ASE model, smoking behavior can be explained by behavioral intention, which in turn is determined by the proximal psychosocial determinants, namely attitudes, perceived social influences and self-efficacy expectations. Distal factors, such as demographics and genetic pre-disposition, are supposed to influence smoking behavior through the three psychosocial determinants. The attitude toward smoking is determined by the evaluation of respondents’ salient beliefs concerning smoking (e.g. smoking is expensive, bad for one’s health, relieves tension). With respect to social influences on smoking, three independent influences are assumed to play a role [20]. First, the perceived norms toward smoking of important others (e.g. parents, siblings, friends). Second, the support or pro-tobacco pressure concerning smoking which adolescents experience from their direct environment (e.g. from parents, siblings, friends). The third social influence appears when the smoking behavior of important others is taken as an example: modeling [17]. Self-efficacy refers to adolescents’ expectations regarding their capability to resist smoking, e.g. refuse cigarettes.

Considering the following findings (i) age of smoking initiation has decreased, however, until recently, smoking determinant studies in The Netherlands had been conducted only among secondary schoolchildren [21–24] and (ii) the trend that smoking among young people has become increasingly gendered [10]. As stated, smoking among 15-year old girls is now higher than among 15-year old boys. And (iii) cross-sectional study conducted among elementary schoolchildren revealed a clear distinction between smoking stages [25]. The distinction manifested itself in different backgrounds and motives of the youngsters. For example, never smokers were more often female, perceived more disadvantages in their attitudes toward smoking than experimental and regular smokers. Cross-sectional research improves our insights into the relation between smoking behavior and its risk factors, but does not elucidate whether the relationship is causal [26]. The present longitudinal study aims to assess the risk factors for smoking initiation and continuation among never- and ever-smoking elementary school students, using separate assessments for girls and boys since so far we have only a limited understanding of the reasons behind these gender patterns.

**Methods**

**Design and procedure**

The present study used data from a smoking prevention project for Dutch upper-grade elementary schoolchildren (mean age 11.64, SD 0.57 at the start of the study), with a longitudinal design and randomization of schools to in-school and out-of-school conditions, to a combined in-school and out-of-school condition (in × out) and to a non-intervention control condition. These data were collected from September 1997 till September 1998. The project proceeded until September 2000. In this
period, the influence of booster sessions was studied. Students in the in-school and in × out condition were exposed to a school-based smoking prevention program. Students in the out-of-school and in × out condition received three personalized letters with smoking information mailed to their home addresses at 3-week intervals. Both in-school and out-of-school programs were based on essential components for successful social influence programs [27]. Topics included short-term physical and social consequences of smoking, pro-tobacco pressure, other people’s smoking behavior and refusal skills. For a detailed description of both programs, see Ausems et al. [28]. In 1997, Dutch school principals had the authority to approve in-school health courses, so that no consent procedure was required for participation in the in-school intervention and for the evaluation part of the study. Schools participating in the out-of-school program distributed consent forms to students’ parents, as their children were selected to receive educational materials sent to the home addresses. Twenty-two parents refused to participate, so their children did not receive the out-of-school materials.

Both in-school and out-of-school interventions were administered between the pre-test in September 1997 (N_{school} = 143, N_{student} = 3775) and the first post-test in February 1998 (N_{school} = 140, N_{student} = 3349). Short-term results of this post-test are described elsewhere [28]. The second follow-up assessment, which results are described in this paper, was in 1998, 9 months after the pre-test (N_{school} = 135, N_{student} = 3236).

The class teachers received oral and written instructions, after which they were asked to schedule three 1-hour periods for completing the three written questionnaires by the students in class. After students’ questionnaire completion, the teachers collected the questionnaires, put them in a postage-paid envelope and—having sealed them—returned the envelopes to the researchers.

**Questionnaire**

The questionnaires were based on the ASE constructs of the I-Change model and have been used in several smoking prevention studies [7, 22, 23]. After age adjustment, they were pilot tested among the target group. The questionnaire assesses both the psychosocial determinants of smoking (attitudinal beliefs, social influences, self-efficacy expectations and intentions) and the outcome measures (smoking initiation and continuation). Based on literature evidence, demographic variables like age (years), gender (male/female), adhering to a religion (yes, no), family composition (two parents, other), amount of pocket money (more than average, less than average), parents employment status (employed, not employed) and parents origin (Dutch parents, other—most likely Turkish or Moroccan origin) were also included as predictors.

Factor analyses (oblique rotation) were used to form four attitude scales: (i) Disadvantages of smoking (11 items, Cronbach’s \( \alpha = 0.80 \)) measured on a five-point scale ranging from ‘negative’ (1) to ‘very positive toward smoking’ (5), referring to nausea, coughing, irritated eyes, breathing problems, unwise activity, expenses, bad for one’s health, annoying others, causing passive smoking, regrets afterward and bad smell; (ii) advantages of smoking (five items, Cronbach’s \( \alpha = 0.63 \)) measured on a five-point scale ranging from negative (1) to very positive toward smoking (5), referring to growing up, relieving boredom, relieving tension, tasting good, feeling tough; (iii) social acceptability (three items, Cronbach’s \( \alpha = 0.75 \)) measured on a seven-point scale ranging from ‘very negative’ (1) to very positive toward smoking (3), referring to receiving attention from friends, acceptance by friends and making contacts; (iv) long-term physical consequences (two items, \( r = 0.57 \)) measured on a seven-point scale ranging from very negative (−3) to very positive toward smoking (3), referring to risks of cancer and heart diseases.

Social influence was measured in four ways: (i) modeling ‘nuclear’, sum score of four items measured on a three-point scale: ‘no’ (0), ‘absent’ (1) and ‘yes’ (2), measuring the perceived smoking behavior of the student’s father, mother, brother/sister and best friend; (ii) modeling ‘diffuse’, sum score of four items measured on a five-point scale ranging from ‘almost none are smokers’ (0) to ‘almost all are smokers’ (4), measuring the number of smoking
friends, peers, teachers and relatives (e.g. aunts and uncles); (iii) social norms, sum score of six items on seven-point scales ranging from very negative (−3) to ‘very positive toward student’s smoking’ (3), measuring the perceived beliefs of the student’s father, mother, brother, sister, best friend and friends; (iv) social pressure, sum score of 10 items ranging from ‘never’ (0) to ‘very often’ (5), measuring the perceived pro-tobacco pressure to smoke from the student’s father, mother, brother, sister, best friend, friends, peers, teacher, relatives and advertisements.

Self-efficacy expectations (six items, Cronbach’s α = 0.91) measured on seven-point scales ranging from ‘very certain’ (−3) to ‘very uncertain’ (3), each item referring to both smokers’ and non-smokers’ expectation about being able not to smoke or not to initiate smoking in different situations with increasing level of difficulty (when others or friends smoke, when a cigarette is offered by someone, by parents or by friends or when you are called a coward).

Intention to smoke was measured by one item on a seven-point scale, ranging from ‘definitely do’ (−3) to ‘definitely do not intend to smoke’ (3).

Smoking behavior, based on self-reports, was measured in one item [29]. The question asked the students to indicate which option best described them: ‘I have never smoked (one puff) of a cigarette’ (1); ‘I have ever smoked, albeit one puff’ (2); ‘I have tried smoking up to five times (3)’; ‘I have quit smoking’ (4); ‘I smoke occasionally, but not every week’ (5); ‘I smoke at least one cigarette a week’ (6); ‘I smoke at least one cigarette a day’ (7). Students were categorized as never smokers if they reported no smoking at all (1), as non-current smokers, if they reported smoking before, but not during the past month (2–4) and as current smokers, if they reported smoking before at least occasionally, weekly or daily (5–7). When a baseline never-smoking student indicated that he or she smoked at follow-up, this was categorized as smoking initiation. Smoking continuation was recorded when a baseline ever smoker (baseline non-current + baseline current smokers) indicated current smoking at follow-up [30].

Objective validation could not be used for this young age group because available methods only detect very recent smoking, at most weekly smoking, and smoking family members can induce elevated readings [31–33]. Self-reports have been demonstrated to be accurate provided confidentiality is assured and an identification coding system is used [31, 34]. Hence, the front page of the questionnaires provided information about confidentiality. An identification code was used in the data file, with researchers replacing the names before the data were entered.

Analyses

Students were nested within schools, and this nesting has to be taken into account in the data analyses, as ignoring nesting may lead to type I errors and too narrow confidence intervals (CIs) for outcome effects due to ignoring intraclass correlation [35]. Therefore, most of the analyses were performed using multilevel regression modeling with the MIXREG (linear regression) program for continuous variables [36] and with MIXOR (logistic regression) for dichotomous variables [37].

To check randomization, the treatment groups were compared on age, gender, baseline smoking and baseline psychosocial ASE variables, using these variables as outcomes and treatment indicators (In, Out) and their interaction as predictors in multilevel analyses [e.g. ln(P/(1 − P)) where P = P(gender = girl) = B0 + B1 × in-school + B2 × out-of-school + B3 × in × out-of-school]. Dropout rate was checked using logistic regression (MIXOR) with attrition at follow-up as the outcome and baseline demographics, baseline smoking and psychosocial variables and treatment conditions and their interaction as predictors [ln(P/(1 − P)) where P = P(attrition occurs) = B0 + B1 × gender + B2 × age + B3 × religion + B4 × origin + B5 × family composition + B6 × in-school + B7 × out-of-school + B8 × in × out-of-school + B9 × baseline smoking + B10 × disadvantages + B11 × advantages + B12 × social acceptability + B13 × long-term consequences + B14 × modeling nuclear + B15 × modeling diffuse + B16 × social norms + B17 × pressure + B18 × self-efficacy + B19 × intention]. Smoking percentages were calculated using the SPSS package.
Data were analyzed looking at two separate outcomes—smoking initiation among never smokers and smoking continuation among ever smokers. The first step in analyzing intervention effects and smoking predictors was model reduction using SPSS stepwise logistic regression analysis. Smoking initiation and continuation at follow-up were each predicted from treatment dummy variables; subsequently, the demographic variables were entered and finally the psychosocial ASE variables were entered, e.g. for smoking initiation:

(i) \( \ln\left( \frac{P}{1-P} \right) \) where \( P = P_{\text{initiation}} = B_0 + B_1 \times \text{in-school} + B_2 \times \text{out-of-school} + B_3 \times \text{in} \times \text{out-of-school} \).

(ii) \( \ln\left( \frac{P}{1-P} \right) = B_0 + B_1 \times \text{in-school} + B_2 \times \text{out-of-school} + B_3 \times \text{in} \times \text{out-of-school} + B_4 \times \text{age} + B_5 \times \text{gender} + B_6 \times \text{religion} + B_7 \times \text{origin} + B_8 \times \text{family composition} + B_9 \times \text{mother’s occupational status} + B_{10} \times \text{father’s occupational status} + B_{11} \times \text{pocket money} \).

(iii) \( \ln\left( \frac{P}{1-P} \right) = B_0 + B_1 \times \text{in-school} + B_2 \times \text{out-of-school} + B_3 \times \text{in} \times \text{out-of-school} + B_4 \times \text{age} + B_5 \times \text{gender} + B_6 \times \text{religion} + B_7 \times \text{origin} + B_8 \times \text{family composition} + B_9 \times \text{mother’s occupational status} + B_{10} \times \text{father’s occupational status} + B_{11} \times \text{pocket money} + B_{12} \times \text{advantages} + B_{13} \times \text{disadvantages} + B_{14} \times \text{long-term consequences} + B_{15} \times \text{modeling nuclear} + B_{16} \times \text{social acceptability} + B_{17} \times \text{modeling diffuse} + B_{18} \times \text{social norms} + B_{19} \times \text{pressure} + B_{20} \times \text{self-efficacy} \).

Interactions with gender were tested simultaneously with the predictors. Non-significant interactions and main effects were deleted stepwise using a two-tailed alpha of 0.05, except for the main effects of treatment and of predictors involved in an interaction term in the model, which were maintained no matter their \( P \)-value. The final models as obtained with SPSS were checked with MIXOR. If a predictor was significant but did not interact with gender, the predictor was included in a multilevel analysis on the total sample. If the predictor interacted significantly with gender, separate multilevel analyses were run for girls and boys with the same regression model excepting gender and interactions involving gender.

### Results

#### Sample characteristics, randomization and attrition

Table I presents the demographic and psychosocial characteristics of the baseline sample.

The randomization check revealed no significant baseline differences on demographic, psychosocial and behavioral characteristics between the conditions.

Attrition between baseline and follow-up 9 months later was 13.3% at student level and 5.2% at school level. Seven schools did not return the questionnaires because of time constraints due to the end of term period and the students’ preparations for secondary school. Questionnaires from one school were never received, even though the teacher affirmed that they had been posted. Multilevel logistic regression analysis with attrition as the dependent variable suggested that older children were less likely to drop out than younger students [odds ratio (OR) = 0.72; 95% CI = 0.59–0.87], baseline smokers were more likely to drop out than baseline non-smokers (OR = 1.86; 95% CI = 1.16–2.97) and children from the in-school condition were more likely to drop out than children from the control condition (OR = 5.53; 95% CI = 2.86–10.71). Higher dropout in the in-school condition was due to complete school dropout, which in turn was due to time constraints. Gender was not predictive to dropout. The following analyses were performed without those students who dropped out. Because follow-up smoking measures from 31 students were missing, these students were also excluded from analyses.

#### Smoking initiation and continuation

Smoking prevalence at baseline and follow-up are shown in Table II for girls and boys with students as units of analyses. At baseline, the percentage of ever-smoking was higher for boys than for girls. Among baseline, never-smoking boys’ smoking
initiation at follow-up was higher than among baseline never-smoking girls. Baseline ever-smoking girls and boys did not differ with respect to smoking continuation at follow-up.

Predictors of smoking initiation and continuation

Model reduction resulted in a set of significant predictors of smoking initiation among baseline never-smokers and a significant gender × origin interaction. The final model included age, gender, origin, gender × origin interaction, modeling nuclear, modeling diffuse, pro-tobacco pressure and both treatment dummy conditions. Table III shows that relatively older baseline never-smokers, baseline never-smokers who perceived more smoking people in their nuclear (e.g. smoking parents, siblings) and diffuse (e.g. smoking peers, friends) environment were more likely to have initiated smoking. Besides, those baseline never-smoking girls and boys who perceived more pro-tobacco pressure were more likely to have initiated smoking at follow-up. A significant interaction was found between gender and parents’ origin ($P < 0.01$). The multilevel analysis conducted separately for girls and boys showed that baseline never-smoking girls were more at risk of having started smoking 9 months later if they had at least one parent of non-Dutch origin than if both parents were Dutch. Table III finally showed that neither in- nor out-of-school programs prevented smoking initiation at follow-up.

Model reduction resulted in a set of significant predictors of smoking continuation among baseline ever-smokers (the final model included age, gender, attitude ‘disadvantages’, modeling nuclear, modeling diffuse, self-efficacy and both treatment dummy conditions). Because no significant interactions with gender were found, multilevel analyses on smoking continuation were performed for the total baseline ever-smoking sample. Table IV shows that relatively older girls and boys were more likely to have continued smoking. Smoking people in the nuclear (e.g. smoking parents, siblings) and diffuse (e.g. smoking peers, friends) environment during the baseline

| Table I. Demographic and psychosocial characteristics of the baseline sample (including students who completed both pre- and post-test questionnaires), means or proportions |
|-------------------------------------------------|-----------------|-----------------|
| Total sample, N = 3205 | Girls, n = 1630 | Boys, n = 1575 |
| Age (years) | 11.6 | 11.6 | 11.7 |
| Religious (%) | 64.3 | 63.4 | 65.2 |
| Family composition, two parents (%) | 88.7 | 87.7 | 89.7 |
| Origin, two Dutch parents (%) | 82.5 | 82.1 | 82.9 |
| Mother’s occupational status | | | |
| Full- or part-time job (%) | 52.1 | 53.1 | 51.1 |
| Father’s occupational status | | | |
| Full- or part-time job (%) | 77.0 | 76.7 | 77.4 |
| Pocket money < 6.8 euros (%) | 90.8 | 93.3 | 88.3 |
| Lifetime smoking (%) | 35.9 | 31.0 | 40.9 |
| Current smoking (past month) (%) | 7.4 | 6.6 | 8.3 |
| Disadvantages: 11 (neg) to 55 (pos) | 18.8 | 18.3 | 19.2 |
| Advantages: 5 (neg) to 25 (pos) | 10.6 | 10.4 | 10.7 |
| Social acceptability: −9 (neg) to 9 (pos) | −0.2 | 0.0 | −0.4 |
| Long-term consequences: −6 (neg) to 6 (pos) | −2.6 | −2.6 | −2.5 |
| Modeling nuclear: 0 (neg) to 8 (pos) | 2.3 | 2.4 | 2.3 |
| Modeling diffuse: 0 (neg) to 16 (pos) | 5.0 | 5.0 | 5.0 |
| Social norms: −18 (neg) to 18 (pos) | −10.1 | −10.2 | −10.1 |
| Pressure: 0 (neg) to 50 (pos) | 2.4 | 2.1 | 2.6 |
| Self-efficacy: −18 (neg) to 18 (pos) | −9.5 | −9.2 | −9.7 |

‘neg’ means negative, ‘pos’ means positive toward smoking.
assessment increased the risk that ever-smoking pupils continued smoking 9 months after the pre-test. Finally, baseline ever-smoking students, who perceived fewer disadvantages of smoking and lower self-efficacy expectations toward non-smoking, were at greater risk to continue smoking. In addition, Table IV shows that both the in-school and the out-of-school interventions were ineffective in preventing smoking continuation at follow-up.

### Intraclass correlation

The school intraclass correlation coefficient reflects the proportion of unexplained outcome variance accounted for by differences between the schools and is defined for binary outcomes by Hedeker and Gibbons [37]. As regards smoking initiation at follow-up, intraclass correlations were 0.04, 0.00 and 0.05 for the total, the female and the male samples, respectively. As regards smoking continuation, the intraclass correlation was 0.17.

### Discussion

Multilevel analyses showed that the rate of smoking initiation at follow-up was lower for girls than for boys in our elementary school sample.
The greater rate of smoking by females than males was not confirmed by this study. Smoking initiation at pre-adolescent age in The Netherlands seemed still higher for upper-grade elementary school boys than for girls. This finding is concordant with some other European findings on pre-adolescent smoking [38]. Data on slightly older adolescents (13- and 15-year olds) published by the Health Behavior in School-aged Children (HBSC) study, an international study including adolescents from 32 countries in Europe, Israel and North America [39], showed that the association of smoking with gender seemed to vary significantly between countries. In Austria and Germany, the occurrence of daily smoking was relatively high for both boys and girls, whereas Estonia, Lithuania and the Ukraine had most smokers among boys and Finland, Czech Republic and the UK had most smokers among girls. The lowest overall prevalence of daily smoking was found in Greece and Israel, whereas Sweden had the lowest prevalence among boys and Lithuania, together with Poland, had the lowest prevalence among girls.

Considering smoking initiation at follow-up, girls and boys shared the following risk factors: older age, presence of smoking people in the nuclear (e.g. smoking parents, siblings) and diffuse (e.g. smoking peers, friends) environment and higher perceptions of pro-tobacco pressure. These findings are in accord with other European reports [40]. This study confirms earlier findings, which suggested that the availability of cigarettes in the home and family members being users promote smoking initiation [41, 42]. Smoking may also be encouraged by internalization of family norms, values or lifestyle [43]. At the same time, one gender-specific feature was found. The risk of girls starting to smoke 9 months later seems higher for girls with at least one parent of non-Dutch origin than for girls with two Dutch parents. Results of other studies examining the variable impact of acculturation on smoking behaviors of immigrant youth suggest that smoking rates are significant associate with levels of acculturation: the more acculturated adolescents were more likely to be smokers, while the less acculturated were more likely to be non-smokers [44–47]. Such studies also found higher smoking rates for higher acculturated adult females. However, in our Dutch study, we did not measure the level of acculturation, so we can only assume an association between those variables. Further research should bring more evidence into the relation between acculturation and girls’ smoking initiation.

### Table IV. Predictors of smoking continuation (1 = yes, 0 = no) at follow-up in the baseline ever-smoking sample: OR with 95% CIs

<table>
<thead>
<tr>
<th>Predictor</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-school (1 = yes, 0 = no)</td>
<td>1.04</td>
<td>0.65–1.65</td>
</tr>
<tr>
<td>Out-of-school (1 = yes, 0 = no)</td>
<td>0.86</td>
<td>0.54–1.36</td>
</tr>
<tr>
<td>Age (1 = boy, 0 = girl)</td>
<td>1.48*</td>
<td>1.08–2.01</td>
</tr>
<tr>
<td>Disadvantages (11, neg to 55, pos)</td>
<td>1.04***</td>
<td>1.02–1.07</td>
</tr>
<tr>
<td>Modeling nuclear (0, neg to 8, pos)</td>
<td>1.20***</td>
<td>1.11–1.30</td>
</tr>
<tr>
<td>Modeling diffuse (0, neg to 16, pos)</td>
<td>1.07*</td>
<td>1.01–1.14</td>
</tr>
<tr>
<td>Self-efficacy (−18, neg to 18, pos)</td>
<td>1.03**</td>
<td>1.01–1.05</td>
</tr>
</tbody>
</table>

Significance of predictors in the total ever-smoking sample is based upon the final regression model for the total baseline ever-smoking sample. ‘Neg’ means negative toward smoking, ‘pos’ means positive toward smoking. *P < 0.05; **P < 0.01; ***P < 0.001.

In general, in our elementary school sample of baseline ever smokers, the rate of smoking continuation was comparable for girls and boys. The higher uptake of smoking continuation among girls was not (yet) visible among the upper-grade elementary school students. There were also no significant gender differences in the prediction of smoking continuation. The presence of smoking people in the nuclear (e.g. smoking parents, siblings) and diffuse (e.g. smoking peers, friends) environment was predictive of smoking continuation among these elementary schoolchildren. Besides,
lower perceptions of self-efficacy expectations with respect to the ability to refuse cigarettes and lower perceptions of the disadvantages of smoking predicted smoking continuation 9 months after the pre-test assessment. Leventhal and Clearly [48] already mentioned the ‘unreasoned’ aspects of smoking initiation. The lack of attitudinal predictors of smoking initiation found in the present study supports this view. Elementary schoolchildren appear to encounter smoking haphazardly and smoking people in the child’s environment seem to trigger this initiation without interference of attitudinal reasoning. With respect to smoking continuation, it seems that some level of reasoning is involved before the decision whether to continue smoking or not is made, considering the predictive influence of the perceived disadvantages of smoking.

This study has limitations. No validation of self-reported smoking behavior was used in this study because objective measurements among 11- to 12-year olds are unreliable. These measurements can only detect very recent smoking, while most smokers in our selected age group were still experimenting with smoking. Furthermore, self-reports have been demonstrated to be accurate provided confidentiality is assured and an identification coding system is used [32, 34], precautions that were indeed taken in the present study. Although the prevention intervention was not successful, one might wonder if it had an effect on the relationship between the predictor variables and gender and the outcomes. Absence of significant interaction between treatment (In, Out, In × Out) on the one hand and gender and other predictors on the other hand implies two things (ignoring possible type II errors): (i) treatment effects on smoking do not depend on gender or the other predictors and (ii) gender and other predictor effects on smoking do not depend on the treatment given.

The findings of this study have some implications for smoking prevention in elementary school settings. Firstly, the strong influence from the nuclear and diffuse environment on both smoking initiation and continuation suggests family-directed programs in which the role models of smoking parents, siblings, peers and friends and perceived pro-tobacco pressure are discussed. Although both social influence-based programs used in this study did not prevent smoking 9 months after pre-test, this approach was able to produce short-term positive out-of-school effects. The main goal of a social influence approach is to equip younger adolescents with specific skills and other resources that would help them to resist direct and indirect social influences to try cigarettes [3]. Because short-term results showed positive out-of-school effects, a booster intervention might be indicated since research has demonstrated its effectiveness [23]. Secondly, self-efficacy with regard to the ability to refuse cigarettes should be given a prominent place in prevention programs since low-efficacy expectations predicted smoking continuation in girls and boys. Thirdly, although developing a negative opinion about smoking may not seem to influence smoking initiation, it seems to be protective with regard to smoking continuation. Therefore, information about negative consequences of smoking should continue to be emphasized in smoking prevention programs. Fourthly, developing separate prevention programs for girls and boys seems unnecessary during the elementary school period because only one interaction of gender with origin was found. With respect to the latter, more research on the relation between origin, acculturation and smoking initiation among girls is suggested.

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## Conflict of interest statement

None declared.

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