Social-Cognitive and School Factors in Initiation of Smoking among Adolescents: A Prospective Cohort Study

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Abstract

Aims: **The aim of the present study was to examine the association between social-cognitive factors, school factors, and smoking initiation among adolescents who had never smoked.**
Methods: **The study was based on longitudinal data on Danish adolescents attending randomly selected public schools. Adolescents enrolled in grade 7 (mean age, 13 years) who had never smoked (n = 912) were followed up for 6 months after baseline. Those who had still never smoked were followed up again 18 months after baseline, in grade 8 (n = 442). Social-cognitive factors were examined with five measures: self-efficacy, social influence (norms), social influence (behavior), social influence (pressure), and attitude. We used multilevel analyses to estimate the associations between social-cognitive factors at baseline and smoking initiation as well as the random effects of school, school class, and gender group in the school class.**
Results: **At the first follow-up, we found significant associations between attitude, father's smoking, best friend's smoking, and smoking initiation. At the second follow-up, we found a significant association with pressure to smoke from friends. Of the school factors, gender group in the school class showed an effect at both first and second follow-up.**
Conclusion: **Our results suggest that father's smoking, best friend's smoking, attitude, and pressure to smoke from friends affect smoking initiation. The results for school factors suggest an effect of classmates of the same gender, which has not previously been examined longitudinally.** (Cancer Epidemiol Biomarkers Prev 2009;18(2):384–92)

Introduction

To prevent smoking, it is essential to understand why some adolescents start experimenting with cigarettes and some do not. Several social and psychological factors have been suggested to affect smoking initiation, and several theories have been proposed to describe how and why these factors are related to smoking initiation. Ideally, these theories would allow precise prediction of smoking initiation and thus form a basis for prevention. One proposed theory is the ASE model, which suggests that attitude, social influence (smoking, norms, and pressure from parents and friends), and self-efficacy (believing that one will be able to refuse cigarette offers) influence the decision to experiment with cigarettes (1, 2). The ASE model was developed by de Vries and colleagues (1). It is an integrative model, combining theoretical constructs from cognitive affective theory, specifically the ''theory of reasoned action'' of Fishbein and Ajzen (attitude, social norms, self-efficacy, and pressure), and the ''social cognitive learning theory'' of Bandura (behavior of others and self-efficacy; ref. 3). The theory of reasoned action states that the intention to do certain behavior is the most important determinant of later behavior (4). Beliefs about the personal consequences of behavior (attitude) are seen as the most important predictor of intention and actual behavior. The social-cognitive learning theory of Bandura also focuses on intention and attitude but also emphasizes behavior-specific modeling or imitation in the acquisition of social behavior (5). The self-efficacy construct was introduced by Bandura in his social cognitive learning theory, and a similar but broader construct was later adopted by Ajzen in his theory of planned behavior, where it was called ''perceived behavioral control.'' In a previous article (6), we extended the ASE model by adding three school factors and thus taking into account the fact that adolescents are affected by people in their proximity (Fig. 1).

Previous studies, including two reviews, have shown that the school (7–10), the school class, and the gender group in the school class (11) may play important roles in smoking status. The school environment can be important because adolescents at the same school share attributes, such as their physical environment and neighborhood. Adolescents in the same school class furthermore have the same teachers and spend up to 9 years together on school days. Adolescents in the same gender group (boys versus girls) in a school class also often share friends (12). These school factors have been found to be of particular importance in studies in which

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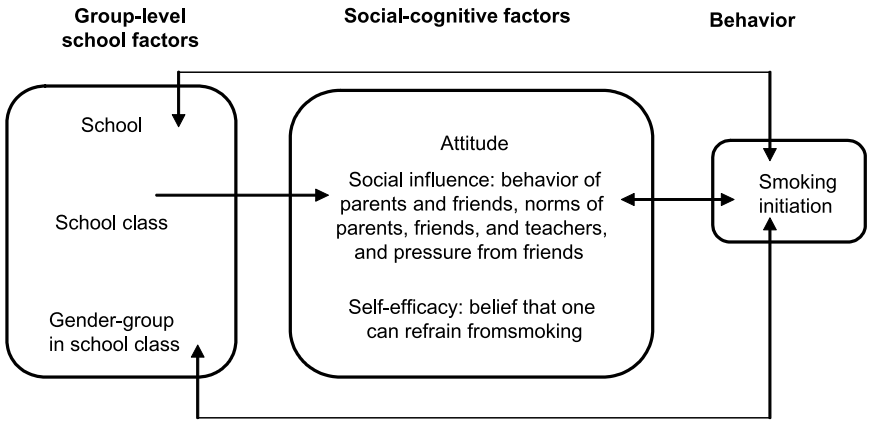

Figure 1. Revised version of ASE model.

the population is sampled by school or school class because persons in the same sampling unit often have more in common than with those in a different unit. This is referred to as a ''clustering effect.'' When sampling has been done by school, the school factors can be measured at a group level (instead of at the individual level) and this way one can take into account the variability between schools instead of only between adolescents.

We tested the revised version of the ASE model on cross-sectional data for 2,913 Danish adolescents and found that all the social-cognitive factors were significantly associated with smoking status (6), supporting the conclusion of several reviews (3, 13, 14). As the data were cross-sectional, however, experimental smoking might have affected attitude, social influence, and self-efficacy to resist pressure to smoke, rather than the other way round. To determine whether social-cognitive factors are associated with smoking initiation, follow-up studies are necessary. To this aim, we followed up on the smoking status of the never-smoking adolescents in the cross-sectional study (2) 6 months after baseline, and adolescents who were still never smokers after 6 months were followed up again 18 months after baseline. Associations between social-cognitive factors, school factors, and smoking initiation were examined, taking into account potential confounders in multilevel analyses.

Materials and Methods

Materials. The study is based on longitudinal data from the Danish Youth Cohort collected by the Danish National Institute of Public Health in 2004 to 2007; collection of the baseline data has been described previously (15). A randomized intervention study was conducted as part of the Danish Youth Cohort involving adolescents in six counties of Denmark who were followed four times between grade 7 and grade 9. At baseline, 4,819 of 7,037 eligible pupils (68%) responded with informed consent from their parents, representing ~9% of the total population of children in grade 7 at public schools in Denmark (n = 56,739).[7] For the follow-up studies (2005-2007), pupils at all public schools in Denmark were invited to participate, but for the current study, we used only data on pupils who participated in the study at baseline in autumn 2004 (grade 7) and at follow-up in spring 2005 (grade 7) and spring 2006 (grade 8) and who went to schools that had not participated in the intervention.

Two analyses were conducted. Analysis I comprised all adolescents who were never smokers at baseline in 2004 and addressed smoking status at the first follow-up 6 mo later, in 2005. After exclusions were made, the population for the first follow-up was 912 adolescents (Fig. 2). Analysis II comprised adolescents who were never smokers both at baseline and at the first follow-up in spring 2005 and addressed their smoking status at the second follow-up 18 mo after baseline, in 2006. After exclusions, the population for the second follow-up was 442 adolescents (Fig. 2). The first follow-up thus focused on ''early'' smoking initiation and the second follow-up on ''late'' smoking initiation. The statistical models could not estimate separate effects of the ''don't know'' category on the item about mother's smoking due to few responses (n = 8) and these persons were thus excluded from the analyses.

Measures. Smoking was defined as ''lifetime smoking,'' which includes everything from taking one puff to daily smoking. Due to this focus on lifetime smoking we did not include intention in the revised version of the ASE model (Fig. 1). Smoking was measured slightly differently in 2004, 2005, and 2006. In 2004, it was measured from present and past smoking (Fig. 3). Adolescents were considered to be lifetime smokers if they scored 1 to 5 on the first or second item. Thus, if a person answered ''6. No, I don't smoke'' in question 1 and ''5. I have smoked a total of a couple of cigarettes at the most'' in question 2, they would be considered a lifetime smoker. If the answer to one question was missing, the other response was used. If the answers to both questions were missing, they were excluded from further analyses. In the smoking measures used in 2005 and 2006, adolescents were first asked about lifetime smoking and then about their smoking pattern in the relevant grade (Table 1). If the answers to all four questions were missing in 2005 and 2006, they were excluded from further analyses.

[7] Danish Ministry of Education. Statistik på skoler i Denmark 2005. Copenhagen, Danish Ministry of Education. Available from: http://www.uddannelsesstatistik.dk/pls/www_ndb/ndb (19 December 2005).

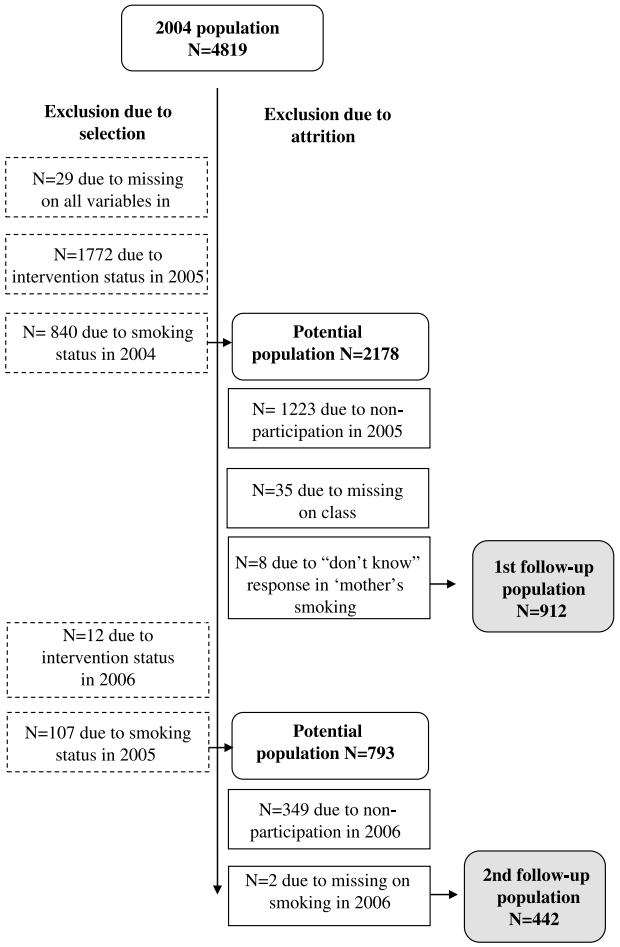

Figure 2. Exclusion flow chart for follow-up analyses 2005 and 2006.

The social-cognitive factors were defined as follows:

- ''Attitude'' was conceptualized as positive and negative evaluations of a type of health-related behavior.
- ''Social influence'' was conceptualized as ''the processes whereby people directly or indirectly influence the thoughts, feelings, and actions of others'' (16) and was measured in three dimensions: perceived smoking behavior of parents and friends; social norms of teachers, friends, and best friend; and direct pressure from friends, which may overlap and may work in different directions.
- ''Self-efficacy to resist pressure to smoke'' was defined as an individual's expectations of his or her capability (17), with a focus on social self-efficacy, which, in the context of smoking, is the expected ability to refrain from smoking in social situations.

The social-cognitive factors (Fig. 3) were measured based on items and indexes constructed and examined for their criterion-related construct validity in a previous study (15). Five indexes were examined: attitude; social influence related to smoking behavior of parents and friends; social influence related to norms of friends, best friend, and teachers; social influence related to pressure from friends; and self-efficacy to resist pressure to smoke. Three of the indexes—social influence (norms) with seven ordinal levels (here used with six), social influence (pressure) with four ordinal levels, and attitude with nine ordinal levels (here used with six)—had satisfactory criterion-related construct validity and were therefore used in the current study. Two indexes, self-efficacy to resist pressure to smoke and social influence related to behavior, did not have satisfactory criterion-related construct validity and had to be represented by individual items. We used one individual measure of social self-efficacy to resist pressure to smoke (five ordinal levels) and three individual measures of social influence related to behavior: mother's, father's, and best friend's smoking (Fig. 3). Three demographic and school well-being factors [living with one parent (no, yes), liking school (four ordinary levels), and family religiousness (no, yes)] that were selected based on theoretical and empirical considerations were included as potential confounders (11, 18). Besides the individual factors, three group levels were explored: school, school class, and gender group in the school class.

Statistical Analysis. Multilevel logistic regression models (GLIMMIX procedure, SAS 9.1 statistical package, SAS Institute, Inc.) were used to estimate the (fixed) effects on an odds ratio (OR) scale of the social-cognitive factors and the (random) effects of school, school class, and gender group in school class in a prospective design. Like conventional (multivariate) logistic regression models, multilevel logistic regression models relate the log odds of the event (e.g., smoking) to a linear combination of risk factors. Whereas in conventional logistic regression estimates of variables for each level of the factors are of interest, in multilevel logistic regression analysis levels of selected factors are assumed to be described by a Gaussian distribution and are included in the logistic model as such. We included school, school class, and gender group as nested random effects in the model. This implies that these factors were modeled in a way that takes into account the clustering between persons within the different structures. Estimates of the random variance components were converted to median ORs (MOR; ref. 19) and thus translated into an OR scale. The MOR is theoretically the increased median risk resulting from a move to, for example, another school with a higher risk for smoking. It is directly comparable with the OR for individual variables (20). The MOR was computed from the following equation (20):

$$\mathrm{MOR} = \exp[(\sqrt{(2 \times V_A)} \times 0.6745)] \approx \exp(0.95\sqrt{V_A})$$

where V_A is the corresponding group-level factor variance and 0.6745 is the 75th percentile of the cumulative standard Gaussian distribution.

To investigate the effects of the group-level factors and the mediating effects of social-cognitive factors in a prospective design, a portfolio of models for both the first and second follow-up was examined. First, models that included only the group-level factors added individually were examined to assess the raw context effects on smoking. Then, each social-cognitive factor

was added individually to the model to assess the association with the individual factor (unadjusted models). This was repeated in the presence of potential confounders (adjusted models). Finally, a model that included all the social-cognitive factors, confounders, and group-level factors was used to estimate the individual effects of the social-cognitive factors (confounder-adjusted and mutually adjusted models). For each of the continuous predictors [self-efficacy to resist pressure to smoke, social influence (norms), social influence (pressure), and attitude], a linear association with smoking initiation was assumed, as no clear pattern of departure from linearity was seen for any of the variables.

Results

The mean age of the participants at baseline was 13 years. At both follow-up times, the population was gender balanced, with 47% boys and 53% girls. At the first

Smoking	Item questions
Smoking item 1 Current smoking	Do you smoke cigarettes? 1 Yes, at least once a day. 2 Yes, at least once a week. 3 Yes, at least once a month. 4 Yes, but less than once a month. 5 I have smoked a total of a couple of cigarettes at the most. 6 No, I don't smoke.
Smoking item 2 Past smoking	Which sentence fits you the best? 1 I have stopped smoking, I smoked at least once a day. 2 I have stopped smoking, I smoked at least once a week. 3 I have stopped smoking, I smoked at least once a month. 4 I have stopped smoking, I smoked less than once a month. 5 I have smoked a total of a couple of cigarettes at the most. 6 I have never tried smoking, not even a single puff.
ASE factors	**Item questions**
Attitude	Item $_1$) I think that smoking is 1 very bad for my health 2 bad for my health 3 Don't know 4 only somewhat bad for my health 5 not bad for my health Item $_2$) I think that smoking is 1 very stupid 2 stupid 3 Don't know 4 somewhat stupid 5 not stupid
Social influence (behavior)	Does your item $_1$) mother $_2$) father $_3$) best friend smoke? 1 No 2 Don't know 3 Yes
Social influence (norms)	My item $_1$) teachers, item $_2$) friends, item $_3$) best friend 1 think it is OK if I smoke 2 don't care or don't know if I smoke 3 think I shouldn't smoke
Social influence (pressure)	Have you ever felt pressured to smoke by your: Item $_1$) friends, item $_2$) best friend, item $_3$) other adolescents? 1 No 2 Yes
Self-efficacy	Imagine that you have a crush on someone in your class who wants you to smoke. Do you think you could refrain from smoking? 1 I am sure that I could refrain from smoking. 2 I could probably refrain from smoking. 3 I don't know. 4 I probably couldn't refrain from smoking. 5 I am certain that I couldn't refrain from smoking.

Figure 3. Social-cognitive factors and smoking items measured at baseline 2004.

Table 1. Distribution of answers to two questions about smoking from Danish adolescents in 2005 and 2006

Question	2005 (n = 912)	2006 (n = 442)
	n (%)	n (%)
Have you ever tried smoking?		
1. Yes	108 (12)	81 (18)
2. No	804 (88)	361 (82)
Have you smoked cigarettes in grade 7/8?		
Missing	806 (88)	361 (82)
1. Yes, I smoke at least once a day.	5 (1)	4 (1)
2. Yes, I smoke at least once a week.	3 (0)	3 (0)
3. Yes, but I don't smoke much—less than once a week.	40 (5)	44 (10)
4. No, I haven't smoked in 7th/8th grade.	58 (6)	30 (7)

follow-up of 912 adolescents who were never smokers at baseline, 108 (11.8%) had experimented with smoking during follow-up (Table 1). At the second follow-up, of 442 adolescents who were never smokers both at baseline and at the first follow-up, 81 (18.3%) had experimented with smoking during follow-up (Table 1). Taking into account that ~24% of the total baseline population were lifetime smokers, these percentages are in line with a recent Danish cross-sectional study that found that 26% of adolescents age 13 were lifetime smokers and 52% of adolescents age 15 were lifetime smokers. All the potential confounders, family structure (living with one parent), not liking school, and lack of family religiousness, were associated with smoking initiation in both follow-ups.

Individual-Level Social-Cognitive Factors. In the unadjusted analyses at first follow-up, all the social-cognitive factors were significantly associated with smoking initiation (Table 2).

Adjustment for confounders changed the estimates only slightly, but after mutual adjustment, only father's smoking, best friend's smoking, and attitude remained significantly associated with smoking initiation. In the mutually adjusted analyses, the effects of mother's smoking and norms were still present but were not significant. In the unadjusted analyses at second follow-up, mother's and father's smoking was significantly associated with smoking initiation (Table 2). After adjustment for confounders, the associations between mother's smoking and pressure to smoke with smoking initiation were significant. In the mutually adjusted analyses, only pressure to smoke was significantly associated with smoking initiation; associations with self-efficacy to resist pressure to smoke and mother's and father's smoking were still present but not significant.

Group-Level School Factors. In the analyses at the first follow-up, empty models without individual-level factors showed a small random effect of school alone on smoking initiation. When all three levels of school factors were included, the strongest effect on smoking initiation was gender group in the school class (empty model: school class MOR = 1.5, gender group in the school class MOR = 1.9). The effects of school class and gender group in the school class on smoking initiation changed between the empty model and the full model, including all the social-cognitive factors (full model: school class MOR = 3.2, gender group in the school class MOR = 3.3). In the analyses at the second follow-up, in empty models the small random effect of school vanished when school class was added. When all three levels of school factors were included, the effect of school class also vanished and only gender group in the school class affected smoking initiation (gender group in school class MOR = 1.7). Only a slight increase in the effect of gender group in the school class on smoking initiation was seen between the empty and the full model (gender group in school class MOR = 1.8). This MOR suggests that if an adolescent moves from one randomly chosen gender group to another with a higher risk for smoking, the risk is increased by a median of 1.8 times.

Discussion

Individual-Level Social-Cognitive Factors. In the mutually adjusted analyses, father's smoking, best friend's smoking, and attitude were significantly associated with smoking initiation in the first follow-up, whereas the social influence of pressure from friends was significantly associated with smoking initiation in the second follow-up. In our previous study of baseline data (n = 2,913), we found significant associations between all the social-cognitive factors and smoking status (6).

One previous study examined variation between schools and smoking, but the effects of individual factors similar to the constructs were not reported, although they were taken into account (21). Ours is thus the first study of social-cognitive factors from the ASE model that takes into account group-level school factors. Direct comparisons with previous studies examining ASE factors might be difficult, as the results for social-cognitive factors in the current study are likely to have been affected by the inclusion of school, school class, and gender group in the school class.

Our results nevertheless support those of most previous recent studies (since 2003), suggesting an association between best friend's smoking and smoking initiation (22, 23). Although the results have been mixed, our findings support those that suggest an association between father's smoking and smoking initiation (22, 24–27). In line with our results, most previous studies, with either lifetime smoking as the outcome (27) or not (28, 29), did not find support for an association between social norms and smoking initiation. However, the results of previous studies vary, possibly due to the use of different measures. We combined norms among friends, best friend, and teachers, whereas other studies made separate measurements.

The results with regard to attitude have also been divergent. Three studies of lifetime smoking found no effect of attitude (27, 30, 31), but studies in which ''smoking within the past year'' was used as the outcome did find associations (32), thus supporting the results of the current study. Mixed results have also been found with respect to pressure from friends. Most studies focused on smoking outcome other than lifetime smoking and found an effect of pressure on, for example, monthly smoking (28). In our study, pressure from friends was significantly associated with smoking initiation only at the second follow-up. It is possible that pressure from friends mainly influences adolescents who start smoking later and who have been able to withstand other influences, such as father's and friends' smoking. One of the few studies in which ASE factors were investigated among adolescents who initiated smoking early and late showed that parental and friends' smoking played a role among those who started early, whereas only friends' smoking influenced those who started later (33). Most studies on self-efficacy to resist pressure to smoke and smoking initiation in which outcomes other than lifetime smoking were used support the hypothesis that self-efficacy to resist pressure to smoke delays smoking initiation (32, 34, 35). Our results are in line with those of a previous study on lifetime smoking, showing no support for an association between self-efficacy to resist pressure to smoke and lifetime smoking (27). The absence of support for associations between self-efficacy to resist pressure to smoke, mother's smoking, and smoking initiation in our study might be due to colinearity: self-efficacy to resist pressure to smoke might be encompassed in, for example, attitude, whereas mother's smoking might be encompassed in the measurement of father's smoking because we used mutually adjusted models.

The results of this study suggest that some of the associations might have been overestimated in the baseline analyses, perhaps because of cognitive dissonance (e.g., self-efficacy to resist pressure to smoke and social influence of norms might have been affected by smoking status). The results do provide some support for the ASE model, especially for adolescents who started smoking early. The finding that social-cognitive factors are not strong predictors among persons aged 13 might suggest that the social-cognitive constructs might not be appropriate for adolescents a time of so many social and psychological changes.

Group-Level School Factors. The results with regard to the group-level school factors support our previous results with baseline data (6) and show that group-level factors and especially gender group in the school class play a role in future smoking initiation. Several studies

Table 2. Longitudinal multilevel analysis of smoking: unadjusted, confounder-adjusted, and mutually adjusted fixed effects of social-cognitive factors at follow-up 2004-2005 and 2004-2006 among 912 and 442 adolescents, respectively

Individual level	1st follow-up	1st follow-up	2nd follow-up	2nd follow-up
	OR* (95% CI)	OR† (95% CI)	OR‡ (95% CI)	OR§ (95% CI)
	n = 877-908‖	n = 847	n = 426-441¶	n = 411
Attitude toward smoking	1.2 (1.0-1.4)	1.4 (1.1-1.7)	1.1 (0.8-1.3)	1.0 (0.8-1.4)
Social influence (behavior)				
Mother smokes**				
No	1.0	1.0	1.0	1.0
Yes	1.6 (1.1-2.2)	1.4 (0.9-2.3)	1.8 (1.2-2.9)	1.5 (0.9-2.5)
Father smokes				
No	1.0	1.0	1.0	1.0
Don't know	6.1 (2.4-16.0)	18.1 (3.8-85.3)	2.8 (0.6-13.4)	2.0 (0.3-15.8)
Yes	2.3 (1.6-3.2)	2.7 (1.7-4.3)	1.8 (1.1-2.8)	1.6 (0.9-2.7)
Best friend smokes				
No	1.0	1.0	1.0	1.0
Don't know	0.7 (0.3-1.6)	0.1 (0.0-0.5)	0.7 (0.2-2.3)	0.3 (0.1-1.7)
Yes	6.8 (4.0-11.5)	13.2 (6.0-28.8)	2.2 (0.7-6.1)	0.7 (0.2-2.8)
Social influence (norms)				
Linear score 1-6 per score	1.3 (1.1-1.5	1.2 (0.9-1.4)	1.1 (0.9-1.4)	1.0 (0.8-1.3)
Social influence (pressure)				
Linear score 1-4 per score	1.5 (1.2-2.0)	0.9 (0.6-1.5)	1.6 (0.9-2.7)	1.8 (1.0-3.2)
Self-efficacy				
Linear score 1-5 per score	1.4 (1.2-1.6)	1.1 (0.9-1.4)	1.2 (0.9-1.6)	1.3 (0.9-1.8)

Abbreviation: 95% CI, 95% confidence interval.

*First follow-up included adolescents who were nonsmokers at baseline; univariate unadjusted estimates.

†First follow-up included adolescents who were nonsmokers at baseline; analyses mutually adjusted and adjusted for family religiousness, living with only one parent, and liking school and all social-cognitive factors.

‡Second follow-up included adolescents who were nonsmokers at baseline and still nonsmokers at the first follow-up; univariate unadjusted estimates.

§Second follow-up included adolescents who were nonsmokers at baseline and still nonsmokers at the first follow-up; analyses mutually adjusted and adjusted for family religiousness, living with only one parent, and liking school.

‖Number of persons included in these analyses varied between 877 and 908 because information was missing on one or more of the social-cognitive factors.

¶Number of persons included in these analyses varied between 426 and 441 because information was missing on one or more of the social-cognitive factors.

**Don't know category for mother's smoking was excluded because of empty categories.

have suggested the importance of school factors in adolescent smoking initiation, such as senior student smoking at school (36), school smoking policy (37), school rules for students and teachers' workload (38), school culture (authoritative, laissez-faire, or indeterminate; ref. 39), school-level smoking (40), school-level senior student smoking (36, 41–44), class norms (45), and school class (8). No effect of school norms (46) or health promotion policy (38) was seen.

In contrast to this and to the results of some previous reviews (7, 10), we did not find a separate effect of school, perhaps because this school effect is encompassed in the class effect: in both follow-up periods, the effect of school decreased when school class and gender group in the school class were included. Only few longitudinal studies on school-level factors and smoking initiation using multilevel analyses have been conducted (21, 47). One study found interschool variation in smoking prevalence (21) and the other study found that school-level smoking prevalence was not associated with smoking initiation when taking into account baseline smoking status (47). The effects of school class and other close social groups are relatively unexplored, but school class (8, 11, 48, 49) and friendship cliques (50) have been suggested to play a role in smoking status. A previous study also suggested that proximity (tutor group instead of school) plays a role in the effect of school and schoolmates on smoking initiation (51). Our study further suggests that gender-specific relationships in the school class play a role. The MOR for gender group in the school class was 1.8, indicating that if an adolescent moves from one randomly chosen gender group to another with a higher risk for smoking, the risk is increased by a median of 1.8 times. Gender group in the school class is a more refined way of measuring a class effect because it takes into account differences in smoking prevalence between boys and girls: in some school classes, for example, most of the boys are smoking, whereas none or few of the girls are smoking or the other way around. Our results on gender group in the school class suggest that the social influence of peers does not operate across the gender boundary; instead, girls are influencing each other to smoke and the boys are influencing each other to smoke. This is possibly due to that close friendships are often gender specific in this age group and that it is especially within close friendships adolescents influence and model each other.

Thus, gender may play a role in smoking initiation through its influence on structuring friendships within which the social processes take place. To our knowledge, only one previous study addressed gender group in the school class and smoking status in a cross-sectional design and found that it affected smoking status (11). In addition, gender-specific influence on smoking initiation in general is fairly unexplored but a recent study suggested that girls are more susceptible to social pressure compared with boys, whereas attitude and parental norms are more strongly associated with smoking among boys (28). As this is the first study in which gender group in the school class has been explored longitudinally, more studies are needed on what the group-level factors capture and how gender differences may be at play in predictors of smoking initiation.

Our study has several advantages. We used a gender-balanced sample of adolescents at schools, which were randomly selected from the public school system. Inclusion of adolescents in six counties meant that those in both rural and urban areas were represented and that the study population was reasonably representative of the general population of the same age group with regard to exogenous variables, such as ethnicity and family structure.[8,9] Another advantage is the prospective design, which makes it possible to interpret the effects as predictive and (as in the current study) question the associations observed in cross-sectional data. In addition, because of the hierarchical structure of the data, the effects of the group-level factors could be assessed in multilevel analyses. Alternatively, one could measure an interaction between school class and gender, but this would not take into account the clustering of adolescents within a specific school and school class (11). To our knowledge, this is the first study to include group-level factors in multilevel analyses for exploring the ASE model and also the first study to explore gender group in the school class in a longitudinal design. Finally, we adjusted for important confounders, such as liking school, family religiousness, and family structure.

This study also has some potential limitations. Overall, fairly large confidence intervals were observed in the adjusted analyses of the second follow-up, indicating poor statistical power. The social-cognitive factors for the follow-up samples had less variance than the baseline sample, which may have decreased the effect and broadened the confidence intervals. Another potential limitation lies in the strong colinearity among the social-cognitive factors, which suggests that some of the factors cover the same psychosocial aspects. We conducted unadjusted, confounder-adjusted, and mutually adjusted analyses to illustrate the influence of colinearity. The effects of some of the social-cognitive factors were slightly reduced in the confounder-adjusted and mutually adjusted analyses, suggesting only slight changes due to colinearity. Selection bias might be a potential problem, as 56% of the invited schools did not participate, and these schools might have differed from the participating schools, for example, with higher smoking rates. It is unlikely but theoretically possible that social-cognitive factors play a different role in schools with high smoking rates than in schools with low smoking rates, thus leading to selection bias. We were unable to investigate this hypothesis, as we had no information on the nonparticipating schools. As the study population seemed to be representative of the general population in respect to several variables, however, there was no detectable indication of selection bias.

As illustrated in Fig. 2, not all adolescents participated in the follow-ups. Attrition may, for example, be due to moving to a different school, absence from school on the day of the questionnaire, or reluctance to participate. We

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examined whether adolescents who did not participate in the follow-up answered differently on ASE factors at baseline compared with adolescents who did participate in the follow-up. The results for the first follow-up (attrition n = 1,266) showed some differences were seen between adolescents who did and adolescents who did not participate in the follow-up with regard to friends' smoking and pressure to smoke at baseline, with nonparticipants being more likely to answer that they do not know if their friends smoke and that they have felt a medium level of pressure. No significant differences were seen between those who did participate and those who did not in the second follow-up (attrition n = 351). Thus, we found no clear indications of the ASE factors being related to attrition, but the differences found on friends' smoking and pressure to smoke mean that we cannot rule out that the generalizability of the results has been affected. As a consequence, the conclusions mainly apply to adolescents who do not drop out or move to a different school.

Another potential limitation is that lack of statistical power prevented us from taking into account results from a previous validation study that provided evidence of deviations from criterion-related construct validity for the social-cognitive indexes. It is possible that the results were distorted by lack of inclusion of interaction terms for these factors. An example of the effect of differential item functioning was given in Appendix A of a previous article (15). The results for these measures should therefore be interpreted with caution.

Conclusion. Our results showed that father's smoking, best friend's smoking, and attitude were associated with smoking initiation after 6 months of follow-up. Among adolescents who were still not smoking 6 months after baseline and were followed up a second time 18 months after baseline, pressure from friends was associated with smoking initiation. These results provide only partial support for the ASE model. The results for school factors suggest that same-gender classmates are important for smoking initiation. More longitudinal studies are needed to examine the effect of ASE factors among adolescents who start smoking both early and late and to explore what is captured in gender-group school-level factors. If school prevention programs are used to prevent future smoking among adolescents, they could be targeted to specific high-risk school classes.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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