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Own and Friends’ Smoking Attitudes and Social Preference as Early Predictors of Adolescent Smoking

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This study examined the role of friends’ attitudes in adolescent smoking (N = 203). Growth mixture modeling was used to identify three trajectories of smoking behavior from ages 12 to 14 years: a low-rate group, an increasing-rate group, and a high-rate group. Adolescents’ own and their friends’ attitudes at age 11 years were not significantly related to smoking. However, in the increasing-rate group (compared with the low-rate group), friends’ attitudes interacted with both adolescents’ own and friends’ social preference (i.e., likeability). The link between friends’ attitudes and membership in the increasing-rate group was stronger for early adolescents with low social preference scores and for early adolescents with friends who had low social preference scores. Other than for the high-rate group, for which causal factors of smoking may be located early in childhood (e.g., family and personality or temperamental characteristics), the combination of low social preference and friends who hold a positive attitude toward smoking is associated with escalating cigarette use among young adolescents.

Worldwide every day, between 80,000 and 100,000 early adolescents start smoking (World Health Organization, 2005). For example, in the United States alone every day 4,000 adolescents try their first cigarette, and another 2,000 become regular or daily smokers (Centers for Disease Control and Prevention, 2006). Psychosocial theories of health behavior and empirical research suggest that smoking initiation and its timing is influenced by a variety of individual and social environmental factors. Peers are one of the most powerful sources of social influence (for a review, see Kobus, 2003), and peer smoking is considered a strong predictor of adolescent smoking (Alexander, Piazza, Mekos, & Valente, 2001). Besides smoking itself, a positive attitude toward smoking behavior has been found to predict later smoking (e.g., Otten, Harakeh, Vermulst, Van den Eijnden, & Engels, 2007). Further, because the peer group provides a model for attitude formation and subsequent behavior (Piko, 2001), friends’ attitudes toward smoking are also determinants of smoking and attitudes toward smoking (Smet et al., 1999). Therefore, when we focus on the role of friends’ before friends have started smoking, it is useful to explore friends’ attitudes toward smoking.

Attitudes toward smoking reflect the extent to which adolescents appraise or have a positive regard for smoking (Piko, 2001). For example, adolescent girls may believe...
that smoking promotes a slim figure (e.g., French & Perry, 1996), whereas other adolescents may have a negative attitude toward smoking (e.g., because of effects on health; Jensen & Overgaard, 1993; Piko, 2001). The study presented here focuses on one specific type of attitude: the extent to which adolescents perceive smoking as having social benefits (Engels, Scholte, van Lieshout, de Kemp, & Overbeek, 2006). Younger children tend to endorse adult norms and thus reject deviant behaviors, including smoking (French, 1988). However, as children grow older they tend to distance themselves from parents and develop their own peer orientation (Vaux, 1985). During this period contact with peers intensifies (Schulenberg, Wadsworth, O’Malley, Bachman, & Johnston, 1996), early adolescents spend more time with friends outside the parental home (Engels et al., 2006) and may learn new attitudes through interaction with these peers. Together with the increasing tolerance and even promotion of minor deviant behaviors in adolescence, such as smoking (Allen, Porter, McFarland, Marsh, & McElhaney, 2005), peer interaction may instigate a pro-smoking attitude.

Attitudes that ultimately lead to smoking are formed years before adolescence or the actual point of smoking onset. For instance, early exposure to parental tobacco use was shown to influence the child’s perception of tobacco use before they consider smoking themselves (Dalton et al., 2005), and peer pro-smoking attitudes are reported to lead to smoking (see Tyas & Pederson, 1998). Until now, research on pro-smoking attitudes of peers and actual smoking of the target adolescent has been hindered by three limitations related to assessing attitudes. Many studies based on peer attitudes focus exclusively on the adolescent’s own perception of friends’ attitudes. Moreover, these studies did not consider the effects of social preference (i.e., likeability) within the peer group, which may be important because low social preference by normative peers may restrict access to normative and socially accepted friends (Dishion, Patterson, Stoolmiller, & Skinner, 1991). Finally, few studies have assessed attitudes about smoking prior to the initiation of peers’ or adolescent smoking. Therefore, our study was designed to fill this gap by looking directly at adolescent friends’ (AFs’) attitudes instead of focusing on the target adolescents’ (TAs’) perception of friends’ attitudes prior to the initiation of smoking. Furthermore, by using sociometric information, our study tested the moderating role of the social preference of both TA and AF that may affect the link between attitudes and smoking.

ATTITUDES

The attitude concept is a well-known construct in social psychology and expresses the positive or negative evaluation of an object or behavior. Moreover, attitudes and behavior are reported to be directly related (e.g., Otten et al., 2007). A well-established model in predicting health risk behavior is the Theory of Planned Behavior (Ajzen, 1985: Godin & Kok, 1996). This model postulates that smoking (or any other behavior) is guided by a favorable or unfavorable attitude toward smoking, subjective norms (perception of approval of smoking by, e.g., parents), and self-efficacy to resist smoking (i.e., not to smoke in smoking-specific and tempting situations). Intention is a function of these three determinants and, in turn, is assumed to be an immediate antecedent of smoking (Ajzen, 1985). Of these three determinants, a positive attitude toward smoking appeared to be the strongest predictor of intention and thus of smoking (Otten et al., 2007). Other longitudinal studies also found that a person’s own attitude toward smoking is predictive of future smoking behavior (Hanson, 1997). For example, Castrucci, Gerlach, Kaufman, and Orleans (2002) showed that positive attitudes toward tobacco use are associated with a greater likelihood of experimenting with cigarettes and of becoming a regular smoker.

Adolescents may learn new attitudes, at least in part, through interaction with peers. Perceived AF attitudes are reported to have a strong effect on the adolescent’s own attitudes and subsequent behavior (with respect to sexual behavior: Iannotti & Bush, 1992; with respect to drug use: Hansell & Mechanic, 1990; and with respect to smoking: Smet et al., 1999). For instance, peer behavior and attitudes are more influential for children’s socially censured behaviors (e.g., alcohol use without permission) than for more socially approved behaviors (e.g., using alcohol with parental permission; Iannotti & Bush, 1992). However, these studies used TA perceptions of peer attitudes and thereby ignored the fact that TA perceptions of peer attitudes may be partially shaped and biased by TA attitudes. Adolescents who smoke, or have a pro-smoking attitude, may overestimate the prevalence of smoking among their peers, or the extent to which peers have a positive attitude toward smoking, according to the “false consensus effect” (Ross, Greene, & House, 1977). Overestimation of AF attitudes or behavior may also be because of “pluralistic ignorance” or adhering to a norm that nobody privately endorses. For instance, Prentice and Miller (1993) demonstrated that students engaged in certain behaviors, such as excessive drinking, because they believed that their peers were comfortable with heavy drinking. Similar effects may occur with respect to smoking. Therefore, it would be more appropriate to look at AF attitudes as reported by the friends themselves rather than those reported by the TA.
In this study we focus on a specific attitude that assumes that smoking has social benefits and implies that smoking enhances social preference by peers. As a consequence, adolescents who are not well accepted by peers may adopt social attitudes toward smoking that are conveyed by delinquent friends (who are rejected by conventional peers). For adolescents who endorse the pro-smoking attitude of friends, AF attitudes may be predictive of subsequent TA smoking rather than TA attitudes. Moreover, the link between AF attitudes, AT attitudes, and TA smoking should only be found among those adolescents with low social preference scores and friends with low social preference scores. In other words, the social preference of TA and AF can be assumed to moderate the link between AF attitudes and TA smoking.

SMOKING TRAJECTORIES

In contrast to hierarchical and latent growth-curve modeling, growth mixture models can test whether subgroups of individuals exist within the population that follow qualitatively distinct developmental trajectories on a specific variable of interest that is repeatedly measured over time (i.e., latent trajectory groups; for details, see, e.g., Muthén & Muthén, 1998–2004; Nagin, 1999). This group-based approach considers simultaneously the time of initiation, the changes in smoking behavior over time, and the absolute level of smoking. Studies using this approach identified different groups with distinct profiles of smoking behavior (e.g., Abroms, Simons-Morton, Haynie, & Chen, 2005); because these studies covered a longer period and/or included older children than in our study, they were more likely to identify four or five different trajectories. An earlier study (Vitaro, Wanner, Brendgen, Gosselin, & Gendreau, 2004) examining adolescents (aged 11–15 years) found that from age 11 until 13 years, every year a new group of adolescents initiated smoking; after age 13 years no new group was found so that, in total, the authors found four trajectory groups (i.e., one early, two late, and one never/experimenter group).

Based on these findings, and as we focused on the age group 12 to 14 years (with every year a new group starting to smoke), we expected to find three groups that differed in both the onset and pattern of smoking behavior (i.e., smoking rate or number of cigarettes). More specifically, we expected to find a group that never initiates/or only experiments with smoking, one group that initiates smoking during the assessment period and shows a large increase in smoking rate over time, and one group that has already initiated smoking at the first time of measurement and increases in intensity over time. Previous studies suggested that early onset of smoking is influenced by factors such as personality and socioeconomic status that may exert their influence early, whereas friends may exert their influence later in adolescence (e.g., Vitaro et al., 2004). Adolescents may emulate their friends’ smoking behavior or attitudes because they expect to gain specific social rewards within the social hierarchy (Prinstein & Wang, 2005). The group that initiates smoking during the period of assessment and shows a large increase of smoking over time may be the one that is particularly affected by peer influence.

THE PRESENT STUDY

By examining associations between attitudes and adolescent smoking trajectories, our study had three goals. The first was to identify groups of adolescents that differ with respect to the timing of onset and rate of increase of the number of cigarettes they smoke per week during the age range of 12 to 14 years. Specifically, we expected to find one group that shows no smoking or marginal smoking behavior prior to the week of assessment (this group mainly includes experimenters and never smokers—the low-rate group), an early-onset group with a high and increasing rate of smoking (high-rate group), and a late-onset group that rapidly increases smoking (increasing-rate group).

The second goal of our study was to examine the prospective associations between TA attitudes and TA smoking trajectory membership, as well as the prospective associations of the four best friends’ attitudes (AF attitudes) and TA smoking trajectory membership. In other words, we examined whether TA and AF attitudes at age 11 years were linked to subsequent development of TA smoking between ages 12 to 14 years. Because friends provide a model for attitude formation and subsequent behavior (Piko, 2001), we expected to find a link between AF attitudes and TA adolescents’ smoking trajectories even after controlling for TA attitude, which is known to be linked to TA smoking. Because parental smoking, socioeconomic status, and AF smoking are also known to influence adolescent smoking (e.g., Vitaro et al., 2004), we also controlled for their effects.

The third goal was to test whether the links between AF attitudes and TA smoking trajectories were moderated by AF and TA social preference. Low social preference by normative peers can cause unpopular children to associate with delinquent or antisocial children who, in turn, are also characterized by low social preference (Dishion et al., 1991). Further, because smoking may be seen as minor antisocial behavior and a marker for later antisocial behavior, we expected the link between AF attitudes and subsequent TA smoking to be stronger for adolescents who are less well accepted among peers.
than for adolescents who are highly socially accepted, and/or for adolescents with friends who are less well accepted among peers than for adolescents with friends who are highly socially accepted. Because early onset is influenced by factors such as personality and socioeconomic status and friends start to exert their influence later on (Vitaro et al., 2004), we expected to find the effects of social preference especially in the increasing-rate group.

Membership of AF in the latter trajectory groups served as a control variable when examining our hypotheses regarding TA membership in trajectory groups. Thus, we controlled for the concurrent development of AF smoking behavior when addressing the subsequent goals of our study. Notably, this control variable conveys more information than when controlling for AF smoking at a single point in time. Moreover, AF concurrent effects should be stronger than the AF prospective effect at age 11 years. In addition, at this early age only a minority of friends may have already initiated smoking. Given that friends are relatively homogenous with respect to both smoking and age (e.g., Engels, Knibbe, Drop, & de-Haan, 1997), we expected to find similar trajectories for AF smoking during this age period. Specifically, we examined the average scores of the number of cigarettes smoked per week as reported by an adolescent’s four best friends and thereby the smoking behavior of the adolescent’s friendship network (Berndt & Keefe, 1995).

METHODS

Participants

Participants were 203 French-Canadian early adolescents (98 male, 105 female) who attended five elementary schools in a small urban community in western Quebec (Canada) and who were part of an initial sample of 284 school children (attrition rate = 28.5%). At the first time of measurement, more than 90% of the school population participated. Adolescents who did not participate were for the large part absent (e.g., sick) on the day of data collection. Before each wave of data collection the teachers distributed a letter asking for the parents' permission for their child to participate in the study in the classroom; the teachers also collected the parental permission slips (the study was approved by the ethics board of the University of Montreal). The students were also asked to return the permission slips if the parents opposed participation in the study. After Grade 6, all children attended the same high school, because there was only one. In high school, the parents were asked for permission for their child to participate in the study by mail with a stamped return envelope. Presumably some adolescents did not participate because they either forgot to show the permission slip to their parents or forgot to return the permission slips to school (even though signed by the parents).

For the four measurement waves, data of 81 participants were missing more than two times. The participants lost through attrition did not differ from the study participants in any of the measures assessed at the first time of measurement. All participants were in Grade 5 (n = 109) or in Grade 6 (n = 94) at the time of the first measurement1 (M age = 10.93 years, SD = 0.73, min = 9.0, max = 13.0). Predictors were assessed at T1 (≈11 years old). Smoking was assessed at each of the four annual waves of data collection. Children’s socioeconomic status, as assessed by Statistics Canada, was in the middle and upper range, and most of the participants were Caucasians and French speaking (>90%).

Measures

TA smoking behavior. Smoking behavior was assessed at all four times of measurement using two items. Studies have shown that the reliability and validity of self-report with respect to smoking is similar to the validity found with more objective methods, such as biochemical verification (Dolcini, Adler, Lee, & Bauman, 2003). Because regular smoking at this age is a good predictor for future smoking and establishing a long-lasting smoking habit we were interested in those that smoked weekly or more frequently, which can be defined as regular smoking (e.g., Tucker, Ellickson, & Klein, 2002); therefore, the first item referred to the number of cigarettes smoked during one week. The second item assessed the number of cigarettes smoked the day before data collection; this latter number was multiplied by seven. The correlation coefficients of this pair of items were r = .90, .89, and .91 at Time 2 to Time 4, respectively. Next, a composite score of the two items was created by averaging both items; the latter mean values were rounded to the next integer. At the first time of measurement only 4% of the participants reported that they had smoked one cigarette last week, and only 1 participant reported a consumption of 20 cigarettes. Therefore, because 96% of the sample could not be labeled as regular smoking, we did not use the first measurement of smoking for trajectory analyses or as a control variable. The mean levels for the subsequent times of measurement are provided in Table 1.

1As preliminary analyses we tested whether any of the measures used in the study was significantly different across the two cohorts that were in Grades 5 and 6 at Time 1. A series of t tests yielded all non-significant results. Therefore we collapsed the measures across cohorts.
AF smoking behavior. Participants were asked to nominate up to four friends in their classroom. Consequently, social preference scores, attitudes, and information on smoking were available for all nominated friends that also participated in the study. To calculate AF social preference, AF attitudes and AF smoking scores of all nominated (reciprocal and unilateral) friends were included. Friendship nomination was limited to the classroom because the composition of the class remained stable throughout the year, and participants spent all of their in-school time within the same classroom. It could be argued that limiting nominations to the classroom might restrict selection of friends; however, it was found that most elementary school friends select a best friend among their classmates, even when allowed to nominate a friend from outside the classroom (Kupersmidt, Burchinal, & Patterson, 1995). To represent each participant’s degree of smoking friends’ affiliations, the smoking behavior scores (see earlier) for his or her friends were averaged across all nominated friends. Hence, these scores represented smoking of the adolescent’s friendship network (Berndt & Keefe, 1995). The mean values of the smoking behavior scores were rounded to the next integer.

Parental smoking. Two items were used to assess parental smoking behavior: Does your mother smoke? Does your father smoke? These items could be scored on a 4-point scale ranging 1 (not at all), 2 (occasionally), 3 (regularly), and 4 (very often). An average score was computed using both items for two-parent families and only the relevant item for single-parent families (see also Vitaro et al., 2004). The correlation of parents’ smoking was r = .44. Recent studies investigating the reliability of proxy reports have shown high specificity and predictive value indicating that children can be used as reliable source to assess the smoking status of their parents (Harakeh, Engels, Vries, & Scholte, 2006).

Attitude toward smoking. Attitude toward smoking was assessed at the first time of measurement by using three items that concerned the social benefits (see also Botvin, Baker, Dusenbury, Tortu, & Botvin, 1990). Statements were introduced, such as “A guy who smokes has a lot of friends,” “Boys like girls who smoke a lot,” and “Girls are attracted to guys who smoke.” For each of these items the participant had to respond on a 5-point Likert scale with response categories ranging from 1 (not true) to 5 (true). Individual total scores were calculated by averaging across item scores (Cronbach’s α = .75, M = 2.81, SD = .56). For each of the participants, attitudes toward smoking (see earlier) of his or her friends were averaged across all nominated friends.

Social preference. A standard sociometric nomination procedure was used to assess participants’ social preference at age 11 years. There is evidence supporting the reliability (test–retest reliability >.80) of such a nomination procedure (for a review, see Lu Jiang & Cillessen, 2005). Each participant was given a classroom roster with all classmates’ names. Each participant was then asked to nominate three classmates he or she liked most (positive nominations) and three classmates he or she liked least (negative nominations). A social preference score was then computed for each participant following the criteria outlined by Coie, Dodge, and Cappotelli (1982). Specifically, the total number of received positive nominations was calculated for each participant and z-standardized within the classroom to create a total Liked-Most score. The total number of received negative nominations was calculated for each participant and z-standardized within classroom to create a total

### TABLE 1

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Means, Standard Deviations, Minimum and Maximum Scores, and Zero-Order Correlations of Model Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Sex</td>
<td>−.18*</td>
</tr>
<tr>
<td>Socioeconomic Status</td>
<td>−.21*</td>
</tr>
<tr>
<td>Parental Smoking</td>
<td>.01</td>
</tr>
<tr>
<td>TA Attitude (Age 11)</td>
<td>.06</td>
</tr>
<tr>
<td>AF Social Preference (Age 11)</td>
<td>.21</td>
</tr>
<tr>
<td>AF Smoking (Age 12–14)</td>
<td>.00</td>
</tr>
<tr>
<td>TA Smoking Age 12</td>
<td>.15*</td>
</tr>
<tr>
<td>TA Smoking Age 13</td>
<td>.12</td>
</tr>
<tr>
<td>TA Smoking Age 14</td>
<td>.15*</td>
</tr>
</tbody>
</table>

Note. Sex is coded such that 0 indicates girls and 1 indicates boys. Socioeconomic status, parental smoking, TA attitude toward smoking, AF attitude toward smoking, TA social preference, and AF social preference were standardized. Therefore, means (0) and standard deviations (1) are not reported.

*p < .05. **p < .01. ***p < .001, two-tailed tests.
Likelihood score. The Liked-Least score was then subtracted from the Liked-Most score to create the Social Preference score, which was again z-standardized within the classroom (Coie & Dodge, 1983; Prinstein & Wang, 2005). For each of the participants, social preference scores (see earlier) of his or her friends were averaged across all nominated friends.

Annual family income. Annual family income was measured in units of $5,000 CA ranging from $5,000 or less to $70,000 or more. The modal family income was $60,000 to $64,000 CAD (skewness = –1.21, kurtosis = 0.92).

Data Analysis

Analysis in our study proceeded in two blocks. First, we used a recently developed semiparametric clustering technique to identify groups of adolescents with distinct longitudinal trajectory profiles of smoking across ages 12 to 14 years (TRAJECTORIES; Nagin, 1999; henceforth referred to as TRAJ). Using maximum-likelihood estimation, the TRAJ procedure empirically tests whether different groups with distinct trajectories exist in the population and provides an empirical basis for determining the number of groups and the shapes of the trajectories in the different groups that best fit the analyzed data. A detailed description of the statistical rationale underlying the TRAJ estimation procedure is given elsewhere (i.e., Jones, Nagin, & Roeder, 2001; Nagin, 1999). In a second set of analyses, we used the latter procedure to identify groups of the AF with distinct longitudinal trajectories of smoking. AF membership in one of the trajectory groups was used as a covariate in the second block of the analyses. Hierarchical multinomial logistic regression analysis was performed in the second block to predict TA membership in one of the smoking trajectory groups. In a first step, covariates were included to predict membership in the trajectory groups. Apart from sex, socioeconomic status, parental smoking, and TA attitude, AF trajectory group membership was included as covariate. Thus, we controlled for the concurrent development of AF smoking when predicting TA smoking. In a second step, we included AF attitude about smoking, and TA as well as AF social preference as predictors. Finally, interaction terms of the predictors were included in the equation to test the hypothesized moderating effects.

RESULTS

Identification of Smoking Trajectories

We used the TRAJ procedure to empirically test whether different groups with different longitudinal smoking profiles exist for both TA and AF smoking across ages 12 to 14 years (a similar approach was employed in Vitaro, Brendgen, & Wanner, 2005). Both TA smoking and AF smoking represented count variables of the number of cigarettes smoked during the previous week that also included a large number of zeros. We used a Zero-Inflated Poisson distribution as the basis of model estimation. A Zero-Inflated Poisson distribution changes the mean structure of the pure Poisson model and therefore improves the predictive quality of the model (Lambert, 1992).

We first specified a single-group model and then tested a series of alternative models, increasing the number of groups. The Bayesian information criterion (BIC), the classification likelihood criterion (CLC; Biernacki & Govaert, 1997), and the integrated complete likelihood criterion (ICL–BIC; Biernacki, Celeux, & Govaert, 2000) were used to evaluate model fit. Model specification included linear trajectories for all groups for both sets of analyses (i.e., TA and AF smoking). The BIC (TA = 2245.04; AF = 2820.08), the CLC (TA = 2392.69; AF = 2915.19), and also the more conservative ICL–BIC (TA = 2466.81; AF = 2987.36) indicated that a three-group solution better fitted the data for both TA and AF smoking compared to the single and the two-group solution. Although a four-group model had superior fit, we selected the more parsimonious three-group model for both TA and AF smoking. In the four-group model, the already rather small group that showed an increasing rate of smoking over time was split into a group with a steeper increasing slope and a group with a less steep increasing slope. Thus, for both TA and AF trajectories the four-group model did not provide a real gain in information but resulted in small groups.

On the next step, the trajectory parameters from the three-group model were examined with respect to whether the modeling of a quadratic trend or a zero-order (intercept only) trend was necessary to adequately fit the trajectory in each group. As such, not only the specific values but also the number of growth parameters could differ between groups in the final model. However, with respect to both TA and AF smoking trajectories, the previous three group models that specified linear trends for each group showed superior fit compared to any of the tested alternative models.

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2 There are no absolute indicators for a good fit of the models. The indicators that we used are relative indicators and provide indications for the model that fits best to the data. More specifically, lower values for all three criteria indicate improvement of the model when compared to the model with one class less (for more detailed information, see Bauer & Curran, 2003).

3 For a four-group model, TA: BIC = 2141.16, ICL-BIC = 2423.47; AF: BIC = 2678.11, ICL-BIC = 2901.08.
Both the observed and estimated trajectories for TA smoking are depicted in Figure 1. The first group was composed of adolescents who displayed hardly or no smoking at all across each time of measurement and was estimated for 71.4% (n = 145) of the population, the low-rate group (Intercept = −1.48, SE = 0.47, p < .01, Slope = 1.45, SE = 2.5, p < .000). A second group also started low but showed a trajectory of increasing smoking over time (Intercept = 2.01, SE = 0.09, p < .000, Slope = 0.83, SE = 0.48, p < .000) and was estimated at 18.2% (n = 37) of the population (increasing-rate group). The third group was estimated to comprise 10.3% (n = 21) of the population and was composed of adolescents that already started with a relatively high intercept and an age-related linear increase (Intercept = 3.92, SE = 0.04, p < .000, Slope = 0.19, SE = 0.30, p < .000), the high-rate group.4

For each individual in the sample, posterior probabilities of group membership estimate the probability of belonging to each group (e.g., Jones et al., 2001). The posterior probability estimate for a group in which individuals are classified should approach 1, as it is this group that best conforms to their behavior, whereas the posterior group estimate for a group to which individuals are not assigned should be close to 0. The average posterior assignment probability for the individuals assigned to a specific group indicates the precision of group classification based on the estimated model. The average probabilities for the three assigned groups of TA smoking were 0.655 (SD = 0.19; low-rate group), 0.991 (SD = 0.03; increasing-rate group), and 0.998 (SD = 0.01; high-rate group). Thus, for the increasing-rate and the high-rate groups excellent classification precision of the three-group model was indicated. The lower posterior probability for the low-rate group was because of participants who never smoked or experimented with smoking only a few times. However, the composition of these groups was not heterogeneous enough to result in separate groups.

With respect to AF smoking, the results regarding trajectory groups resembled the results for TA trajectory groups. Again, the first group was composed of adolescents who displayed hardly or no smoking at all across each time of measurement and was estimated for 57.6% (n = 117) of the population, the low-rate group (Intercept = −0.15, SE = 0.27, ns, Slope = 0.93, SE = 1.48, p < .000). A second group also started low and showed a trajectory of increasing smoking over time (Intercept = 2.13, SE = 0.11, p < .000, Slope = 0.89, SE = 0.57, p < .000) and was estimated at 17.7% (n = 36) of the population (increasing-rate group). Finally, the third group was estimated to comprise 24.6% (n = 50) of the population, and was composed of adolescents that already initially had a relatively high intercept and showed an age-related linear increase (Intercept = 3.89, SE = 0.04, p < .000, Slope = 0.22, SE = 0.23, p < .000), the high-rate group. With respect to classification precision of the three-group model for friends, the average probabilities for the three assigned groups were 0.616 (SD = 0.30; low-rate group), 0.994 (SD = 0.01; increasing-rate group), and 0.970 (SD = 0.10; high-rate group). Here also, the lower posterior probability for the low-rate groups was because of participants that only experimented with smoking.

Bivariate Correlations

Table 1 shows the bivariate correlations among all variables. AF involvement in smoking is dummy-coded. A score of 0 indicated membership in the low trajectory group and a score of 1 indicated membership in either the increasing or high trajectory groups. We used this parsimonious representation of AF smoking involvement, because the two dummy variables contrasting the high and the increasing trajectory versus the low

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4Table 2 shows the means and standard deviations of smoking for each of the observed groups.
trait trajectory showed very similar patterns of correlations with the remaining variables. AF involvement in smoking was significantly linked to TA attitude toward smoking and to the continuous counts of cigarette smoking by the TA at ages 12, 13, and 14 years. Notably, AF smoking was not linked to AF attitudes toward smoking but AF smoking was linked to TA attitudes. Similarly, AF attitude was positively related to TA smoking at ages 12, 13, and 14 years, whereas the corresponding links of TA attitude to TA smoking failed to be significant. AF attitude and TA attitude were only slightly but nevertheless significantly correlated. TA and AF social preference scores were significantly correlated. AF social preference was linked to a negative TA attitude toward smoking. In contrast, AF social preference was independent of AF attitude toward smoking. Finally, the correlations among TA smoking at ages 12, 13, and 14 years were significant.

Regarding the remaining covariates, girls were more likely than boys to have higher social preference scores, and they were more likely than boys to smoke at age 12 and age 14 years. Children from families with a higher socioeconomic status were less likely to have parents who smoked. Finally, children of parents who smoke were more likely to smoke at age 13 years.

Multinomial Regression Analyses

A hierarchical multinomial logistic regression analysis was performed to predict membership in one of the three smoking trajectory groups, using the low-rate group as reference category (Table 2). On the first step of the logistic regression, we included sex, socioeconomic status, parental smoking, TA attitude toward smoking, and AF smoking involvement as predictors in the model. On the second step, we added AF attitudes toward smoking, AF social preference, and TA social preference. On the third step, we tested whether the predictive links of the AF attitudes toward smoking to TA smoking were moderated by TA or AF social preference scores. To test an interactive effect between AF and TA social preference and AF attitudes toward smoking, we added the following two-way interaction terms on Step 3a: AF Attitudes Toward Smoking × AF Social Preference. On Step 3b we added AF Attitudes Toward Smoking × TA Social Preference.

The results from the first two steps of the logistic regression showed that sex, socioeconomic status, and parental smoking did not significantly contribute to the odds of following either the increasing or the high-rate smoking trajectory. However, participants were significantly more likely to follow an increasing-rate smoking trajectory (odds = 8.13, p < .001) or a high-rate smoking trajectory (odds = 25.23, p < .001) if their friends were involved in smoking. We did not find any main effects regarding TA attitude or AF attitude on smoking. However, in Step 3a, the inclusion of the interaction term AF Attitudes Toward Smoking × AF Social Preference indicated a significant moderating effect of AF social preference regarding the link between AF attitudes and in membership in the increasing-rate group (p < .05). Similarly, in Step 3b, the inclusion of the interaction term AF Attitudes × TA Social Preference indicated a significant moderating effect of

### Table 2

**Multinomial Logistic Regression Analysis Predicting Smoking Trajectory Groups**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Nagelkerke R²-Change</th>
<th>Predictor</th>
<th>Nagelkerke R²-Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>2.46 (2)</td>
<td>ns</td>
<td>.77</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td>.08 (2)</td>
<td>ns</td>
<td>.94</td>
</tr>
<tr>
<td>Parental smoking</td>
<td>1.07 (2)</td>
<td>ns</td>
<td>.84</td>
</tr>
<tr>
<td>AF smoking involvement</td>
<td>49.47 (2)</td>
<td>.001</td>
<td>8.13***</td>
</tr>
<tr>
<td>TA attitude</td>
<td>1.48 (2)</td>
<td>ns</td>
<td>1.20</td>
</tr>
<tr>
<td>AF attitude</td>
<td>4.37 (2)</td>
<td>ns</td>
<td>1.40</td>
</tr>
<tr>
<td>TA social preference</td>
<td>1.63 (2)</td>
<td>ns</td>
<td>.76</td>
</tr>
<tr>
<td>AF social preference</td>
<td>3.58 (2)</td>
<td>ns</td>
<td>1.47</td>
</tr>
<tr>
<td>AF Attitude × AF Social Preference</td>
<td>14.73 (8)</td>
<td>.066</td>
<td>.63*</td>
</tr>
<tr>
<td>AF Attitude × TA Social Preference</td>
<td>15.36 (8)</td>
<td>.069</td>
<td>.54*</td>
</tr>
</tbody>
</table>

**Note.** Sex is coded such that 0 indicates boys and 1 indicates girls. The change in χ² and R² reported in the second and in the fourth column is a change compared to the χ² and R² in Step 1. TA = Target Adolescent; AF = Adolescent Friend.

***p < .001, two-tailed tests.**
TA social preference regarding the link between AF attitudes and in membership in the increasing-rate group ($p < .05$).

To interpret the two interaction effects, we explored the observed interaction effects according to suggestions by Jaccard (2001). We examined the effect of AF attitudes toward smoking on membership in the increasing-rate smoking trajectory group at two levels of AF social preference—a low level of social preference (i.e., $1 SD$ below the mean) and a high level of social preference (i.e., $1 SD$ above the mean). Results of this procedure illustrated that the (positive) link between AF attitudes toward smoking and TA smoking in the increasing-rate group was only significant for early adolescents who had friends with low social preference scores (odds $= 2.59$, $p < .01$) and not for early adolescents who had friends with high social preference scores (odds $= 1.03$, $ns$; Figure 2). This procedure was also conducted for the second interaction effect of TA social preference on the link between AF attitudes toward smoking and the increasing-rate smoking trajectory group. The (positive) link between AF attitudes toward smoking and TA smoking in the increasing-rate group was only significant for early adolescents with low social preference scores (odds $= 2.53$, $p < .01$) than for early adolescents with high social preference scores (odds $= 0.75$, $ns$; Figure 3).

**DISCUSSION**

Our findings suggest that there are three groups that follow distinct smoking trajectories for both TA and AF smoking between age 12 and 14 years. One group experimented with smoking at low levels or displayed no smoking at all across early adolescence (i.e., ages 12 to 14 years; low-rate group). The other two trajectories show different smoking behavior over time; one group initiated smoking early and remained high (high-rate group), whereas the second group started later than the previous group and showed increasing intensity of smoking (increasing-rate group). These findings confirm previous results, although most previous studies that concentrated on smoking trajectories found more than three groups because they had a longer follow-up period (Vitaro et al., 2004) and/or included older children (Abroms et al., 2005).

We did not find the expected main effects of TA and AF attitudes on TA smoking. Instead we found that AF attitudes showed significant bivariate correlations with the continuous counts of cigarettes target adolescents smoked at ages 12, 13, and 14 years, whereas AF attitudes were not correlated with their AF smoking, and TA attitudes were linked to AF smoking, whereas TA attitude was not correlated with TA smoking. Each of these findings indicates that the attitude of the other respondent predicts the respective respondents’ subsequent behavior, but not the attitude of the respective respondent. The latter result may provide support for the idea that AF attitudes precede the development of TA pro-smoking attitudes. We argued that, through interaction with peers children learn new attitudes (e.g., Hansell & Mechanic, 1990; Ianotti & Bush, 1992) and that AF attitudes could precede the development of TA pro-smoking attitudes. Nevertheless, the data of our study do not allow testing this assumption, because TA and AF social attitudes toward smoking were measured only once.

Although we did not find main effects regarding AF and TA attitude toward smoking, we found that the link between TA later smoking and AF attitude toward smoking was moderated by both AF and TA social preference in the increasing-rate group. More specifically, we found a significant link in the increasing-rate group between AF attitudes and TA smoking if these friends had low social preference scores and if the target adolescent had a low social preference score.
Adolescents with low social preference scores may have greater exposure to and affiliation with deviant youth, which may lead in one way or another to a subsequent increase in smoking behavior. This would suggest that rejected (and antisocial) children tend to be drawn towards other antisocial children (Dishion et al., 1991). This possibility is supported by our study because we found that adolescents with low social preference scores have friends with low social preference scores (the bivariate correlation between TA and AF social preference was $r = .28, p < .001$). Learning these attitudes is one obvious explanation. Other possibilities include that smoking may serve as a form of group conformity, a behavior reinforced contingently by peers, or a way to increase one’s identification with the peer group.

These results are in line with Patterson and Yoerger (1997), who suggest that late onset of antisocial or problem behavior is associated with deviant peer affiliation, whereas early onset of problem behavior is associated with family and personality or temperamental characteristics (Moffitt, 1993). Vitaro and colleagues supported this hypothesis with respect to delinquent behavior (Vitaro, Tremblay, Kerr, Pagani, & Bukowski, 1997); however, the same may apply for minor antisocial behavior, such as smoking.

A possible explanation for not finding an association between AF attitudes and TA smoking for adolescents in the high-rate and the low-rate groups is that these groups may have little variability in their attitudes and behavior toward smoking, which would attenuate any estimates of association. This explanation is supported by the variability in attitudes which was largest for the increasing-rate group (see Table 3).

Limitations

There are some limitations that need to be addressed. With regard to attitudes, only one very specific type of attitude was evaluated (i.e., the idea that smoking has social benefits). Whereas this type of attitude is a predictor of smoking in the increasing-rate group among low social preference adolescents and among adolescents with low social preference friends, it would be interesting to see whether other attitudes are predictive of smoking in other groups. Moreover, although our study contributes to an increased understanding of the role of AF attitudes, we were not able to capture the exact moment of transmission of those attitudes. Prospective studies with more measurements over a longer period of time could help to capture the moment of transmission of the attitudes from friends to the children themselves. At the first assessment of attitudes, if the link between TA attitude toward smoking and later smoking is not present, but the link between AF social attitudes toward smoking is, it should be possible to identify a critical point in time at which AF attitudes are emulated. Moreover, assuming that children at an early age endorse parental attitudes toward smoking (which is probably negative), it should be examined at what point in time parents’ attitudes are “superseded” by AF attitudes; in other words, when do antismoking attitudes (endorsed by parents) turn into more pro-smoking AF attitudes. If this critical point in time could be identified, this would help to implement more effective antismoking campaigns.

In our study we focused on the role of potential moderators. Because mechanisms of mediation probably play an important role in the process of transmission of attitudes, future studies should also test for mediating processes. For example, AF attitudes and TA behavior could be mediated by a selection effect (e.g. in forming new friendships adolescents may seek peers that endorse attitudes similar to their own). A developmental perspective is needed when exploring the impact of psychosocial factors on smoking. For instance, it could be tested whether the impact of AF attitudes, as well as their actual smoking, maintain their importance or become less important over time. Popularity and social preference are particularly important during adolescence and are expected to become less important in early adulthood after having reached milestones such as marriage (e.g., Arnett, 1999).

In our study we concentrated on the role of attitudes and social preference in explaining adolescent smoking. Although these are important in predicting smoking trajectories, other factors also play a role in explaining different profiles of smoking behavior. For example, genetic receptivity or nicotine dependence (Colby, Tiffany, Shiffman, & Niaura, 2000) may explain why some children start smoking and others never even try (Plomin & Bergman, 1991). Also, although we conducted a widely used procedure to assess the most liked and the least liked adolescents in the class (Coe et al., 1982), it is likely that identified friends are more likely to be nominated as likeable. However, friendship represents a dyadic concept, whereas social preference represents a group-related concept. Although these concepts are not identical, they do overlap in some ways (Bukowski & Hoza, 1989).

### TABLE 3

<table>
<thead>
<tr>
<th>Group</th>
<th>Smoking T1</th>
<th>Smoking T2</th>
<th>Smoking T3</th>
<th>Attitude T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-rate group</td>
<td>0.05 (0.21)</td>
<td>0.15 (0.65)</td>
<td>0.73 (2.41)</td>
<td>1.90 (0.85)</td>
</tr>
<tr>
<td>Increasing-rate group</td>
<td>0.67 (1.67)</td>
<td>15.42 (14.06)</td>
<td>35.91 (19.55)</td>
<td>2.19 (1.03)</td>
</tr>
<tr>
<td>High-rate group</td>
<td>20.47 (27.61)</td>
<td>44.89 (30.51)</td>
<td>64.86 (19.93)</td>
<td>2.00 (0.79)</td>
</tr>
</tbody>
</table>

**Note.** Values are means and standard deviations (in parentheses) of Target Adolescents (TAs).
Another limitation refers to the assessment of child smoking. In our study we decided to focus on weekly smoking. Based on the finding that only 4% of the participants reported having smoked only one cigarette the previous week we did not include the first time of measurement as a control variable. Because some of the participants were already experimenting with smoking but not on a weekly basis, it would have been more accurate if smoking at age 11 years had been assessed by looking at lifetime smoking.

Finally, although the analyses conducted to identify groups with different smoking profiles are new and sophisticated, final determination of the number of groups is somewhat arbitrary and depends on factors such as sample size and the longitudinal nature of the study. Larger samples may result in finer distinctions of developmental trends that still have a substantial number of members. Moreover, larger samples would enable to examine more moderators than those tested in our study.

Implications for Research, Policy, and Practice

Within the context of these limitations, our findings have a number of potentially important implications. The results of this study support the idea that smoking functions as a marker for antisocial behavior. In particular, adolescents with low social preference scores and adolescents with friends with low social preference scores may consider smoking as normative behavior if their friends have a strong pro-smoking attitude. Moreover, these early adolescents may consider smoking as a behavior that helps increase their social status (prototypes; Gibbons & Gerrard, 1995). Particularly in the increasing-rate group, these social aspects refer to the benefits over a relatively short period and may play a more important role in the decision to smoke than in the decision not to smoke (e.g., for health reasons) on the long term. In terms of interventions, this study can help parents, schools, and mental health professionals in their attempt to reduce smoking rates among early adolescents by not only emphasizing the negative health consequences of smoking but also focusing on the social benefits that adolescents erroneously tend to attribute to smoking.

REFERENCES


