Psychology & Health

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gpsh20

The influence of best friends and siblings on adolescent smoking: A longitudinal study

Zeena Harakeh a, Rutger C. M. E. Engels a, Ad A. Vermulst a, Hein De Vries b & Ron H. J. Scholte a

a Behavioural Science Institute, Radboud University Nijmegen, 6500 HE Nijmegen, The Netherlands
b Department of Health Education and Health Promotion, Maastricht University, 6200 MD Maastricht, The Netherlands


To cite this article: Zeena Harakeh, Rutger C. M. E. Engels, Ad A. Vermulst, Hein De Vries & Ron H. J. Scholte (2007): The influence of best friends and siblings on adolescent smoking: A longitudinal study, Psychology & Health, 22:3, 269-289

To link to this article: http://dx.doi.org/10.1080/14768320600843218

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.tandfonline.com/page/terms-and-conditions

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.
The influence of best friends and siblings on adolescent smoking: A longitudinal study

ZEENA HARAKEH¹, RUTGER C. M. E. ENGELS¹, AD A. VERMULST¹, HEIN DE VRIES², & RON H. J. SCHOLTE¹

¹Behavioural Science Institute, Radboud University Nijmegen, 6500 HE Nijmegen, The Netherlands and ²Department of Health Education and Health Promotion, Maastricht University, 6200 MD Maastricht, The Netherlands

(Received 21 October 2005; in final form 30 May 2006)

Abstract
The present study investigated whether best friend and/or siblings’ smoking affected adolescent smoking. Data of the Dutch Family and Health study was used in which 428 families participated with two adolescent children between the age of 13 and 17 years. Our findings showed that adolescents with older siblings who smoked were more likely to smoke one year later. In contrast, older adolescents were not affected by smoking of their younger siblings. Smoking of the best friend influenced smoking of the younger sibling. With regard to the specific transition from never smoking to smoking initiation, older and younger siblings with a smoking best friend were more likely to start smoking one year later. Younger siblings with older siblings who smoked were more likely to initiate smoking one year later. The influence of friends and siblings on adolescent smoking appeared to be small to moderate.

Keywords: Adolescent smoking, smoking onset, siblings, best friends

Introduction
Tobacco is the cause of several diseases and death worldwide. The World Health Organization indicated that tobacco is the fourth most common risk factor for disease and the second major cause of death in the world, resulting in the death of approximately 5 million adults each year (WHO, 2005). Most of the smokers start using tobacco products before the age of 18 years (Secretary of State for Health and Secretaries of State for Scotland, Wales and Northern Ireland, 1999;
US Department of Health and Human Services, 1994). In most of the Western countries, there is an increase in the prevalence of smoking in the adolescence period (Office for National Statistics, 1997; US Department of Health and Human Services, 1994). For example, results from the United Kingdom, the United States, and the Netherlands show that the prevalence of smoking among adolescents has been stable or increasing in the last 10–20 years (e.g., Engels, Knibbe, & Drop, 1999). In the Netherlands, the highest increase of ever smoking among adolescents occurs in 12 to 14-year old children (Stivoro, 2002). In many of the Western countries, the prevalence of regular smoking for 13-year olds varies from 3.5 to 12.5% and increases to 17 to 24.5% for 15-year olds (King, Wold, Tudor-Smith, & Harel, 1996). Most smokers start smoking during adolescence. Adolescents who experiment with smoking are prone to develop physiological dependence on nicotine, and in turn, become regular smokers later in life (e.g., Prokhorov, Pallonen, Fava, Ding, & Niaura, 1996; Stanton, 1995). Insight into processes of uptake in adolescence may facilitate development of prevention programs and adaptation of policies that effectively deal with preventing adolescents from starting to smoke.

Strong and consistent empirical evidence has shown that peer smoking is one of the major factors related to experimentation and regular use of smoking (Flay, d’Avernas, Best, Kersell, & Ryan, 1983; Petraitis, Flay, & Miller, 1995; see also review of Avenevoli & Merikangas, 2003). In the teenage years, peer relationships become more important as compared to childhood. Adolescents experience feelings of uncertainty about their self-image (e.g., Engels, Knibbe, Drop, & De Haan, 1997), show a need for social approval, group membership and having close friends and spend substantial time with peers (e.g., Hartup, 1997). Therefore, in the period of adolescence, persons are more vulnerable to conform to prevailing norms than in any other period (Finkenauer, Engels, Meeus, & Oosterwegel, 2002). Adolescents exposed to smoking peers are vulnerable to initiate or maintain smoking because (a) there is an increase in availability of cigarettes, (b) they might perceive that smoking is the norm, and related (c) they might assume that smoking will increase social acceptance (Graham, Marks, & Hansen, 1991). Research on peer influences has defined peers in several ways (see review by Avenevoli & Merikangas, 2003). In this present study, we defined peers as the best friend of the adolescent and the close-in-age sibling of the adolescent. Best friends function as a close intimate friend and are usually also a member of the same friendship group of the adolescent (e.g., Urberg, Degirmenciglu, & Pilgrim, 1997) and therefore, as suggested by previous studies, they affect adolescents’ smoking onset (Urberg et al., 1997). Another source of peer influence stems from the adolescent’s siblings. A close-in-age sibling is not only a family member but also a peer of the adolescent (Bard & Rodgers, 2003). However, among the studies that have examined peer influence, very few have investigated the influence of siblings. Furthermore, there are hardly any longitudinal studies that have tested the relative influence of smoking friends and siblings on changes in adolescent use.
In this current study, we investigate whether the best friend and a close-in-age sibling of the adolescent affect the adolescent smoking over time.

**Best friends**

Empirical evidence indicates that friends’ smoking is one of the most consistent and robust predictors of adolescent smoking (e.g., Flay et al., 1994). From 19 prospective studies on peer influence and adolescent smoking, discussed in a comprehensive review of Conrad, Flay and Hill (1992), 15 studies showed that friends’ smoking influenced adolescent smoking.

There are several theories that explain social influence in relation to adolescent smoking. Cialdini, Reno and Kallgren (1990) suggested that it is useful to make a differentiation between injunctive norms and descriptive norms (see also Turner, 1991). Injunctive norms concern the social approval or disapproval of others. With respect to smoking, these norms refer to the adolescent’s motivation to become a smoker because of opinions of (important) others in the environment (e.g., peers) on smoking. Descriptive norms refer to the actual behaviour of others in the direct environment (e.g., peers). In this study, we focus only on descriptive norms. The descriptive norms are in line with the Social Learning Theory of Bandura (1977, 1986). The Social Learning Theory is one of the theories that are frequently used to explain how friends influence adolescent smoking. This theory indicates that individuals observe, model and imitate behaviour of other important individuals (i.e., role models) in their environment. According to this theory, best friends set an example or function as a (role) model for adolescents, and therefore, adolescents are likely to imitate their best friends’ smoking. Besides evidence from longitudinal survey studies indicating that adolescents model the behaviour of their best friends (Conrad et al., 1992), a few experimental studies (e.g., Antonuccio & Lichtenstein, 1980; Harakeh, Engels, Van Baaren, & Scholte, 2005b; Kniskern, Biglan, Lichtenstein, Ary, & Bavry, 1983; Miller, Frederiksen, & Hosford, 1979) have shown that imitation of peer smoking is an important mechanism in explaining why adolescents and young adults continue smoking. Mutual influence process between peers result in friends becoming similar with regard to smoking (Berndt & Keefe, 1995).

Similarities in smoking behaviour among friends can be caused by two processes: influence and selection (e.g., Engels, Vitaro, den Exter Blokland, de Kemp, & Scholte, 2003; Urberg et al., 1997). Wang et al. (1999) showed that both peer influence and selection occur, although selection might play a greater role in the similarity in the smoking pattern among friends. However, in most studies peer influence and selection processes have not been disentangled. Thus, it may be that the impact of friends’ smoking on adolescent smoking has been overestimated. In the present study we decided to disentangle influence and selection processes and exclusively focus on influences by best friends over time. Urberg and colleagues (1997) argued that there are a few ways to disentangle influence and selection process. To study the influence process, the following
issues have to be taken into account: (a) use longitudinal data, (b) focus only on friendships that are stable over the study period (examining influence after selection has occurred), (c) exclusively examine initiation of cigarette smoking, and (d) include the stability paths of adolescent smoking behaviour and best friends’ smoking behaviour in order to take out the variance that the adolescent and friend have in common (i.e., similarity). Thus, these four issues were incorporated in our present study.

**Siblings**

There are very few studies investigating sibling influence on smoking. Studies that have tested friend and sibling influence simultaneously have shown that friends’ smoking is a stronger predictor of adolescent smoking initiation than the sibling smoking (Avenevoli & Merikangas, 2003). Nevertheless, recent research indicates that siblings are important in affecting smoking and focus the need for additional research on how siblings influence each other (Rajan et al., 2003; Vink, Willemsen, Engels, & Boomsma, 2003a).

As siblings who are close in age share the same environment, they are more likely to attract the same friends and have the ‘opportunity’ to share similar experiences. In line with the Social Learning Theory (Bandura, 1977, 1986) and because of the natural hierarchical structure of a sibling relationship (Tucker, Barber, & Eccles, 1997), older siblings function as important role models and facilitators, and are perceived by their younger sibling as more competent and as an influential resource of guidance, advice, support and knowledge. Therefore, younger siblings may imitate the behaviour of older siblings spontaneously without being aware that they are imitating the older sibling’s behaviour, or intentionally when it may immediately lead to positive rewards. Imitation will occur, especially, when adolescents spend a lot of time with his/her siblings in and outside the home. Besides, the close-in-age sibling also serves to legitimize association of others outside the family, for example introducing the other sibling to smoking peers. So, the question is not only whether siblings influence each other in terms of smoking, but also whether birth order plays a role. Studies have shown that sibling smoking, in particular the older sibling, influences adolescent smoking initiation (Conrad et al., 1992, Jensen & Overgaard, 1993; Wang, Fitzhugh, Westerfield, & Eddy, 1995). However, it should be stressed that most studies have not distinguished between older or younger siblings, or only investigated the influence of older sibling on the younger sibling (see also review Avenevoli & Merikangas, 2003). In addition, most of the studies could only provide conclusions on the similarity of siblings’ smoking behaviour due to applying a cross-sectional design. In order to make conclusions on whether siblings influence each other’s smoking, a longitudinal design is needed. Thus, the mutual influence of siblings, including the influence of the younger sibling on the older siblings’ smoking has not been often taken into account.
Present study

In a longitudinal study, we tested with structural equation models (SEM) whether best friends’ and biologically related siblings’ smoking influenced adolescent smoking. We tested a cross-lagged path model (see also as an example, Figure 1), including the stability paths, whether (a) the best friend of the older sibling influenced the smoking behaviour of the older sibling one year later, (b) the older sibling influenced the smoking behaviour of his/her best friend, (c) the older sibling influenced the smoking behaviour of his/her younger sibling, (d) the younger sibling influenced the smoking behaviour of his/her older sibling, (e) the younger sibling influenced the smoking behaviour of his/her best friend, and (f) the best friend of the younger sibling influenced the smoking behaviour of the younger sibling. To investigate in a cross-lagged path design (see for more information, Engels, Knibbe, de Vries, Drop, & van Breukelen, 1999a) the transition from never smoking to smoking initiation, we selected the non-smoking adolescents at T1 and tested whether the best friend and the sibling influenced their smoking uptake one year later (see Figures 2 and 3).

Method

Participants

A total of 428 Dutch families participated in the ‘Family and Health’ study (see for more information on several aspects of this longitudinal study,
Harakeh, Scholte, de Vries, & Engels, 2005a; Harakeh, Scholte, Vermulst, De Vries, & Engels, 2006a; Van Der Vorst, Engels, Meeus, Dekovic, & Van Leeuwe, 2005). Four members from each family participated (i.e., mother, father and two adolescent children in the age of 13 to 17 years). Thus, in each family an older and younger adolescent sibling participated, and because of the focus in the present study we used only the data of these two family members. The age of the 428 older siblings ranged from 14 to 17 years ($M=15.22$, $SD=0.60$); 8.9% were aged 14 years, 60.5% 15 years, 30.4% 16 years, and 0.2% were aged 17 years. The age of the 428 younger siblings ranged from 13 to 15 years ($M=13.36$, $SD=0.50$); 65.4% were aged 13 years, 33.6% 14 years, and 0.9% were aged 15 years. Of the older siblings, 52.8% were male and of the younger siblings 47.7% were male (for demographic details of our sample, see Harakeh et al., 2005a, 2006a).

Procedure

The addresses of families were selected from 22 municipalities in the Netherlands. Families were sent a letter to invite them to participate in a longitudinal study. In total, 885 families responded that they were willing to participate and gave their informed consent. The families had to fulfil the following inclusion criteria of this study; parents were married or living together, the family members were biologically related to each other, and the participating siblings were neither twins nor mentally or physically disabled. To establish whether these families fulfilled all these criteria, the families were telephoned and 765 families fulfilled these inclusion criteria. To ensure an equal distribution of the educational level of the adolescents, and an equal number of all the possible sibling dyads (i.e. boy–boy, girl–boy, boy–girl, and girl–girl), a total of 428 families were selected to participate. Interviewers visited all the families at home between November 2002 and April 2003 (T1), and one year later between November 2003 and April 2004 (T2). Attrition between T1 and T2 was extremely low; only 12 families dropped out. During the home visits, at both measurements, each family member completed the questionnaire individually and separately at the same time. However, in this present study we only used the data collected from the older and younger adolescent siblings. To maintain anonymity, the interviewers asked the participants to sit apart from each other and not to discuss the questions while filling out the questionnaires. Filling in the questionnaire took approximately 90 min. Each family received 30 Euros when all four family members had completed the questionnaire. Participants were acquainted with the fact that at the end of the study five cheques of 1000 Euros each would be raffled among families who took part at all the three waves.

Measures

Adolescent smoking. To assess adolescents’ smoking behaviour, both siblings in each family were asked to report which stage of smoking applied to them
(De Vries, Engels, Kremers, Wetzels, & Mudde, 2003) on a 9-point scale responses ranged from 1 = ‘I have never smoked, not even one puff’ to 9 = ‘I smoke at least once a day’. We recoded the responses into four categories: 1 = ‘never smoked’ (this category included the response category ‘I have never smoked, not even one puff’), 2 = ‘stopped smoking’ (‘I tried smoking, but I do not smoke anymore’, ‘I quit, I used to smoke less than once a week’, and ‘I quit after I had smoked for a period at least once a week’), 3 = ‘smoked occasionally, less than weekly’ (‘I try smoking once in a while’, ‘I smoke less than once a month’, and ‘I do not smoke weekly but at least once a month’), and 4 = ‘smoked at least once a week’ (‘I do not smoke daily but at least once a week’ and ‘I smoke at least once a day’).

**Best friends’ smoking.** Adolescents were asked to write down the first name and the first letter of the surname of his/her best friend. We asked them explicitly not to list the name of a possible intimate partner, or a sibling, but to list the name of the single best friend who, according to the participants, also perceived the adolescent as his/her best friend (reciprocal best friend). To assess smoking of the best friend of the adolescent, we applied the same question as for smoking by the participants. Both siblings were asked to report which stage of smoking applied to their best friend. We recoded the responses into the same four categories mentioned earlier.

We checked whether siblings mentioned the other sibling as their best friend, and if this was the case we replaced the scores with a missing value. Three older siblings mentioned their sibling at T1 and two older siblings mentioned their sibling at T2; at both waves none of the younger siblings mentioned their older sibling as their best friend. Furthermore, we verified whether the siblings shared the same best friend. This was the case in zero pairs at T1 and three pairs at T2. In these three latter cases, we replaced the scores with a missing value.

We also examined whether the best friend of the older and younger sibling at T1 was the same person one year later. In our study, the aim was to investigate the influence of the best friend on adolescent smoking and vice versa. Therefore, in the analyses the best friend at T1 had to be the same best friend one year later. The latter was also done because the stability of smoking of the best friend would be included in the model and it would make more sense if this would be the same best friend one year later. If this was not the case, we replaced the value at T2 in the database with a missing value (251 older siblings missing and 250 younger siblings missing). Among the older siblings 177 had the same best friend at T1 and T2, and among the younger siblings this number was 178.

There is a debate in the literature on whether it is appropriate to use adolescent’s reports on their friends’ smoking behaviours as these reports may be distorted (e.g., Bauman & Ennett, 1996). Therefore, we examined whether the adolescents in the present study were accurate in their reports about their best friends’ smoking. We collected data of the best friend of the adolescent in a
subsample. At the second wave, both siblings participating in this study filled in the name and address of their best friend. The best friends of both siblings were approached at the second wave to participate and a questionnaire was sent to them by post. The best friend filled in the questionnaire and returned the completed questionnaire. A total of 323 best friends returned the completed questionnaire. The proxy reports of the older sibling on his/her best friend lifetime smoking (‘never smoked, not even one puff’ versus ‘smoked once or more’ see also Harakeh, Engels, De Vries, & Scholte, in press) corresponded with best friends’ self-reports ($\chi^2[1, N=163] = 60.06, p \leq 0.001$), with a kappa of 0.61 ($p \leq 0.001$). The proxy reports of the older sibling on his/her best friend current smoking (‘non-smoker’ versus ‘smoke at least once a month’, see also Harakeh et al., in press) corresponded with best friends’ self-reports ($\chi^2[1, N=163] = 58.41, p \leq 0.001$), with a kappa of 0.60 ($p \leq 0.001$). The proxy reports of the younger sibling on his/her best friend lifetime smoking corresponded with best friends’ self-reports ($\chi^2[1, N=160] = 61.32, p \leq 0.001$), with a kappa of 0.62 ($p \leq 0.001$). The proxy reports of the younger sibling on his/her best friend current smoking corresponded with best friends’ self-reports ($\chi^2[1, N=160] = 71.54, p \leq 0.001$), with a kappa of 0.65 ($p \leq 0.001$). Overall, the kappa indicated a moderate agreement between adolescents’ reports about their best friends’ lifetime and current smoking and self-reports of the best friend.

We also tested with cross-tabulations whether older and younger siblings who smoked overestimated the smoking behaviour of their best friend (false consensus effect). With regard to the older siblings, older siblings who smoked in their lifetime overestimated 10.6% of the lifetime smoking behaviour of best friend compared to 9.0% of the older siblings who did not smoke in their lifetime. With regard to the younger siblings, younger siblings who smoked in their lifetime overestimated 16.3% of the lifetime smoking behaviour of best friend compared to 6.4% of the older siblings who did not smoke in their lifetime. In general, younger siblings who smoked more strongly overestimated smoking of their best friends as compared to younger siblings who did not smoke. However, for older siblings the percentages showed no overestimation of best friend’s smoking by smokers.

**Data analyses**

To test our models on adolescent, siblings and best friend smoking and smoking onset, we used structural equation modelling (SEM) with the software package Mplus (Muthén & Muthén, 2001). Mplus was used because the observed smoking variables at T1 and T2 in the model were ordered categorical variables. The parameters in the models were estimated according to the weighted least square method with adjusted mean- and variance chi-square statistic (WLSMV estimator; Muthén & Muthén, 2001, p. 39). Mplus has several options to deal with missing values. In this case, pairwise information is used with categorical outcomes using the WLMSV estimator.
To test our models, cross-lagged panel analyses (Finkel, 1995) were carried out. An initial model was estimated (depicted in Figure 1) and nonsignificant paths were removed. The variables indicating siblings’ and best friend’s smoking were also allowed to correlate within one measurement wave. Stability relations over time between corresponding smoking variables (observed variables) and cross-lagged relations were tested. Cross relations over time gives the possibility to test causal predominance: Is best friend’s smoking and older siblings’ smoking the ‘cause’ of younger siblings’ smoking or can younger siblings’ smoking be seen as the ‘cause’ of best friends’ smoking (Byrne, 1998, p. 352).

To test the effects of friends’ and siblings’ smoking on adolescent smoking onset, we computed two additional models, for each sibling separately. One model in which we tested whether the younger sibling and/or the best friend of the older sibling predicted older siblings’ smoking onset one year later (model depicted in Figure 2), and one model in which we tested whether the older sibling and/or the best friend of younger sibling predicted younger siblings’ smoking onset one year later (model depicted in Figure 3). To test the model whether best friend of the older sibling and/or the younger sibling predicted older siblings’ smoking onset, we selected the older siblings who reported at T1 to never have smoked (not even a puff) and examined smoking behaviour at T2 (the four response categories). We did the same to test the model of younger siblings’ smoking onset.

Results

Characteristics of the sample

Table I shows the smoking prevalence among the adolescents in the present study. The majority of the adolescents had never smoked (not even a puff).

Correlations

Table II depicts the associations between the smoking behaviour of older and younger siblings, between smoking of adolescents and their best friends, between smoking of the older sibling and the best friend of the younger sibling, and between smoking of the younger sibling and the best friend of the older sibling. First, there was a substantial association between the smoking of older and younger siblings. Second, the association between smoking of older sibling and his or her best friend was quite strong at both waves; older siblings who smoke were more likely to have best friends who smoke. These findings also applied for younger siblings and their best friends. There was a positive association between smoking of the older sibling and the best friend of the younger sibling, and also a positive association between the smoking of the younger sibling and the best friend of the older sibling. Furthermore, smoking of the younger siblings’ best friend and that of the best friend of the older sibling was not significantly correlated.
The total model showed a good fit ($N=428$, $\chi^2(5) = 3.38$, $p=0.6411$, RMSEA = 0.00, and CFI = 1.00) (Figure 1). The variables in the model explained 61.7% of the variance in the older siblings’ smoking, 48.4% in the younger siblings’ smoking, 67.1% of the variance in smoking of the best friend of the older sibling, and 57.5% in smoking of the best friend of the younger sibling at T2.1

The correlations within the model are shown in Figure 1. The findings indicated that there was strong relative stability in smoking of both the older and younger sibling over time, as well as a strong stability in best friends’ smoking over time. Furthermore, older siblings’ smoking affected smoking of the
younger sibling, but not the other way around. Smoking of the older sibling affected smoking of his/her best friend, although the influence of best friend smoking on older sibling’ smoking appeared not to be significant. The younger siblings’ smoking was related to their best friend smoking over time, and their best friend affected the younger sibling to smoke.

**Model on smoking onset older sibling**

The model on older sibling’s smoking onset showed a good fit \( (N=220, \chi^2(3) = 4.53, p = 0.2083, \text{ RMSEA} = 0.048, \text{ and CFI} = 0.99) \) (Figure 2). The model explained 35.9% of the younger siblings’ smoking, and 37.2% of
the variance of the smoking behaviour of the best friend of the older sibling (see Figure 2). An explanation why the explained variance of the older siblings’ smoking onset (5.9%) was relatively low compared to the explained variance of the total model might be that we selected the older siblings who did not smoke at T1 and therefore the stability path of the older siblings’ smoking from T1 to T2 was not included in the model. Another plausible explanation is that there might be important variables that are more important in predicting adolescent smoking onset than predicting smoking behaviour.

Cross-lagged associations in Figure 2 showed that the smoking of the younger sibling did not predict smoking onset of the older sibling, whereas best friend’s smoking affected smoking onset among the older sibling.

Model on smoking onset younger sibling

The model on smoking onset of the younger sibling (see Figure 3) showed a good fit ($N = 272$, $\chi^2(2) = 2.00$, $p = 0.3640$, RMSEA = 0.00, and CFI = 1.00). The model explained 50.0% of the variance of the older siblings’ smoking, and 40.8% of the variance of the smoking behaviour of the best friend of the younger sibling. The explained variance of the younger siblings’ smoking onset was 8.5%.

Cross-lagged associations in Figure 3 showed that the smoking behaviour of the older sibling predicted smoking onset of the younger sibling, and best friend’s smoking affected smoking onset in the younger sibling.

Additional analyses

We wanted to examine whether the best friend of one sibling affected smoking of the other sibling within the same family. Modification indices showed that this was not the case. In none of the models smoking status of the best friend of one sibling affected the smoking of the other sibling.

Discussion

In this present prospective study, we investigated whether best friends’ and close-in-age siblings’ smoking influenced adolescent current smoking. To analyse this we used a cross-lagged path design. Our unique design with longitudinal data and focus on friends as well as siblings, makes it possible to look at bi-directionality; investigating the reciprocal influences between best friends, siblings and adolescent smoking in one model. In addition, we investigated whether best friends’ and siblings’ smoking predicted adolescent smoking initiation.

The findings of the present study showed that the smoking behaviour of the best friend influences adolescent smoking one year later. This is in line with other prospective studies (see review of Conrad et al., 1992). In addition, the findings of this study showed that the influence of best friend smoking and adolescent smoking is reciprocal (i.e., bi-directional): friends influence adolescents while adolescents influence their friends. However, the effect sizes of these reciprocal influences of best friend and adolescent smoking were small to moderate.
These small to moderate effect sizes indicating that best friend smoking does not substantially add to the prediction of adolescent smoking are in line with the findings of other studies investigating friend and peer group smoking (e.g., Aloise-Young, Graham, & Hansen, 1994; De Vries et al., 2003; Engels et al., 2003; Engels et al., 1997, 1999a; Engels, Knibbe, & Drop, 1999b; Ennett & Bauman, 1994; Urberg et al., 1997).

Thus, influence processes only contribute to a small proportion of the similarities in smoking behaviour among friends. Previous studies investigating both selection and influence process have showed that friends are similar merely due to selection processes rather than influence processes (e.g., see review Bauman & Ennett, 1996). Adolescents select friends who have similar characteristics, attitudes and behaviour (e.g., Engels et al., 2003; Urberg et al., 1997). Most of the friendships adolescents engage in are not stable and even in a period of 6 months adolescents’ friendships are open to change (Engels et al., 2003). Thus, previous studies have showed that selection more strongly affect homogeneity of smoking among friends than peer influence.

Nevertheless, although the effect sizes shown in our study and other longitudinal studies were small, this should not lead to the conclusion that peer influence processes are not important (e.g., Urberg et al., 1997). The role of friend’s smoking is important for two reasons. First, small effects are important because they may have enormous implications in a practical context and might be quite important theoretically (see e.g., Abelson, 1985; Mook, 1983; Rosenthal & Rubin, 1983; Yeaton & Sechrest, 1981). Experimental studies on peer influence and young adult’s smoking have shown that in naturalistic settings such as in bars individuals imitate the smoking behaviour of others, even of complete strangers (Antonuccio & Lichtenstein, 1980; Harakeh et al., 2005b; Kniskern et al., 1983; Miller et al., 1979). Imitation proved to be an important mechanism when people light up a cigarette and continue smoking in public places such as bars, restaurants, public transport, work and educational environment. A second reason is that small effects over time have a large cumulative impact. For example, it has been shown that adolescent risk to smoke increases when there are more smoking models in their environment (Taylor, Conard, Koetting O’Byrne, Haddock, & Poston, 2004). Thus, if parents smoke, in addition to the adolescent’s best friend and sibling, the risk of taking up smoking will increase because of the cumulative impact. This assumption needs to be investigated in long-term prospective studies to provide more insights into the cumulative effect of friends’ smoking over time.

With respect to siblings’ influence, the findings of our study showed that only older siblings influenced the younger siblings’ smoking and smoking onset one year later. Younger siblings’ smoking did not affect the older siblings’ smoking. A possible explanation of this result is that younger siblings see older siblings as important role models, and that they imitate the smoking behaviour of the older siblings. Perhaps older siblings do not see their younger siblings as important role models even if they are close in age (Bard & Rodgers, 2003). The majority of previous studies have shown that siblings influence adolescent smoking
Most of these studies did not differentiate between older and younger siblings and those that did, primarily looked at the influence of older siblings on younger siblings (Avenevoli & Merikangas, 2003).

In sum, the influence of best friends’ smoking on adolescent smoking was stronger than that of sibling’s smoking. This is in line with other studies that have indicated that peers’ smoking (best friend or most friends) is the best predictor of adolescent smoking, followed by siblings and then parents (e.g., Jensen & Overgaard, 1993; O’Loughlin, Paradis, Renaud, & Gomez, 1998; Presti, Ary, & Lichtenstein, 1992; Vink, Willemsen, & Boomsma, 2003b; Wang et al., 1995; Webster, Hunter, & Keats, 1994).

We did not find support for the assumption that the smoking behaviour of the older sibling’s best friend influenced the younger siblings’ smoking behaviour, or the other way around. An explanation may be that although siblings are close in age and may share the same environment, such as parents, family, and neighbourhood, these close-in-age siblings still have different friends and activities. Therefore, it is likely that they are each involved in part of the environment that they do not share together (non-shared environment) such as school, and extracurricular activities. Due to this non-shared environment the older and younger siblings will meet different peers and are less likely to engage in the same friendships or share the same friend. However, this may differ across cultures and countries. Unfortunately, we lack information on how much time adolescents spend together with their siblings as well as friends. This would allow testing the hypothesis that peers affect each other more strongly when they spend a lot of time together.

Limitations

Besides the strengths of this study such as the longitudinal approach, the cross-lagged path design and including both best friend and sibling, there are also some limitations that need to be mentioned. First, in this study we measured best friends’ smoking by adolescents’ reports of their best friends’ smoking rather than by best friends’ self-reports. Our study showed that mainly younger siblings overestimated how similar they were to their best friends (e.g., Bauman & Ennett, 1996; Bauman & Fisher, 1996; Fisher & Bauman, 1988; Urberg, Cheng, & Shyu, 1991). However, the kappa indicated moderate agreement between adolescents’ reports about their best friends’ lifetime and current smoking and the self-reports of the best friends, suggesting that this did not affect our general set of multivariate findings. In addition, it appeared that younger siblings who smoked overestimated the lifetime smoking behaviour of their best friend more than older siblings who smoked, and younger siblings who did not smoke. More research is needed to understand why this overestimation occurred. The reasons for this overestimation, and for the differences in overestimation might also have implications for smoking prevention (Bauman & Ennett, 1996).
Second, we did not take into account the duration of the friendship. For example, the mutual influence of best friend’s smoking and adolescent smoking may differ when adolescents know his/her best friend for a long time compared to adolescents who have just established this friendship. Perhaps (reciprocal) friends who have a long lasting relationship do not feel the need to be similar and therefore, may be more open to variation in behaviours between friends and therefore affect adolescents’ smoking behaviour less than for example just established, new friendships (Engels et al., 2003). Stable friendships may not continuously lead to more similarity over the entire course of their friendship as there may be an equilibrium point at which stable friendships stop becoming similar on a given behaviour such as smoking (Urberg et al., 1997). Related to this issue, we did not take into account whether the best friend also nominated the adolescent as his/her best friend, thus whether there was a reciprocal relationship. Even if the friendships had been unilateral, the results would probably have been found, although in our study underestimation may have occurred because of including unilateral friendships. On the other hand, there is some evidence that unilateral friends may more strongly affect adolescent substance use than reciprocal friends (Bot, Engels, Knibbe, & Meeus, 2005). One possible reason for this finding is that adolescents with unilateral friends have a stronger desire and an intrinsic need to be similar to the person they perceive as their best friend. One of the ways to achieve this is adaptation (Aloise-Young et al., 1994; Bot et al., 2005; Kiesner, Cadinu, Poulin, & Bucci, 2002). Thus, adolescents may adapt to their best friends’ smoking and therefore start to smoke.

Third, the variability in change in smoking behaviour from the first wave to the second was relatively low. The change from smoking weekly to daily was 2.9% for the older siblings and 5.2% for the younger siblings. However, when including smoking once in a while (but not weekly) these percentages were 3.4 and 7.6%, respectively. Thus, some of the variance of adolescent smoking is explained. However, to obtain more variance and a higher change in smoking rates between measurements we would recommend including longer time intervals between two measurements (see Engels et al., 1999).

Fourth, in our study, adolescents were derived from intact biologically related families. The influence process of friends and siblings might be different for adolescents from disrupted families (Baumrind, 1985; Flay et al., 1994, Hu, Flay, Hedeker, Siddiqui, & Day, 1995; Kandel, 1978). The family structure is important, it may be that in these disrupted families more problems occur within the family and parents perhaps are less able to provide support and to be a secure environment for their children. Therefore, adolescents from disrupted families are maybe more at risk for influence by peers (Hirschi, 1969).

Finally, besides peer influence, there are important predictors of adolescent smoking that are not included in this present study. Previous studies have shown that, for example, parental smoking, smoking-related cognitions, adolescent’s personality, and parenting add to the prediction of adolescent smoking.
smoking (e.g., Avenevoli & Merikangas, 2003; Harakeh et al., 2006a; Harakeh, Scholte, Vermulst, De Vries, & Engels, 2004).

Future research

Future research is needed to obtain a better understanding on how peers (including siblings) are involved in causing similarity or dissimilarity in adolescent smoking in different age groups. First, besides the influence and selection processes there may be other factors that influence friends to become similar. For instance, general and smoking-specific parenting and parental smoking behaviour may be important. Parents influence the behaviour and the peer relations of their offspring and further research is needed to obtain more insight into how parents affect the influence of peers (Engels et al., 2003). Parents may exert influence, for example, by transmitting their values and norms about which kind of friends their offspring selects or chooses to be friends with.

Second, besides investigating the short-term effects, it is important to examine the long-term effects of smoking peer models. It may be that, even if peer influence is weak as has been shown in our study, over the years, continuous exposure to smoking models may have a large cumulative impact (Taylor et al., 2004). For example, adolescents with non-smoking family members and smoking friends may be less at risk to smoke than adolescents with smoking family members and smoking friends (Engels et al., 1999a).

Third, genetic resemblance might also account for similarities in sibling pairs (Rose, 1998; Vink et al., 2003a, 2003b). Findings of twin studies imply that there is a genetic component that causes similarity in smoking among siblings (e.g., Boomsma, Koopmans, van Doornen, & Orlebeke, 1994), and therefore sibling influence is not only due to the environment but also due to inheritance. More studies are needed to identify the underlying mechanisms of sibling similarity and how genetic and environmental influences are involved (e.g., Slomkowski, Rende, Novak, Lloyd-Richardson, & Niaura, 2005).

Fourth, gender and ethnicity may also be important factors that have to be studied further to understand whether some adolescents are more at risk. For example, same-sex siblings may influence and imitate each other more than mixed-gender siblings, or girls may be more susceptible for social influences than boys (Flay et al., 1994).

Fifth, few studies have explored whether smoking of a close/best friend of the opposite sex and/or a romantic partner affects adolescents’ smoking (e.g., van Roosmalen & McDaniel, 1992; Wang et al., 1995). More research is needed to understand how and why opposite sex friendships and romantic relationships influence adolescent smoking.

Sixth, the identity theory (see also Thoits & Virshup, 1997) is an important theoretical perspective to take into account in future research. This theory might explain why friends, siblings and peer group members become similar with respect to smoking. Falomir and Invernizzi (1999) suggested that smoking is a behaviour that could be a part of a person’s identity. It might be that individuals
with a smoker identity (i.e., feelings of being a smoker or being identified with smokers as a group) feel strongly connected and engage with other peers who smoke. Previous studies have shown that smoker identity is related to adolescent smoking initiation, current smoking behaviour, and intention to quit smoking (e.g., Biddle et al., 1985; Burton, Sussman, Hansen, Johnson, & Flay, 1989; Falomir & Invernizzi, 1999).

Finally, because of the multi-faceted nature of peer relationships, other factors may be important in understanding how peers (including siblings) affect adolescent smoking such as characteristics of schools and neighbourhoods, socio-demographic factors, and policy-related or environmental factors (Kobus, 2003).

Implications

The findings of the present study may have implications for the development of prevention programs. Most of the prevention programs designed to prevent adolescents from smoking aim at making them aware of peer influences (Engels et al., 1999a; Kobus, 2003). In these prevention programs, adolescents learn general skills on how to resist pressures from friends. Our findings show that influence processes are more subtle, suggesting that individuals are not only influenced directly by peer pressure but also indirectly by processes such as imitation or selection processes.

The influence of friends appeared to be moderate. Studies investigating peer influence and selection processes indicate that selection processes are the major factor in explaining why friends are similar. Adolescents might select peers and be selected by peers because of certain individual (predisposed) characteristics (e.g., Harakeh et al., 2006b), and this is a possible explanation why friends and peer group members are similar with respect to smoking. Therefore, the content of prevention programs may need to be reconsidered. Besides teaching adolescents to resist peer pressure to smoke, prevention programs might consider to focus on the selection processes in friendships, and make adolescents aware of their own role in these processes and the implicit choices they make with regard to engaging and selecting new friends (e.g., Engels et al., 1997). Furthermore, usually the peer resistance training is fairly broad in defining a peer and an appropriate resistance skill (Urberg et al., 1997). It is important to understand in future research whether there are resistance skills that work better with a close friend than in a peer group or the other way around (Urberg et al., 1997). Wang and colleagues argued that in addition to the prevention programs developed to resist peer pressure, future studies are needed to identify the factors that influence adolescents’ decision in choosing friends who smoke (Wang et al., 1999). In addition, Urberg and colleagues (1997) suggest that adolescents with a specific ethnic background are more susceptible to peer influence than others. If adolescents who are more at risk for social influence could be identified, prevention programs could target those adolescents who are most susceptible to adopt peer behaviours. Therefore, our findings indicate that not only best friends
but also siblings do influence adolescents’ smoking and, although effect sizes were small, should be taken into account when developing prevention programs.

**Note**

[1] The stability paths included in our Structural Equation Models showed to be strong over time. These stability paths contribute to the high proportion of explained variance of adolescent smoking.

**References**


