Similarities and bi-directional influences regarding alcohol consumption in adolescent sibling pairs

Haske Van Der Vorst a,⁎, Rutger C.M.E. Engels a, Wim Meeus b, Maja Dekovicć b, Jan Van Leeuwe a

a Radboud University Nijmegen, The Netherlands
b Utrecht University, The Netherlands

Abstract

Ample studies have established that parents as well as peers function as role models in the development of adolescents’ alcohol use. The role of siblings, however, has been largely neglected despite the long-term nature of a sibling relationship. The present study examined the impact of siblings on drinking behavior of adolescents using longitudinal data from 416 sibling dyads. Moreover, we explored which factors (gender constellation of the sibling dyad, quality of the sibling relationship, and similarity in norms about alcohol) affect reciprocal influences in alcohol use of siblings. Descriptive analyses showed that although older siblings drink more frequently and intensively than the younger siblings, moderate associations were found between frequency and intensity of drinking in siblings. Findings of structural equation modeling demonstrated that alcohol use of the older sibling marginally affected drinking of the younger sibling one year later. Drinking of the younger sibling did not affect drinking of the older sibling. Further, we found no moderating effects of having the same or opposite gender as a sibling, a low or high quality relationship, and the same or different norms about alcohol, on the association between siblings’ alcohol use and adolescents’ drinking over time.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Adolescents; Alcohol use; Siblings; Longitudinal; Bi-directionality

1. Introduction

Ample studies established that parents as well as peers function as role models in shaping adolescents’ alcohol use (e.g., Beal, Ausiello, & Perrinn, 2001; Ennett & Bauman, 1991; Yu, 2003). The relative

⁎ Corresponding author. Tel.: +31 24 3615767; fax: +31 24 3612776. Behavioural Science Institute, Radboud University Nijmegen, P.O. Box 9104, 6500 HE Nijmegen, The Netherlands.
E-mail address: h.vandervorst@bsi.ru.nl (H. Van Der Vorst).

0306-4603/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
importance of siblings, however, has largely been neglected in research on social influence processes in alcohol use of youths. This seems remarkable, because of the often (intimate) daily contacts between siblings, and the long-term nature of a sibling relationship. Just like peers, adolescents may observe the drinking behavior of their siblings and imitate it. In addition, siblings could also explicitly introduce them in a drinking culture.

The few recent studies that investigated the influence of siblings support the assumption that siblings should not be overlooked in the development of adolescents’ alcohol use. It seems that siblings’ alcohol use is related to adolescents’ experimental drinking, regular drinking, intentions to drink in the future, and quantity of alcohol use per drinking occasion (Epstein, Botvin, Baker, & Diaz, 1999). Siblings play also indirectly a role in adolescence alcohol use; siblings’ drinking behavior tends to influence adolescents’ selection of drinking friends, which in turn predicts adolescents’ alcohol use later in adolescence (Conger & Rueter, 1996). Further, the more alcohol younger siblings think that their older brother or sister consume, the more younger siblings actual drink (D’Amico & Fromme, 1997). To our knowledge, only one empirical study examined not only similarities in drinking on the cross-sectional level, but also tested whether siblings affect each other’s drinking behavior over time. Ary, Tildesley, Hops, and Andrews (1993) showed a concurrent relation between siblings’ alcohol use and adolescents’ drinking, but did not find evidence for sibling influences over time.

Other studies on the influence of siblings’ substance use measured a combination of drinking, smoking and drug use. Again siblings’ substance use is related to adolescents’ drinking (Brook, Whiteman, Gordon, & Brook, 1990; Duncan, Duncan, & Hops, 1996; Windle, 2000). In addition, exposure to siblings’ substance use contributes to affiliation with substance using peers, which in turn is related to adolescents’ alcohol involvement. Siblings’ substance use seems also to be related to coping motives – drinking to handle negative emotions – which in turn affects adolescents’ drinking (Windle, 2000).

Although these studies suggest that siblings play a role in adolescents’ alcohol use, several issues remain unresolved. First, the direction of the siblings’ influence is not clear at the moment. In general, older siblings are viewed as an influential resource of guidance, advice, support and knowledge for younger siblings, because of the natural hierarchical structure of a sibling relationship (Jenkins Tucker, Barber, & Eccles, 1997). In regards to alcohol use, older siblings generally start to drink earlier than their younger siblings. Therefore, scholars assumed that older siblings are an important role model for their younger brothers and sisters. However, does this implicate that there is no mutual influence? A sibling relationship significantly transforms from a relative unequal power structure into a more egalitarian relationship as the younger siblings enter adolescence (Buhrmester, 1992). It is conceivable that the influence of younger siblings on her of his older brother or sister increases in adolescence, also concerning alcohol. Nonetheless, previous studies did not answer this question of bi-directionality, since, for instance, they did not make a distinction between older or younger siblings’ alcohol use, or just simply because they lack longitudinal data to rigorously test bi-directional effects.

Second, the quality of the sibling relationship may be a significant factor underlying the effect of siblings’ influence (Yeh & Lempers, 2004). It would be more likely that an adolescent with a positive, satisfactory sibling relationship adopt the drinking patterns of his or her (older) sibling than in the cases that the quality of the relationship is low. In addition, siblings whose relationship is rather positive will also experience more opportunities to observe and learn from each other (Brody, 1998). Nevertheless, the studies confirming this hypothesis are still lacking. Yeh and Lempers (2004) do give an indication. They examined whether a positive sibling relationship decreases loneliness, depression and delinquency, including substance use. The authors found that adolescents who are more positive about their sibling
relationship tend to have better friendships with peers and higher self-esteem one year later, which was associated with less loneliness, depression and substance use. Further, male siblings resemble each other in delinquent behavior if they have a warm and supportive relationship (Slomkowski, Rende, Conger, Simons, & Conger, 2001). Thus, a positive sibling relationship can reflect an interactive context in which siblings reinforce and promote delinquent acts. Summarized, there is some indication that the quality of sibling relationship contributes to similarities and mutual influence in drinking behavior.

A third matter of concern that to our knowledge has hardly been examined, is whether adolescents are more sensitive to the alcohol consumption of siblings who share basic features, like gender, than to siblings who are more distinct. Within an adoption design, McGue, Sharma, and Benson (1996) demonstrated that the association between siblings’ alcohol use was stronger for siblings with same gender than for siblings with opposite gender, as well as for siblings who were more nearer in age compared to siblings who were more distant in age. So, similarity of siblings in basic characteristics, such as gender and age, might affect similarities in drinking as well as mutual influence on drinking over time.

Fourth, the extent to which siblings adopt each other’s drinking behavior may strongly depend on whether they share similar norms on drinking. Norms about drinking affect the uptake and maintenance of alcohol use in young people (e.g. Aas & Klepp, 1992). Alcohol use becomes normative in late adolescence, but children are often conservative on drinking in late childhood and early adolescence (Wiers, Gunning, & Sergeant, 1998). Thus, in adolescence, youth experience a movement towards liberal views on drinking. However, adolescents vary substantially in their norms on drinking, partly due to differences in pubertal timing and maturation. It would be plausible that when siblings have convergent ideas on appropriateness of drinking, they are more likely to adopt each other’s alcohol use. We wonder whether sharing similar norms on drinking affects similarities in drinking and mutual influences over time.

The aim of the current study was to assess the similarities between sibling’s drinking, and the reciprocal influence of siblings’ alcohol use on adolescents’ drinking behavior using data from a longitudinal sample of 416 sibling dyads. In addition, we tested whether the gender constellation of the sibling dyads, the quality of the sibling relationship and similarity in norms about alcohol moderates the assumed mutual impact of siblings’ drinking. It is hypothesized that the effect of a drinking brother or sister on adolescents’ alcohol use would be stronger when siblings (a) have the same gender, (b) have a positive, satisfactory relationship, and (c) share similar norms about alcohol.

2. Method

2.1. Participants and procedure

A total of 428 sibling-pairs participated in the longitudinal study called “Family and Health”, in which socialization processes underlying several health behaviors in adolescence were assessed. A sample of Dutch families with at least two siblings between the age of 13 to 16 years old were asked to take part in the project (for details of the sample selection, see Van Der Vorst, Engels, Meeus, Deković, & Van Leeuwe, 2005). The addresses of these families were derived from registers of 22 municipalities in the Netherlands. A total of 885 of the approached families agreed to participate by returning the included response form. Of these families, a selection was made on the basis of the following criteria: the adolescents and their parents had to be biological related and the parents had to be married or living together. In addition, families with twins or with offspring who had mental or physical disabilities were excluded from the study. Furthermore, we also made a selection to gather an equal division of education, and an equal amount of sibling dyads (i.e.
boy–boy, boy–girl, girl–girl, girl–boy). Finally, 428 Dutch families participated in this longitudinal study at the first wave (T1) and 416 at the second wave a year later (T2).

All four family members separately filled out an extensive questionnaire at home in the presence of a trained interviewer. The questionnaire took about two hours to complete. The respondents were instructed not to discuss the questions or answers with each other. Each family received 30 euros after each of the four family members completed the questionnaire. At the end of the project five cheques of 1000 euros are raffled between the families who participated in all three waves of the study.

The majority of the participating adolescents were of Dutch origin (>95%). The mean age of the older siblings was 15.22 (SD=.60) at the first wave and varied between 14 to 17 years. The mean age of the younger siblings at the first wave was 13.36 (SD=.50) and varied between 13 to 15 years. Gender of both siblings was almost equally divided: 52.8% older boys and 47.7% younger boys at the first wave. The study consisted of 108 boy–boy dyads, 118 boy–girls dyads, 96 girl–boy dyads and 106 girl–girl dyads. At the first wave, approximately one-third of both siblings followed special or low education, one-third followed an intermediate general education, and one-third followed the highest level of secondary school in the Netherlands, namely, preparatory college and university education.

2.2. Measures

2.2.1. Alcohol consumption

Both siblings in each family were asked how often they consumed alcohol in the past four weeks (frequency of drinking). They had to respond on a 6-point scale ranging from (1) “have not been drinking” to (6) “every day” (Engels & Knibbe, 2000). The intensity of drinking was measured by asking the number of alcohol beverages the siblings had been drinking in the previous week during weekdays and in weekends into contexts at home and outside the home (Engels, Knibbe, & Drop, 1999a). The scores on these four questions were summed to get an indication about the total number of glasses of alcohol each sibling consumed in the past week.

2.2.2. Quality of the relationship between siblings

Both the older and younger sibling of each family was asked about their perception of the quality of their sibling relationship using the short version of the Sibling Relationship Questionnaire (SRQ; 33 items; Furman & Buhrmaster, 1985). A higher score suggests a better relationship. Answers were given on a 5-point scale, ranging from (1) “hardly at all” to (5) “extremely much”. The internal reliability was $\alpha=.88$ for both siblings. We used the mean score of both siblings on the SRQ.

2.2.3. Norms about alcohol

We used 7 items of a Dutch translation of The Alcohol Use Norms Scale (Brody, Flor, Hollet-Wright, McCoy, & Donovan, 1999) to measure norms about drinking. The instrument assesses the degree of perceived acceptability of various drinking behaviors for twelve years old adolescents. Because in the current study no twelve year olds participated, we asked siblings about the acceptability of drinking for thirteen years old boys and girls separately. We chose to acquire information about boys and girls separately, in order to capture possible differences in norms between drinking by boys and girls. Each item of the scale began with the phrase “How acceptable is it for a thirteen year old boy (girl) to...” followed by situations such as “have a small glass of wine during a family dinner” or “get drunk when drinking alone”. Response categories were from (1) “totally unacceptable” to (5) “totally acceptable”. A higher score
indicates more liberal norms toward drinking of thirteen year olds. The internal consistencies of this scale were high with Cronbach’s alphas of .83 (the older sibling about boys), .82 (the older sibling about girls), .78 (the younger sibling about boys) and .80 (the younger sibling about girls).

2.3. Strategy of analyses

First, descriptive analyses were conducted on the drinking variables (intensity and frequency) to study possible differences in alcohol consumption between the two siblings. Furthermore, paired t-tests were used to compare the responses of the siblings on the SRQ and the Norms about Alcohol Scale. Thirdly, to answer our research questions, we used structural equation modelling (SEM; Arbuckle, 2003) to test a two-wave model depicted in Fig. 1. Since the intensity of drinking variables were too skewed for SEM, we divided those into four categories: 0 glasses, 1 to 3 glasses a week, 4 to 9 glasses a week, and 10 or more glasses a week. We collapsed the last three answer categories of frequency of drinking variables into one category named “more than 3 days a week”, because just a few siblings (less than 1% on each wave) reported that they drank 5 to 6 days or every day. The fit of the model was assessed by the following global fit indexes: $\chi^2$, CFI (Comparative Fit Index), and RMSEA (Root Mean Square Error of Approximation).

As presented in Fig. 1, each latent variable of alcohol consumption in the model was assessed by two manifest variables, namely frequency and intensity of drinking. The input was a covariance matrix. We first tested the initial model as depicted in Fig. 1. In the model, the error-terms of the intensity of drinking variables were correlated over time for both siblings. Second, we measured whether the strength of the stability paths and the cross-lagged paths (the association between alcohol consumption of the older adolescents at time 1 and alcohol consumption of the younger siblings at time 2 and vice versa) were

![Fig. 1. Initial model with standardised path estimates and factor loadings.](image-url)
similar. Constraining the same associations to be equal is the way to assess this. Next, the $\chi^2$ of this constrained model was calculated. If $\chi^2$ increased significantly, one or more associations should be significantly different between the older and the younger siblings.

Third, with regard to the moderating effects of sibling dyad configurations, quality of the sibling relationship and norms about alcohol, we conducted multi-group analyses (Byrne, 1998; Jöreskog & Sörbom, 1996a,b). Concerning gender, the siblings were divided in two groups: one with same sex pairs (boys–boys dyads and girls–girl dyads) and one with opposite sex pairs (boy–girl dyads and girl–boy dyads). To measure the moderator effect of the quality of the sibling relationship on the associations between older siblings’ drinking and younger siblings’ drinking, we assessed the conceptual model under two conditions: low and high quality of the sibling relationship. The median split method was used to divide the sample in a high quality group and a low quality group (For additional explanation on the procedures to test moderating effects, see Van der Vorst, Engels, Meeus, Deković, & Vermulst, 2006). Siblings scoring above the median belonged to the high quality group and siblings scoring below belonged to the low quality group. Further, because of the high Pearson correlations between norms about alcohol use of boys and norms about alcohol use of girls for both siblings ($r_{\text{older}}=.92$; $r_{\text{younger}}=.90$), we summed them into one norm variable for the older siblings and one for the younger adolescents. Siblings scoring below the median were assigned to the conservative norms group and siblings scoring above the median were assigned to liberal norms group. Next, we divided the older and younger siblings of these two groups in three groups: a group in which both siblings had liberal norms about alcohol, a group in which both siblings had conservative norms about alcohol, and a group in which the older and the younger siblings had different norms about alcohol (conservative–liberal and liberal–conservative).

For each multi-group analysis, we initially computed a baseline $\chi^2$ with no equality constraints between parameters of the two groups (unconstrained model). Next, all the betas were constrained to be equal for both groups. The $\chi^2$ of this constrained model was calculated. If $\chi^2$ increases significantly from step 1 to step 2 one or more betas are significantly different across groups. To observe which betas were different between two (or three) groups, additional difference tests for each individual beta were conducted.

3. Results

3.1. Descriptives

The older siblings consumed almost 4.4 drinks a week at T1 (Table 1). One year later, the alcohol use of the older siblings significantly increased to an average of 7 glasses a week ($t(407)=6.50, p<.001$). The younger siblings drank on average 1.2 glasses a week at T1. At T2, the alcohol use of the younger adolescents raised to 3.1 drinks a week ($t(423)=5.94, p<.001$). Furthermore, the siblings differed significantly in their drinking behavior at both time points ($t_{T1}(417)=9.30, p<.001$ and $t_{T2}(412)=8.24, p<.001$). In addition, the older siblings drank on average more often than the younger ones at the first wave ($t_{T1}(424)=11.85, p<.001$), but also a year later ($t_{T2}(422)=10.36, p<.001$). The increase in the frequency of alcohol consumption of both siblings appeared to be significant ($t_{\text{oldest}}(422)=3.79, p<.001$; $t_{\text{youngest}}(424)=6.70, p<.001$).

Both siblings reported to be moderately satisfied with their relationship ($t(426)=1.37, p=.171$). Siblings differed also not in their norms about alcohol for boys as well as for girls ($t_{\text{boys}}(425)=-1.40, p=.163$ and $t_{\text{girls}}(426)=.04, p=.966$). However, both siblings were more liberal towards drinking of boys than towards drinking of girls ($t_{\text{oldest}}(425)=6.70, p<.001$ and $t_{\text{youngest}}(427)=10.18, p<.001$).
3.2. Siblings’ influence

The fit of the model appeared to be satisfactory ($\chi^2(12)=26.295, p=.010$; CFI=.990; RMSEA=.053). Further, the factor loadings of the latent variables in the conceptual model were high, varying between .73 and .91 (Fig. 1). This implies that the indicators measured the latent variables of alcohol use accurately in the model.

3.2.1. Initial model

Alcohol use of the older siblings and that of the younger siblings were significantly cross-sectionally related. The more alcohol the older siblings consumed, the more the younger ones drank. Further, the results showed a strong stability in drinking for both siblings over time. Moreover, the cross-lagged path between alcohol use of the oldest sibling at T1 and alcohol use of the younger sibling at T2 appeared to be significant. This indicates that the alcohol use of the older sibling predicts younger siblings’ alcohol use one year later. However, drinking of the younger sibling was not a precursor of drinking of the older sibling. In a third step of analysis we tested whether the magnitude of the association between alcohol use of the oldest sibling at time 1 and alcohol use of the younger sibling at time 2 was as strong as the association between the alcohol consumption of younger sibling at time 1 and drinking of the oldest at time 2. The magnitude of the effects of these two cross-paths appeared to be not statistical significantly different ($\Delta \chi^2(1)=.216, p=.669$).

3.3. Differences between groups: multiple group testing

To test whether structural parameter estimates of the cross-lagged associations were significantly different for same gender dyads and opposite gender dyads, for a low quality relationship and a high quality relationship, and for liberal norms, conservative norms and different norms in the conceptual model of the siblings, a multiple group testing procedure had been conducted (Byrne, 1998; Jöreskog &
In general, it appeared that there are no differences in the effects of older siblings’ alcohol consumption on younger siblings’ drinking and vice versa for different and same sex sibling dyads in the initial model ($\Delta \chi^2(6)=6.522, p=.367$). The same result was found for the comparison of the cross-lagged effects in the quality of the relationship model ($\Delta \chi^2(6)=11.294, p=.080$). This indicates that the quality of the relationship does not moderate the effect of the association between the drinking behavior of both siblings. Finally, in the norms about alcohol model also no significant different beta weights of the cross-lagged associations were found when the models of liberal norms, conservative norms and different norms were compared ($\Delta \chi^2(12)=15.592, p=.211$). This implies that norms about alcohol do not moderate the relation between older siblings’ alcohol use and younger siblings’ use.

4. Discussion

Our study was designed to test similarities and bi-directional influences of siblings’ alcohol consumption. Our findings showed moderate concurrent similarities in drinking between siblings. This is
in line with previous studies involving biologically related, non-twin samples of siblings (e.g. Epstein et al., 1999). Our main interest was, however, the extent to which homogeneity in drinking can be ascribed to mutual influence processes. In our longitudinal analyses over a one year, we found older siblings’ drinking affects younger siblings’ drinking over time and not vice versa. However, rigorous model testing showed no significant differences in cross-lagged paths, which suggest that our results should be treated carefully. It also underlines the importance of future research replicating our study on other sibling data. Our findings are in line with the findings of Needle et al. (1986) and Stormshak, Comeau, and Shepard (2004), although these studies seem to have some methodological shortcomings, such as lack of control for previous drinking levels and small sample sizes, which limit the opportunity to draw accurate comparisons.

We will raise a few explanations concerning why we did not find strong bi-directional influences. First, older siblings may exclusively model younger siblings’ drinking habits when they are close in age. In our sample, siblings differed on average 1.8 years in age. Especially in adolescence, even small differences in age can result in completely different drinking patterns. In the Netherlands, only a small proportion of the 13–14-year olds drink regularly whereas a substantial part of the 15–16-year olds drink frequently (Poelen, Scholte, Engels, Boomsma, & Willemsen, 2005). In our study, the younger siblings showed primarily experimenting behavior whereas many of the older siblings revealed a more elaborated drinking pattern. Perhaps if the children were closer in age, or were both older and established a stable drinking pattern, we would come up with mutual influences in drinking. One can find some evidence for this hypothesis in twin studies. For example, alcohol use of dizygotic twins – who share on average 50% of their genes just like non-twin siblings – affect development of frequency of alcohol use and drunkenness over time (Poelen, Scholte, Willemsen, Boomsma, & Engels, 2006). In a same vein, fluctuations in drinking in sibling pairs may affect similarity and mutual influences processes.

On the other hand, mutual influence processes might already have taken place, and has resulted in similarities in drinking at baseline measurement. Since this similarity between siblings can not be explained by selection processes and is relatively stable over time, this might be a plausible interpretation. Furthermore, similarities in drinking might occur through a third variable, such as parental drinking, or socialization practices such as parental enforcement of rules (Van Der Vorst et al., 2005), having the same peers, or peers with similar drinking habits (e.g., Hetherington, Reiss, & Plomin, 1994). In addition, genetic resemblance might also account for similarities in drinking in sibling pairs (Rose, 1998). However, in an adoption study, McGue et al. (1996) stressed that the effect of alcohol use by the sibling on the target child is significant among non-biologically related siblings, suggesting also environmental effects. Finally, a methodological aspect might play a role. The choice for conducting annual assessments in our full family study has advantages and disadvantages. One of the disadvantages of these frequent assessments is that it creates rather high stability coefficients of adolescent drinking over time (auto-correlations), leaving less space for other explanatory variables to predict changes over time. Of course this is a major concern in many prospective studies (see Engels et al., 1999b).

With regard to our analyses on possible moderators, we found, in contrast with our expectations, no moderator effect of sibling dyad configurations. We assumed that siblings sharing the same gender would be more likely to influence each other than siblings with the opposite gender (McGue et al., 1996). Our multi-group model testing, however, did not reveal significant differences between same- and opposite gender groups. With regard to the quality of sibling relationship, we expected a higher correspondence in drinking and stronger modeling effects over time in sibling pairs reporting a relationship characterized by
high levels of support, spending time together, and few conflicts. We also found no support for this assumption. An explanation for this lack of effect might be that the general variance in the scores on sibling relationship quality in this sample was relatively low. Most siblings did not consider the quality of their relationship as really low or high. So using a median split procedure in order to conduct multi-group testing resulted in two groups of which the quality actually did not differ that much. Future research might benefit from including sibling pairs with particular bad or really good relationships.

We also expected that siblings with similar norms on drinking would influence each other more strongly. This was not what we found. However, we did find that adolescents have quite similar norms regarding male and female drinking, that youth liberal norms on teenage drinking are positively linked to their own drinking, and that siblings do not share these norms to a large extent. The latter may also reflect variations in drinking between the siblings. A reason for the lack of a moderating effect might be that it depends on whether siblings actually know that they have similar norms on drinking. Thus, when they regularly communicate on issues related to alcohol, they may have more insights into each other’s drinking habits, and will be more likely to adopt drinking patterns of their sibling. On the other hand, it is also plausible that similarities in drinking norms between siblings have a common ground. Brody et al. (1999) revealed that for children with a supportive and communicative relationship with their parents, parental permissiveness towards alcohol use affected their own liberal norms on drinking. When parents have a permissive attitudes this might affect both siblings’ alcohol use, and thus affect similarities in drinking, but not mutual influence processes per se.

A methodological concern may reflect our lack of moderator effects. In particular in multi-group analyses in structural models, one encounters problems with statistical power, even if one considers the fact that we have a relatively large sample of sibling pairs as compared to other projects. It would be preferable to conduct these types of analyses in a larger sample. Perhaps pooling data from various international projects on biologically-related non-twin sibling pairs may be a good way to proceed.

We like to raise to two additional issues of concern. First, it is very useful to examine similarities in drinking trajectories in siblings. Relatively new analytic strategies, such as latent growth modeling and mixed growth modeling, provide the opportunity to test whether siblings have identical or different developmental trajectories of alcohol use in their teenage years (Duncan et al., 1996). Of course this type of analyses put constraints on data collection, because it is required to collect data on at least three measurement waves and preferable a cohort-sequential design. A second limitation is that we relied heavily on adolescent self-reports on alcohol use. In future studies it is preferable to include collateral reports, for instance by friends or siblings. It is relevant to note that we do not think that reports by parents should be used to estimate adolescent drinking as we have shown that parents are rather inaccurate in estimating adolescent drinking, especially when the children are in their early adolescent years (Engels, Van Der Vorst, Dekovic, & Meeus, in press).

Despite these limitations, we would like to stress that the vast majority of studies on sibling effects on drinking (a) are using collateral reports on siblings drinking, (b) have relatively small samples, (c) use cross-sectional data, or longitudinal data but do not examine bi-directionality in sibling influences as rigorously as we did, or (d) do not test possible effects of moderating variables. The strength of our design and analytic strategy provided us with confidence in the robustness of our findings. Thus, the main conclusion that can be derived from this paper is that adolescent siblings are rather similar in their alcohol use, and that especially older siblings affect younger siblings’ alcohol consumption.
Acknowledgment

Rutger Engels was supported by a fellowship of the Dutch Organization of Scientific Research during the preparation of this manuscript.

Appendix A. Sample correlations between model variables

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
<th>10.</th>
<th>11.</th>
<th>12.</th>
<th>13.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>.30</td>
<td>.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>.26</td>
<td>.31</td>
<td>.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>.42</td>
<td>.72</td>
<td>.21</td>
<td>.28</td>
<td>.45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>.23</td>
<td>.25</td>
<td>.71</td>
<td>.43</td>
<td>.28</td>
<td>.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>.15</td>
<td>.25</td>
<td>.42</td>
<td>.65</td>
<td>.22</td>
<td>.30</td>
<td>.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>.01</td>
<td>.08</td>
<td>.01</td>
<td>.05</td>
<td>.04</td>
<td>.06</td>
<td>.06</td>
<td>.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>.02</td>
<td>.05</td>
<td>.01</td>
<td>.03</td>
<td>.01</td>
<td>.02</td>
<td>.05</td>
<td>.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>.22</td>
<td>.15</td>
<td>.05</td>
<td>.03</td>
<td>.27</td>
<td>.23</td>
<td>.12</td>
<td>.02</td>
<td>.14</td>
<td>.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>.21</td>
<td>.13</td>
<td>.00</td>
<td>.04</td>
<td>.25</td>
<td>.21</td>
<td>.10</td>
<td>.01</td>
<td>.11</td>
<td>.05</td>
<td>.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>.20</td>
<td>.15</td>
<td>.31</td>
<td>.25</td>
<td>.20</td>
<td>.19</td>
<td>.32</td>
<td>.20</td>
<td>.05</td>
<td>.06</td>
<td>.25</td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>.18</td>
<td>.12</td>
<td>.32</td>
<td>.25</td>
<td>.18</td>
<td>.17</td>
<td>.30</td>
<td>.19</td>
<td>.04</td>
<td>.05</td>
<td>.21</td>
<td>.21</td>
<td>.90</td>
</tr>
</tbody>
</table>

Note. O = Older adolescents, Y = Younger adolescents; Correlations below .10 are not significant, with the exception of the correlation between Intensity Y2 en Quality OY (p<.05).

References


