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Chapter 5
Predictive associations of parental solicitation, parental control, and child disclosure with adolescent alcohol and cannabis use

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Submitted for publication
ABSTRACT
We examined the prospective, bidirectional associations of parental solicitation, parental control, and child disclosure with alcohol and cannabis use across adolescence. In total, 497 adolescents (43.1% female) and their parents were followed annually from age 13 to 18. Cross-lagged panel models showed that child disclosure predicted lower levels of substance use (adolescent- and parent-reports) and that parental solicitation predicted higher levels of substance use (adolescent-reports). Parental control did not predict substance use. Alcohol use predicted lower levels of parental control, while cannabis use predicted higher levels of parental solicitation (adolescent-reports). Our results suggest that child disclosure is an important factor in predicting lower levels of alcohol and cannabis use and that perceived parenting practices are influenced by substance use.

Keywords: Child disclosure; Parental solicitation; Parental control; Parental monitoring; Alcohol use; Cannabis use
INTRODUCTION

In adolescence, experimentation with substance use may be regarded as relatively normative behavior (Baumrind, 1991; Shedler & Block, 1990). However, research has related substance use during this period to poor educational attainment, later substance use disorders, and affected brain functioning causing attention and memory problems (Van Ours & Williams, 2009, 2011; Verweij, Huizink, Agrawal, Martin, & Lynskey, 2013; White & Swartzwelder, 2005). Therefore, prevention of adolescent substance use and its associated negative outcomes is demanded, and parenting practices involving knowledge and monitoring of the adolescent child constitute candidate factors for enhancement of this aim (Barnes, Hoffman, Welte, Farrell, & Dintcheff, 2006; Coley, Votruba-Drzal, & Schindler, 2008; Mares, Lichtwarck-Aschoff, Burk, Van Der Vorst, & Engels, 2012).

Indeed, studies show that parental knowledge about their children’s whereabouts and parental monitoring behaviors have an important protective effect on substance use (e.g., Borawski, Ievers-Landis, Lovegreen, & Trapl, 2003; Lac & Crano, 2009; Ledoux, Miller, Choquet, & Plant, 2002). From these studies, it was concluded that parents should actively track and control their children’s whereabouts, in order to prevent (the escalation of) substance use. However, most studies did not separate child disclosure, where children voluntarily provide information to their parents, from active parental monitoring behaviors to increase knowledge about the whereabouts of their child(ren). Stattin and Kerr (2000) defined these monitoring behaviors as parental solicitation, where parents actively ask their children about their whereabouts, and parental control, where parents use rules and restrictions to control, and consequently gain knowledge about, their children’s whereabouts. It was intriguing that once child disclosure was included in the analyses in the prediction of delinquency, results showed that child disclosure predicts more engagement in delinquent behavior, whereas parental solicitation and control were unrelated to delinquency development (Keijsers, Branje, VanderValk, & Meeus, 2010; Kerr, Stattin, & Burk, 2010). Furthermore, child disclosure has been found to contribute more to parental knowledge on their children’s whereabouts than parent’s own monitoring behaviors (Keijsers et al., 2010; Kerr & Stattin, 2000; Kerr et al., 2010; Stattin & Kerr, 2000). To identify the specific actions that parents can take to prevent (the escalation of) substance use, it is
important to disentangle the impact of these different sources of parental knowledge on adolescent substance use.

There is also a lack of longitudinal studies that can give more insight in the direction of the associations of parental solicitation, parental control, and child disclosure with adolescent substance use. On the one hand, high levels of parental solicitation, parental control, and child disclosure may lead to lower levels of adolescent substance use. A possible explanation for these parent-effects is that parents who are well informed about their children’s activities, friendships, and whereabouts may be more able to prevent their children from using substances (Buhrmester & Prager, 1995; Marshall, Tilton-Weaver, & Bosdet, 2005). On the other hand, child-effects may be present. As a child’s behavior can affect parenting in general (Bell, 1968), adolescent substance use may influence parenting behavior as well. Also, children who use substances may have more to hide from their parents.

Findings from the few available longitudinal studies are contradictory, but suggest the presence of both parent- and child-effects. With regard to parent-effects, Fletcher, Steinberg, and Williams-Wheeler (2004) demonstrated that parental control predicted lower levels of substance use, while parental solicitation did not. Kiesner, Poulin, and Dishion (2010) confirm the protective effect of parental control on subsequent substance use, however, they did not examine parental solicitation. Although findings by Stavrinides, Georgiou, and Demetriou (2010) confirm the absence of a prospective relation between solicitation and substance use, their study does not confirm the prospective link between parental control and later substance use. The study by Stavrinides et al. is the only longitudinal study focusing on all three sources of parental knowledge, however, they cover a time span of only three months. Findings from this study further indicate that mother-reported child disclosure negatively predicted hazardous alcohol use and dependence. With regard to child-effects, findings by Stavrinides et al. (2010) indicate that adolescent alcohol dependence symptoms predicted lower levels of parental solicitation, parental control, and child disclosure, while hazardous alcohol use did not influence parental knowledge.
In addition to the scarcity of longitudinal studies on all three sources of parental knowledge, several other gaps in the literature remain. First, it is unclear if the findings by Stavrinides et al. (2010) pertaining to hazardous alcohol use in 15 year olds can be generalized to a broader age span and to use of other substances. With regard to the latter, previous researchers have stressed the importance of distinguishing between behaviors with different levels of deviancy, such as licit and illicit substance use, because they may be differentially related to parenting (Choquet, Hassler, Morin, Falissard, & Chau, 2008; Osgood, Johnston, O'Malley, & Bachman, 1988). For instance, cannabis use has been found to be more strongly related to a general measure of parental monitoring than alcohol use, which was explained by the researchers by differences in the legal status of the two substances (Choquet et al., 2008). A second gap in the literature is that available studies focus on perceptions of parenting or disclosure of either the adolescent or the parent, but not both. This gives an incomplete picture as mother-reports (such as used by Stavrinides et al., 2010) could be unreflective of the parenting that the child perceives (Latendresse et al., 2009; Tein, Roosa, & Michaels, 1994), whereas adolescent reports may not adequately capture the parenting behavior of the parents. A third gap in the literature is the absence of studies focusing on gender differences in the associations between the sources of parental knowledge and substance use. Girls have been found to disclose more to their parents and to be exposed to higher levels of parental solicitation and control than boys (Finkenauer, Engels, & Meeus, 2002; Kerr & Stattin, 2000), while boys have been found to be more likely to use alcohol than girls (e.g., Johnston, O'Malley, Bachman, & Schulenberg, 2010). It remains unclear whether such differences in levels of disclosure, solicitation, control and actual use between boys and girls translate into differences in the prospective relations between the sources of parental knowledge and substance between boys and girls.

Using data from a multi-informant, longitudinal population study covering the adolescent period from age 13 to 18 years, the aims of the present study were 1) to examine the bidirectional, prospective relations between parental solicitation, parental control, and child disclosure, with weekly alcohol use and past year cannabis use, and 2) to identify which sources of parental knowledge are most important in relation to adolescent alcohol and cannabis use. As including all three
sources of parental knowledge might be important, our hypotheses follow the results of Stavrinides et al. (2010). Based on this study and other studies on externalizing behavior problems (e.g., Keijsers et al., 2010; Kerr et al., 2010), we hypothesized only child disclosure to predict lower levels of alcohol and cannabis use. Parental solicitation and control were expected to be unrelated to later use of these substances. Furthermore, following the results of alcohol dependence symptoms on the sources of parental knowledge by Stavrinides et al. (2010), we expected child-effects of alcohol and cannabis use to predict lower levels of child disclosure, parental solicitation, and parental control. The current study presents data from the Netherlands where at the time of data-collection, alcohol use was legal for adolescents aged 16 years and older, while cannabis use was (and still is) illegal for minors. Because cannabis use is regarded as more deviant than alcohol use, parental knowledge may be more important in relation to cannabis use when compared to alcohol use. To provide a complete picture on the prospective, bidirectional relations between the sources of parental knowledge and substance use, we studied these relations using adolescent- and parent-reports of parental knowledge, and tested whether the relations are similar for boys and girls.

METHOD

Sample and respondents
Participants from the study Research on Adolescent Development and Relationships younger cohort (RADAR-y) were included in the present study. RADAR is a multi-informant, longitudinal population-based cohort study aimed at understanding the interplay between adolescent relationships with family and friends and various developmental outcomes. The medical ethical committee of Utrecht University approved of RADAR. For an extensive description of the RADAR study see Keijsers et al. (2012). In short, adolescents \((n = 497)\) were followed annually from age 13 (wave 1, mean age 13.03, SD = 0.46; 43.1% female) to age 18 (wave 6, mean age 18.03, SD = 0.46). Mothers’ mean age at baseline was 44.41 (SD = 4.45), and fathers’ mean age was 46.74 (SD = 5.10). In the total sample, 10.7% of the families had a low SES (characterized by unemployment or holding an elementary job, see measurements), which is lower than in the general Dutch population (29.5%; Statistics Netherlands, 2012).
The original aim of the RADAR study was to focus on the development of delinquency in adolescence, and therefore, adolescents at risk for this behavior were oversampled (i.e., 200 at-risk and 300 normal-risk adolescents). Via schools in or around the cities of Amsterdam, Rotterdam, The Hague, Utrecht and Almere, children were screened at age 12 for the presence of externalizing problems with the Teacher’s Report Form (T. Achenbach, 1991b). Based on this information and a second screening using parent and child information, two-parent families were recruited to participate in the study. Parents provided written informed consent for each family member. Trained research assistants visited the families at home to conduct annual assessments. The adolescent, all family members and the adolescent’s best friend completed a battery of questionnaires. For the present study we used adolescents, mothers’, and father’s self-reported questionnaires from wave 1 to wave 6.

In total, 14.3% of the 497 participants dropped out from the first to the sixth wave. Responders and non-responders did not differ with respect to alcohol and cannabis use at most measurement waves. However, at wave 2 and 3, responders reported lower levels of alcohol use than non-responders ($\chi^2 (2) = 13.03$ and 11.71 respectively, both $p < .01$), and at wave 5, responders were less likely to have used cannabis when compared to non-responders ($\chi^2 (1) = 4.80$, $p = .03$). To estimate whether the pattern of missing values was at random, we conducted Little’s (1988) Missing Completely at Random (MCAR) test. This very stringent test was significant, $\chi^2 (1336) = 1792.96$, $p < .01$, however, the $\chi^2/df$ ratio of 1.34 indicated a good fit between data with and without imputation (Ullman, 2001), indicating that participants with partially missing data could be included in the analyses. Missing data of predictors and covariates were handled in Mplus using the Full Information Maximum Likelihood procedure (FIML; Muthén & Muthén, 1998-2012).

**Measures**

**Alcohol use.** At each wave, participants were first asked whether they had ever used alcohol. Those reporting to have ever used alcohol subsequently answered the question “On how many days in the past four weeks did you drink alcohol?”, with answer categories (0) did not drink alcohol, (1) 1-3 days in the past four weeks, (2) 1-2 days a week, (3) 3-4 days a week, (4) 5-6 days a week, and (5) every day.
Because of low frequencies in the last three categories, alcohol use was categorized into never use (0), less than weekly use (1), and weekly use (2).

**Cannabis use.** Past year cannabis use was annually assessed with the question “How many times did you use cannabis in the past 12 months?”. Response options ranged from 0 to 40 times or more. Answers were dichotomized into (0) not used cannabis in the past year and (1) used cannabis in the past year.

**Parental solicitation, parental control, child disclosure.** The Dutch translation (Keijsers, Frijns, Branje, & Meeus, 2009) of a questionnaire developed by Stattin and Kerr (2000) was used to measure parental solicitation, parental control, and child disclosure at wave 1-6. Adolescent-reported parental solicitation, i.e. what parents ask, was measured with three questions for each parent (e.g., How often does your mother/father initiate a conversation about things that happened during a normal day at school?). Adolescent-reported parental control, i.e. rules parents set, was measured with five questions for each parent (e.g., Do you need to have your mother’s/father’s permission to stay out late on a weekday evening?). Adolescent-reported child disclosure, i.e. what children voluntarily disclose, was measured with six questions for each parent (e.g., Do you talk with your mother/father about how you are doing in the different subjects in school?). Response options ranged from (1) never to (5) always. We used mean scores to create the scales. As correlations between adolescent-reports for mothers and fathers were medium to high (ranging from 0.46 to 0.71 for parental solicitation, from 0.65 to 0.70 for parental control, and from 0.64 to 0.71 for child disclosure), mean item scores of mother and father were averaged. When the adolescent had answered questions on only one parent, that parent score was used. Mothers and fathers answered similar questions, with minor changes in wording (e.g., How often do you initiate a conversation with your child about things that happened during a normal day at school?). Mean scores of mother’s and father’s reports were averaged. When only one parent had completed the questionnaire, that parent’s mean score was included in the analyses. Reliabilities for each scale were sufficient to good: Cronbach’s α (calculated separately for adolescent- and parent-report) ranged from 0.62 to 0.82 for parental solicitation, from 0.82 to 0.91 for parental control, and from 0.71 to 0.85 for child disclosure.
Covariates

**Socioeconomic Status (SES).** SES, measured at the first wave, was divided into two levels: (0) *medium or high SES*, where at least one parent held a job that was classified as medium or high level (e.g., police officer or school teacher), and (1) *low SES*, where both parents were unemployed or held an elementary job (e.g., construction worker, janitor or truck driver; Statistics-Netherlands, 1993).

**Parental alcohol use.** In waves 1-6, parents answered on a 6-point scale how many days they had drunk alcohol in the past four weeks. Per wave, level of alcohol consumption of mother and father were averaged, and when only one parent had filled in this question, that parent’s level of consumption was used.

**Externalizing behavior problems.** At all waves, adolescent externalizing behavior problems were assessed with the externalizing behavior subscales (delinquent and aggressive behavior) of the Child Behavior Checklist (CBCL; Achenbach, 1991a) and the Youth Self-Report (YSR; Achenbach, 1991c), including 33 and 30 items respectively (e.g., Get(s) in many fights). Parents (CBCL) and adolescents (YSR) rated these items as being (0) *not true*, (1) *somewhat or sometimes true*, or (2) *very or often true* in the past 6 months. Items regarding substance use were deleted from the subscale. Mothers and fathers filled in the CBCL separately. Sum scores of mother and father were averaged.

**Statistical Analysis**

Statistical analyses were performed using the Statistical Package of Social Sciences version 20.0 (SPSS Inc., Chicago, IL) and Mplus 6.1 (Muthén & Muthén, 1998-2012). For descriptive purposes, means and prevalence rates for boys and girls, and correlations between variables at wave 1, were calculated.

To answer our research questions, separate cross-lagged models were specified for adolescent and parent-reports and for alcohol and cannabis use. For the categorical outcome alcohol use, we used the weighted least square with adjusted means (WLSM) estimator, a robust weighted least squares estimator, specifically developed for ordered categorical dependent variables (Muthén & Muthén, 1998-2012). For the dichotomous outcome cannabis use, we used the Maximum Likelihood (ML) estimator. For both alcohol and cannabis use, we first fit a baseline model with all stability paths and within-wave associations. Next, we added cross-
Chapter 5

lagged parent-effects, i.e. prospective paths between the sources of parental knowledge and substance use, and child-effects, i.e. prospective paths between substance use and the sources of parental knowledge (Finkel, 1995). Then, to assess whether the cross-lagged paths were similar for boys and girls, we specified a multiple group model and compared model fit of a model in which the cross-lagged paths were freely estimated across gender to the model fit of a model in which the cross-lagged paths were set equal for boys and girls. For alcohol use, differences in model fit were tested using the Satorra-Bentler $\chi^2$ difference test (Satorra & Bentler, 2001). For cannabis use, differences in model fit were tested using Akaike Information Criteria (AIC; Wagenmakers & Farrell, 2004). All regression paths were controlled for SES, and for the time-varying covariates parental alcohol use and adolescent externalizing behavior.

RESULTS
Descriptive statistics
Table 5.1 presents descriptive statistics of the study variables, separate for boys and girls, and Table 5.2 shows the correlations between alcohol and cannabis use, the three sources of parental knowledge and the covariates at wave 1. For both boys and girls, especially weekly alcohol use became more likely over the waves. At the first and the last three waves, boys reported more alcohol use than girls. Additionally, boys reported more cannabis use than girls in the last three waves. In most waves and according to both adolescent- and parent-report, parental solicitation and child disclosure were higher for girls than for boys. Parental control was, according to adolescent-reports, higher for girls than for boys in the last three waves, and according to parent-reports, higher for girls only in the last wave.

Alcohol use
Results from the models using adolescent-reports indicated that the baseline model including stability paths and within-wave associations fit significantly worse than the model including cross-lagged child- and parent-effects ($\Delta \chi^2 (N = 497, 60) = 110.49, p < .05$). The multiple group models to test gender differences showed no significant differences in model fit ($\Delta \chi^2 (\Delta df = 60) = 22.42, p = .14$), indicating that the associations between the sources of parental knowledge and alcohol use do not
differ between sexes. Constraining the significant cross-lagged relations to be equal over time did not worsen model fit ($\Delta \chi^2(N = 497, 12) = 24.19, p = .52$), indicating that relations were time-invariant.

In the final model (depicted in Figure 5.1a), both parent- and child-effects were found. Across waves, higher levels of child disclosure predicted decreases in alcohol use one year later ($B = -.19, SE = 0.06, \beta = -.10, p < .01$). In addition, higher levels of parental solicitation predicted increases in levels of alcohol use ($B = .15, SE = 0.05, \beta = .10, p < .01$). Alcohol use predicted lower levels of parental control one year later ($B = -.08, SE = 0.02, \beta = -.10, p < .01$).

Results from the models using parent-reports indicated that the baseline model fit significantly worse than the model including cross-lagged relations between child- and parent-effects and alcohol use ($\Delta \chi^2(N = 497, 60) = 88.24, p < .01$). The cross-lagged paths were found to be equal for boys and girls, as indicated by the non-significant differences in model fit ($\Delta \chi^2(\Delta df = 60) = 284.74, p = .31$) between the multiple group models. Constraining the significant cross-lagged relations to be equal over time did not worsen model fit ($\Delta \chi^2(N = 497, 8) = 26.50, p = .37$), indicating that relations were time-invariant. Results of the final model (depicted in Figure 5.1b) showed that higher levels of child disclosure predicted decreases in level of alcohol use one year later ($B = -.20, SE = 0.06, \beta = -.08, p < .01$).
Table 5.1

Overview of study variables (percentages, means [M], and standard deviations [SD]), for boys and girls separately.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wave 1 Boys</th>
<th>Wave 2 Boys</th>
<th>Wave 3 Boys</th>
<th>Wave 4 Boys</th>
<th>Wave 5 Boys</th>
<th>Wave 6 Boys</th>
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</thead>
<tbody>
<tr>
<td>Alcohol use (A) (%)</td>
<td></td>
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<tr>
<td>Never</td>
<td>30.8</td>
<td>46.2</td>
<td>27.9</td>
<td>15.1</td>
<td>4.2</td>
<td>3.3</td>
</tr>
<tr>
<td>Less than weekly</td>
<td>67.4</td>
<td>51.4</td>
<td>67.5</td>
<td>68.0</td>
<td>72.9</td>
<td>38.0</td>
</tr>
<tr>
<td>Weekly</td>
<td>1.8</td>
<td>2.4</td>
<td>4.5</td>
<td>3.5</td>
<td>12.0</td>
<td>57.8</td>
</tr>
<tr>
<td>Cannabis use (A) (%)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Past year</td>
<td>2.5</td>
<td>1.4</td>
<td>6.1</td>
<td>5.0</td>
<td>18.6</td>
<td>27.8</td>
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<tr>
<td>Child disclosure (A) (M; SD)</td>
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<td></td>
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<tr>
<td>Past year</td>
<td>3.78</td>
<td>3.88</td>
<td>3.60</td>
<td>3.83</td>
<td>3.49</td>
<td>3.70</td>
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<tr>
<td>Child disclosure (P) (M; SD)</td>
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<tr>
<td>Past year</td>
<td>4.10</td>
<td>4.27</td>
<td>3.99</td>
<td>4.21</td>
<td>3.92</td>
<td>4.11</td>
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<tr>
<td>Parental Solicitation (A) (M; SD)</td>
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<tr>
<td>Past year</td>
<td>3.01</td>
<td>3.11</td>
<td>2.84</td>
<td>3.01</td>
<td>2.68</td>
<td>2.91</td>
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<tr>
<td>Parental Solicitation (P) (M; SD)</td>
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<tr>
<td>Past year</td>
<td>3.85</td>
<td>3.77</td>
<td>3.80</td>
<td>3.73</td>
<td>3.70</td>
<td>3.60</td>
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<tr>
<td>Parental Control (A) (M; SD)</td>
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<tr>
<td>Past year</td>
<td>3.58</td>
<td>3.52</td>
<td>3.32</td>
<td>3.48</td>
<td>3.15</td>
<td>3.31</td>
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<tr>
<td>Parental Control (P) (M; SD)</td>
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</tr>
<tr>
<td>Past year</td>
<td>4.42</td>
<td>4.50</td>
<td>4.30</td>
<td>4.34</td>
<td>4.01</td>
<td>4.12</td>
</tr>
</tbody>
</table>
| Note: Informants are indicated in parentheses: A = adolescent; P = parent. a Based on χ²; b Based on t-tests; difference is significant at p < .05
Table 5.2

*Correlations between study variables and covariates at wave 1.*

<table>
<thead>
<tr>
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<th>1</th>
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<th>9</th>
<th>10</th>
<th>11</th>
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<tbody>
<tr>
<td>1. Alcohol use (A)</td>
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<td>2. Cannabis use (A)</td>
<td></td>
<td>0.52**</td>
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<tr>
<td>3. Child disclosure (A)</td>
<td></td>
<td>-0.19**</td>
<td>-0.57**</td>
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<tr>
<td>4. Child disclosure (P)</td>
<td></td>
<td>-0.05</td>
<td>-0.31**</td>
<td>0.36**</td>
<td></td>
<td></td>
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<tr>
<td>5. Parental Solicitation (A)</td>
<td></td>
<td>-0.08*</td>
<td>-0.33</td>
<td>0.51**</td>
<td>0.16**</td>
<td></td>
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<tr>
<td>6. Parental Solicitation (P)</td>
<td></td>
<td>0.03</td>
<td>-0.29**</td>
<td>0.21**</td>
<td>0.31**</td>
<td>0.20**</td>
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<tr>
<td>7. Parental Control (A)</td>
<td></td>
<td>-0.06</td>
<td>-0.19</td>
<td>0.18**</td>
<td>0.02</td>
<td>0.25**</td>
<td>0.09</td>
<td></td>
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<tr>
<td>8. Parental Control (P)</td>
<td></td>
<td>-0.03</td>
<td>-0.15</td>
<td>0.00</td>
<td>0.15**</td>
<td>0.04</td>
<td>0.09*</td>
<td>0.33**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. SES (0 = medium/high; 1 = low)</td>
<td></td>
<td>0.17*</td>
<td>0.3*†</td>
<td>-0.1</td>
<td>-0.08</td>
<td>-0.15*</td>
<td>-0.24**</td>
<td>-0.04</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Parental alcohol use</td>
<td></td>
<td>-0.00</td>
<td>0.01</td>
<td>-0.09*</td>
<td>0.07*</td>
<td>0.08*</td>
<td>0.09*</td>
<td>0.02</td>
<td>0.04</td>
<td>-0.26**</td>
<td>-</td>
</tr>
<tr>
<td>11. Externalizing problems (A)</td>
<td></td>
<td>0.28**</td>
<td>0.64**</td>
<td>-0.37**</td>
<td>-0.18**</td>
<td>-0.12**</td>
<td>-0.07</td>
<td>-0.05</td>
<td>-0.00</td>
<td>0.09</td>
<td>-0.06</td>
</tr>
<tr>
<td>12. Externalizing problems (P)</td>
<td></td>
<td>0.13**</td>
<td>0.17*</td>
<td>-0.28**</td>
<td>-0.26**</td>
<td>-0.06</td>
<td>-0.07</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.23**</td>
<td>-0.12*</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01, † Tetrachoric correlation.

Note: Informants are indicated in parentheses: A = adolescent report; P = parent report
Cannabis use

Due to the low prevalence rates of cannabis use at the early waves, we could not test for differences between boys and girls. Instead, models were adjusted for gender. For adolescent-reports, the model including cross-lagged child- and parent-effects (AIC = 25605.01) fit better than the baseline model including all cross-sectional and stability relations over time (AIC = 25632.88). A test for time-invariance of these associations (AIC = 25591.82) indicated that the model was time-invariant.

Results from the final model – depicted in Figure 5.2a – demonstrated both parent- and child- effects. More specifically, findings indicated that higher levels of child disclosure was predicted decreases in the likelihood of cannabis use (Odds Ratio [OR] = 0.49, 95% Confidence Interval [CI] = 0.38 – 0.63, \( p < .01 \)), and that higher levels of parental solicitation were related to increases in the likelihood of cannabis (OR = 1.53, 95%CI = 1.23 – 1.91, \( p < .01 \)). Furthermore, cannabis use predicted increases in parental solicitation over time (B = .08, SE = 0.04, \( p < .05 \)).

Results from the models using parent-reports showed that the baseline model including cross-sectional and stability relations over time (AIC = 20344.83) fit better than the model including cross-lagged child- and parent-effects (AIC = 20353.19). Thus, no parent- or child effects were demonstrated. In the final model, depicted in Figure 2b, stability paths and within-wave associations are presented.
Figure 5.1a
Cross-lagged model of the relation of adolescent-reported parental solicitation, parental control, and child disclosure with alcohol use
* $p < .05$, ** $p < .01$; Note: coefficients represent unstandardized relations. Relations between alcohol use and the sources of parental knowledge are constrained over time; model is corrected for SES, parental alcohol use, and adolescent-reported externalizing behavior.
Figure 5.1b
Cross-lagged model of the relation of parent-reported parental solicitation, parental control, and child disclosure with alcohol use
* $p < .05$, ** $p < .01$; Note: coefficients represent unstandardized relations. Relations between alcohol use and the sources of parental knowledge are constrained over time. Model is corrected for SES, parental alcohol use, and parent-reported externalizing behavior.
Figure 5.2a
Cross-lagged model of the relation of adolescent-reported parental solicitation, parental control, and child disclosure with cannabis use

* $p < .05$, ** $p < .01$; Note: coefficients represent unstandardized relations. Relations between cannabis use and the sources of parental knowledge are constrained over time. Model is corrected for SES, parental alcohol use, and adolescent-reported externalizing behavior.
Figure 5.2b
Cross-lagged model of the relation of parent-reported parental solicitation, parental control, and child disclosure with cannabis use
* $p < .05$, ** $p < .01$; Note: coefficients represent unstandardized relations. Model is corrected for SES, parental alcohol use, and parent-reported externalizing behavior.
DISCUSSION
The present study examined the prospective, bidirectional relations of parental solicitation, parental control, and child disclosure with alcohol and cannabis use across the adolescent years. Consistent with previous research (Stavrinides et al., 2010), our findings demonstrated the presence of both parent- and child effects, indicating that the sources of parental knowledge predict alcohol and cannabis use one year later, and that adolescent substance use affects sources of parental knowledge over time. These findings were observed when controlling for SES, parental alcohol use, and externalizing behavior problems, indicating that results are specific for adolescent substance use and not dependent on broader measures of adversity including level of SES, alcohol use by parents, or externalizing behavior.

With regard to parent-effects, our findings based on adolescent-reports indicated that child disclosure predicts lower levels of substance use and parental solicitation predicts higher levels of substance use. Only the prospective negative link between child disclosure and alcohol use, but not cannabis use, was confirmed by analyses based on parent-reports of the sources of parental knowledge.

Our results on child disclosure are in line with findings from a previous longitudinal study on alcohol use indicating that child disclosure serves as a protective factor for substance use (Stavrinides et al., 2010). Furthermore, these results are in line with previous studies on various problem behaviors like delinquency and rule-breaking behavior (e.g., Keijsers et al., 2012; 2010; Kerr & Stattin, 2000; Kerr et al., 2010; Stattin & Kerr, 2000). One explanation for the prospective link between child disclosure and a lower level of substance use may be that child disclosure enables parents to prevent problem behavior through guidance and advice (Buhrmester & Prager, 1995; Marshall et al., 2005). When child disclosure is low, parents are generally less aware of their child’s activities, friendships, and whereabouts, which may limit their ability to guide their child’s behavior. Alternatively, personality characteristics may underlie the association between child disclosure and substance use. Individuals with higher levels of agreeableness are less likely to use substances (Walton & Roberts, 2004) and more likely to be communicative and open, which is associated with more spontaneous disclosure (Sherman, 2010). Furthermore, when adolescents are less likely to show deviant or disruptive behavior, which is associated with a heightened risk of
substance use (Elkins, McGue, & Iacono, 2007), disclosure may be higher because they feel they have less to hide from their parents.

The prospective link between adolescent-reported parental solicitation and higher levels of substance use has not been demonstrated in previous research (Kiesner et al., 2010; Stavrinides et al., 2010). Possibly, this association reflects that parents react to precursors of substance use, such as affiliation with delinquent and substance using peers (Lynskey & Hall, 2000), in order to prevent substance use involvement. Alternatively, adolescents could interpret parental solicitation as intrusive and privacy-invasive (Hawk, Hale, Raaijmakers, & Meeus, 2008), which may negatively affect the parent-child relationship, increasing the risk of deviant behavior, including substance use (Branstetter & Furman, 2013).

According to both adolescent- and parent-reports, parental control did not predict alcohol or cannabis use. Although this is consistent with findings from Stavrinides et al. (2010), Fletcher et al. (2004) and Kiesner et al. (2010) found a protective effect of parental control on substance use. As child disclosure has been found to be the most important source of parental knowledge (Kerr & Stattin, 2000; Stattin & Kerr, 2000), the difference in findings may be explained by the absence of a measure of child disclosure in the studies of Kiesner et al. (2010) and Fletcher et al. (2004), which was included in both our study and the study by Stavrinides et al. (2010). This would indicate that including all three sources of parental knowledge is important the actions of the child (i.e., disclosure) from the actions of the parents (i.e., solicitation and control).

Although analyses based on parent-reports of parental knowledge did not yield any child-effects, findings based on adolescent-reports indicated that alcohol use predicted lower levels of parental control, while cannabis use predicted higher levels of parental solicitation. This confirms the theory that parenting can be influenced by the behavior of the child (Bell, 1968).

Interestingly, child-effects diverged for alcohol and cannabis use. Under the assumption that parents are aware of their child’s substance use, our findings may indicate that parents react differently to various types of substance use. The difference in legal status between alcohol and cannabis use of minors may affect parental attitudes towards its use by their children, making it more likely that parents react with increased solicitation to cannabis use rather than to alcohol use.
Lower levels of parental control following adolescent alcohol use may indicate that parents of alcohol-using adolescents are more inclined to use an authoritative parenting style, characterized by negotiation, than an authoritarian parenting style, characterized by rules and control, when adolescents already consume alcohol. Another possibility is that parents decrease parental control because they are more permissive about alcohol use when adolescents are older (Van Der Vorst et al., 2005).

Alternatively, unconventional behavior associated with cannabis use, such as affiliation with delinquent and substance using peers (Lynskey & Hall, 2000), might make it more likely that parents keep a closer eye on their children, manifested in increased solicitation, to prevent the development of disruptive behavior. A relation with a general unconventional lifestyle is less apparent for alcohol use (Koch & Ribar, 2001). With regard to parental solicitation, our findings suggest a reciprocal relation in which parents solicit more when they observe precursors of substance use, which is followed by actual substance use of their child, which may subsequently lead to increased solicitation in response to differences observed by parents in their child’s behavior or friends. However, it may also be that adolescents who engage in cannabis use perceive solicitation by their parents as more intrusive, causing them to report higher levels of parental solicitation.

Our results showed that all prospective associations between the sources of parental knowledge and alcohol use were similar for boys and girls. Thus, although we established differences between boys and girls with regard to frequency of alcohol use, and levels of child disclosure, parental solicitation, and control, the bidirectional links were similar. Unfortunately, due to power issues, we could not determine gender differences in the associations of the sources of parental knowledge with cannabis use.

In the current study, findings diverged for adolescent- and parent-reports of the sources of parental knowledge. According to parent-reports, only child disclosure was related to future alcohol use. Parent-reports reflect the behaviors parents think they engage in, whereas adolescent-reports reflect parental behaviors that adolescents perceive. The child’s perception of their parents’ parenting behaviors seems to be more important in relation to substance use than the
perception of the parents. As more studies have found (small) differences in parent- and child-reported sources of parental knowledge (e.g., Keijsers et al., 2009; Kerr & Stattin, 2000; Stattin & Kerr, 2000), more insight into these differences is necessary, and thus future research should include both parents’ and adolescents’ perspectives.

Besides the strengths of the present study, including the multi-informant, longitudinal design with a low drop-out rate across the waves, it also has some limitations. First, due to low levels of substance use at the earlier waves, we categorized alcohol and cannabis use in three and two categories, respectively. This resulted in heterogeneity within the categories weekly alcohol use and past year cannabis use. For example, in the fifth wave (age 17), 5.8% of the adolescents reported to have used alcohol more than 3 times a week in the past month, possibly indicating more deviancy than those reporting alcohol use 1-2 times a week in the past month. In addition, because of low levels of cannabis use, we were not able to examine gender differences in the associations with the sources of parental knowledge. Next, we relied on adolescent self-report of substance use, which is subject to recall bias and can be influenced by social desirability. However, previous research showed that self-reported measures of substance use are reliable, also in adolescent populations (Del Boca & Darkes, 2003; Fendrich, Johnson, Wislar, Hubbell, & Spiehler, 2004). A final limitation is the sample of adolescents from predominantly intact families, which may limit the generalizability to adolescents from broken families.

To conclude, the present study provides important information on the bidirectional associations of parental solicitation, parental control, and child disclosure with alcohol and cannabis use, indicating that child disclosure predicts lower levels of substance use and that parental solicitation predicts higher levels of substance use. Results also indicate that substance use affects the adolescents perception of parent’s monitoring activities, with alcohol use predicting lower levels of parental control, and cannabis use predicting higher levels of parental solicitation. More longitudinal studies using a large sample size are needed to further explore the bidirectional associations between these sources of parental knowledge and frequency of substance use by adolescent boys and girls, as well as the mechanisms underlying these associations. For preventing the (escalation of)
substance use, this study and previous studies indicate that child disclosure is an important factor. Adolescents spend increasingly more time with peers when they grow older, increasing the need for parents to gain knowledge on their children’s whereabouts. Child disclosure has been found to be the most important source of parental knowledge (Stattin & Kerr, 2000; Kerr & Stattin, 2000), and, as suggested by Keijsers et al. (2009), could be an essential facet of a positive parent-child relationship, a valuable factor in preventing substance use (Branstetter & Furman, 2013). Findings by Tilton-Weaver et al. (2010) suggests that positive reactions by parents, defined as attempted understanding and warmth, increase child disclosure, while negative reactions such as emotional outbursts and coldness reduce disclosure. For the development of effective prevention strategies, it is necessary for future research to focus on the changeability of child disclosure and its subsequent influence on maladaptive behaviors such as substance use.