EMPIRICAL RESEARCH

# Other-Sex Friendships as a Mediator Between Parental Monitoring and Substance Use in Girls and Boys

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**Abstract** Previous research examining relationships between parental monitoring, friendship networks, and substance use did not take into account the gender of both the adolescent and the friends. The goal of this study was to test a mediation model in which having other-sex friends during mid-adolescence mediates the relationships between parental monitoring in early adolescence and substance use during late adolescence. We hypothesized that mediation would be observed for girls but not for boys. A sample of 333 adolescents (60 % girls) was surveyed yearly from ages 12 to 19. The findings provided support for an indirect relationship (mediation via other-sex friendships) between early adolescent parental monitoring and late adolescent alcohol use among girls only. That is, for girls, higher levels of parental monitoring lead to fewer other-sex friendships, which then lead to lower levels of subsequent alcohol use. For drug use, the findings provided support for a direct relationship between early adolescent parental monitoring and late adolescent drug use for both boys and girls. Thus, parents seem to have a protective effect on their daughters' later use of alcohol by limiting inclusion of male friends in their networks.

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## Introduction

Tobacco use, alcohol abuse, and frequent use of marijuana are examples of damaging substance use behaviors that typically peak during late adolescence and young adulthood (Johnston et al. 2008). Until recently, males were seen as using substances at higher rates than females. However, recent studies suggest that females have closed this gap. By late adolescence, there are no gender differences in rates of cigarette, alcohol, and marijuana use (Andrews 2005). Despite these similar rates, the risk factors for later substance use problems might differ for males and females (Schinke et al. 2008). Poor parenting practices and peer influence are among the most important risk factors that can contribute to problematic substance use in late adolescence (Engels et al. 2007; Mayes and Suchman 2006). Gender differences in these two types of personal relationships (Maccoby 1990; Rose and Rudolph 2006) suggest that they might operate differently in the developmental course of substance using behaviors among males and females. The current study focuses on one feature of peer relations for which gender differences have been documented: the formation of other-sex friendships during adolescence (Poulin and Pedersen 2007). Specifically, we test the hypothesis that, for females (but not for males), this variable mediates the relationships between parenting (i.e., parental knowledge) in early adolescence and substance use in late adolescence.

### Parental Monitoring Knowledge, Friendship Networks, and Adolescent Substance Use

In early adolescence, youth spend an increasing amount of time with their peers away from direct parental supervision (Larson et al. 1996). During this period, parents must

monitor their child's whereabouts (i.e., keeping track of where the child is, who she/he is spending time with, and what she/he is doing when out of the house) in order to prevent exposure to risky peer contexts. *Monitoring knowledge* is seen as the result of this monitoring process (Hayes et al. 2003; Laird et al. 2003). A high level of monitoring knowledge indicates that parents are aware of their child's whereabouts, activities, and peer relationships.

Relationships between monitoring knowledge, adolescent substance use, and peer networks have been documented in several studies. An empirical connection between low monitoring knowledge and adolescent substance use has been found in cross-sectional (Dishion et al. 1995) and longitudinal (Yabiku et al. 2010) studies, indicating that monitoring knowledge in early adolescence predicts lower rates of use in later adolescence. A lack of monitoring knowledge is also associated with greater involvement with peers who engage in delinquency and substance use (Brown et al. 1993; Dishion et al. 1991). Finally, research has established that having substance-using peers can lead to both initiation and escalation in tobacco, alcohol, and marijuana use (Dishion and Owen 2002; Poulin et al. 2011; Wills and Cleary 1999).

Researchers also have attempted to integrate these three constructs (i.e., monitoring knowledge, substance use, and friendships) into a broader framework that includes mediation. Specifically, the relationship between monitoring knowledge and substance use could be mediated by the child's involvement with substance-using friends. In other words, the less aware parents are of their child's activities and friends, the higher the chances that the child will become involved with friends who engage in deviant behavior. Exposure to these friends might then contribute to the child's own substance use through imitation or reinforcement mechanisms. In general, this mediation model has received empirical support in studies focusing both on adolescent substance use (Dishion et al. 1995) and delinquency (Barrera et al. 2001; Chung and Steinberg 2006). The goal of the present study is to re-examine the relationships between monitoring knowledge, friendship networks, and substance use by taking into account the gender of both the adolescent and his/her friends.

Considering Adolescent Gender

Examining the role of gender in the development of substance use should go beyond simple tests of gender differences in risk factors and consider risk factors that could be gender specific (Andrews 2005; Schinke et al. 2008). A rare illustration of this point comes from a recent study showing that relational aggression predicted later substance use for females whereas physical aggression predicted later substance use for males (Skara et al. 2008). The idea that

the risk factors and developmental processes leading to substance use may be different for males and females also is echoed by research in the field of antisocial behavior, in which distinct developmental trajectories have been identified for each gender (Fontaine et al. 2009; Silverthorn and Frick 1999).

In this study, we suggest that mediation models of monitoring knowledge and adolescent substance use through friendship networks should take into account gender differences in these networks. During adolescence, an important transition takes place in the gender composition of boys' and girls' friendship networks. These networks become increasingly gender-mixed (Connolly et al. 2000; Feiring 1999) and girls experience this transition earlier and at a faster pace than boys during mid-adolescence (Poulin and Pedersen 2007). Moreover, cumulating empirical evidence indicates that, for girls, friendships with other-sex peers are associated with many forms of problem behavior during adolescence. For instance, a longitudinal study conducted with young adolescents showed that having other-sex friends predicted an increase in antisocial behavior for girls (Arndorfer and Stormshak 2008). Other studies found that, for girls, having other-sex friends was associated with delinquency (Solomon 2006), serious violence (Haynie et al. 2007), early onset of sexual behavior (Cavanagh 2004) and substance use (Dick et al. 2007; Gaugnan 2006; Malow-Iroff 2006; Mrug et al. 2011). A study conducted with young adults revealed that women's substance use was mostly influenced by men's substance use (Andrews et al. 2002). For adolescent boys, having other-sex friends does not seem to be associated with substance use or problem behavior (Arndorfer and Stormshak 2008; Haynie et al. 2007).

Parenting, Adolescent Gender, and Gender of Friends

Research examining direct associations between parenting (e.g., supervision, management of peer relations; see Mounts 2008) and adolescent friendships suggest that parents monitor the activities of their daughters more closely than those of their sons. Indeed, levels of monitoring knowledge are greater for female than for male children (Crouter et al. 2005; Friedlander et al. 2007; Pettit et al. 2001; Smetana and Daddis 2002; Svensson 2003; Waizenhofer et al. 2004). Regarding friends, researchers usually focus on their behavioral orientation (e.g., whether they engage in delinquency or substance use), but have never specifically considered their gender. However, there are reasons to believe that, in early adolescence and later on, parents may pay attention to the gender of their child's friends, and this may be especially true for daughters. During childhood, parents see their child forming friendships almost exclusively with same-sex peers (Kovacs et al.

1996). In early adolescence, parents are aware that an interest in other-sex peers eventually will emerge (Richards et al. 1998) and will translate gradually into the inclusion of other-sex friends in their child's network. Parents will most likely pay attention to these emerging friendships because they indicate changes in their child's social world, because these relationships may become significant for their child if romantic feelings develop, and because their child may eventually engage in sexual activity with these peers.

Even though this transition applies to both boys and girls, parents probably will pay greater attention to their daughter's other-sex friendships. Parents might be more reluctant to see their young daughter form friendships with boys. Given that boys initiate problem behavior (e.g., delinquency, substance use) earlier than girls, parents might see them as a source of negative influence. More-over, the consequences of early sexual activity are more salient for girls (i.e., pregnancy) than for boys. In support of this, recent research has shown that parents monitor their daughters' romantic activities more closely than their sons' (Kan et al. 2008; Madsen 2008).

According to developmental models (Connolly et al. 2004; Dunphy 1963), first encounters between boys and girls often take place in mixed-sex group settings where parents are usually not present. Close parental monitoring (as reflected by monitoring knowledge) might thus result in fewer friendship formations with other-sex peers, espe-cially for girls. In turn, as discussed earlier, a reduced number of other-sex friendships throughout adolescence might prevent girls from engaging in later substance using behaviors.

## Current Study

The main goal of this study was to test a mediation model in which having other-sex friends during mid-adolescence mediates the relationships between monitoring knowledge in early adolescence and substance use during late ado-lescence. We hypothesized that the mediating effect of other-sex friends would be observed for girls only. This hypothesis is based on the idea that, in early adolescence, parents may start to pay attention to the gender of their child's friends, and this may be especially true for daughters, and also is based on studies showing that for adolescent girls, other-sex friendships are associated with problem behavior (e.g., Arndorfer and Stormshak 2008; Mrug et al. 2011). In this study, two aspects of other-sex friendships will be examined as mediator: the proportion of other-sex friends in the network and the proportion of other-sex friends in the network who use of substance.

The model was tested using an 8-year longitudinal design. A normative sample of adolescent males and females was surveyed yearly from ages 12 to 19. Moni-toring knowledge was measured during early adolescence (ages 12–14) because a decrease in knowledge usually accompanies the transition to adolescence (Laird et al. 2003) and because knowledge is particularly critical during this developmental period (Guilamo-Ramos et al. 2010). The gender composition of the youth's friendship networks was assessed across mid-adolescence (ages 15–17) since other-sex friendships have been found to be increasingly prevalent during this developmental period (Connolly et al. 2000; Feiring 1999). Substance use was assessed during late adolescence (ages 18–19) since substance use typically peaks during this developmental period (Johnston et al. 2008). Finally, early adolescent substance use and antiso-cial behaviors were controlled for because research has identified early initiation of substance use as the strongest predictor of subsequent use and abuse (Gruber et al. 1996; Hawkins et al. 1997).

## Method

### Participants

This longitudinal study began with 390 Grade 6 students (58 % girls; mean age = 12.38 years; SD = 0.42) enrolled in eight elementary schools in a large French-speaking school district in Canada. Parents provided written consent for their child's participation. Approximately 75 % of the available student population participated in this study. The sample was 90 % European Canadian, 3 % Haitian Cana-dian, 3 % Middle Eastern Canadian, 2 % Asian Canadian, and 2 % Latino Canadian. Seventy-two percent of the participants lived with both biological parents. The sample was largely middle class, with a mean family income of between $45,000 and $55,000 (CAN). Mothers and fathers had completed an average of 13.10 (SD = 2.68) and 13.20 (SD = 3.20) years of schooling, respectively. Of the ori-ginal sample, 320 participants (81 %) were still involved in the study 8 years later.

In this study, only youth with data at ages 18 or 19 were retained in the sample (n = 333). Of these youths, all had data at age 12, 312 had data at age 13 (94 %), 267 had data at age 14 (80 %), 277 had data at age 15 (83 %), 278 had data at age 16 (83 %), 290 had data at age 17 (87 %), 308 had data at age 18 (92 %), and 318 had data at age 19 (95 %). The subsample used in the analyses (n = 333) was compared to the excluded sample (n = 57) with respect to gender, proportion of other-sex friendships at age 12, antisocial behaviors at age 12, alcohol and cigarette use at age 12, and mothers' and fathers' education levels. The

only significant difference was that girls were more likely to be overrepresented in the analytic sample than in the excluded sample, $\chi^2$ (1, $N = 390$) = 4.17, $p = .04$ (200 girls and 133 boys in the analytic sample vs. 26 girls and 31 boys in the excluded sample).

Procedures

This longitudinal sample initially was recruited in Grade 6 following three steps. First, the project was presented to the school officials and Grade 6 teachers who agreed to be part of the study. Second, the project was described to the Grade 6 students in class by graduate research assistants. Third, the students who were interested in the project were asked to bring home to their parents a flyer and a consent form. Only the students who brought back the consent form signed by their parents were part of the study. Parents also provided written consent for their child's participation at each year of the study until the youths were 18. At ages 18 and 19, written consent was provided by the participants. In order to track the youths over the course of the longitudinal study, we used the contact information (e.g., phone, address, email) provided by the parents and later on by the participants. From age 15 onward, youths received a $20 gift certificate (to a movie theater, music store, or sports store) for their participation at each time point. The Internal Review Board for Ethics in Research with Humans, at the first author's University, approved this study.

In elementary school (Grade 6; age 12), questionnaires were completed in the classroom. Graduate research assistants were in charge of administering the questionnaire. In high school (Grades 7–11; ages 13–17), similar procedures were followed. Again, questionnaires were completed in the school setting under the supervision of research assistants. However, participants were spread throughout more than 30 schools and, in some cases, assessments had to be conducted individually at the participant's home (approximately 10 cases per year) or questionnaires had to be sent by mail (approximately 5 cases per year). After high school (ages 18 and 19), assessments were conducted individually. In most cases, the interviews took place at the participant's home. In some cases, questionnaires were sent by mail.

Measures

*Parental Knowledge in Early Adolescence (Ages 12–14)*

Participants were asked to complete Kerr and Stattin's (2000) parental knowledge questionnaire at ages 12, 13, and 14. Using a 5-point Likert scale, children answered nine questions about their parents' knowledge of their whereabouts, activities, and peer relationships (age 12:

$M = 4.03$, SD = 0.80; age 13: $M = 3.88$, SD = 0.75; age 14: $M = 3.85$, SD = 0.74). Internal consistency was high at each assessment (alpha = .87, .84, and .85). Values were averaged across time to achieve more stable estimates of parental knowledge. Year-to-year stability coefficients were .46 and .62.

*Other-Sex Friendships in Mid-Adolescence (Ages 15–17)*

Participants were asked to report on their friendship networks at ages 15, 16, and 17. In a first step, they were asked to write down the complete name (first and last names) of up to 10 friends. No constraints were imposed regarding the context in which these friendships took place. Friends could be from school, the neighborhood, an after-school activity, or another context. The number of friends was limited to 10 in order to be consistent with procedures used by other adolescent friendship-network researchers (e.g., Degirmencioglu et al. 1998; Kuttler et al. 1999; Ryan 2001). It should be noted that romantic partners were not included in our conceptualization of the friendship network. Researchers have emphasized the importance of distinguishing between platonic and romantic friendships in research on other-sex relationships (Furman and Shaffer 1999; Sippola 1999).

In a second step, participants were asked to answer a series of questions for each of the friends named. The items included in the present study were the friend's gender, the friend's use of alcohol (yes/no) and drugs (yes/no), and the nature of the relationship. For this last question, alternatives were provided and the participant was asked to choose those which best described each relationship. For the present study, the friends who were designated by the participants as cousins, brothers/sisters, or boyfriends/girlfriends were removed from the network and were not considered in the current analyses. These friendships represented fewer than 5 % of the total nominations. The proportion of the friendship network comprised of other-sex friends was computed (age 15: $M = .25$, SD = 0.20; age 16: $M = .27$, SD = 0.20; age 17: $M = .29$, SD = 0.21). Values were averaged across time to achieve more stable estimates of the proportion of other-sex friends in the participant's network. Year-to-year stability coefficients were .57 and .55. Two other variables were also computed each year: the proportion of other-sex friends using alcohol and the proportion of other-sex friends using drugs. For each of these variables, values were averaged across time (alcohol use: age 15: $M = .13$, SD = 0.20; age 16: $M = .17$, SD = 0.21; age 17: $M = .22$, SD = 0.24; drug use: age 15: $M = .12$, SD = 0.20; age 16: $M = .13$, SD = 0.21; age 17: $M = .12$, SD = 0.21; year-to-year stability coefficients were .51 and .49 and .51 and .51 for alcohol and drug use respectively).

## Alcohol Use at Ages 18 and 19

Eight indicators of alcohol use taken from Dishion and Owen (2002) were used to create this composite score (four indicators at age 18 and 19, respectively). These variables were chosen because they were indicative of severe and problematic use. First, the adolescents were asked to recall the number of times they had consumed beer, wine, or spirits during the previous 3 months (3 items). Response options ranged from 0 (never) to 7 (2–3 times a day or more). A mean score was computed for the three items (age 18: $M = 1.63$, SD = 1.21; age 19: $M = 1.90$, SD = 1.23). Second, they were asked to report the number of drinks they usually consumed on each occasion, using a 7-point scale (less than one to six and more), separately for beer, wine, and spirits (3 items). For those who reported no use over the last 3 months, a score of 0 was attributed. A mean was calculated across the three items (age 18: $M = 2.14$, SD = 1.38; age 19: $M = 2.17$, SD = 1.28). Third, the adolescents were asked the number of times they had ever consumed five drinks in a row, using a 4-point scale (never to more than twice; 1 item; age 18: $M = 1.41$, SD = 1.28; age 19: $M = 1.82$, SD = 1.66). Fourth, they were asked to report on a series of questions assessing alcohol intoxication (no = 0/yes = 1; 7 items): (a) "Have you ever tried to stop using alcoholic beverages and found you couldn't?" (b) "Have you ever been drunk at school or at work?" (c) "Have you ever been drunk in a public place?" (d) "Have you ever had problems at school or at work because of alcohol?" (e) "Have you ever passed out from drinking?" (f) "Have you ever thrown up from drinking?" (g) "Have you ever lost or broken things because you were drinking?" An average score was computed for these seven items (age 18: $M = 0.19$, SD = 0.18; age 19: $M = 0.22$, SD = 0.20). The composite score for alcohol use at ages 18 and 19 was formed by standardizing and averaging these eight indicators ($\alpha = .88$).

## Drug Use at Ages 18 and 19

Twelve indicators of drug use taken from Dishion and Owen (2002) were used to create this composite score (six indicators at age 18 and 19, respectively). These variables were chosen because they were indicative of severe and problematic use. First, the adolescents were asked to recall the number of times they had consumed marijuana during the previous 3 months. Response options ranged from 0 (never) to 7 (2–3 times a day or more) (1 item; age 18: $M = 1.17$, SD = 2.01; age 19: $M = 1.36$, SD = 2.24). Second, they were asked to recall the average number of joints smoked on each occasion. Response options ranged from 1 (1–2 puffs) to 6 (more than 2 joints) (1 item; age 18: $M = 0.82$, SD = 1.44; age 19: $M = 0.86$, SD = 1.47). For

those who reported no use over the last 3 months, a score of 0 was attributed. Third, the adolescents were asked to report on problems related to marijuana use (4 items; no = 0/yes = 1): (a) "When you use marijuana, do you get high?," (b) "Have you ever tried to stop using marijuana and found you couldn't?," (c) "Have you ever gone to school or work while high on marijuana?," (d) Have you ever had any problems related to school or work because of marijuana?." An average score was computed for these four items (4 items; age 18: $M = 0.13$, SD = 0.22; age 19: $M = 0.13$, SD = 0.23). Fourth, the adolescents were asked to report on the number of hard drugs taken in the previous 3 months (1 item; sum of six drugs such as cocaine or crack, heroin, speed, LSD, and mescaline; age 18: $M = 0.11$, SD = 0.40; age 19: $M = 0.11$, SD = 0.40). Fifth, they were asked to report on the average frequency of hard drug use during the previous 3 months (1 item; age 18: $M = 0.18$, SD = 0.76; age 19: $M = 0.22$, SD = 0.85). Sixth, they were asked to report on problems related to hard drug use using the same items described earlier for marijuana use (4 items; age 18: $M = 0.06$, SD = 0.16; age 19: $M = 0.06$, SD = 0.17). A composite score for drug use at ages 18 and 19 was formed by standardizing and averaging these 12 indicators ($\alpha = .87$).

## Control Variables

### Substance Use at Age 12

Use of alcohol was measured using a 14-point self-report item asking how many drinks of alcohol the participant had had in the previous month. Responses were given on a 14-point scale ranging from "0 drinks" to "41 drinks or more." Given that this variable was not normally distributed, it was coded "0" for no use and "1" for use (81 and 19 %, respectively). Use of tobacco was measured using a self-report item asking how many cigarettes the participant had smoked in the previous month. Responses were given on a 24-point scale starting with number of cigarettes (range of "0 cigarettes" to "9 cigarettes") and increasing to number of packs of cigarettes (range of "half a pack" to "31 packs or more"). Given that this variable was not normally distributed, it was coded "0" for no use and "1" for use (87 and 13 %, respectively).

### Antisocial Behaviors at Age 12

Three indicators of antisocial behavior were used to create this composite score: (a) self-report, (b) teacher ratings, and (c) peer nominations. For self-reported antisocial behaviors, a modified version of a previously developed youth antisocial behavior scale was used (Metzler et al. 1998). The adolescents were asked to report on 16 items

rated on a 6-point Likert scale ranging from 1 (*never*) to 6 (*more than 10 times*). Examples of items included lying to parents, vandalizing public property, stealing, and fighting at school. A mean was calculated across the 16 items ($M = 1.43$, $SD = 0.53$; $\alpha = .83$). The teacher rating scale of antisocial behaviors was comprised of 10 items including Dodge and Coie's (1987) 6-item proactive/reactive aggression scale as well as four other indicators of antisocial behavior. Response options ranged from 1 (*never*) to 5 (*almost always*). A mean was calculated across the 10 items ($M = 1.62$, $SD = 0.75$; $\alpha = .95$). Peer nominations of antisocial behavior were collected using five items from the Revised Class Play scale (Masten et al. 1985). Examples of items included "Gets into a lot of fights," and "Hits and pushes others around." The names of students whose parents provided written permission for them to participate as respondents in the study were listed on an alphabetical roster given to all participants. With the help of this roster, participants were asked to select up to three peers who best fit each behavioral descriptor. The participants' scores for each item were obtained by summing up the nominations received from their classmates. These scores were then transformed into $z$ scores within each classroom, and a total score was obtained by computing the mean of the 5 items ($M = -0.03$, $SD = 0.89$; $\alpha = .90$). The composite score for *antisocial behaviors* was formed by standardizing and averaging the self-report, teacher ratings, and peer nominations (correlations from .38 to .51; $\alpha = .70$).

Analytical Strategy

A series of structural equation models (SEM) was conducted to test the hypothesized mediation pathway that links early adolescent parenting to late adolescent substance use behavior through middle adolescent other-sex friendships. Models were tested separately for alcohol and drug use. All analyses were conducted using Mplus 5.0 (Muthén and Muthén 2008). In this statistical package, missing data (1.4 %) were handled with a full information maximum likelihood procedure.

The tested model appears in Fig. 1. As can be seen from this figure, a substance use outcome in late adolescence was predicted by parental knowledge in early adolescence (total effect: path $c$). In addition, the proportion of other-sex friendships in middle adolescence was predicted by early parental knowledge (path $a$), which predicted a substance use outcome in late adolescence (path $b$). Early parental knowledge and late adolescent substance use outcomes were also regressed on age 12 control variables (antisocial behaviors and a corresponding age 12 substance use variable: alcohol use for late adolescent alcohol use and cigarette use for late adolescent drug use). In each model, the paths between early antisocial behaviors and adolescent substance use and middle adolescent other-sex friendships were not specified based on our hypothesis that other-sex friendships pose a risky context for substance use rather than that substance use leads to involvement in other-sex friendships. Estimating these paths allowed us to test the hypothesized mediation pathway (indirect effect: *ab*), i.e., that early parenting characteristics predict involvement in other-sex friendships, which then predict substance use problems, particularly among girls. It should be noted that the direct effect (path $c'$) can be expressed as the difference between the total effect (path $c$) and the indirect effect (*ab*), that is, $c' = c - ab$. We used the Sobel test with bootstrapping ($n = 5,000$) to assess the significance of the indirect effect (*ab*), or to test mediation (Preacher and Hayes 2004). The confidence intervals of the Sobel tests are also reported. As a first step, we tested whether the mediated models provided a significant improvement in fit over the unmediated models using nested models and Chi-square difference tests. In all cases, the mediated models provided a significant improvement in fit over the unmediated models.

To verify for gender differences, each model was first tested with all paths unconstrained across the two groups.
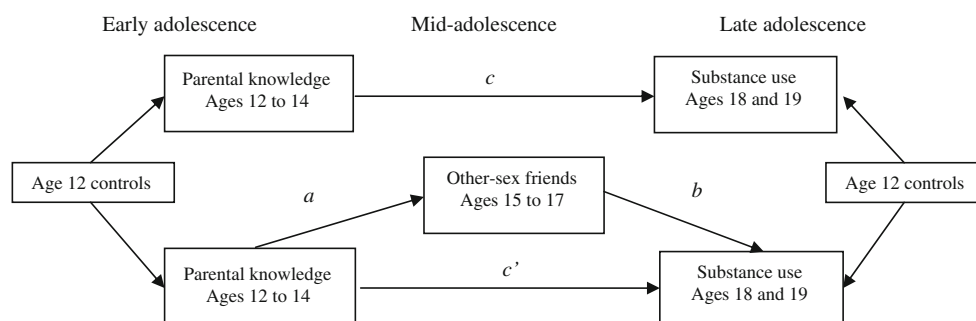


Fig. 1 Mediation of the association between early adolescent parental knowledge and late adolescent substance use by middle adolescent other-sex friendships

Second, each model was tested where all paths were constrained to be equal across gender. The resulting Chi-square difference was then examined to see whether each model significantly differed by gender or not. To test for gender differences on the mediation pathway more specifically (*ab*), the Wald test of parameter constraints was used in both models. In addition, in the case of a significant mediating effect of the proportion of other-sex friendships in middle adolescence on the link between early adolescent parenting and late adolescent substance use behavior, the proportions of other-sex friends using alcohol or drugs were also examined as potential mediators, using the same steps as described above.

## Results

### Descriptive Analyses

Means, standard deviations, and correlations between parental knowledge, the proportion of other-sex friends and substance (alcohol and drug) use are presented, separately for boys and girls, in Table 1. As shown in this table, parental knowledge in early adolescence was negatively associated with the proportion of other-sex friendships in mid-adolescence (as well as the proportion of other-sex friends using alcohol and drugs) and with both outcomes in late adolescence among girls. Among boys, the same was true except for the correlation between parental knowledge and the proportion of other-sex friendships (as well as the proportion of other-sex friends using alcohol and drugs). It can also be observed that alcohol and drug use in late adolescence were correlated at .53 and .48 among boys and girls, respectively. For covariates, antisocial behaviors were negatively and significantly associated with parental

knowledge and positively and significantly linked to outcomes among both boys and girls.

Gender differences in the variables of interest were also examined. Results revealed that boys showed higher levels of antisocial behaviors at age 12 and higher levels of drug use at ages 18 and 19 than girls ($t(331) = -6.84$, $p < .001$; $t(331) = -2.31$, $p = .02$). However, girls had a higher proportion of other-sex friends in their friendship networks in mid-adolescence than boys ($t(311) = 3.88$, $p < .001$). This was also true for the proportion of other-sex friends using alcohol and drugs (alcohol: $t(311) = 4.81$, $p < .001$; drugs: $t(311) = 5.17$, $p < .001$). There were no gender differences concerning parental knowledge in early adolescence. In studies using the same scale with older adolescents, levels of parental knowledge were higher for girls (see Kerr and Stattin 2000). There were also no gender differences regarding alcohol use in late adolescence and regarding alcohol and drug use at age 12.

### Mediation Models

#### Alcohol Use at Ages 18 and 19

First, overall gender differences were tested on the alcohol use model. The constrained and freed gender pathways were compared and indicated a significant overall gender difference ($\Delta\chi^2(7) = 21.94$, $p < .01$). Consequently, the final model was tested with freely estimated paths across gender.

Results for the models testing the mediation pathway linking early adolescent parenting to late adolescent alcohol use through middle adolescent other-sex friendships appear, separately for boys and girls, in Table 2. The two-group model was a good fit to the data ($\chi^2(4) = 2.53$, $p = .64$ [girls = 1.60; boys = .93], CFI/TLI = 1.00/1.01,

**Table 1** Descriptive statistics for parental knowledge, proportion of other-sex friendships, and alcohol and drug use

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Antisocial behaviors (age 12) | – | −.35* | −.01 | .14 | .06 | .27* | .19* |
| Parental knowledge (ages 12–14) | −.51* | – | −.08 | −.15 | −.02 | −.22* | −.37* |
| % of other-sex friends (ages 15–17) | .14* | −.17* | – | .70* | .50* | −.03 | −.01 |
| % of other-sex friends using alcohol (ages 15–17) | .25* | −.25* | .77* | – | .67* | .22* | .11 |
| % of other-sex friends using drugs (ages 15–17) | .33* | −.32* | .64* | .80* | – | .24* | .22* |
| Alcohol use (ages 18–19) | .29* | −.30* | .35* | .46* | .50* | – | .53* |
| Drug use (ages 18–19) | .35* | −.35* | .23* | .34* | .46* | .48* | – |
| *M* girls | −.242 | 3.96 | .297 | .211 | .159 | −.051 | −.050 |
| SD girls | .574 | .631 | .175 | .186 | .187 | .696 | .623 |
| *M* boys | .378 | 3.86 | .222 | .115 | .061 | .104 | .127 |
| SD boys | .934 | .662 | .155 | .145 | .118 | .796 | .725 |

% = proportion. Correlations for girls are below the diagonal ($n = 200$); correlations for boys are above the diagonal ($n = 133$)

\* $p < .05$

**Table 2** Results of the mediation models for alcohol use in late adolescence

| | $b$ | SE | $z$ | $p$ | $\beta$ | CI for $b$ |
|---|---|---|---|---|---|---|
| *Girls (n = 200)* | | | | | | |
| Covariates | | | | | | |
| Antisocial behaviors, age 12 → parental knowledge | −.51 | .09 | −5.82 | .001 | −.46 | [−.68, −.34] |
| Alcohol use, age 12 → parental knowledge | −.22 | .11 | −1.99 | .046 | −.13 | [−.43, −.00] |
| Antisocial behaviors age 12 → alcohol use ages 18 and 19 | .18 | .11 | 1.64 | .101 | .15 | [−.03, .39] |
| Alcohol use, age 12 → alcohol use, ages 18 and 19 | .03 | .15 | 0.18 | .857 | .02 | [−.27, .32] |
| Model | | | | | | |
| Parental knowledge → other-sex friends ($a$) | -.05 | .02 | −2.32 | .020 | −.18 | [−.09, −.01] |
| Other-sex friends → alcohol use, ages 18 and 19 ($b$) | 1.20 | .27 | 4.40 | .001 | .31 | [.67, 1.74] |
| Parental knowledge → alcohol use, ages 18 and 19 ($c'$) | −.19 | .10 | −1.91 | .056 | −.18 | [−.39, .01] |
| Indirect effect ($ab$) | −.06 | .03 | −2.05 | .041 | −.05 | [.12, −.00] |
| *Boys (n = 133)* | | | | | | |
| Covariates | | | | | | |
| Antisocial behaviors, age 12 → parental knowledge | −.21 | .06 | −3.77 | .001 | −.30 | [−.33, −.10] |
| Alcohol use, age 12 → parental knowledge | −.24 | .16 | −1.52 | .129 | −.14 | [−.54, .07] |
| Antisocial behaviors age 12 → alcohol use ages 18 and 19 | .15 | .08 | 1.83 | .068 | .17 | [−.01, .30] |
| Alcohol use, age 12 → alcohol use, ages 18 and 19 | .37 | .16 | 2.31 | .021 | .18 | [.06, .67] |
| Model | | | | | | |
| Parental knowledge → other-sex friends ($a$) | −.02 | .02 | −0.82 | .413 | −.08 | [−.06, .02] |
| Other-sex friends → alcohol use, ages 18 and 19 ($b$) | −.26 | .46 | −0.58 | .562 | −.06 | [−1.16, .63] |
| Parental knowledge → alcohol use, ages 18 and 19 ($c'$) | −.15 | .12 | −1.24 | .214 | −.12 | [−.38, .08] |
| Indirect effect ($ab$) | .01 | .02 | 0.33 | .745 | .00 | [−.02, .03] |

CI = 95 % confidence intervals

RMSEA = .00, 90 % CIs [.00, .09]). Variables in the model explained 20 and 10 % of the variance of alcohol use at ages 18 and 19 for girls and boys respectively. As can be seen from the upper part of Table 2, the indirect effect ($ab$) is significant for girls but not for boys. To further test gender differences on the indirect pathway, the Wald test of parameter constraints was used and revealed a significant difference between boys and girls, $\chi^2(1, N = 333) = 4.96, p = .02$. Consequently, model for girls found support for an indirect relationship (via other-sex friendships) between early parental knowledge and late alcohol use ($ab$). Parental knowledge from ages 12 to 14 negatively predicted involvement in other-sex friendships from ages 15 to 17 ($a$), which positively predicted alcohol use at ages 18 and 19 ($b$). For boys, none of the paths were significant ($a, b, c'$), suggesting no associations between the variables in the mediation model.

Given that the mediating effect was significant, further analyses examined the proportion of other-sex friends who used alcohol as a potential mediator. First, overall gender differences were tested and results indicated a significant difference ($\Delta\chi^2(7) = 15.54, p < .05$). Consequently, this model was tested with freely estimated paths across gender.

Results for this model are presented separately for boys and girls in Table 3 (for parsimony, the pathways involving

control variables are not reported, even though they were included in the tested model). The two-group model was an adequate fit to the data ($\chi^2(4) = 9.80, p = .04$ [girls = 5.73; boys = 4.08], CFI/TLI = .97/.86, RMSEA = .09, 90 % CIs [.01, .17]). Variables in the model explained 25 and 13 % of the variance of alcohol use at ages 18 and 19 for girls and boys, respectively. As can be seen in Table 3, the indirect effect ($ab$) is significant for girls but not for boys. To further test gender differences on the indirect pathway, the Wald test of parameter constraints was used and revealed a significant difference between boys and girls, $\chi^2(1, N = 333) = 3.93, p = .047$. Consequently, model for girls found support for an indirect relationship (via other-sex friends' alcohol use) between early parental knowledge and late alcohol use ($ab$). Parental knowledge from ages 12 to 14 negatively predicted involvement in friendships with other-sex friends using alcohol from ages 15 to 17 ($a$), which positively predicted alcohol use at ages 18 and 19 ($b$). For boys, none of the paths were significant ($a, b, c'$) (Fig. 2).

### Drug Use at Ages 18 and 19

First, overall gender differences were tested on the drug use model. The constrained and freed gender pathways were

**Table 3** Results of the mediation models for drug use in late adolescence

| | $b$ | SE | $z$ | $p$ | $\beta$ | CI for $b$ |
|---|---|---|---|---|---|---|
| *Girls (n = 200)* | | | | | | |
| Covariates | | | | | | |
| Antisocial behaviors, age 12 → parental knowledge | −.50 | .10 | −5.08 | .001 | −.46 | [−.69, −.31] |
| Cigarette use, age 12 → parental knowledge | −.18 | .15 | −1.22 | .223 | −.09 | [−.47, .11] |
| Antisocial behaviors, age 12 → drug use, ages 18 and 19 | .29 | .13 | 2.19 | .029 | .27 | [−.03, .56] |
| Cigarette use, age 12 → drug use, ages 18 and 19 | −.19 | .14 | −1.34 | .179 | −.10 | [−.46, .09] |
| Model | | | | | | |
| Parental knowledge → other-sex friends (*a*) | −.05 | .02 | −2.25 | .024 | −.17 | [−.09, −.01] |
| Other-sex friends → drug use, ages 18 and 19 (*b*) | .56 | .24 | 2.30 | .021 | .16 | [.08, 1.04] |
| Parental knowledge → drug use, ages 18 and 19 (*c′*) | −.21 | .08 | −2.54 | .011 | −.22 | [−.38, −.05] |
| Indirect effect (*ab*) | −.03 | .02 | −1.42 | .156 | −.03 | [−.06, .01] |
| *Boys (n = 133)* | | | | | | |
| Covariates | | | | | | |
| Antisocial behaviors, age 12 → parental knowledge | −.23 | .06 | −3.73 | .001 | −.33 | [−.36, −.11] |
| Cigarette use, age 12 → parental knowledge | −.10 | .16 | −0.59 | .556 | −.05 | [−.42, .22] |
| Antisocial behaviors, age 12 → drug use, ages 18 and 19 | .01 | .07 | .10 | .919 | .01 | [−.13, .15] |
| Cigarette use, age 12 → drug use, ages 18 and 19 | .41 | .21 | 1.92 | .055 | .19 | [−.01, .83] |
| Model | | | | | | |
| Parental knowledge → other-sex friends (*a*) | −.02 | .02 | −0.84 | .403 | −.08 | [−.06, .03] |
| Other-sex friends → drug use, ages 18 and 19 (*b*) | −.20 | .36 | −0.56 | .573 | −.04 | [−.90, .50] |
| Parental knowledge → drug use, ages 18 and 19 (*c′*) | −.380 | .13 | −2.98 | .003 | −.34 | [−.62, −.13] |
| Indirect effect (*ab*) | .00 | .01 | 0.31 | .754 | .00 | [−.02, .03] |

CI = 95 % confidence intervals
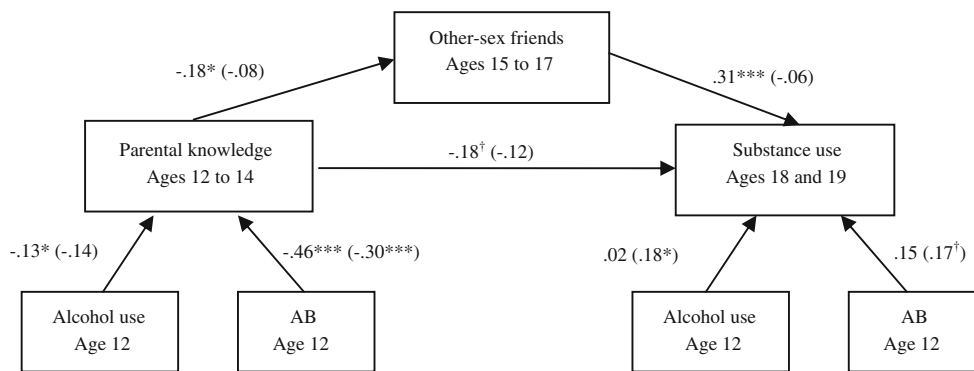


**Fig. 2** Tested model of the mediated effect of the proportion of other-sex friendships on the association between parental knowledge and adolescents' alcohol use. *Note* $N = 333$; Girls = 200, Boys = 133. *AB* Antisocial behaviors. Path values are standardized. Path values for boys appear in brackets. $^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

compared and indicated a significant overall gender difference ($\Delta\chi^2(7) = 23.52$, $p < .01$). Consequently, the final model was tested with freely estimated paths across gender.

Results for the models testing the mediation pathway linking early adolescent parenting to late adolescent drug use through middle adolescent other-sex friendships appear, separately for boys and girls, in Table 4. The two-group model was a good fit to the data ($\chi^2(4) = 2.62$, $p = .62$ [girls = 2.45; boys = .16], CFI/TLI = 1.00/1.04, RMSEA = .00, 90 % CIs [.00, .10]). Variables in the

model explained 19 and 18 % of the variance of drug use at ages 18 and 19 for girls and boys respectively. As can be seen from Table 4, the indirect effect (*ab*) was not significant for both boys and girls. Parental knowledge in early adolescence negatively predicted drug use in late adolescence for both boys and girls. In addition, for girls, as opposed to boys, early parental knowledge negatively predicted involvement in other-sex friendships in middle adolescence (*a*), which positively predicted drug use in late adolescence (*b*). Yet, even though all the paths in the model

more desirable ones. It would be important to verify the impact of these parental practices in the specific case of girls' friendships with boys. Parental attitudes and values toward the formation of other-sex friendships during adolescence also should be investigated.

The model predicting girls' drug use did not provide evidence of mediation, even though all the paths were significant and in the expected direction. Indeed, early parental knowledge negatively predicted girls' involvement in other-sex friendships in middle adolescence, which in turn positively predicted drug use in late adolescence. It is possible that more specific characteristics of the male friends such as their age or their own use of drugs might account for (and mediate) the relationships between knowledge and drug use. Girls are more likely to be influenced by older male friends (Stattin and Magnusson 1990) and use of drugs is more prevalent among older boys.

For boys, as expected, no evidence of mediation was found for either substance. It is possible that, for boys, other characteristics of the friendship network, such as the friends' own use of substances for example, might be more crucial in explaining the link between parental monitoring and later substance use. Moreover, contrary to girls, for boys, the path from parental knowledge to other-sex friendships and the path from other-sex friendships to substance use were not significant in both models. These findings suggest that, when monitoring their sons, parents do not seem to pay attention to the gender of their friends. Also, the result suggesting that other-sex friendships were not related to boys' substance use is consistent with the literature (Arndorfer and Stormshak 2008; Haynie et al. 2007). In fact these researchers even found that, for males, relationships with females had a protective effect, which was not the case here.

Yet, results revealed that lower parental knowledge in early adolescence predicted greater and more problematic drug use in late adolescence among boys. This finding is consistent with previous studies suggesting that, for boys, a lack of monitoring in early adolescence can have serious lasting consequences (Guilamo-Ramos et al. 2010). Surprisingly, this longitudinal association was not found for alcohol use. This suggests that parenting during early adolescence no longer has an effect on alcohol use once the child reaches young adulthood. Use of alcohol is legal at age 18 in Quebec. Other social factors such as peer influence might therefore have a stronger impact on alcohol consumption.

Strengths, Limitations, and Directions for Future Research

Several strengths of the present research are worth noting. First, this study was based on longitudinal data from ages 12 to 19 with a high retention rate of participants. Second, the constructs were measured during the appropriate critical developmental period using repeated yearly assessments, thus increasing reliability. Third, for alcohol and drug use, the variables used to create the composite scores were chosen because they were indicative of severe and problematic use. These indicators took into account the frequency of use, the volume of substance consumed at each occurrence and also problems directly associated with intoxication.

This study is not without limitations, however. Most of the constructs in this study, including monitoring knowledge, other-sex friendships and substance use, were based on self-report measures, which raises the possibility that the findings might result from common method variance. Another limitation concerns the sample. This study used a fairly homogeneous sample of adolescents from a single geographical area. The current findings should be replicated with more ethnically and economically diverse samples in order to determine whether the associations reported here are similar across cultures and economic levels or whether they vary in important ways. Even though a good retention rate was achieved in this longitudinal study (81 % after eight yearly waves of data collection), some participants were lost (with an over-representation of boys) and only 75 % of the available student population initially agreed to be part of the study, which might limit the generalizability of the findings. In addition, in this study, monitoring knowledge was used as a general indicator of parental monitoring. Research by Kerr and Stattin (2000) underlined the importance of examining the source of this knowledge and the fact that both parents and adolescents could play an active role in the monitoring process. For example, parents might modify their monitoring practices when their young adolescent begins to form friendships with other-sex peers while the adolescent might react to these changes in parenting behavior by further expanding his/her other-sex friendship network. Reactions of adolescents to monitoring practices might also vary by adolescents' gender (see Marshal and Chassin 2000). Careful short-term longitudinal studies conducted during the early adolescence transition would be needed to clarify these bi-directional processes between parental monitoring and other-sex friendships. Another limitation concerns the fact that parental effects were analyzed without specifying the parent's gender. Some research has indicated that there may be specific parent–child gendered differences; that is, same or opposite gender effects (mother–daughter, mother–son, father–daughter, father–son) may be operating in regard to adolescent problem behaviors (see Hoeve et al. 2009). Other parent–child relationship constructs, such as warmth, affection, and communication, also may influence offspring problem behaviors

The gender of friends appears to be informative in understanding the longitudinal associations between parental monitoring and substance use for girls. However, as mentioned earlier, other more specific aspects of these friendships should be included in the model. For instance, girls tend to form friendships with males who are older than themselves and a large proportion of these friendships tend to be from out-of-school contexts and are thus less likely to be supervised by adults (Poulin and Pedersen 2007), two features likely to be associated with risk (Stattin and Magnusson 1990; Velazquez et al. 2010). The quality of these other-sex friendships also should be investigated.

## Implications for Practice

Findings from this study raise important issues for the prevention of substance abuse among girls (Andrews 2005). Prevention studies conducted with girls and boys have shown that strategies aimed at increasing parental monitoring of peer relations during early adolescence result in decreases in adolescents' substance use (Dishion et al. 2003). Perhaps parents of girls should pay specific attention to the gender of their daughters' friends in their monitoring efforts. Indeed, first encounters between boys and girls often take place in mixed-gender group settings where parents are usually not present (Connolly et al. 2004). Parents should be aware that a large network of friendships with boys could potentially have damaging effects for their daughter, at least with respect to alcohol use. Recent research has shown that parents monitor their daughters' romantic activities more closely than their sons' (Kan et al. 2008). Based on the present findings, parents should be encouraged to extend this practice to friendships with other-sex peers as well. Finally, given that forming mixed-gender friendships is a normal part of adolescent development, friendships with other-sex peers in early adolescence should by no means be strictly prohibited. However, parents and other significant adults, such as teachers and organized activity leaders, should attempt to create a youth environment in which girls are provided with opportunities to form other-sex friendships with same-age peers in a healthy, monitored context. Our results also suggest that boys show a greater degree of problematic drug use. Future research should examine the potential correlates and predictors of problematic use for boys, so that prevention efforts could be directed toward influential modifiable factors specific to boys.

## Conclusions

We have shown that mediation models of monitoring knowledge and adolescent substance use through friendship networks must take into account the gender of the adolescent and the gender of his/her friends. We provided support for a model in which the relationships between early adolescent parental monitoring and late adolescent alcohol use is mediated by other-sex friendship among girls only. Specifically, higher levels of parental monitoring lead to fewer other-sex friendships, which then lead to lower levels of alcohol use. For drug use, a direct relationship between early adolescent parental monitoring and late adolescent drug use was found for both boys and girls. Parents thus seem to have a protective effect on their daughters' later use of alcohol by closely monitoring the inclusion of male friends in their networks. These findings support the idea that the risk/protective factors and developmental processes leading to substance use may be different for males and females.

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