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Longitudinal Associations Between Other-Sex Friendships and Substance Use in Adolescence

François Poulin
Université du Québec à Montréal

Anne-Sophie Denault
Université de Sherbrooke

Sara Pedersen
Université de Montréal

The impact of the changes in the gender composition of friendship networks during early adolescence on substance use in late adolescence was examined. The hypothesis was that initial level and increase in the proportion of other-sex friends in the network would be associated with higher levels of substance use among girls, but not among boys. Girls and boys ($n = 390$) were interviewed annually from ages 12 to 18 (79% retention). For both boys and girls, initial level in the proportion of other-sex friends predicted alcohol use in late adolescence, whereas it was predictive of drug use in girls only. Moreover, for girls only, a faster increase in the proportion of other-sex friends in the network predicted later use of alcohol and drugs.

During adolescence, young people experience many normative changes—as well, potentially, as maladaptive ones. One major normative change includes the heightened importance of the peer group, leading youths to spend more time with peers (Richards, Crowe, Larson, & Swarr, 1998) and making youths more susceptible to the influence of their peers (Steinberg & Monahan, 2007). Moreover, the childhood segregation of the sexes gradually fades away and friendships between girls and boys begin to emerge more frequently (Feiring, 1999). Maladaptive changes such as the onset of tobacco, alcohol, or drug use are also observed in many individuals (Mayes & Suchman, 2006). From a prevention perspective, clarifying the risk factors associated with substance use is critical. Peer relationships are considered to be one of the main risk factors for substance use (Engels, Bot, Scholte, & Granic, 2007). The present study focuses on one feature of peer relations specific to early adolescence that may also contribute to the use of potentially harmful substances: the inclusion of other-sex friends in the friendship network. Specifically, when experienced early and rapidly, this inclusion of other-sex friends may create a context of risk leading to substance use.

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Requests for reprints should be sent to François Poulin, Département de Psychologie, Université du Québec à Montréal, Case postale 8888, Succursale Centre-ville, Montréal, Canada H3C 3P8. E-mail: poulin.francois@uqam.ca

OTHER-SEX FRIENDSHIPS IN EARLY ADOLESCENCE

During middle childhood, friendships occur almost exclusively with same-sex peers (Kovacs, Parker, & Hoffman, 1996). During the first years of adolescence, the proportion of other-sex friends in youths' networks gradually increases (Connolly, Furman, & Konarski, 2000; Feiring, 1999; Shrum, Cheek, & Hunter, 1988). Recent evidence suggests that girls and boys experience the transition to other-sex friendships very differently. Poulin and Pedersen (2007) assessed the friendship networks of girls and boys annually from ages 12 to 16 and examined changes in the proportion of other-sex friends over this time period. They found that girls initiated the transition to a mixed-gender network earlier than boys and at a significantly faster pace throughout adolescence. Moreover, among girls, antisocial behavior and early pubertal maturation accelerated the increase in the proportion of other-sex friends. An examination of the characteristics of these friendships also revealed that, compared with their same-sex friends, girls tended to form friendships with males who were older than themselves and that this age difference increased over time, which was not the case for boys. Moreover, approximately two thirds of girls' other-sex friendships were from out-of-school contexts and this proportion also increased over time, which was also not the case for boys. Overall, Poulin and Pedersen's findings suggest that other-sex friendships in adolescence

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may be a context in which girls are exposed to risk behaviors. This does not seem to be the case for boys.

OTHER-SEX FRIENDSHIPS AND PROBLEM BEHAVIOR

Stattin and colleagues have argued that friendships with older boys may be a context that is conducive to risky behavior in girls (Stattin & Magnusson, 1990). They showed that this was especially the case in out-of-school settings such as unstructured leisure contexts in which older, norm-breaking boys are likely to facilitate the girls' involvement in a variety of problem behaviors, such as shoplifting, vandalizing property, drinking, and running away from home (Stattin, Kerr, Mahoney, Persson, & Magnusson, 2005). Several other studies have reported a relationship between other-sex friendships and problem behavior in girls. Lacasse, Purdy, and Mendelson (2003) found that girls who reported having a higher proportion of other-sex friends had a greater tendency to experience both moderate and severe potentially offensive sexual harassment behaviors. In a study conducted among a large representative sample of American adolescents, Haynie, Steffensmeier, and Bell (2007) found that exposure to other-sex friends increased females' odds of committing serious violence. Solomon (2006) conducted a series of interviews with delinquent adolescent females detained at a juvenile detention center and found that they were significantly more likely than nondelinquent girls to identify males as their closest friends. A longitudinal study conducted with early adolescent females and males showed that having other-sex friends predicted an increase in antisocial behavior, especially among girls (Arndorfer & Stormshak, 2008). Finally, evidence suggests that having other-sex friends is associated with early onset of sexual behavior among girls (Cavanagh, 2004). Given that these forms of problem behavior and substance use tend to cooccur in adolescence (Jessor & Jessor, 1977), a relationship between other-sex friendships and substance use might also be expected (Malow-Iroff, 2006). Cross-sectional studies documented such a relationship for alcohol use (Dick et al., 2007; Gaughan, 2006).

For boys, the characteristics of their other-sex friendships suggest that these friendships may be less associated with risky behavior. Boys' other-sex friends are not older than they are and are less likely than girls' other-sex friends to come from settings outside of school (Poulin & Pedersen, 2007). Moreover, boys report receiving higher levels of support from their other-sex friends compared with their same-sex friends, whereas girls receive more support from their same-sex friends (Kuttler, La Greca, & Prinstein, 1999; Poulin & Pedersen, 2007). Thus, it is possible that having other-sex friends is protective for boys because they gain emotional support and are therefore less likely to engage in problem behavior. This idea has been supported in recent research showing that other-sex friendships reduce problem behaviors among boys (Arndorfer & Stormshak, 2008; Haynie et al., 2007).

OTHER-SEX FRIENDSHIPS AND SUBSTANCE USE IN LATE ADOLESCENCE

Prior research in this area tends to suggest that other-sex friendships might be a context that is conducive to risky behavior, including substance use, especially among adolescent girls. However, the development of other-sex friendships is a normative process during adolescence and should not be treated as a problem per se. The timing and the pace at which other-sex friends are included in the friendship network likely determine the extent to which the transition to a mixed-gender friendship network is risky. In this context, ''timing'' refers to the age at which an individual initiates the inclusion of other-sex friends in his/her network. ''Pace'' refers to the rate of growth of the inclusion of other-sex friends in the network during subsequent years. With respect to timing, early initiation of other-sex friendships may indicate greater risk. It is possible that girls who begin to form friendships with males at a young age are more disinhibited and sensation seeking. Research has shown that antisocial and early maturing girls begin to include male friends in their network earlier than others girls (Poulin & Pedersen, 2007; Stattin & Magnusson, 1990). Because these girls are already engaging in more precocious behavior, friendships with males may contribute to added pressure to engage in other more adult-like behavior, including substance use.

Once the transition to a mixed-gender network has been initiated, the pace at which other-sex friends are incorporated into the network may also increase the likelihood of risky behavior. Growth in the inclusion of male friends in their networks could facilitate girls' engagement in substance use simply because girls' opportunities to use substances have increased. Also, not only do male friends become more numerous in girls' networks over time, but their potentially harmful characteristics also increase during early adolescence. As mentioned earlier, the age difference between girls and their male friends

increases over time and the proportion of male friends who come from contexts outside of school also increases over time (Poulin & Pedersen, 2007). These older male friends may have already begun to experiment with substances and may facilitate access to substances or to settings in which substances are easily available, such as parties (Veenstra, Huitsing, Dijktra, & Lindenberg, 2010) with older teens. The study of timing and pace requires a longitudinal design with repeated assessments of networks across the early adolescent years in which an increase in the proportion of other-sex friends in youths' networks is expected to occur.

Early inclusion and faster inclusion of other-sex friends in their network are thus expected to be associated with engagement in substance use among girls. A more crucial question, however, is to determine whether the inclusion of other-sex friends in their network during early adolescence places girls on a trajectory toward more serious problems with substance use in late adolescence. In other words, do early development and rapid development of other-sex friendships constitute risk factors for later substance use and the problems associated with substance-using behaviors, such as abuse and intoxication? Moreover, does the proportion of other-sex friends in the network predict these substance use problems beyond personal factors that are known to be reliable predictors of later substance use including antisocial behavior (Dishion, Capaldi, & Yoerger, 1999), early initiation of substance use (Chassin et al., 2004), and early pubertal maturation (Costello, Sung, Worthman, & Angold, 2007)? To our knowledge, the question of whether early and rapid inclusion of other-sex friends in youths' networks may lead to adjustment problems later on in their development has never been investigated.

The goal of this study was to look at the long-term contribution of initial levels and rates of change in the proportion of other-sex friends in youths' friendship networks during early adolescence to alcohol and drug use in late adolescence. Initial levels and rates of change were modeled using latent growth curve analysis (Duncan, Duncan, Strycker, Li, & Alpert, 1999). It was predicted that the proportion of other-sex friends would be associated with substance use in a different way for girls than for boys. For girls, it was expected that early initiation of other-sex friendships and more rapid accumulation of other-sex friends would predict higher substance use in late adolescence. For boys, it was expected that incorporating girls into their friendship networks would predict lower substance use.

METHOD

Participants

This longitudinal study began with 390 (58% girls) grade 6 students (mean age = 12.38 years; standard deviation [*SD*] = 0.42) enrolled in eight elementary schools from 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 consisted of 90% European Canadians, 3% Haitian Canadians, 3% Middle Eastern Canadians, 2% Asian Canadians, and 2% Latino Canadians. 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 original sample, 309 students (79%) were still involved in the study 7 years later. Of the 21% who dropped out of the study, 70% declined to continue and 30% could not be located.

Only youths for whom we had data from at least one wave of data collection from ages 12 to 15 and complete data at age 18 were included in the analyses ($n = 309$; 62% girls). Among the 309 youths included in these analyses, 76.1% had no missing data ($n = 235$), 10.0% had one missing data point ($n = 31$), 10.4% had two missing data points, and 3.6% had three missing data points ($n = 11$). The subsample used in the analyses ($n = 309$) was compared with the intact sample ($n = 390$) with respect to gender, proportion of other-sex friends at age 12, antisocial behaviors at age 12, alcohol use at age 12, tobacco use at age 12, and other demographic variables such as family income, and mothers' and fathers' education levels. Results revealed that youths in the analytic sample showed fewer antisocial behaviors at age 12 than youths in the excluded sample, $t(386) = 2.41$, $p < .05$, $M = -0.05$ versus 0.20. In addition, girls were more likely to be overrepresented in the analytic sample than in the excluded sample, $\chi^2(393) = 8.24$, $p < .01$; 190 girls and 119 boys in the $n = 309$ versus 35 girls and 46 boys in the excluded sample.

Study Design and Procedures

The participants were followed over a 7-year period (ages 12–18). They completed a questionnaire annually from ages 12 to 15 regarding the composition and characteristics of their friendship networks. At age 12, they also reported information on their initial

level of substance use and antisocial behavior. At age 13, pubertal timing was assessed. At age 18, they completed a questionnaire concerning their use of substances and problems associated with intoxication.

In elementary school (age 12), questionnaires were completed in the classroom. Graduate research assistants were in charge of administering the questionnaire. Teachers were given 2 weeks to complete the questionnaire on antisocial behavior among their students. In high school (ages 13–15), similar procedures were followed. Again, questionnaires were completed in the school setting under the supervision of research assistants. However, as participants were spread throughout more than 30 schools, some assessments had to be conducted individually at the participant's home (approximately 10 cases per year) or the questionnaires had to be sent by mail (approximately 5 per year). After high school, assessments were conducted individually. In most cases, these assessments took place at the participant's home. In some cases, questionnaires were sent by mail. From age 13 onward, participants received a $20 gift certificate (to a movie theater, music store, or sports store) for their participation at each time point.

Measures

The adolescent's friendship network from ages 12 to 15. First, participants were asked to write down the name of up to 10 friends. No constraints were imposed regarding the context in which these friendships took place. The 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, Urberg, Tolson, & Richard, 1998; Kuttler et al., 1999; Ryan, 2001).

In a second step, participants were asked to indicate the friend's gender and the nature of the relationship. For this last question, alternatives were provided and the participant was asked to choose those that 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. Finally, the proportion of the friendship network comprised of other-sex friends was computed. The proportion measure was the number of other-sex friends divided by the number of other-sex friends plus the number of same-sex friends.

Substance use at age 12. Use of tobacco was measured using a self-report item asking how many cigarettes, in the previous month, the participant had smoked. 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 ''1 pack'' to ''31 packs or more''). Given that levels of tobacco use were not normally distributed, this score was transformed using the natural logarithm ($M = 0.10$, $SD = 0.33$). Use of alcohol was measured using a 14-point self-report item asking how many drinks of alcohol, in the previous month, the participant had had. 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, this score was also transformed using the natural logarithm ($M = 0.21$, $SD = 0.49$).

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, Biglan, Ary, & Li, 1998). The adolescents were asked to report on 16 items rated on a 5-point Likert scale ranging from 1 (*never*) to 5 (*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 5 items from the Revised Class Play scale (Masten, Morison, & Pellegrini, 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 0.38 to 0.51; $\alpha = .69$).

Pubertal timing at age 13. This variable was assessed using the Pubertal Development Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988). On a scale ranging from 1 (*have not begun*) to 4 (*development completed*), the youths indicated the extent to which they had experienced pubertal development in several domains during the previous 12 months. The total PDS scores were averaged within each gender. Internal consistency was acceptable for both boys ($\alpha = .63$) and girls ($\alpha = .68$). The pubertal timing classification was created according to the procedure recommended in the literature (see Ge et al., 2001; Graber, Petersen, & Brooks-Gunn, 1996). Girls and boys were classified by dividing the sample into early-maturing, on-time, and late-maturing groups. Youths whose scores were more than 1 *SD* above or below the mean of their own sex were classified as early or late maturing, respectively. Youths whose pubertal timing scores fell within 1 *SD* of the mean of their own sex were classified as maturing on time. In the analyses, this classification was treated as a continuous variable with 0 = early, 1 = on time, and 2 = late. To be consistent with prior research (e.g., Ge et al., 2001) pubertal status was used as a continuous variable in the analyses.

Alcohol use at age 18. Four indicators of alcohol use were used to create this composite score. These indicators were used in Dishion and Owen (2002). 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 1 (*never*) to 8 (*2–3 times a day or more*). A mean score for the 3 items was computed ($M = 1.63$, $SD = 1.21$). 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). A mean was calculated across the 3 items ($M = 2.14$, $SD = 1.38$). 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; $M = 1.41$, $SD = 1.28$). Fourth, they were asked to report on a series of questions assessing alcohol intoxication (no/yes; 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 for these 7 items was computed ($M = 0.19$, $SD = 0.18$). The composite score for *alcohol use at age 18* was formed by standardizing and averaging these four indicators (correlations from 0.45 to 0.56; $\alpha = .71$).

Drug use at age 18. Six indicators of drug use taken from Dishion and Owen (2002) were used to create this composite score. First, the adolescents were asked to recall the number of times they had consumed marijuana during the previous 3 months. Response options ranged from 1 (*never*) to 8 (*2–3 times a day or more*) (1 item; $M = 1.17$, $SD = 2.01$). 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; $M = 0.82$, $SD = 1.44$). Third, the adolescents were asked to report on problems related to marijuana use (4 items; no/yes): (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 to work while high on marijuana?'' (d) ''Have you ever had any problems related to school or to work because of marijuana?'' An average score for these 4 items was computed (4 items; $M = 0.13$, $SD = 0.23$). Fourth, the adolescents were asked to report on the number of hard drugs taken in the previous 3 months (1 item; sum of 13 drugs such as cocaine, heroin, speed, LSD, mescaline, and ecstasy; $M = 0.28$, $SD = 0.72$). Fifth, they were asked to report on the average frequency of hard drug use during the previous 3 months (1 item; $M = 0.45$, $SD = 1.32$). Sixth, they were asked to report on problems related to hard drug use using the same items described earlier for marijuana use (4 items; $M = 0.23$, $SD = 0.64$). Given that the three indicators for hard drug use were not normally distributed, scores were transformed using the natural logarithm. A composite score for *drug use at age 18* was formed by standardizing and averaging these six indicators (correlations from 0.28 to 0.86; $\alpha = .70$).

Analytical Strategy

In order to assess the long-term relations between other-sex friendships in early adolescence and alcohol and drug use in late adolescence, latent growth curve analyses were used. First, the latent growth curve of the proportion of other-sex friends from ages 12 to 15 was identified. Fitting this curve provided information about the shape of the mean-level trajectory and the variability around this mean trajectory. Second, the composite scores of alcohol and drug use at age 18 were regressed on this curve and covariates. The tested model is shown in Figure 1. Alcohol and drug use were tested separately. Thus, it was possible to verify whether initial levels of the proportion of other-sex friends and rates of change over time predicted the adolescents' substance use 1 year after high school. In this model, the terms timing and pace used in the introduction are reflected in the intercept and slope, respectively. To look at the moderating effects of gender, a two-group model was estimated to obtain a baseline model and equality constraints were imposed on specific parameters to verify whether that constrained model also fit the data via a nested chi-square difference test against the baseline model. Models were tested using Mplus 4.2 (Muthén & Muthén, 2006). In this statistical package, missing data (6%) were handled with a full information maximum likelihood procedure.

RESULTS

Descriptive Analyses

Means, *SD*s, and correlations between the proportion of other-sex friends from ages 12 to 15, covariates, and alcohol and drug use at age 18 are presented in Table 1, separately for boys and girls. As shown in this table, the proportion of other-sex friends increased over the years, more consistently among girls (0.16, 0.21, 0.24, and 0.29 for girls vs. 0.15, 0.15, 0.16, and 0.18 for boys). This increase in the proportion scores reflects a true increase in the raw number of other-sex friends over the 4 years (1.54, 1.94, 2.25, and 2.70 for girls; 1.32, 1.22, 1.33, and 1.65 for boys). In addition, with respect to the associations between the proportion of other-sex friends and later adjustment, correlations revealed that the proportion of other-sex friends at age 13, 14, and 15 was positively associated with alcohol use at age 18 among girls only ($r = .15$, $p < .05$ at age 13; $r = .33$, $p < .05$ at age 14; $r = .34$, $p < .05$ at age 15). For drug use at age 18, only the correlation with the proportion of other-sex friends at age 15 was significant among girls ($r = .24$, $p < .01$). Alcohol and drug use at age 18 were correlated at 0.47 ($p < .001$) for both boys and girls. Overall, girls with a larger proportion of other-sex friends during early and middle adolescence showed higher levels of alcohol and drug use in late adolescence.

With respect to the covariates, antisocial behaviors at age 12 were positively linked to alcohol and drug use at age 18 for both boys and girls. Baseline levels of the outcomes (alcohol use at age 12 for later alcohol use; tobacco use at age 12 for later drug use) were also positively associated with later outcomes, but only among boys. Finally, age 13 pubertal timing was not correlated to later substance use for either boys or girls (total sample: $r = -.07$, *ns* for alcohol use and $r = .05$, *ns* for drug use). As a result, this variable was not considered in the subsequent regression models. Because this variable was of theoretical interest and may have behaved differently in multivariate analyses, the subsequent regression models were also tested with pubertal timing. This variable was nonsignificant in these models and the main results were replicated. As a result, for reasons of parsimony, this variable was not included in the regression models.

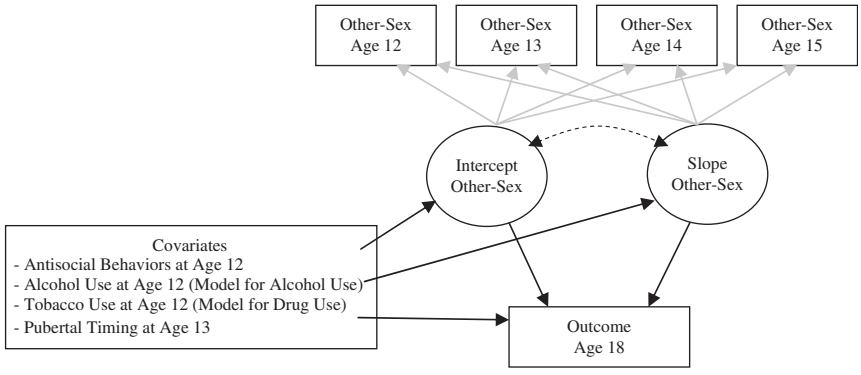

FIGURE 1 Model testing the long-term prediction of alcohol and drug use by the latent growth curve of the proportion of other-sex friends and covariates.

TABLE 1
Descriptive Statistics and Correlations for the Proportion of Other-Sex Friendships From Ages 12 to 15, Covariates, and Alcohol and Drug Use at Age 18 ($n = 309$)

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1. % other-sex friends at age 12	—	.20*	.17	.14	.21*	.12	.05	−.03	.18	.11
2. % other-sex friends at age 13	.49*	—	.54*	.40*	−.02	.07	.05	.15	.02	−.00
3. % other-sex friends at age 14	.42*	.50*	—	.61*	.00	.01	−.05	−.02	.16	.03
4. % other-sex friends at age 15	.32*	.46*	.57*	—	.12	.04	−.07	−.03	.06	−.05
5. Antisocial behaviors at age 12	.22*	.18*	.16*	.27*	—	.30*	.25*	.07	.26*	.20*
6. Alcohol use at age 12	.07	.14	.09	.18*	.51*	—	.23*	.15	.30*	.26*
7. Tobacco use at age 12	.20*	.17*	.14	.05	.47*	.24*	—	−.07	.27*	.29*
8. Pubertal timing at age 13	−.01	−.06	.07	.08	.05	.04	.07	—	−.12	.00
9. Alcohol use at age 18	.10	.15*	.33*	.34*	.26*	.11	−.03	−.02	—	.47*
10. Drug use at age 18	.01	.04	.14	.24*	.23*	.21*	.09	.11	.47*	—
M girls	.16	.21	.24	.29	−.15	.18	.09	2.01	−.05	−.09
SD girls	.17	.18	.19	.20	.77	.46	.29	.49	.74	.64
M boys	.15	.15	.16	.18	.24	.25	.12	2.02	.08	.14
SD boys	.16	.19	.17	.18	.96	.53	.39	.68	.87	.89

Note. % = proportion.
Correlations for girls are below the diagonal ($n = 190$); correlations for boys are above the diagonal ($n = 119$).
*$p < .05$.

Long-Term Contribution of Early Adolescent Other-Sex Friendships to Alcohol and Drug Use in Late Adolescence

The main research question was to uncover whether initial levels and rates of change over time in the proportion of other-sex friends were associated with later alcohol and drug use after controlling for individual risk factors (e.g., antisocial behaviors and baseline levels of the outcome at age 12). Analyses were conducted in three steps. First, the shape of the growth curve of the proportion of other-sex friends from ages 12 to 15 was determined using univariate models. To do so, three models were tested: linear (slope coefficients fixed at 0, 1, 2, and 3), curvilinear (slope coefficients fixed at 0, 1, 4, and 9), and freely estimated (slope coefficients fixed at 0 for age 12 and 1 for age 15). Differences in chi-square between these models were used to select the best fit to the data. Second, alcohol and drug use at age 18 were regressed on the intercept and slope of the latent growth curve of other-sex friends from ages 12 to 15, and the covariates (antisocial behaviors and alcohol use at age 12 for later alcohol use; antisocial behaviors and tobacco use at age 12 for later drug use). The two substances were tested separately. Third, differences between boys ($n = 119$) and girls ($n = 190$) were tested using multigroup analyses. In these analyses, only two paths were freely estimated and then constrained to be equal among boys and girls: the path going from the initial levels of the proportion of other-sex friends (intercept) to alcohol or drug use at age 18 and the path going from the rates of change (slope) to alcohol or drug use at age 18. The chi-square difference between the freely estimated and constrained models was used to detect significant gender differences. In other words, if the model fit was significantly worse after constraining these paths, it would be possible to draw conclusions regarding gender differences.

For the shape of the growth curve, results revealed no significant differences between the three estimated models (linear, quadratic, and freely estimated). As a result, the most parsimonious model was chosen, that is, the linear model, which showed a good fit to the data, $\chi^2(5) = 7.98$, $p = .16$, CFI/TLI = 0.99/0.99, RMSEA = .04, 90% CI = .00, .10. In other words, the proportion of other-sex friends tended to increase linearly from one year to the next. The youths started with a mean proportion of other-sex friends equal to 0.16 ($SE = .009$, $z = 17.78$, $p < .001$, 95% CI = .14, .18), increasing significantly by an average of 0.03 each year ($SE = .004$, $z = 6.29$, $p < .001$, 95% CI = .02, .04). It should be noted that the average increase was significantly higher for girls than for boys, $\Delta\chi^2(1) = 11.88$, $p < .001$; girls: $b = .04$, $SE = .005$, $z = 7.35$, $p < .001$, 95% CI = .03, .05; boys: $b = .009$, $SE = .007$, $z = 1.28$, *ns*, 95% CI = −.01, .02. In addition, the variability around the intercept and slope was significant, $u_0 = .013$, $SE = .002$, $z = 5.65$, $p < .001$, $u_1 = .003$, $SE = .001$, $z = 4.31$, $p < .001$. This suggests that there were interindividual variations

among the youths in their proportion of other-sex friends at age 12 and in the pace at which they introduced other-sex friends into their networks.

To examine whether the proportion of other-sex friends between ages 12 and 15 could predict alcohol use at age 18, this outcome was regressed on the intercept and slope of the latent growth curve of other-sex friends, with antisocial behaviors and alcohol use at age 12 as covariates. The model fit the data adequately, $\chi^2(11) = 19.16$, $p = .06$, CFI/TLI = 0.97/0.95, RMSEA = .05, 90% CI = .00, .08. Results are shown in the upper part of Table 2. As can be seen from this table, antisocial behaviors at age 12 were positively related to both initial levels of other-sex friends and alcohol use at age 18. Controlling for the covariates, results also showed that initial levels of other-sex friends as well as rates of change over time predicted higher levels of alcohol use at age 18 for the total sample. In other words, a higher proportion of other-sex friends at age 12 and a steeper increase in the proportion of other-sex friendships over time predicted higher levels of alcohol use at age 18. The proportion of other-sex friends and the covariates explained 13% of the variance.

The two-group model was also a good fit to the data, $\chi^2(22) = 24.48$, $p = .32$; girls: $\chi^2(11) = 6.20$, $p = .86$; boys: $\chi^2(11) = 18.28$, $p = .08$, CFI/TLI = 0.99/0.99, RMSEA = .03, 90% CI = .00, .07. Results for boys and girls are presented in Table 2. As can be seen from this table, both the intercept and the slope of other-sex friends were significant predictors of alcohol use at age 18 among girls, but not among boys. However, for the path between the intercept and

TABLE 2
Path Coefficients for the Prediction of Alcohol Use at Age 18 by the Latent Growth Curve of Other-Sex Friendships and Covariates

	b	*SE*	*z*	*p*	β	*95% CI*
1. Total sample						
Covariates						
Antisocial behaviors at age 12 → intercept	0.03	0.01	2.44	.05	.21	.04, .37
Alcohol use at age 12 → intercept	0.01	0.02	0.46	*ns*	.04	−.13, .20
Antisocial behaviors at age 12 → slope	−0.01	0.01	−1.00	*ns*	−.11	−.31, .10
Alcohol use at age 12 → slope	0.01	0.01	0.64	*ns*	.06	−.12, .24
Antisocial behaviors at age 12 → alcohol use	0.20	0.06	3.40	.001	.22	.09, .34
Alcohol use at age 12 → alcohol use	0.14	0.10	1.46	*ns*	.09	−.03, .20
Prediction of the outcome						
Intercept → alcohol use	1.01	0.49	2.08	.05	.15	.01, .29
Slope → alcohol use	3.12	1.27	2.46	.05	.20	.05, .36
2. Girls						
Covariates						
Antisocial behaviors at age 12 → intercept	0.05	0.02	2.79	.01	.29	.09, .48
Alcohol use at age 12 → intercept	−0.01	0.03	−0.46	*ns*	−.05	−.25, .15
Antisocial behaviors at age 12 → slope	−0.00	0.01	−0.13	*ns*	−.02	−.28, .25
Alcohol use at age 12 → slope	0.01	0.01	1.03	*ns*	.13	−.12, .38
Antisocial behaviors at age 12 → alcohol use	0.21	0.08	2.56	.05	.22	.05, .39
Alcohol use at age 12 → alcohol use	−0.13	0.13	−0.96	*ns*	−.08	−.24, .08
Prediction of the outcome						
Intercept → alcohol use	1.20	0.51	2.36	.05	.21	.03, .40
Slope → alcohol use	6.75	1.94	3.47	.01	.45	.25, .65
3. Boys						
Covariates						
Antisocial behaviors at age 12 → intercept	0.02	0.02	1.08	*ns*	.17	−.14, .48
Alcohol use at age 12 → intercept	0.02	0.03	0.85	*ns*	.13	−.17, .44
Antisocial behaviors at age 12 → slope	−0.00	0.01	−0.27	*ns*	−.05	−.38, .29
Alcohol use at age 12 → slope	−0.00	0.01	−0.32	*ns*	−.05	−.33, .24
Antisocial behaviors at age 12 → alcohol use	0.14	0.09	1.58	*ns*	.15	−.04, .34
Alcohol use at age 12 → alcohol use	0.35	0.16	2.23	.05	.21	.03, .40
Prediction of the outcome						
Intercept → alcohol use	1.87	1.44	1.30	*ns*	.20	−.08, .47
Slope → alcohol use	−0.10	2.32	−0.04	*ns*	−.01	−.26, .25

alcohol use, multigroup analyses revealed no significant gender differences, $\Delta\chi^2(1) = 0.21$, *ns*. For the path between the slope and alcohol use, there were significant gender differences, $\Delta\chi^2(1) = 3.95$, $p < .05$. Girls who increased their proportion of other-sex friends at faster rates showed higher levels of alcohol use at age 18, but not boys.

To examine whether the proportion of other-sex friends between ages 12 and 15 could predict drug use at age 18, this outcome was regressed on the intercept and slope of the latent growth curve of other-sex friendships, with antisocial behaviors and tobacco use at age 12 as covariates. The model fit the data well, $\chi^2(11) = 17.92$, $p = .08$, CFI/TLI = 0.98/0.96, RMSEA = .04, 90% CI = .00, .08. Results are shown in the upper part of Table 3. As can be seen from this table, both antisocial behaviors and tobacco use at age 12 were positively associated with later drug use. Controlling for the covariates, results showed no significant associations between the proportion of other-sex friends from ages 12 to 15 and drug use at age 18. In other words, for the total sample, the proportion of other-sex friends at age 12 and changes over time in this variable did not predict higher levels of drug use at age 18. The proportion of other-sex friends and the covariates explained 9% of the variance.

The two-group model was also a good fit to the data, $\chi^2(22) = 23.04$, $p = .40$; girls: $\chi^2(11) = 5.17$, $p = .92$; boys: $\chi^2(11) = 17.87$, $p = .08$, CFI/TLI = 1.00/0.99, RMSEA = .02, 90% CI = .00, .07. Results for boys and girls are presented in Table 3. As can be seen from this table, the intercept of other-sex friends was not a significant predictor of drug use at age 18

TABLE 3
Path Coefficients for the Prediction of Drug Use at Age 18 by the Latent Growth Curve of Other-Sex Friendships and Covariates

	B	*SE*	*z*	*p*	β	*95% CI*
1. Total sample						
Covariates						
Antisocial behaviors at age 12 → intercept	0.02	0.01	1.94	.10	.16	.00, .33
Tobacco use at age 12 → intercept	0.05	0.03	1.73	.10	.15	−.02, .31
Antisocial behaviors at age 12 → slope	0.00	0.01	0.11	*ns*	.01	−.19, .22
Tobacco use at age 12 → slope	−0.02	0.01	−1.70	.10	−.16	−.34, .02
Antisocial behaviors at age 12 → drug use	0.15	0.05	2.89	.01	.18	.06, .30
Tobacco use at age 12 → drug use	0.40	0.15	2.76	.01	.18	.05, .30
Prediction of the outcome						
Intercept → drug use	−0.08	0.48	−0.16	*ns*	−.01	−.16, .13
Slope → drug use	1.29	1.20	1.07	*ns*	.09	−.07, .24
2. Girls						
Covariates						
Antisocial behaviors at age 12 → intercept	0.03	0.02	1.52	*ns*	.16	−.04, .37
Tobacco use at age 12 → intercept	0.08	0.05	1.67	.10	.18	−.03, .39
Antisocial behaviors at age 12 → slope	0.01	0.01	1.24	*ns*	.17	−.10, .45
Tobacco use at age 12 → slope	−0.04	0.02	−1.75	.10	−.23	−.48, .03
Antisocial behaviors at age 12 → drug use	0.14	0.08	1.79	.10	.16	−.02, .34
Tobacco use at age 12 → drug use	0.20	0.20	1.02	*ns*	.10	−.09, .28
Prediction of the outcome						
Intercept → drug use	0.09	0.46	0.20	*ns*	.02	−.17, .21
Slope → drug use	3.99	1.58	2.52	.05	.31	.10, .51
3. Boys						
Covariates						
Antisocial behaviors at age 12 → intercept	0.02	0.02	1.23	*ns*	.20	−.11, .50
Tobacco use at age 12 → intercept	0.02	0.04	0.43	*ns*	.07	−.24, .37
Antisocial behaviors at age 12 → slope	0.00	0.01	0.05	*ns*	.01	−.32, .34
Tobacco use at age 12 → slope	−0.02	0.02	−1.00	*ns*	−.14	−.42, .14
Antisocial behaviors at age 12 → drug use	0.10	0.09	1.08	*ns*	.11	−.09, .30
Tobacco use at age 12 → drug use	0.58	0.22	2.56	.01	.25	.06, .44
Prediction of the outcome						
Intercept → drug use	1.00	1.46	0.69	*ns*	.10	−.18, .38
Slope → drug use	−1.86	2.34	−0.79	*ns*	−.10	−.35, .14

among both boys and girls. However, the slope of other-sex friends was a significant predictor of drug use among girls but not among boys and multigroup analyses revealed significant gender differences on this path, $\Delta\chi^2(1) = 3.95$, $p < .05$. Girls who increased their proportion of other-sex friends at faster rates showed higher levels of drug use at age 18, but not boys.

DISCUSSION

The association between changes in the proportion of other-sex friends in early adolescents' networks and substance use in late adolescence was tested longitudinally using a 7-year prospective design. Latent growth curve analyses revealed that initial levels and rates of change in the proportion of other-sex friends predicted use of alcohol and drugs in late adolescence. As expected, most of these longitudinal associations were observed for girls only. The study's findings are described below, along with a discussion of their developmental significance.

Significant linear growth in the proportion of other-sex friends in the network was observed from ages 12 to 15. Thus, the youths' friendship networks became increasingly mixed during this period. As expected, and consistent with prior research (Connolly & Johnson, 1996; Feiring, 1999), the average increase was significantly higher for girls than for boys. According to Poulin and Pedersen (2007) the most likely explanation to account for this gender difference is socialization. Girls and boys might have been socialized differently in their relationships with the other sex. For example, during childhood, boys are more active in maintaining sex segregation and may thus be more reluctant than girls to initiate and form friendships with the other sex in adolescence (Maccoby, 1998).

In addition, the variability around the growth parameters (e.g., intercept and slope) was significant, indicating interindividual variations among youths in their proportion of other-sex friends at age 12 and in the pace at which they introduced other-sex friends into their networks. In other words, at age 12, some individuals already had a higher proportion of other-sex friends than others and during the subsequent years, some individuals introduced other-sex friends into their networks much faster than others. These growth parameters could therefore be used to predict developmental outcomes, in this case late adolescence substance use. The study hypothesis predicted that these parameters would increase risk for girls and have a protective effect for boys. This hypothesis was confirmed for girls but not for boys.

The current findings indicate that for girls, earlier inclusion of other-sex friends contributed to alcohol use in late adolescence. In addition, a more rapid increase in girls' other-sex friendships was associated with late-adolescent alcohol and drug use. These effects were observed even after controlling for personal characteristics. Thus for girls, both the timing and the rate of inclusion of other-sex friends in their networks predicted late adolescence substance use.

Before considering other-sex friends as a risk factor for substance use among girls, two issues should be discussed: (1) the content of the alcohol use and drug use composite scores, and (2) the level of use among girls in this sample. First, the variables were chosen to create the composite scores because they were indicative of a severe and problematic use of substances. These indicators went beyond simply measuring whether the adolescents were or were not users, taking into account the *frequency* of use, the *volume* of substance consumed at each occurrence, and also *problems* directly associated with intoxication (Mayes & Suchman, 2006). Second, the information reported by the girls in this sample revealed that their use of substances at age 18 was quite high. In summary, given the measurement of substance use and the level of use reported by the girls in this study, other-sex friendship in early adolescence could be considered as a risk factor for substance use in late adolescence.

Three possible explanations might account for this longitudinal association between other-sex friendships and substance use among girls. First, the increase in the proportion of other-sex friends in girls' networks and engagement in substance use could simply be a manifestation of girls' more general quest for autonomy and maturity and their willingness to adopt adult-like behaviors prematurely. According to Moffitt (2006), early adolescence is characterized by a maturity gap in which individuals begin to show signs of biological maturity but have not yet acquired adult status in society. During this period, youths may perceive behaviors such as substance use and involvement in other-sex friendships as a sign of independence. Such behavior becomes normative—even valued—because of its apparent association with adult status. Second, girls could decide to engage in substance-using behavior because they think it might facilitate the formation of other-sex relationships. For example, a study by Lucas and Lloyd (1999) found that, for girls, attracting boys is one of the main reasons for smoking.

A third and most likely explanation stipulates that the inclusion of male friends in girls' networks might

facilitate girls' engagement in substance use because their male friends tend to be older (Poulin & Pedersen, 2007) and may have already begun to experiment with substances. These older male friends may facilitate access to substances or to settings in which substances are easily available, such as parties with older teens. Since the legal drinking age is 18 in Canada, it may simply be more difficult for younger girls to purchase their own alcohol, thus older boys become one point of access for this substance. Similarly, drugs such as marijuana are not available for legal purchase at all, and girls may be exposed to drugs primarily through older youths—especially boys—who are more likely to use this substance and to be dealing it (Centers & Weist, 1998). However, this interpretation remains to be tested given that the present study did not directly verify whether girls' male friends were indeed older. Moreover, going to mixed-gender social events such as parties or dances has been found to be associated with initiation of marijuana use especially among girls (Engels et al., 2007; Guxens, Nebot, & Ariza, 2007).

The boys' greater access to other illegal substances leads to increased use of alcohol and marijuana among their younger female friends. These younger girls' earlier initiation of substance use and greater levels of use in early adolescence enhance the likelihood that they will display problem levels of substance use in late adolescence. To the degree that the girls more rapidly incorporate males into their networks, their access to substances will also increase more rapidly and later levels of use will be higher.

From a developmental perspective, an important question remains: Does this ''negative'' effect of other-sex friendships for girls persist throughout their development or is there a critical period? The current study covered the early adolescent transition during which the most noticeable changes in gender composition of friendship networks were expected (Connolly et al., 2000; Feiring, 1999). We suspect that by middle adolescence, once this transition has been completed, the impact of other-sex friendships on girls' maladjustment fades away. Mixed-gender networks then become more normative and girls are more likely to form romantic relationships with their male peers (Connolly & McIsaac, 2009). The influence of boys on girls' substance-using behavior might then operate in the context of these romantic relationships (Engels & Knibbe, 2000).

For boys, the current study hypothesis stipulating that inclusion of girls in their friendship networks would predict lower substance use was not confirmed. The inclusion of other-sex friends in their networks during the subsequent years did not have an effect on their use of substances, suggesting that girls may not have an influence on boys in this regard. It is possible that the protective effect that females may exert on substance-using behavior among males may only be observed later in development. For example, romantic relationships in late adolescence or early adulthood may promote the desistance of substance use (Rhule-Louie & McMahon, 2007).

Limitations and Future Studies

A first limitation of this study concerns the definition of friendship. Reciprocity of nominations was not taken into account even though it is often considered to be an important aspect of friendship (Hartup, 1996). However, studies in which friendship reciprocity is controlled for are constrained to school friendships. Previous research suggests that constraining adolescents' friendship nominations to the school setting might induce a bias in the gender composition of the friendship network, given that the majority of other-sex friendships take place outside of school (Poulin & Pedersen, 2007). Most of the constructs in this study, including substance use, are 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 geographic area. The current findings should be replicated with more ethnically and economically diverse samples in order to determine whether the associations between other-sex friendships and substance use are similar across cultures and economic levels or vary in important ways.

The present study focused on changes in the proportion of other-sex friends in youths' friendship networks. The processes that might explain why having an increasing number of male friends was associated with substance use among girls were not directly investigated. For instance, future studies should examine the male friends' use of substances, their age, the context of these friendships, and whether (and how) they directly facilitate the girls' access to alcohol and drugs. Another possible mechanism that should be studied concerns the nature of these friendships. For example, having several male friends in her network could increase the likelihood that a girl will find a romantic partner (Connolly et al., 2000). The relationship with this romantic partner and the social events they attend together could then explain an increase in the girl's substance-using behavior (Engels & Knibbe, 2000).

Future studies should also examine the longitudinal associations between other-sex friends and other outcomes such as educational achievement and antisocial behavior. Finally, aspects of these other-sex friendships in early adolescence should be more carefully investigated, including the setting in which they take place, their linkages with the rest of the youth's friendship network, and parental supervision of these new emerging relationships.

In conclusion, it was shown that, even though other-sex friendships could be seen as a desirable and normative form of interpersonal relationship in early adolescence, the *pace* (e.g., slope factor) at which girls introduce boys into their network could also be a reliable indicator of developmental risk.

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