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Longitudinal Associations between Sibling Relationship Qualities and Risky Behavior across Adolescence

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Abstract

This study examined the associations between sibling intimacy and conflict and youths' reports of risky behavior in a sample of adolescents aged 11 to 20. Participants were mothers, fathers, and sibling dyads in 393 families who were interviewed annually for 3, 4, or 5 years. Multivariate multilevel models tested longitudinal links between sibling intimacy and conflict and youths' risky behavior and whether these associations were moderated by birth order, sex, or dyad sex constellation. Controlling for parent-youth conflict, the results showed positive within-person covariation between sibling conflict and risky behavior for all youths except firstborns with younger brothers. Controlling for parent-youth intimacy, sibling intimacy was positively linked with risky behavior at the between-person level, but only in brother-brother pairs. The discussion focuses on sibling relationships as a context for adolescents' individual development and the roles of birth order, sex, and dyad sex constellation.

Keywords

sibling relationships; risky behavior; birth order; adolescence; multilevel modeling

Siblings are a fixture in adolescents' daily lives, and a growing body of evidence suggests that they play a unique role in youths' development (East, 2009; McHale, Kim, & Whiteman, 2006). The sibling bond is unlike any other because it is lifelong, non-elective, and often characterized by an emotionally intense love-hate dynamic (Cicirelli, 1995). For these reasons, siblings have the potential to significantly impact one another's development. The most widely studied sibling influence mechanisms fall under the umbrella of social learning theories (Bandura, 1977), which hold that sisters and brothers influence one another through positive and negative reinforcement in their everyday interactions and through direct observation and modeling. Sibling influences on a range of externalizing problems, such as substance use and delinquency, may be particularly strong during adolescence as youths begin to engage in more of these risky behaviors (Bullock & Dishion, 2002; Rende, Slomkowski, Lloyd-Richardson, & Niaura 2005; Slomkowski, Rende, Conger, Simons, & Conger, 2001). Further, sibling characteristics, such as birth order and sex, have been identified as key factors that shape sibling influences (e.g., Branje, van Lieshout, van Aken, & Haselager, 2004). The present longitudinal study builds on primarily cross-sectional research to address two goals: (1) to test time-varying links between sibling conflict and intimacy and adolescents' risky behavior, and (2) to examine birth order, sex, and dyad sex constellation as potential moderators of these associations.

Sibling Influences on Risky Behavior

Youths who engage in conflict and coercive exchanges with their brothers or sisters are more likely to take part in criminal activities and exhibit higher rates of externalizing behavior problems compared to youths with less conflictual sibling relationships (Compton, Snyder, Schrepferman, Bank, & Shortt, 2003; Natsuaki, Ge, Reiss, & Neiderhiser, 2009;

Stocker, Burwell, & Briggs, 2002). Patterson's (1986) coercive process model provides a framework for understanding the processes underlying these associations and suggests that the sibling context serves as a training ground where children learn how to interact with a social partner. If sibling exchanges are predominantly hostile, then negative interaction patterns are reinforced and the child develops a generalized coercive interpersonal style that may include poor self-regulation skills and an inability to communicate and solve problems calmly and effectively. That style then carries over into other social contexts, leading youths to become friends with peers who have similarly poor social skills and trouble at school, and eventually to develop behavior problems (Criss & Shaw, 2005; Patterson, DeBaryshe, & Ramsey, 1989). The coercive process model has received empirical support across a ten year span for at-risk males and their younger siblings (Bank, Burraston, & Snyder, 2004; Snyder, Bank, & Burraston, 2005).

Although conflictual sibling relationships are clearly a risk factor for problem behaviors, the role of sibling warmth and intimacy in youths' externalizing behavior is less straightforward. On one hand, the same mechanisms at work in the coercive process model might apply to warm and supportive relationships, as a more intimate sibling bond may protect against involvement in delinquent activities (Branje et al., 2004; Buist, 2010; East & Khoo, 2005). For example, siblings can serve as models for one another and reinforce adaptive social skills such as social competence and empathy (Howe, Aquan-Assee, Bukowski, Lehoux, & Rinaldi, 2001; Tucker, Updegraff, McHale, & Crouter, 1999). Youths might then apply these skills to peer interactions, develop healthy relationships with friends and teachers, and avoid getting involved in risky activities.

The peer-like nature of sibling dynamics, however, creates a further layer of complexity, as intimate sibling relationships may also give rise to a "partners in crime" or collusion dynamic (Bullock & Dishion, 2002; Slomkowski et al., 2001; Snyder et al., 2005). Siblings who are close may encourage each other to undertake reckless or illegal activities like smoking, drinking, and engaging in criminal acts together (Bullock & Dishion, 2002). In this case, high sibling intimacy would be associated with *more* risky behavior, in contrast to the typically expected protective effects. Sibling intimacy in itself does not necessarily promote delinquent behavior; rather, it is having an intimate relationship *with a sibling who engages in risky behavior* (Rowe & Gulley, 1992). For example, Slomkowski and colleagues (2001) found that warmth and closeness with an older brother predicted younger brothers' delinquency four years later, but only when the older brother reported a high level of delinquency.

Consistent with social learning theory predictions (Bandura, 1977), sibling intimacy has been shown to moderate the influence of adolescents' substance use, risky sexual behavior, and delinquency on their sibling's behavior, with the strongest degree of sibling similarity found in pairs characterized by a high level of warmth (McHale, Bissell, & Kim, 2009; Rende et al., 2005; Rowe & Gulley, 1992). When delinquent adolescents have warm relationships with a sibling, they may be more likely to encourage their sibling's risky behavior, for instance, by introducing them to a circle of deviant friends or providing illegal substances. Indeed, sisters and brothers who share friends are more likely to report similar levels of delinquency and substance use (Rende et al., 2005; Rowe & Gulley, 1992), and siblings are a source for cigarettes, alcohol, and marijuana for some adolescents (Forster, Chen, Blaine, Perry, & Toomey, 2003; Needle et al., 1986). Taken together, these studies suggest that sibling intimacy may underlie collusion dynamics.

Although the body of research on longitudinal sibling influences is growing, an important limitation of most longitudinal studies is that they do not separate between- and within-person sibling effects (for an exception, see Kim, McHale, Crouter, & Osgood, 2007). Most

theoretical predictions posit within-person processes (Curran & Bauer, 2011), and only a within-person analysis can address questions such as whether youths engage in more risky behavior at times when they report higher sibling conflict than at times when they report lower sibling conflict. In this study, we used multilevel modeling (MLM) to distinguish between- from within-person effects. This approach allowed us to treat each individual as his or her own control, isolate within-person changes in sibling conflict and intimacy, and test whether these changes predicted changes in risky behavior.

The Roles of Birth Order and Sex

Sibling dyad characteristics, including birth order, sex, and dyad sex constellation, create unique family roles for siblings and may moderate sibling influences. Social learning theory (Bandura, 1977) suggests that, by virtue of their maturity, older siblings often act as teachers or role models for their younger siblings (Rowe & Gulley, 1992; Slomkowski et al., 2001) and may therefore impact the younger sibling's participation in risky activities, such as by initiating them into involvement with older, delinquent adolescents (Snyder et al., 2005). Consequently, most sibling analyses are framed to test how older siblings influence their younger siblings, but not vice versa. The few studies that have tested both directions of effect, however, suggest that the associations between sibling relationship qualities like warmth and conflict and youths' adjustment do not differ for older and younger siblings (Branje et al., 2004; Kim et al., 2007; Lauritsen, 1993) and, in some cases, may be stronger for older siblings (Buist, 2010). A limitation of past work is that older and younger siblings are often tested in separate models, making it difficult to assess birth order differences statistically. By using multivariate MLM, we were able to include both siblings in the same model and test statistically for birth order differences.

Sex and dyad sex constellation have also been identified as key factors in sibling influences, though findings are inconsistent. For example, some studies suggest that low sibling warmth and high coercion are more strongly linked to internalizing problems for female adolescents than male adolescents (Compton et al., 2003; Kim et al., 2007). Branje et al. (2004) found that sibling support had a protective effect against externalizing problems, but only for female adolescents with older brothers. A longitudinal study by Buist (2010) showed that improvements in sibling relationship quality (a measure that combined both positive and negative dimensions of the sibling relationship) were associated with slower increases in delinquent behavior for male adolescents with younger brothers.

Some studies have found evidence for collusion only among same-sex dyads (Buist, 2010; Rowe and Gulley, 1992), and particularly among brother pairs (Slomkowski et al., 2001). A caveat of the latter study is that male adolescents reported much higher rates of serious delinquent behaviors than female adolescents, allowing for more opportunities for two brothers to collude. The authors suggested that a stereotypically masculine culture may be more conducive to exchanges wherein brothers enjoy their own and others' delinquent behaviors by recalling stories of previous deeds or laughing about friends' transgressions. Given the conflicting findings from this research, more work is needed to understand the complex dynamics of sex and birth order in sibling influences.

Study Goals

This study explored the role of sibling conflict and intimacy in youths' risk behavior using data from a longitudinal study that followed siblings across the course of adolescence. We built on previous research first, by testing the time-varying associations between sibling intimacy and conflict and risky behavior while controlling for parent-youth relationship qualities. The latter is an essential step in isolating sibling effects because parenting may act as a third variable that explains associations, to the extent that parent-youth conflict is

related to both sibling conflict and youths' risky behavior, for example. Using an MLM approach, we examined within-person associations, testing whether changes in sibling conflict and intimacy predicted changes in risky behavior. We expected to find negative links between intimacy and risky behavior and positive links between conflict and risky behavior. Second, we examined sibling dyad characteristics, including birth order, sex, and dyad sex constellation, as potential moderators of sibling relationship-risky behavior linkages. Consistent with prior research and social learning theory tenets, we expected that sibling effects would be stronger for younger siblings than for older siblings. We also hypothesized that sibling influences would be more prevalent in same-sex dyads, and possibly most evident in brother-brother pairs as demonstrated by previous studies (Buist, 2010; Rowe & Gulley, 1992; Slomkowski et al., 2001).

Method

Participants

Data came from a sample of 400 mothers, fathers, and two target siblings who participated in a longitudinal study of family relationships. Families were recruited via letters sent home through 18 rural and small urban school districts in a northeastern state. Criteria for participation included: (1) having a firstborn child in the target age range, (2) having a second-born child one to four years younger than the first, and (3) having always-married parents. About half of the sample ($n = 197$) was recruited when the firstborn sibling was in 8th, 9th, or 10th grade, and participated in three annual waves of data collection. The remaining 203 families were recruited when the firstborn sibling was in 4th or 5th grade, and participated in as many as 10 annual waves of data collection. For the current analyses, we combined these two cohorts in the years when the participants were approximately the same ages, namely, Years 1, 2, and 3 from the adolescent-age cohort and Years 6, 7, 8, 9, and 10 from the middle childhood-age cohort (termed Times 1, 2, 3, 4, and 5 here). Thus, siblings in the combined sample contributed between 3 and 5 data points, depending on cohort.

By Year 6 (Time 1 in this study), seven families from the middle childhood cohort had withdrawn. Over the course of data collection points used in this study, six more families dropped out, for a total attrition rate of 3%. An additional 1% of the data were missing across all time points and family members. The final sample consisted of the 393 families who provided data for at least one of the measurement points used in this study.

Most families were working or middle class, as reflected by parents' education levels ($M = 14.56$ years, $SD = 2.17$ for mothers, $M = 14.54$ years, $SD = 2.39$ for fathers, where 12 years was equivalent to a high school degree) and family income ($M = \$72,962$, $SD = \$41,265$) at Time 1. Nearly all participants (99%) were European American, with the exception of six African American, five Asian, and three Hispanic participants. Average family size was 4.56 ($SD = 0.85$, range 3-9 family members). The sample was approximately evenly divided by dyad sex constellation (94 older sister-younger sister, 96 older sister-younger brother, 102 older brother-younger sister, and 101 older brother-younger brother pairs). At Time 1, firstborns averaged 15.69 ($SD = 1.06$) and second-borns averaged 13.17 ($SD = 1.28$) years of age. Across all time points, firstborns' age ranged from 13.08 to 20.09 years, and second-borns' age ranged from 10.50 to 18.86. Because of the age difference between siblings and multiple waves of data collection, between 36 and 504 youths provided data at each chronological age from 11 (i.e., 10.5-11.5 years) to 20 (i.e., 19.5-20.5 years).

Although the sample is not representative of U.S. families, it approximates the racial background of families from the area from which the sample was drawn (> 85% White). Data from the U.S. Census Bureau (2002) indicated that the average annual family income in this sample was roughly \$10,000 higher than the statewide average. This is likely because

the sample included two-parent, mostly dual-earner families, with parents who had been in the labor force for many years.

Procedures

Home interviews were conducted separately with mothers, fathers, and the two siblings each year. After receiving a general introduction to the study, families completed informed consent/assent forms and were paid an honorarium (ranging from \$50 to \$200, depending on the year of the study). Family members reported on their family relationships and personal adjustment in interviews lasting between 2 and 3 hours.

Measures

Both siblings reported on *sibling intimacy* using an eight-item (e.g., “How much do you go to your brother/sister for support?”), 5-point scale (1 = *not at all*, 5 = *very much*) adapted from Blyth, Hill, and Thiel (1982). Cronbach's alphas ranged from .84 to .87 across the study waves, and stability coefficients averaged .75 for firstborns and .73 for second-borns. *Sibling conflict* was measured with five items (e.g., “How often do you feel mad or angry at your sister/brother?”) on a 5-point scale (1 = *not at all*, 5 = *very much*) from the Sibling Relationship Inventory (Stocker & McHale, 1992). Reliabilities ranged from .75 to .83 and stability coefficients averaged .67 for firstborns and .63 for second-borns. Responses were averaged and higher scores indicated more conflict or intimacy.

Parent-youth intimacy was assessed with firstborn and second-born siblings' reports of intimacy with their mother and father on the same scale used to measure sibling intimacy (Blyth et al., 1982). Youths answered eight items (e.g., “How much do you go to your mother/father for support?”) about their experiences with each parent during the past year using a 5-point scale. Cronbach's alphas ranged from .79 to .89. *Parent-youth conflict* was measured with a scale adapted from Smetana (1988) on which youths rated the frequency of conflict with each parent in ten domains (e.g., appearance, social life, chores) ranging from 1 (*not at all*) to 6 (*several times a day*). Cronbach's alphas ranged from .71 to .87. Responses were averaged and higher scores indicated more parent-youth conflict or intimacy.

Correlations between youths' reports of mother and father intimacy were moderate (average $r = .52$, $.50$ for firstborns and second-borns, respectively) and correlations between mother and father conflict were high (average $r = .79$, $.74$ for firstborns and second-borns, respectively). Because we did not have hypotheses about different effects for mothers vs. fathers and because indices of parent-youth relationships were control variables and not of central interest in the current study, we averaged across mother- and father-youth intimacy and mother- and father-youth conflict to create single scores for parent-youth intimacy and parent-youth conflict at each time point. (Results from models that included separate effects for mother- and father-child relationship qualities were similar to those in which parents were averaged.) Average stability coefficients were .77 and .74 for parent-youth intimacy, and .65 and .60 for parent-youth conflict reported by firstborns and second-borns, respectively.

Siblings reported on how often they had participated in 18 *risky behaviors* (e.g., smoked cigarettes, skipped a day of school, had contact with the police) in the past year using a 4-point scale (1 = *never*, 4 = *more than 10 times*; Eccles & Barber, 1990). Items were summed and Cronbach's alphas ranged from .86 to .91. A log transformation was applied to correct for positive skew. Stability coefficients averaged .39 for firstborns and .37 for second-borns.

Parents provided information on family background characteristics, including adolescent age and sex, dyad sex constellation, and parent education.

Results

Analysis Plan

Given the nonindependence inherent in the data structure (i.e., individuals over time, firstborn and second-born siblings in the same family), we used a multivariate MLM approach to test the longitudinal associations between sibling relationship qualities and youths' risky behavior. An advantage of MLM is that it does not require each individual to be observed at every chronological age. Further, it uses Maximum Likelihood estimation that accommodates data that are missing at random, thus allowing all available data to be used. Using the MIXED procedure in SAS 9.2, we estimated a series of models in which firstborn and second-born siblings' reports of risky behavior were treated as two time-varying dependent variables. We estimated separate fixed effects for each sibling when appropriate, and all models included separate random effects and residual variances for firstborns and second-borns that were allowed to co-vary (Laurenceau & Bolger, 2005). Youths' age was used as the metric of time, and we included polynomial age terms (i.e., linear, quadratic) to describe the developmental course of risky behavior. Age was centered at 15 years because (1) this was the average age across all years of measurement, and (2) there is substantial variability in risky behavior by middle adolescence, whereas centering at the youngest age would have meant that the fixed effects would capture primarily early starters.

To distinguish between- and within-person effects, we included two versions of sibling conflict and intimacy as predictors. At Level 1, sibling conflict and intimacy each were indicated by a time-varying variable that was centered at each individual's cross-time average. The Level 1 variable reflected within-person effects. At Level 2, sibling conflict and intimacy each were indicated by the individual's (time-invariant) cross-time average, centered at the sample mean. This Level 2 variable captured all between-person variation, meaning that the Level 1 version isolated within-person variation and tested whether *changes* in sibling relationship qualities predicted *changes* in risky behavior, net of stable individual differences in these variables and in other stable individual (e.g., personality) and contextual (e.g., social class) characteristics, whether measured or not (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). The time-varying controls, parent-youth conflict and intimacy, were centered at their sample means and entered at Level 1.

We conducted the analysis in three steps. First, we examined the developmental course of risky behavior by estimating an unconditional growth curve model (Model 1). To identify whether the coefficients should be treated as random or fixed, we estimated a series of nested models and conducted deviance tests to determine the statistical significance of the random effects (Raudenbush & Bryk, 2002). Second, Model 2 tested whether the fixed slopes were conditioned by firstborn sex, second-born sex, or dyad sex constellation. By including firstborn and second-born sex as separate predictors, we were able to test whether adolescents' *own sex* predicted their self-reports of risky behavior (indicated for firstborns by the effect of firstborn sex, and for second-borns by the effect of second-born sex) and whether their *sibling's sex* predicted their self-reports of risky behavior (indicated for firstborns by the effect of second-born sex, and for second-borns by the effect of firstborn sex, labeled "SB sex: FB" and "FB sex: SB", respectively, in Tables 2 and 3). Third, we added between- and within-person sibling conflict (Model 3a) and intimacy (Model 3b) as predictors of change in risky behavior, controlling for the corresponding parent-youth relationship quality and parent education at Time 1 (average of mother and father). Models 3a and 3b also tested whether sex and/or dyad sex constellation moderated sibling relationship-risky behavior associations. Only statistically significant interactions were retained in the final models (Aiken & West, 1991).

At each step in the analysis, we tested whether there were statistically significant birth order differences in any of the effects. The process involved first testing a model that was parameterized so that the main effects represented the effects for firstborns and included interactions with a dummy-coded birth order variable (0 = first born, 1 = second-born). These interaction terms represented the *difference* in effect for firstborns and second-borns. If the difference was significant, separate effects were estimated for each sibling; if the difference was not significant, the effect was pooled across the two siblings.

Growth Curve of Risky Behavior

On average, youths engaged in relatively few risky activities, scoring on the low end of the risky behavior scale which had a range of possible scores from 18 to 72 (Table 1). The deviance tests revealed that the best error structure included random intercepts and linear slopes. As shown in Table 2, we included fixed linear and quadratic slopes that were pooled across both siblings. Although the fixed quadratic slope was not significant in the unconditional model, it became significant in the conditional models and therefore was retained.

Results for Model 2 are presented in Table 2. There was a main effect for firstborn sex, which varied significantly by birth order, $\gamma_{\text{birth order difference}} = -0.10$, $SE = 0.03$, $p = .001$, indicating that it was necessary to estimate separate effects for firstborns and second-borns. The coefficients showed that firstborn sex was predictive of both firstborn and second-born siblings' risky behavior, but that the effect was significantly stronger for firstborns' own behavior. At age 15 (the centering point), risky behavior was higher among firstborn males, $M = 3.28$, $SD = 0.27$, than firstborn females, $M = 3.17$, $SD = 0.23$. In addition, second-borns with older brothers reported more risky behavior, $M = 3.26$, $SD = 0.29$, than those with older sisters, $M = 3.18$, $SD = 0.24$.

Second-born sex ("SB sex") was also a significant predictor, but in contrast to the effects of firstborn sex, this effect did not differ by birth order. At age 15, second-born males reported more risky behavior, $M = 3.24$, $SD = 0.26$, than second-born females, $M = 3.19$, $SD = 0.28$. Firstborns with younger brothers reported more risky behavior, $M = 3.23$, $SD = 0.25$, than those with younger sisters, $M = 3.22$, $SD = 0.27$. The effects for dyad sex constellation (the four combinations of firstborn and second-born sex) were tested by including the interaction between firstborn and second-born sex, but no significant effects emerged.

Significant interactions between age and sex indicated that there were different risky behavior trajectories for females and males. Interactions were followed up by rerunning the same models, but changing the reference group from female to male (in Table 2 the reference group was female). As shown in Figure 1, Panel A, females started off with lower risky behavior scores than males in early and mid-adolescence, but females' risky behavior increased at a faster rate over time. A series of follow-up tests revealed that, by age 18 for firstborns and age 15 for second-borns, females had caught up with males and the sex differences were no longer statistically significant. As shown in Figure 1, Panel B, the effects for sibling's sex indicated that firstborns with younger brothers reported significantly more risky behavior than firstborns with younger sisters from age 14 to 15. Second-borns with older brothers reported significantly more risky behavior than second-borns with older sisters from age 12 to 15.

Links between Sibling Conflict and Risky Behavior

Results for Model 3a revealed significant main effects for sibling conflict at both between- and within-person levels, indicating that youths with higher cross-time average levels of conflict and higher levels relative to themselves at other occasions, also reported engaging in

more risky behavior (see Table 3). Both the between-person and within-person sibling conflict effects were qualified by interactions with second-born sex, and these interaction effects differed significantly by birth order, γ_{B-P} birth order difference = 0.06, $SE = 0.03$, $p = .05$, γ_{W-P} birth order difference = 0.05, $SE = 0.02$, $p = .005$. As shown in Table 3, the sibling conflict $\times$ second-born sex interactions were significant for firstborns but not second-borns. For firstborns with younger sisters, sibling conflict was positively linked with risky behavior at the between-person level, $\gamma_{\text{younger sister}} = 0.06$, $SE = 0.02$, $p < .001$, meaning that firstborns who experienced relatively more conflict with sisters, as compared to other firstborns, also exhibited more risky behavior. There was no link for firstborns with younger brothers, $\gamma_{\text{younger brother}} = -0.02$, $SE = 0.03$, $p = .53$. The same pattern was observed for within-person conflict, indicating that, on occasions when firstborn siblings reported more conflict with their younger sisters than usual, they also reported more risky behavior than usual, $\gamma_{\text{younger sister}} = 0.03$, $SE = 0.01$, $p = .002$; for firstborns with younger brothers, this effect was not significant, $\gamma_{\text{younger brother}} = -0.01$, $SE = 0.01$, $p = .61$. For second-born siblings, the main effects for sibling conflict were significant at both the within- and between-person levels, but there were no significant interactions with firstborn or second-born sex.

Links between Sibling Intimacy and Risky Behavior

The results for Model 3b predicting risky behavior with sibling intimacy revealed no significant between- or within-person main effects; however, a significant interaction between dyad sex constellation and intimacy emerged at the between-person level (Table 3). As shown in Figure 2, follow-up tests revealed that there was a significant positive association between sibling intimacy and risky behavior for brother-brother pairs, $\gamma_{\text{brother-brother}} = 0.08$, $SE = 0.03$, $p = .003$, but there was no link for sister-sister, sister-brother, or brother-sister dyads. This between-person level interaction effect showed that, pooled across all time points, males who reported higher levels of sibling intimacy with their brothers also reported more risky behavior.

Discussion

We estimated the growth curve of risky behavior across adolescence and tested how changes in sibling conflict and intimacy were associated with changes in risky behavior. Using a multivariate MLM approach that included two siblings in the same statistical model allowed us to extend prior research by testing time-varying covariates of risky behavior and examining birth order and sex differences in these effects. By controlling for parent-youth relationship qualities and stable, individual differences – in sibling relationship qualities, but also in unmeasured stable individual qualities and family circumstances – we were able to rule out potential third variable explanations and identify within-person sibling relationship-risky behavior linkages (Curran & Bauer, 2011; Jacobs et al., 2002). Our findings showed that changes in sibling conflict were associated with changes in adolescents' risky behavior, even after accounting for parent-youth conflict and the average level of sibling conflict across time. Within-person effects did not emerge for sibling intimacy, but between-person findings revealed that for brother pairs only, intimacy was positively associated with risky behavior.

Changes in Risky Behavior across Adolescence

Although charting the developmental course of adolescents' risky behavior was not a primary goal of the present study, our findings provide an illustration of how risky behavior changes from early to late adolescence. Youths in this community sample reported relatively low levels of risky behavior on average. Consistent with previous research (see Farrington, 2009 for a review), youths reported increasing levels of delinquent activities with age. We found evidence for distinct trajectories for females and males: Females reported lower risky

behavior in early adolescence, but increased more rapidly over time to catch up with males by their mid- to late teens. The finding that second-born females caught up to their male counterparts more quickly than firstborn females is in line with research from this and other projects suggesting that second-born siblings' developmental trajectories of risky behavior in adolescence may be influenced by having an older sibling. For instance, Rodgers and Rowe (1988) found that younger siblings reported higher levels of sexual activity than their older siblings at the same chronological age. Using the same data as the current study, Shanahan, McHale, Osgood, and Crouter (2007) found that both firstborns and second-borns experienced elevated parent-child conflict during the *firstborn's* transition to adolescence. Second-borns' precocious development may be evidence for collusion or modeling processes, but additional research is needed to explore the underlying mechanisms.

Expanding on previous findings about adolescent sex, we also explored *sibling's* sex as a correlate of growth in risky behavior. In early and mid-adolescence, having a brother was associated with higher levels of risky behavior, regardless of the brother's birth order. This result is consistent with other research documenting the protective effects of older sisters (Updegraff & Umaña-Taylor, 2010).

Links between Sibling Relationship Qualities and Risky Behavior

The main goals of this study were to test the time-varying associations between sibling conflict and intimacy and youths' risky behavior, to examine birth order differences in these links, and to test sex and dyad sex constellation as moderators. The findings were generally consistent with previous research and suggest that sibling conflict is a risk factor for problem behaviors (Compton et al., 2003; Natsuaki et al., 2009; Stocker et al., 2002). Further, our findings suggest that intimacy may be a marker for sibling collusion around risky behavior for brother-brother pairs (Rowe & Gulley, 1992; Slomkowski et al., 2001). It is important to note that the differences between brother-brother pairs and the other three dyad sex constellations were significant, but given the low baseline levels of risky behavior in this sample, the implications of higher levels of risky behavior may not be a cause for concern.

Sibling conflict—Findings for sibling conflict revealed a within-person effect which indicated that, controlling for stable individual differences in sibling conflict, on occasions when youths reported more sibling conflict than usual for them, they also reported more risky behavior. Separating between- and within-person effects allowed us to make a stronger inference about the direction of effect than more commonly used between-person analyses (Curran & Bauer, 2011). The pattern of results is consistent with Patterson's (1986) coercive process model. Youths who engage in excessive arguing or deliberate acts designed to bother or harm a sibling may apply this interpersonal approach in other relationships, making it more likely that they will be involved with similarly coercive peers who may evoke negative reactions from authority figures (Criss & Shaw, 2005; Patterson et al., 1989).

Importantly, the sibling conflict effects emerged even after controlling for time-varying parent-youth conflict, ruling out the possibility that changes in parent-youth conflict explained changes in both sibling conflict and risky behavior. Parent-youth conflict appeared to be an equally strong, if not stronger, predictor of risky behavior than sibling conflict. However, note that the parent-youth conflict effect represents a mixture of between- and within-person effects, as we did not distinguish between them the same way we did for sibling relationships.

For firstborn siblings, the link between conflict and risky behavior was qualified by an interaction with second-born sex. Sibling conflict was positively linked to risky behavior at the between- and within-person levels for all adolescents *except* firstborns with younger

brothers. Although firstborns with younger brothers may engage in the same *amount* of conflict as those with younger sisters (Kim, McHale, Osgood, & Crouter, 2006), the meaning and implications of conflict with a younger brother versus a younger sister may be different. Studies of sex differences in temperament suggest that, compared to girls, boys exhibit more surgency and a tendency to seek high-intensity pleasure such as in rough-and-tumble play (Else-Quest, Hyde, Goldsmith, & van Hulle, 2006). As such, it may be normative to argue with younger brothers who may pick fights with their older siblings. If conflict is instigated by younger brothers, older siblings may take it in stride and not generalize conflict to their relationships with peers or adults the same way that they might generalize conflict with a younger sister. Detailed research on the sequencing and dynamics of sibling conflicts, including which sibling initiates the dispute, how each sibling behaves both during and after the conflict, and the attributions each sibling makes about the event, would help to shed light on these complex processes.

Sibling intimacy—We did not find main effects linking sibling intimacy with risky behavior, but there was a significant interaction with dyad sex constellation showing that higher levels of sibling intimacy were associated with more risky behavior among brother-brother pairs only. This finding suggests that sibling intimacy may not function as a protective factor for risky behavior the same way it does for depressive symptoms and self-esteem (Branje et al., 2004; Kim et al., 2007). Instead, this finding is consistent with research which suggests that an intimate bond with a sibling may be one marker of sibling collusion, wherein siblings encourage or reinforce each other's risky behavior through shared delinquent activities or mutual antisocial friend groups (Rowe & Gulley, 1992; Slomkowski et al., 2001). Like most previous studies, we did not explicitly measure sibling collusion, but rather infer its possible presence from the observed pattern of results. More work that assesses collusion directly (e.g., Bullock & Dishion, 2002) is needed to illuminate how collusion operates in the context of more commonly measured sibling relationship dynamics like intimacy and conflict.

The distinctive pattern of effects for sibling intimacy in brother-brother pairs underscores the role of gender dynamics in family processes. Maccoby (1998) argued that boys and girls grow up in different worlds and that boys' culture is more accepting of shared risk-taking and aggression than is girls'. As suggested by Slomkowski et al. (2001), two brothers who have a warm relationship may be more likely to bond over each other's antisocial behaviors, talk about future or past exploits, or plot to break family rules together. When one (or both) of the siblings is a female, however, the same enjoyment over risk-taking behaviors may be less likely. This effect was evident at the between-person level, but a within-person link between brothers' intimacy and risky behavior did not emerge. An important step for future research is to establish the longitudinal direction of effect, parsing out whether brothers who are more intimate subsequently engage in delinquent behaviors together, or whether antisocial males are more likely to recruit their brothers as partners in crime.

Birth order—Our multivariate MLM approach allowed us to expand on past research, which has primarily focused on sibling influences on younger siblings, by estimating the effects of conflict and intimacy separately for firstborn and second-born siblings and testing for birth order differences. Although social learning theories (Bandura, 1977) suggest that younger siblings are more susceptible to influences from their older siblings than vice versa, few birth order differences emerged in this study, and when they did, they were further moderated by sex. The lack of evidence for birth order differences in the effects for intimacy on brothers' risky behavior is consistent with previous work that has tested both older – to – younger and younger – to – older effects and found similar results for both directions of influence (Branje et al., 2004; Lauritsen, 1993). The findings for conflict, in contrast, indicated different effects for firstborns and second-borns: Conflict appeared to have

universal implications for second-borns, whereas the effects for firstborns were conditioned by their younger sibling's sex such that conflict with younger sisters was associated with more risky behavior, but conflict with younger brothers was not. These findings suggest that birth order dynamics are complex and that they vary depending on the relationship dimension and dyad sex constellation. Although our direct tests of birth order differences are an important step toward disentangling these complexities, a direction for future research is to recruit sibling samples that include youths with a range of ages and age spacings, and that represent all four dyad sex constellations.

Limitations and Implications

This study provides new insights into sibling influences on adolescents' risky behavior, but it also has limitations. First, although our sample shared many characteristics with the population in the area from which it was drawn, it was not nationally representative and the findings should be replicated in more diverse samples. Mexican American siblings spend even more time together than European American siblings (Updegraff, McHale, Whiteman, Thayer, & Delgado, 2005), and ethnic minority adolescents have more siblings than European American adolescents on average (Hernandez, 2004), making the potential for sibling influences even greater in these groups. Cultural values about gender and family roles could have further implications for sibling effects, for example, to the extent that stronger orientation to family intensifies the links between sibling relationships and youths' adjustment (Soli, McHale, & Feinberg, 2009). The results presented here suggest that sibling intimacy may be a risk factor in some sibling pairs, but others have found that a warm sibling relationship can act as a buffer under difficult circumstances like marital hostility (Jenkins & Smith, 1990). Future work should replicate our findings that are suggestive of collusion between brothers across family structures and under conditions of adversity.

Our findings suggest that sibling conflict was more strongly linked with risky behavior than was sibling intimacy, which is consistent with a larger body of research showing that negative interpersonal interactions tend to have larger impacts than positive ones (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). This pattern could be due to the measures we used, for example, to the extent that youth are able to report conflict more accurately than intimacy because it is easier to remember and quantify. This limitation could be addressed by using more objective data collection procedures, such as videotaped observations or daily diary methods. These kinds of approaches, along with collecting reports from other individuals, would also help to address the possibility of inflated associations due to shared method variance, as all measures in this study were self-reports.

By focusing on the time-varying, within-person associations, we were able to eliminate stable third variable explanations of sibling relationship-risky behavior links and control for time-varying parent-youth relationship qualities. Although within-person effects allow for stronger inferences (Curran & Bauer, 2011), it is not possible to determine direction of effect because we studied concurrent co-variations. A direction for future research is to explore the sequencing of these effects such as by using a lagged design to test whether particular sibling experiences lead to later risky behavior, or whether youths' participation in risky behavior leads to subsequent sibling dynamics. Experimental data from interventions aimed at shaping sibling influences would provide for the best test of siblings' causal role in one another's risky behavior (Feinberg, Solmeyer, & McHale, 2012).

In sum, this study illustrates the important role that siblings play in adolescents' development and sheds light on birth order and sex dynamics. Our results are relevant to recent calls (Feinberg et al., 2012; Stormshak, Bullock, & Falkenstein, 2009) to apply sibling research to a prevention framework by working with families around sibling issues, such as conflict and rivalry, with the ultimate goal of reducing youths' adjustment problems.

Our findings suggest that sibling conflict is likely an appropriate behavior for such interventions to target. At the same time, we need to learn more about the role of brothers' intimacy in the development of risky behavior lest programs designed to build positive sibling relationships inadvertently foster collusion or joint sibling deviancy.

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References

- Aiken, L.S.; West, S.G. Multiple regression: Testing and interpreting interactions. Thousand Oaks, CA: Sage; 1991.
- Bandura, A. Social learning theory. Englewood Cliffs, NJ: Prentice Hall; 1977.
- Bank L, Burraston B, Snyder J. Sibling conflict and ineffective parenting as predictors of adolescent boys' antisocial behavior and peer difficulties: Additive and interactional effects. *Journal of Research on Adolescence*. 2004; 14:99–125.10.1111/j.1532-7795.2004.01401005.x
- Baumeister RF, Bratslavsky E, Finkenauer C, Vohs KD. Bad is stronger than good. *Review of General Psychology*. 2001; 5:323–370.10.1037//1089-2680.5.4.323
- Blyth D, Hill J, Thiel K. Early adolescents' significant others: Grade and gender differences in perceived relationships with familial and nonfamilial adults and young people. *Journal of Youth and Adolescence*. 1982; 11:425–450.10.1007/BF01538805 [PubMed: 24310956]
- Branje SJ, van Lieshout CF, van Aken MA, Haselager GJ. Perceived support insibling relationships and adolescent adjustment. *Journal of Child Psychology and Psychiatry*. 2004; 45:1385–1396.10.1111/j.1469-7610.2004.00332.x [PubMed: 15482499]
- Buist KL. Sibling relationship quality and adolescent delinquency: A latent growth curve approach. *Journal of Family Psychology*. 2010; 24:400–410.10.1037/a0020351 [PubMed: 20731486]
- Bullock BM, Dishion TJ. Sibling collusion and problem behavior in early adolescence: Toward a process model for family mutuality. *Journal of Abnormal Child Psychology*. 2002; 30:143–153. 1014753232153.10.1023/A:1014753232153 [PubMed: 12002395]
- Cicirelli, VG. Sibling relationships across the life span. New York, NY: Plenum Press; 1995.
- Compton K, Snyder J, Schrepferman L, Bank L, Shortt JW. The contribution of parents and siblings to antisocial and depressive behavior in adolescents: A double jeopardy coercion model. *Development and Psychopathology*. 2003; 15:163–182. doi:10.1017.S0954579403000099. [PubMed: 12848440]
- Criss MM, Shaw DS. Sibling relationships as contexts for delinquency training in low-income families. *Journal of Family Psychology*. 2005; 19:592–600.10.1037/0893-3200.19.4.592 [PubMed: 16402874]
- Curran PJ, Bauer DJ. The disaggregation of within-person and between-person effects in longitudinal model of change. *Annual Review of Psychology*. 2011; 62:583–619.10.1146/annurev.psych.093008.100356
- East, PL. Adolescents' relationships with siblings. In: Lerner, R.M.; Steinberg, L., editors. *Handbook of adolescent psychology: Contextual influences on adolescent development*. 3rd. Vol. 2. Hoboken, NJ: John Wiley and Sons; 2009. p. 43-73.
- East PL, Khoo ST. Longitudinal pathways linking family factors and sibling relationship qualities to adolescent substance use and sexual risk behaviors. *Journal of Family Psychology*. 2005; 19:571–580.10.1037/0893-3200.19.4.571 [PubMed: 16402872]

- Eccles, J.; Barber, B. The risky behavior scale. The University of Michigan; 1990. Unpublished measure
- Else-Quest NM, Hyde JS, Goldsmith HH, Van Hulle CA. Gender differences in temperament: A meta-analysis. *Psychological Bulletin*. 2006; 132:33–72.10.1037/0033-2909.132.1.33 [PubMed: 16435957]
- Farrington, DP. Conduct disorder, aggression, and delinquency. In: Lerner, RM.; Steinberg, L., editors. *Handbook of adolescent psychology: Individual bases of adolescent development*. 3rd. Vol. 1. Hoboken, NJ: John Wiley and Sons; 2009. p. 683-722.
- Feinberg ME, Solmeyer AR, McHale SM. The third rail of family systems: Sibling relations, mental and behavioral health, and preventive intervention in childhood and adolescence. *Clinical Child and Family Psychology Review*. 2012; 15:43–57.10.1007/s10567-011-0104-5 [PubMed: 22105663]
- Forster J, Chen V, Blaine T, Perry C, Toomey T. Social exchange of cigarettes by youth. *Tobacco Control*. 2003; 12:148–154.10.1136/tc.12.2.148 [PubMed: 12773724]
- Hernandez DJ. Demographic change and the life circumstances of immigrant families. *The Future of Children*. 2004; 14:17–47.
- Howe N, Aquan-Assee J, Bukowski WM, Lehoux PM, Rinaldi CM. Siblings as confidants: Emotional understanding, relationship warmth, and sibling self-disclosure. *Social Development*. 2001; 10:439–454.10.1111/1467-9507.00174
- Jacobs JE, Lanza S, Osgood DW, Eccles JS, Wigfield A. Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development*. 2002; 73:509–527.10.1111/1467-8624.00421 [PubMed: 11949906]
- Jenkins JM, Smith MA. Factors protecting children living in disharmonious homes: Maternal reports. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1990; 29:60–69.10.1097/00004583-199001000-00011 [PubMed: 2295580]
- Kim JY, McHale SM, Crouter AC, Osgood DW. Longitudinal linkages between sibling relationships and adjustment from middle childhood through adolescence. *Developmental Psychology*. 2007; 43:960–973.10.1037/0012-1649.43.4.960 [PubMed: 17605528]
- Kim JY, McHale SM, Osgood DW, Crouter AC. Longitudinal course and family correlates of sibling relationships from childhood through adolescence. *Child Development*. 2006; 77:1746–1761.10.1111/j.1467-8624.2006.00971.x [PubMed: 17107458]
- Laurenceau JP, Bolger N. Using diary methods to study marital and family processes. *Journal of Family Psychology*. 2005; 19:86–97.10.1037/0893-3200.19.1.86 [PubMed: 15796655]
- Lauritsen JL. Sibling resemblance in juvenile delinquency: Findings from the National Youth Survey. *Criminology*. 1993; 31:387–409.10.1111/j.1745-9125.1993.tb01135.x
- Maccoby, EE. *The two sexes: Growing up apart, coming together*. Cambridge, MA: Harvard University Press; 1998.
- McHale SM, Bissell J, Kim JY. Sibling relationship, family, and genetic factors in sibling similarity in sexual risk. *Journal of Family Psychology*. 2009; 23:562–572.10.1037/a0014982 [PubMed: 19685991]
- McHale, SM.; Kim, JY.; Whiteman, SD. Sibling relationships in childhood and adolescence. In: Noller, P.; Feeney, JA., editors. *Close relationships: Functions, forms, and processes*. Hove, England: Psychology Press; 2006. p. 127-150.
- Natsuaki MN, Ge X, Reiss D, Neiderhiser JM. Aggressive behavior between siblings and the development of externalizing problems: Evidence from a genetically sensitive study. *Developmental Psychology*. 2009; 45:1009–1018.10.1037/a0015698 [PubMed: 19586176]
- Needle R, McCubbin H, Wilson M, Reineck R, Lazar A, Mederer H. Interpersonal influences in adolescent drug use: The role of older siblings, parents, and peers. *International Journal of the Addictions*. 1986; 21:739–766. [PubMed: 3781689]
- Patterson, GR. The contribution of siblings to training for fighting: A microsocial analysis. In: Olweus, D.; Block, J.; Radke-Yarrow, M., editors. *Development of antisocial and prosocial behavior: Research theories and issues*. New York: Academic Press; 1986. p. 235-261.
- Patterson GR, DeBaryshe BD, Ramsey E. A developmental perspective on antisocial behavior. *American Psychologist*. 1989; 44:329–335.10.1037/0003-066X.44.2.329 [PubMed: 2653143]

- Raudenbush, SW.; Bryk, AS. Hierarchical linear models. Thousand Oaks, CA: Sage; 2002.
- Rende R, Slomkowski C, Lloyd-Richardson E, Niaura R. Sibling effects on substance use in adolescence: Social contagion and genetic relatedness. *Journal of Family Psychology*. 2005; 19:611–618.10.1037/0893-3200.19.4.611 [PubMed: 16402876]
- Rodgers JL, Rowe DC. Influence of siblings on adolescent sexual behavior. *Developmental Psychology*. 1988; 24:722–728.10.1037/0012-1649.24.5.722
- Rowe DC, Gulley BL. Sibling effects on substance use and delinquency. *Criminology*. 1992; 30:217–233.10.1111/j.1745-9125.1992.tb01103.x
- Shanahan L, McHale SM, Osgood DW, Crouter AC. Conflict frequency with mothers and fathers from middle childhood to late adolescence: Within- and between-families comparisons. *Developmental Psychology*. 2007; 43:539–550.10.1037/0012-1649.43.3.539 [PubMed: 17484569]
- Slomkowski C, Rende R, Conger KJ, Simons RL, Conger RD. Sisters, brothers, and delinquency: Evaluating social influence during early and middle adolescence. *Child Development*. 2001; 72:271–283.10.1111/1467-8624.00278 [PubMed: 11280484]
- Smetana, JG. Concepts of self and social convention: Adolescents' and parents reasoning about hypothetical and actual family conflicts. In: Gunnar, MR.; Collins, WA., editors. *Minnesota Symposia on Child Psychology: Development during the transition to adolescence*. Vol. 21. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988. p. 79-122.
- Snyder J, Bank L, Burraston B. The consequences of antisocial behavior in older male siblings for younger brothers and sisters. *Journal of Family Psychology*. 2005; 19:643–653.10.1037/0893-3200.19.4.643 [PubMed: 16402880]
- Soli AR, McHale SM, Feinberg ME. Risk and protective effects of sibling relationships among African American adolescents. *Family Relations*. 2009; 58:578–592.10.1111/j.1741-3729.2009.00576.x [PubMed: 21743763]
- Stocker CM, Burwell RA, Briggs ML. Sibling conflict in middle childhood predicts children's adjustment in early adolescence. *Journal of Family Psychology*. 2002; 16:50–57.10.1037/0893-3200.16.1.50 [PubMed: 11915410]
- Stocker CM, McHale SM. The nature and family correlates of preadolescents' perceptions of their sibling relationships. *Journal of Social and Personal Relationships*. 1992; 9:179–195.10.1037/0893-3200.16.1.50
- Stormshak EA, Bullock BM, Falkenstein CA. Harnessing the power of sibling relationships as a tool for optimizing social-emotional development. *New Directions for Child and Adolescent Development*. 2009; 126:61–77.10.1002/cd.257 [PubMed: 19960535]
- Tucker CJ, Updegraff KA, McHale SM, Crouter AC. Older siblings as socializers of younger siblings' empathy. *The Journal of Early Adolescence*. 1999; 19:176–198.10.1177/0272431699019002003
- Updegraff KA, McHale SM, Whiteman SD, Thayer SM, Delgado MY. Adolescent sibling relationships in Mexican American families: Exploring the role of familism. *Journal of Family Psychology*. 2005; 19:512–522.10.1037/0893-3200.19.4.512 [PubMed: 16402866]
- Updegraff, KA.; Umaña-Taylor, AJ. Structure and process in Mexican-origin families and their implications for youth development. In: Landale, NS.; McHale, SM.; Booth, A., editors. *Growing up Hispanic: Health and development of children of immigrants*. Washington, DC: The Urban Institute Press; 2010. p. 97-143.
- U.S. Census Bureau. Pennsylvania: 2000. 2002. Retrieved from: <http://www.census.gov/prod/2002pubs/c2kprof00-pa.pdf>

Figure 1.

Estimated growth curves for risky behavior as a function of age, adolescent sex (Panel A), and sibling's sex (Panel B). Lines in Panel A represent the effects of the adolescent's own sex (i.e., firstborn lines are the effects for firstborn sex on firstborn risky behavior, second-born lines are the effects for second-born sex on second-born risky behavior). Lines in Panel B represent the effects of *sibling's sex* (i.e., firstborn lines are the effects for second-born sex on firstborn risky behavior, second-born lines are the effects for firstborn sex on second-born risky behavior). Because there were no Dyad sex constellation $\times$ Age effects and because female was the reference group, the line for firstborn females in Panel A is identical to the line for firstborns with younger sisters in Panel B. Similarly, the line for second-born females in Panel A is the same as the line for second-borns with older sisters in Panel B.

Figure 2. Interaction between between-person sibling intimacy and dyad sex constellation predicting youths' risky behavior. Asterisks indicate an effect that was significantly different from zero, $p < .01$.

Table 1
Means and (Standard Deviations) for Risky Behavior, Sibling Intimacy, and Sibling Conflict

	Firstborns		Second-borns	
	M	(SD)	M	(SD)
Risky behavior				
Time 1	26.08	(7.20)	23.48	(6.01)
Time 2	27.31	(8.13)	24.45	(7.10)
Time 3	28.46	(8.36)	25.95	(7.82)
Time 4	31.26	(9.67)	27.30	(8.77)
Time 5	32.70	(10.19)	29.94	(10.03)
Sibling intimacy				
Time 1	2.86	(0.69)	2.97	(0.72)
Time 2	2.91	(0.69)	3.01	(0.75)
Time 3	3.08	(0.72)	3.16	(0.79)
Time 4	3.32	(0.68)	3.36	(0.76)
Time 5	3.24	(0.74)	3.44	(0.86)
Sibling conflict				
Time 1	2.78	(0.67)	2.83	(0.75)
Time 2	2.61	(0.69)	2.68	(0.74)
Time 3	2.36	(0.69)	2.49	(0.78)
Time 4	2.02	(0.63)	2.13	(0.63)
Time 5	2.01	(0.58)	2.14	(0.64)

Table 2
Unstandardized Coefficients, Standard Errors (SE), Standardized Coefficients, and
Variance Components for Unconditional and Conditional Risky Behavior Growth Curves

Fixed effect	Model 1: Unconditional		Model 2: Conditional	
	Coeff. (SE)	Std. coeff.	Coeff. (SE)	Std. coeff.
Intercept: FB	3.190 (.013)**		3.092 (.022)**	
Intercept: SB	3.206 (.012)**		3.159 (.021)**	
Linear ^a	0.046 (.003)**	.340	0.063 (.005)**	.466
Quadratic ^a	0.001 (.001)	.003	0.004 (.002)**	.055
FB sex: FB			0.163 (.030)**	.157
FB sex: SB			0.060 (.029)*	.058
SB sex ^a			0.047 (.024)*	.089
FB sex × SB sex ^a			-0.031 (.033)	-.030
Linear × FB sex ^a			-0.016 (.007)*	-.060
Linear × SB sex ^a			-0.020 (.005)**	-.074
Quadratic × FB sex ^a			-0.007 (.002)**	-.046
Random effect	Variance (SE)		Variance (SE)	
Residual variance: FB	0.016 (.001)**		0.016 (.001)**	
Residual variance: SB	0.017 (.001)**		0.017 (.001)**	
Residual covariance	-0.001 (.001)		-0.001 (.001)	
Intercept variance: FB	0.056 (.006)**		0.051 (.005)**	
Intercept variance: SB	0.046 (.004)**		0.045 (.004)**	
Intercept covariance	0.020 (.003)**		0.019 (.003)**	
Linear variance: FB	0.003 (.001)**		0.003 (.001)**	
Linear variance: SB	0.002 (.001)**		0.002 (.001)**	
Linear covariance	0.001 (.001)*		0.001 (.001)	

Note. FB = firstborn; SB = second-born. Female = 0; male = 1. Only statistically significant ($p < .05$) interactions were included in the final models.

^aEffect was pooled across both siblings' reports of risky behavior. All other effects were estimated separately for each sibling and followed by "": FB" (firstborn coefficient) or "": SB" (second-born coefficient). For example, the effect labeled "FB sex: FB" indicates the effect for firstborn sex on firstborns' risky behavior, while the coefficient labeled "FB sex: SB" indicates the effect of firstborn sex on *second-borns'* risky behavior.

*
 $p < .05$.

**
 $p < .01$.

Table 3
Unstandardized Coefficients, Standard Errors (SE), Standardized Coefficients, and
Variance Components for Links between Within-Person (W-P) and Between-Person (B-
P) Sibling Relationship Qualities and Risky Behavior

Fixed effect	Model 3a: Sibling Conflict		Model 3b: Sibling Intimacy	
	Coeff. (SE)	Std. coeff.	Coeff. (SE)	Std. coeff.
B-P sib. relationship ^a	0.059 (.015) **	.165	0.003 (.021)	.010
W-P sib. relationship ^a	0.029 (.010) **	.081	0.012 (.008)	.034
B-P sib. relationship × FB sex ^a	---	---	0.001 (.029)	.002
B-P sib. relationship × SB sex: FB ^b	-0.075 (.029) *	-.052	-0.025 (.030)	-.035
B-P sib. relationship × SB sex: SB ^b	-0.020 (.024)	-.014	---	---
B-P sib. relationship × FB sex × SB sex ^a	---	---	0.099 (.044) *	.071
W-P sib. relationship × SB sex: FB	-0.037 (.017) *	-.026	---	---
W-P sib. relationship × SB sex: SB	0.014 (.015)	.009	---	---
Parent education ^a	-0.012 (.004) **	-.089	-0.012 (.004) **	-.088
Parent-youth relationship ^a	0.071 (.007) **	.157	-0.091 (.008) **	-.206
Random effect	Variance (SE)		Variance (SE)	
Residual variance: FB	0.016 (.001) **		0.016 (.001) **	
Residual variance: SB	0.016 (.001) **		0.017 (.001) **	
Residual covariance	-0.001 (.001)		-0.001 (.001)	
Intercept variance: FB	0.042 (.005) **		0.043 (.005) **	
Intercept variance: SB	0.039 (.004) **		0.038 (.003) **	
Intercept covariance	0.017 (.003) **		0.015 (.003) **	
Linear variance: FB	0.002 (.001) **		0.002 (.001) **	
Linear variance: SB	0.002 (.001) **		0.002 (.001) **	
Linear covariance	0.001 (.001)		0.001 (.001)	

Note. FB = firstborn; SB = second-born. Female = 0; male = 1. Sib. = Sibling. Only statistically significant ($p < .05$) and necessary lower-order interactions were included in the final models.

All predictors from Model 2 were included but are not shown.

^aEffect was pooled across both siblings' reports of risky behavior. All other effects were estimated separately for each sibling and followed by “: FB” (firstborn coefficient) or “: SB” (second-born coefficient).

^bFor conflict model, B-P sibling conflict × Second-born sex was estimated separately for firstborns and second-borns; for intimacy model, B-P sibling intimacy × Second-born sex was pooled across both siblings.

*
 $p < .05$.

**
 $p < .01$.