

## Sibling Relationship Quality and Adolescent Delinquency: A Latent Growth Curve Approach

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The present study examined whether level and changes in sibling relationship quality and older sibling delinquency are related to level and changes in younger sibling delinquency, for brother, sister, older brother/younger sister and older sister/younger brother sibling pairs. Questionnaire data were collected from 249 Dutch sibling pairs (11–15 years old) over a period of three years, with annual measurements. Results showed that level and over-time changes in sibling relationship quality and older and younger sibling delinquency were significantly different for the four sibling gender combinations. Results of multivariate growth curve modeling showed that sibling relationship quality was related to delinquency of older siblings (but not younger siblings), and delinquency of older siblings was associated with younger sibling delinquency two years later. We also found differences between the four sibling gender combinations. For example, for brother and sister pairs (but not mixed-sex sibling pairs), over-time changes in older sibling delinquency were related to younger sibling delinquency two years later as well as the change pattern in younger sibling delinquency over time. Strengths, limitations and possible implications for research and intervention of adolescent delinquency are discussed.

*Keywords:* sibling relationship quality, delinquency, adolescence, latent growth curve modeling, gender differences

The sibling relationship is a unique relationship in an individual's life. It is one of the most enduring and emotionally evocative relationships; most sibling relationships are characterized by love and warmth as well as by conflict and rivalry (Deater-Deckard, Dunn, & Lussier, 2002; Noller, 2005). Many studies have shown that siblings have a strong impact on the psychosocial development of children (Dunn, 2000). This influence is found for sibling behavior, as well as for quality of the sibling relationship, and has been found in all developmental periods, including adolescence.

Several studies have shown that there is similarity between siblings concerning adolescent delinquency (Fagan & Najman, 2003; Rowe, Rodgers, & Meseck-Bushey, 1992; Slomkowski, Rende, Conger, Simons, & Conger, 2001). Delinquent behavior of siblings may influence adolescents' delinquency in several ways. First, observation of delin-

quent acts of siblings and of their negative and coercive interactions with parents and peers may promote such behaviors in adolescents (Snyder, Bank, & Burraston, 2005). Observational learning is especially salient in sibling relationships because siblings have three important features (power, nurturance, and similarity) that increase the chance that they will be used as a model for behavior (Whiteman, McHale, & Crouter, 2007). Additionally, deviancy training may also explain the similarity between siblings in delinquency. Deviancy training refers to social processes that stimulate deviant acts, e.g., talking about delinquency and expressing positive attitudes towards such norm-violating talk and activities (Snyder, Schrepferman et al., 2005). Older siblings that discuss delinquent acts in a positive way with their younger siblings are likely to influence them in an adverse way. Whereas most studies on deviancy training have focused on peer influences, the same processes are likely to occur in the sibling context.

In addition to the influence of delinquent behavior of siblings, quality of the sibling relationship may also be a risk factor. If the sibling relationship is characterized by conflict or lack of warmth, this increases the chance that children will become (more) delinquent (Bank, Burraston, & Snyder, 2004; Bank, Patterson, & Reid, 1996). Some studies have indicated that (lack of) positive affect in the sibling relationship is more strongly linked with child adjustment than sibling conflict (Dunn, Slomkowski, Beard-sall, & Rende, 1994; Pike, Coldwell, & Dunn, 2005). Because of the apparent importance of positive sibling relationship quality, we focus on this particular aspect of

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sibling relationships. In addition, several researchers have indicated that the behavior of and relationship with an older sibling is especially influential on behavior of the younger sibling (Dunn et al., 1994; Stocker, Burwell, & Briggs, 2002; Whiteman et al., 2007). Therefore, we will examine whether older sibling delinquency and sibling relationship quality are related to younger sibling delinquency in adolescence.

Whereas research has shown that *level* of older sibling delinquency and sibling relationship quality are associated with younger sibling delinquency, we lack information concerning the associations between *changes* during adolescence in older sibling delinquency and sibling relationship quality and younger sibling delinquency. The sibling relationship is not static, but changes during the life span (Sanders, 2004). Some researchers have indicated that there seems to be a (temporary) decrease in warmth and closeness during adolescence (Noller, 2005; Slomkowski & Manke, 2004). At the same time, delinquency generally increases from early to middle adolescence (e.g., Moffit, 1993; Selfhout, Branje, & Meeus, 2008). Only very few studies have focused on how longitudinal changes in sibling relationships and delinquency are interrelated.

Richmond, Stocker, and Rienks (2005) have studied the links between changes in sibling relationship quality and child externalizing problems and depressive symptoms, and found only effects on depressive symptoms, not on externalizing problems. However, they did not distinguish between aggression and delinquency, and they used only parent reports. Especially for delinquency, this may have led to an underestimation of problem behavior (see for example Fagan & Najman, 2003). Duncan, Duncan, and Hops (1996) have examined these longitudinal links concerning adolescent substance use and found that level as well as change in sibling substance use were significantly related to level and change in target adolescent substance use. Their study showed that levels of concurrent use were similar between sibling pairs, but also that siblings followed similar developmental patterns over time. This might also be the case for delinquency: changes over time in sibling delinquency may be related to changes over time in adolescent delinquency. We therefore aim to study these processes specifically for delinquent behavior.

### Differences Between Gender Compositions

Studies focusing on sibling gender composition differences in sibling relationship quality have indicated more positive interactions in same-sex sibling pairs than in mixed-sex sibling pairs, especially for sister pairs (Aguilar, O'Brien, August, Aoun, & Hektner, 2001; Jenkins Tucker, McHale, & Crouter, 2001). Older brother/younger sister dyads appear to be the most negative (Aguilar et al., 2001).

Inconsistent results were found concerning differences between same-sex and mixed-sex sibling pairs in *changes* in relationship quality during adolescence. Some studies have found different over-time change patterns in sibling relationship quality for different sibling gender compositions

(Buist, Deković, Meeus & van Aken, 2002; Kim, McHale, Osgood, & Crouter, 2006). Other studies found that sibling gender composition was not related to over-time changes in sibling relationship quality (Feinberg, McHale, Crouter, & Cumsille, 2003; Stocker & Dunn, 1994).

Research has also shown several differences in sibling similarity according to gender constellation of sibling pairs. Results of studies on similarity between siblings in delinquency and other deviant behavior indicate that similarity seems to be larger for brother and sister pairs as compared to mixed-sex sibling pairs (Rowe & Gulley, 1992). It is important, however, to study the social patterns that explain these differences in similarity between same-sex and mixed-sex sibling pairs. The fact that there is less similarity in delinquency between mixed-sex siblings does not mean that they do not influence each other (Snyder, Bank et al., 2005). However, research that focused on differences between sibling gender combinations concerning patterns of associations between sibling relationship quality and sibling delinquency is lacking. Therefore, we will also examine whether there are differences between the four sibling gender combinations (brother, sister, older brother/younger sister and older sister/younger brother pairs) concerning the associations between level and changes in sibling relationship quality and older sibling delinquency sibling on the one hand and level and changes in delinquency of the younger sibling on the other hand.

### Aims and Hypotheses

In conclusion, the first aim of the present study is to examine the extent to which level and changes in sibling relationship quality and delinquency of the older sibling are associated with level and changes in delinquency of the younger sibling across a three-year period. Our second aim is to examine whether these patterns are different for the four sibling gender combinations.

Based on previous studies, we expect that both lower levels of sibling relationship quality and higher levels of older sibling delinquency are associated with higher levels of younger sibling delinquency. On the basis of the findings of multivariate longitudinal studies on substance use, we expect comparable patterns for delinquency, namely that *changes* in older sibling delinquency are associated with similar changes in younger sibling delinquency. Due to the lack of studies on longitudinal patterns concerning the link between sibling relationship quality and younger sibling delinquency, it is yet unclear whether changes in sibling relationship quality are related to changes in younger sibling delinquency.

Concerning differences between sibling gender constellations, we hypothesize that associations are stronger for same-sex siblings (brother and sister pairs) than for mixed-sex siblings (older brother/younger sister and older sister/younger brother pairs), based on greater similarity between same-sex sibling pairs.

## Method

### Sample and Procedure

Twenty-three Dutch municipalities supplied a list of candidate families with at least two children between 11 and 15 years old and their two parents, all living at the same address. These families received an invitation letter and were contacted by phone. Of the candidate families, 288 (44.4%) agreed to participate. Data collection took place during three yearly home visits by trained interviewers. A total of 288 families participated in the first measurement wave, and 285 in the second and third measurement wave. So, only three families dropped out during the course of the study.

In each family, father, mother, a target adolescent, and a younger sibling participated in the study. All participating families were intact, of Dutch origin, and from rural as well as urban Dutch municipalities. Of the fathers, 45.1% had a college degree, 18.1% had finished secondary education, 30.9% only had a high school diploma and 5.9% had no high school or other diplomas. The vast majority of fathers (88.9%) worked full time. Of the mothers, 27.9% had a college degree, 19.1% had finished secondary education, 35.7% only had a high school diploma, and 3.2% had no high school or other diplomas. Almost a third (30.9%) of the mothers were stay-at-home moms without paid employment, 59.0% had part time jobs, and 5.6% had full time jobs.

To increase homogeneity of the sample, we limited our sample to sibling pairs in which the younger sibling was between 11 and 13 years old, and the age difference between the siblings was between 1 and 3 years, resulting in 249 sibling pairs. Of these sibling pairs, 59 were brother pairs, 65 were sister pairs, 63 were older brother/younger sister pairs, and 62 were older sister/younger brother pairs. Mean age at Time 1 was 12.4 years for younger and 14.5 years for older siblings.

Siblings filled out questionnaires concerning their relationship and concerning their own and their sibling's delinquency. Parents reported on both adolescents' delinquency. They all did this three times, with one-year intervals between measurements.

### Measures

**Sibling relationship quality.** Sibling relationship quality was measured with the Inventory of Parent and Peer Attachment (IPPA; Armsden & Greenberg, 1987). The IPPA was designed to measure the quality of communication, trust and (lack of) alienation an individual perceives in a particular relationship. The scale contains 10 items, using a 5-point Likert scale response format (1 = very untrue to 5 = very true). Sample items are: "I easily get upset with my brother/sister" (recoded) and "My brother/sister accepts me as I am." Mean Cronbach's alpha (T1, T2, and T3; older and younger sibling) was .84, range .80 to .88. Older and younger sibling reports were significantly correlated (.41, .44, and .43 for T1, T2, and T3 respectively).

Additionally, we used principal component analysis to examine whether scores of both siblings could be combined. The analyses showed that only one factor exceeded unity, explaining 70.9 to 72.6 percent of the variance, and high factor loadings (range from .84 to .85) indicated it was justified to compute composite scores. So, for each measurement wave, scores of both siblings were combined into one Sibling relationship quality score by computing their mean. Higher scores indicate higher sibling relationship quality.

**Delinquent behavior.** Delinquent behavior was assessed by the Delinquency scale of the Nijmegen Problem Behavior List (NPBL Research version; Scholte, Vermulst, & de Bruyn, 2001). Items represent relevant problems in adolescence that cause some concern, but are not serious enough for clinical intervention. The 5 items were rated on a 5-point scale (1 = does not apply to me at all to 5 = applies to me very well), and added to represent a total delinquency score. Sample items are "I do things that could get me in trouble with the law" and "I sometimes use alcohol or cigarettes." Delinquency was rated by the adolescents themselves, as well as by their siblings, fathers and mothers. All reports were significantly correlated (mean  $r = .25$ ).

We used principal component analysis to examine whether delinquency reports of self, sibling, father and mother could be combined. Our analyses showed that for each sibling and each measurement wave, only one factor exceeded unity, explaining 38.9 to 46.4 percent of the variance. Factor loadings ranging from .55 to .72 indicated it was justified to compute composite scores. So, for each measurement wave, delinquency scores for the younger and older sibling were computed by taking the mean of self, sibling, father and mother report. Cronbach's alpha of the total scale (using all informants) ranged between .76 and .83. Higher scores indicate higher levels of delinquency.

## Results

### Descriptive Statistics

Means and standard deviations of sibling relationship quality and older and younger sibling delinquency are presented in Table 1, separately for the four gender combinations.

Repeated measures Anova's indicated that there were significant differences between the four gender combinations concerning sibling relationship quality,  $F(3, 245) = 5.83, p < .01$ . Post-hoc Bonferroni tests showed that sister pairs report significantly higher sibling relationship quality than older brother/younger sister sibling pairs. There were also differences concerning older sibling delinquency,  $F(3, 245) = 4.77, p < .01$ , and younger sibling delinquency,  $F(3, 245) = 4.81, p < .01$ . Post-hoc tests showed that older sibling delinquency was significantly higher in brother pairs than in sister pairs and older sister/younger brother pairs, and that younger sibling delinquency was also significantly higher in brother pairs than in the other three sibling gender combinations.

Table 1

*Descriptive Statistics for Sibling Relationship Quality and Delinquency of Older Sibling and Younger Sibling, Separately for the Four Sibling Gender Combination Groups*

Variable	T1		T2		T3	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Brother pairs ( <i>N</i> = 59)						
Sibling relationship quality	3.20	.47	3.36	.46	3.39	.58
Delinquency older sibling	8.36	1.76	8.39	1.86	8.89	2.28
Delinquency younger sibling	8.05	1.73	8.35	1.89	8.57	1.97
Sister pairs ( <i>N</i> = 65)						
Sibling relationship quality	3.47	.50	3.56	.58	3.63	.53
Delinquency older sibling	7.75	1.68	7.49	1.43	7.48	1.52
Delinquency younger sibling	7.49	1.31	7.37	1.33	7.40	1.41
Older brother, younger sister pairs ( <i>N</i> = 63)						
Sibling relationship quality	3.12	.54	3.24	.52	3.28	.61
Delinquency older sibling	7.88	1.45	8.25	1.68	8.39	1.93
Delinquency younger sibling	7.54	1.55	7.57	1.79	7.56	1.75
Older sister, younger brother pairs ( <i>N</i> = 62)						
Sibling relationship quality	3.32	.54	3.26	.55	3.42	.49
Delinquency older sibling	7.78	1.66	7.68	2.05	7.68	1.99
Delinquency younger sibling	7.56	1.39	7.52	1.80	7.51	1.79

*Note.* Possible range for sibling relationship quality 1–5; for delinquency 5–25.

Correlation analyses showed that for all sibling gender combinations, many correlations between sibling relationship quality on the one hand and delinquent behavior of the older and younger sibling on the other hand were significant, both concurrent and longitudinal.<sup>1</sup> Additionally, all associations between delinquent behavior of the older sibling and delinquent behavior of the younger sibling were found significant, for all four sibling gender combinations.

### Latent Growth Curve Modeling

A latent growth curve modeling (LGM) approach was used (LISREL 8; Jöreskog & Sörbom, 1993) to examine level and changes over time of sibling relationship quality and delinquent behavior of both siblings. In LGM, development in a particular concept is described by two factors. The first factor, the *level factor*, describes the initial level (level mean) and individual differences in the initial level (level variance). The latent factor “level” is a constant for any given individual across time. Therefore, the factor loadings are set at 1 for each point in time. The second factor, the *slope factor*, describes the growth or rate of change (slope mean) and individual differences in rate of change (slope variance). The factor loadings for the slope factors are either fixed or freely estimated, depending on the theorized pattern of growth (e.g., linear or non-linear).

First we tested (separately for sibling relationship quality, older sibling delinquency and younger sibling delinquency, and separately for the four sibling gender combinations) whether the growth trajectories were linear or non-linear. For sibling relationship quality and older sibling delinquency, we formulated linear models in which the factor loadings of the T1, T2, and T3 variables on the latent slope factor were fixed at 0, 1, and 2. We compared these linear models to non-linear models in which the factor loadings of the T1 and T2 variables on the latent slope factor were fixed

at 0 and 1, and the factor loading of the T3 variables was estimated freely. For younger siblings, we were interested in their rate of change and their level of delinquency at T3. Therefore, in the growth curve models for younger sibling delinquency, time was centered at T3 by fixing the factor loadings of the T1, T2, and T3 variables on the latent slope factor at  $-2$ ,  $-1$ , and  $0$  (for the linear model). So, in these models, level indicates the amount of delinquency at T3 (East & Khoo, 2005).

We used chi-square difference tests to determine the best-fitting model. Since non-linear models are more complex and have less degrees of freedom, we only accepted these models when they provided a significantly improved fit compared to the linear models as indicated by a significantly lower chi-square (Keijsers, Frijns, Branje, & Meeus, 2009). Chi-square difference tests indicated that growth was linear for sibling relationship quality, older sibling delinquency as well as younger sibling delinquency, for all four sibling gender combinations.

Second, we formulated a multivariate model in which level of sibling relationship quality was related to level and slope of older and younger sibling delinquency. Slope of sibling relationship quality was related to slope of older and younger sibling delinquency. Level of older sibling delinquency was connected to level and slope of younger sibling delinquency and to slope of sibling relationship quality. Slope of older sibling delinquency was connected to level and slope of younger sibling delinquency. See Figure 1 for this conceptual model. Additionally, within waves, measurement errors between older and younger sibling delinquency were correlated. So, for example, the measurement error of T1 older sibling delinquency was correlated with T1 younger sibling delinquency.

<sup>1</sup> Correlation tables may be obtained from Kirsten Buist.

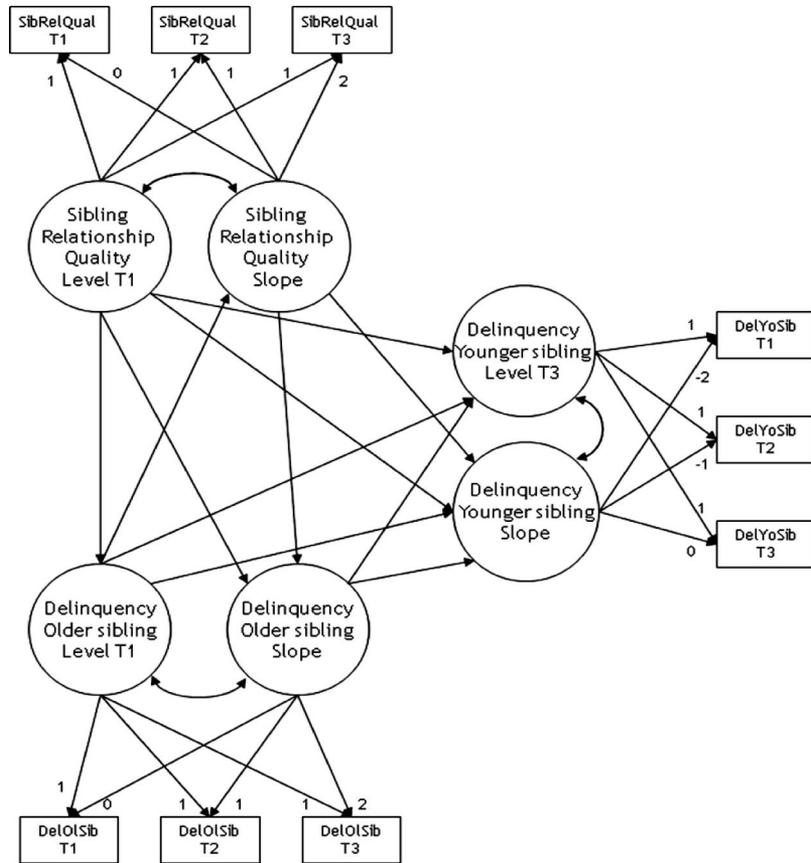


Figure 1. Hypothesized model of the links between level and slope of sibling relationship quality and delinquency older sibling and level and slope of delinquency younger sibling.

We first tested this multivariate model for each of the four sibling gender combinations separately. These models showed an adequate fit:  $\chi^2(21) = 29.69, p = .10, RMSEA = .08, CFI = .98$  for brother pairs,  $\chi^2(21) = 19.68, p = .54, RMSEA = .00, CFI = 1.00$  for sister pairs,  $\chi^2(21) = 27.15, p = .17, RMSEA = .07, CFI = .98$  for older brother/younger sister pairs and  $\chi^2(21) = 25.96, p = .17, RMSEA = .07, CFI = .97$  for older sister/younger brother pairs.

Next, because we hypothesized differences in patterns between the sibling gender combinations, we formulated a multi-group multivariate model. We compared five models,

see Table 2. In the first model (model a), latent growth parameters and paths between latent growth parameters were estimated separately for the four types of sibling pairs, resulting in an adequate fit,  $\chi^2(112) = 114.11, p = .43, RMSEA = .018, CFI = .99$ . This model was compared to a second model (model b), in which all growth parameters and paths were set equal,  $\chi^2(165) = 274.51, p = .00, RMSEA = .090, CFI = .95$ . Model comparison showed a significant difference between this fully constrained model and the unconstrained model,  $\Delta\chi^2(53) = 133.40, p < .001$ . Next, we tested three alternative models, in which respec-

Table 2  
Model Comparison Multivariate Growth Curve Models

Multivariate growth models	df	$\chi^2$	p	RMSEA	CFI
a. Parameters estimated separately	112	114.11	.43	.018	.99
b. All parameters equal	165	247.51	.00	.090	.95
Model b vs. model a	53	133.40	<.001		
c. Means of level and slope (alpha) equal	130	167.14	.02	.068	.97
Model c vs. model a	18	53.03	<.001		
d. Variances of level and slope (psi) equal	136	163.43	.05	.057	.98
Model d vs. model a	24	49.32	<.01		
e. Beta's equal	123	137.25	.18	.043	.99
Model e vs. model a	11	23.14	<.05		

tively level and slope means (alpha's), level and slope variances (psi's) and paths (beta's) were set equal. Model comparison showed that all these constrained models had a significantly worse model fit (see Table 2: models c, d, and e). We therefore concluded that model a, in which all paths were estimated separately for the four sibling gender combinations, fit the data best. So, mean and variance of level and slope of sibling relationship quality, older sibling delinquency and younger sibling delinquency, as well as paths between these growth parameters, were different for the four sibling gender combinations.

To facilitate convergence, non-significant paths were dropped from the model. In our final model, level and slope means, level and slope variances as well as paths were estimated separately for the four sibling gender combinations. This final model had a good fit,  $\chi^2(123) = 122.21$ ,  $p = .50$ , RMSEA = .00, CFI = .99. The parameter estimates of this model can be found in Table 3.

### Means and Variances of Level and Slope

Mean and variance of *level* of sibling relationship quality, older sibling delinquency and younger sibling delinquency were almost all significant (see Table 3). The *slope* mean for sibling relationship quality was significant for brother, sister and older brother/younger sister pairs. Slope mean for older sibling delinquency was only significant for brother and older brother/younger sister pairs, and the slope mean for younger sibling delinquency was only significant for older sister/younger brother pairs. Slope variances were significant for sibling relationship quality (brother and older brother/younger sister pairs), older sibling delinquency (sis-

ter and older brother/younger sister pairs) and for younger sibling delinquency (for older sister/younger brother pairs).

### Paths Between Level and Slope

Table 4 shows the significant paths between level and slope of sibling relationship quality, older sibling delinquency and younger sibling delinquency.

Only one path was significant for all four sibling gender combinations: level of delinquency of the older sibling had a significant positive association with level of delinquency of the younger sibling. More delinquent behavior of the older sibling at T1 was associated with more delinquent behavior of the younger sibling at T3.

For sister, older brother/younger sister and older sister/younger brother pairs, we found a significant negative association of level of sibling relationship quality with level of delinquency of the older sibling. So, higher sibling relationship quality at T1 was associated with less delinquent behavior of older siblings at T1.

For brother and for sister pairs, we found a significant positive association of slope of older sibling delinquency with level and slope of younger sibling delinquency. This indicates that a faster increase in older sibling delinquency was associated with more delinquent behavior of younger siblings at T3, and that rates of change of older and younger sibling delinquency were similar for same-sex sibling pairs.

Level of older sibling delinquency is significantly associated with slope of sibling relationship quality for brother and older sister/younger brother pairs: more older sibling delinquency was linked to a slower increase in sibling relationship quality for brother pairs and a faster decrease in

Table 3

*Parameter Estimates of the Final Multivariate Multi-Group Latent Growth Models for Sibling Relationship Quality and Delinquency of Older Sibling and Younger Sibling, for the Four Sibling Gender Combinations (T-Values Between Parentheses)*

Parameters	Multivariate Multigroup Model		
	Sibling relationship quality	Delinquency older sibling	Delinquency younger sibling
Brother pairs ( $N = 59$ )			
Level mean	3.32 (54.86)	8.26 (38.36)	4.55 (3.33)
Level variance	0.15 (4.43)	1.98 (4.28)	1.77 (4.38)
Slope mean	0.50 (2.63)	2.26 (2.53)	0.07 (0.53)
Slope variance	0.02 (2.13)	0.22 (1.72)	0.03 (0.09)
Sister pairs ( $N = 65$ )			
Level mean	3.48 (53.76)	12.38 (10.11)	2.04 (3.52)
Level variance	0.22 (5.00)	1.88 (4.47)	0.67 (3.30)
Slope mean	0.08 (3.17)	-0.13 (-1.51)	0.03 (0.33)
Slope variance	0.01 (1.19)	0.24 (2.40)	0.09 (1.04)
Older brother-younger sister pairs ( $N = 63$ )			
Level mean	3.13 (47.52)	11.82 (9.30)	0.86 (1.10)
Level variance	0.21 (4.73)	1.51 (4.63)	1.11 (3.11)
Slope mean	0.08 (2.67)	0.26 (2.56)	0.02 (0.20)
Slope variance	0.02 (2.18)	0.41 (4.13)	0.13 (1.27)
Older sister-younger brother pairs ( $N = 62$ )			
Level mean	3.28 (47.91)	14.06 (9.42)	1.15 (1.02)
Level variance	0.20 (4.33)	1.30 (3.24)	1.17 (4.95)
Slope mean	-0.30 (-1.79)	-0.05 (-0.57)	-3.92 (-3.68)
Slope variance	0.00 (0.31)	0.01 (0.12)	-0.13 (-2.31)

Table 4  
Regression Coefficients (Standardized Beta's) Between Growth Parameters in the Final Multivariate Latent Growth Model

	Group 1 N = 59	Group 2 N = 65	Group 3 N = 63	Group 4 N = 62	Significant differences	Model comparison $\Delta\chi^2(1)$
Level sibling relationship quality → Level delinquency older sibling	—	-.41*	-.42*	-.60**	ns	—
Level sibling relationship quality → Slope delinquency older sibling	-.38*	—	—	—	ns	—
Level sibling relationship quality → Level delinquency younger sibling T3	—	—	—	.26*	ns	—
Level sibling relationship quality → Slope delinquency younger sibling	—	—	—	—	2-4** 3-4**	7.63, $p < .01$ 11.72, $p < .001$
Slope sibling relationship quality → Slope delinquency younger sibling	—	—	—	—	ns	—
Slope sibling relationship quality → Slope delinquency older sibling	-.49*	—	—	—	ns	—
Level delinquency older sibling → Slope sibling relationship quality	-.45*	—	—	.78*	1-3** 1-4**	8.79, $p < .01$ 11.04, $p < .001$
Level delinquency older sibling → Level delinquency younger sibling T3	.34*	.89**	.74**	.74**	1-3*	4.60, $p < .05$
Level delinquency older sibling → Slope delinquency younger sibling	—	—	—	.37*	1-4*	4.74, $p < .05$
Slope delinquency older sibling → Level delinquency younger sibling T3	.52*	.50*	—	—	2-4*	4.60, $p < .05$
Slope delinquency older sibling → Slope delinquency younger sibling	.98*	.69*	—	—	3-4** 1-3*	7.12, $p < .01$ 4.05, $p < .05$
					2-3*	6.02, $p < .05$
					1-3*	5.39, $p < .05$
					2-3*	4.40, $p < .05$

Note. Group 1 = brother pairs; Group 2 = sister pairs; Group 3 = older brother/younger sister pairs; Group 4 = older sister/younger brother pairs.  
\*  $p < .05$ . \*\*  $p < .01$ .

sibling relationship quality for older sister/younger brother pairs.

Several patterns were unique for a particular sibling gender combination. Only for brother pairs, a higher level of sibling relationship quality was associated with a slower increase in older sibling delinquency, and a faster increase in sibling relationship quality was associated with a slower increase in older sibling delinquency. Only for older sister/younger brother pairs, a higher level of sibling relationship quality or a higher level of older sibling delinquency was associated with a faster decrease in younger sibling delinquency.

The fact that a beta is significant for one sibling gender combination and not for another does not automatically imply that the difference between these two betas is significant. We therefore used model comparison with chi-square difference tests to examine which paths were significantly different between groups. We compared all betas between all four groups. Results can be found in the two last columns in Table 4. There were no significant differences in associations between brother and sister pairs. Most of the significant differences we found were between a same-sex sibling pair and a mixed-sex sibling pair. For example, the association of slope of older sibling delinquency with level and slope of younger sibling delinquency was significantly stronger for brother and sister pairs than for older brother/younger sister pairs. However, we did find some significant differences between mixed-sex sibling pairs. The association of level of sibling relationship quality and of level of older sibling delinquency with slope of younger sibling delinquency was significantly stronger for older sister/younger brother pairs than for older brother/younger sister pairs.

### Discussion

The first aim of the present study was to examine the extent to which level and changes in sibling relationship quality and delinquency of the older sibling was associated with level and changes in delinquency of the younger sibling. Our second aim was to investigate whether there were differences between the four sibling gender combinations in these patterns.

### Links Between Sibling Relationship Quality and Sibling Delinquency

Our results showed that our hypothesis that lower levels of sibling relationship quality would be related to higher levels of *younger* sibling delinquency was not confirmed. This is not entirely consistent with earlier studies (Bank et al., 2004; Bank et al., 1996; Criss & Shaw, 2005). This inconsistency may be caused by study characteristics: these particular studies mainly focused on negative relationship characteristics (e.g., conflict) of male adolescents. However, we did find that lower levels of sibling relationship quality were associated with higher levels of *older* sibling delinquency, which is consistent with other studies with similar sample characteristics (Branje, van Lieshout, van Aken, &

Haselager, 2004). The sibling relationship is often seen as an important training ground for social competence (Brody, 1998). A less positive sibling relationship may have an adverse effect on competence with peers and on self-esteem, and this may affect vulnerability to deviant peers and acting-out behavior (Yeh & Lempers, 2004). Perhaps these adverse effects are more pronounced during middle adolescence than during early adolescence, when delinquency levels are still relatively low (Moffitt, 1993).

### Links Between Older and Younger Sibling Delinquency

Our results also showed that our expectation that higher levels of older sibling delinquency would be linked to higher levels of younger sibling delinquency was confirmed for all sibling gender combinations. This finding is consistent with earlier findings (e.g., Slomkowski et al., 2001). Sibling similarity in delinquent behavior may be explained by several processes. First of all, modeling explains this association: younger siblings observe negative behavior of their older siblings, and incorporate this behavior in their own behavioral repertoire. Most siblings live in the same household during early and middle adolescence and spend a lot of time together. Exposure and availability make older siblings influential role models, which increases the chance that their behavior is modeled by their younger siblings. This high level of exposure may also facilitate deviancy training: older siblings express their positive views and attitudes concerning delinquency to their younger siblings, which may result in similar positive attitudes towards delinquency and actual delinquent behavior of younger siblings (Pomery, Gibbons, Gerrard, Cleveland, Brody, & Wills, 2005). Additionally, some studies have shown that sibling similarity in delinquency is more pronounced if they have mutual friends (Rowe & Gulley, 1992). Delinquent acts are often committed together or in groups. If siblings frequent the same (deviant) social circle, this increases the possibility that they will commit criminal offenses together and/or with their friends. All of these processes may act together, resulting in a significant association between level of older sibling delinquency and level of younger sibling delinquency.

We expected that changes in older sibling delinquency were associated with similar changes in younger sibling delinquency. This showed to be the case, but only for same-sex sibling pairs. For brother and sister pairs, a faster increase in older sibling delinquency was related to a similarly faster increase in younger sibling delinquency. These results stress the importance of examining delinquency within the sibling context, as the development of deviant behavior seems to be similar across time, at least for same-sex siblings.

Additionally, changes in sibling relationship quality were significantly related to changes in older sibling delinquency, but only for brother pairs (although the difference with other sibling gender combinations was not significant). Faster increases in sibling relationship quality were associated with slower increases in older, but not younger sibling

delinquency. So, the older brothers in our study were more affected by changes in sibling relationship quality than their younger brothers.

### Differences Between Sibling Gender Combinations

Our expectation that associations would be stronger for same-sex sibling pairs than for mixed-sex sibling pairs was partly confirmed. For several paths, we did find significantly stronger associations for brother and sister pairs than for older brother/younger sister pairs: (1) between changes in older sibling delinquency and level of younger sibling delinquency and (2) between changes in older sibling delinquency and changes in younger sibling delinquency. A speculative explanation for the fact that these paths were only found for same-sex sibling pairs may point to the importance of identification processes in deviancy training. For example, for adolescent girls, changes in their older brother's delinquent behavior do not result in similar changes in their own behavior, because they do not identify strongly with them. Therefore, they are less likely to model their brother's behavior over time. In addition to identification processes, same-sex sibling pairs may be more likely to spend time together and have mutual friends than mixed-sex sibling pairs (Rowe & Gulley, 1992). Continued exposure to similar deviant social contexts, may also increase the odds that siblings develop in a similar fashion over time.

However, for other paths, results were similar for the different types of sibling gender combinations and some effects were even stronger for some of the mixed-sex sibling pairs, e.g., for the effect of level of older sibling delinquency on level of younger sibling delinquency. Careful examination of our results show that sibling effects (for relationship quality as well as older sibling delinquency) seem especially pronounced for *younger brothers*, since most significant paths are found for brother pairs and older sister/younger brother pairs. For example, only for younger brothers, a lower level of sibling relationship quality with their older sister is associated with slower decreases in delinquency. Also, younger brothers whose older brother shows increases in delinquency show similar increases in delinquency, as well as a higher level of delinquency at Time 3. These boys appear to be more open to sibling pressure, which is consistent with other findings that early adolescent boys are more susceptible to peer pressure than their female and/or older counterparts (Sumter, Bokhorst, Steinberg, & Westenberg, 2008).

### Strengths and Limitations

When interpreting the results of our study, we have to consider the fact that our sample consisted of predominantly Dutch siblings from intact middle-class families, showing low levels of delinquent behavior, which may limit the generalizability of our conclusions. The modest variance estimates for younger sibling delinquency also suggest that in our sample, there is not much (variability in) delinquency to account for. This probably contributed to the modest level and slope estimates. However, even within our relatively

well-functioning sample, we found significant and meaningful results, which may mean that our results represent an underestimation of these associations. In order to successfully study and correct problems in adolescents, it is prudent to examine development of problem behavior in general adolescent populations in addition to (or even before) focusing on seriously problematic populations (Cummings, Davies, & Campbell, 2000).

In the present study, we did not examine whether sibling warmth moderates the link between older and younger sibling delinquency, a pattern that has been found in previous studies. For example, Slomkowski and colleagues (2001) showed that, at least for brother pairs, delinquency of older brothers mainly influenced their younger brothers' delinquency if the relationship between them was characterized by warmth and support. Similarly, Rowe and Gulley (1992) found that sibling resemblance in delinquency for same-sex sibling pairs was moderated by mutual warmth. In our study, we focused on main effects of level and change in sibling relationship quality and older sibling delinquency on level and change in younger sibling delinquency, for the four sibling gender combinations. Testing whether sibling relationship quality acts as a moderator in the effect of older sibling delinquency on younger sibling delinquency falls beyond the scope of the present study. However, additional hierarchical regression analyses (including main effects as well as an interaction term between sibling relationship quality and older sibling delinquency) indicated that in our sample, the link between older and younger sibling delinquency was not moderated by sibling relationship quality for any of the four sibling gender combinations.<sup>2</sup> Possibly, these patterns are mainly salient when older siblings exhibit higher levels of delinquency than in our relatively well-functioning sample. The "partners in crime" model may hold primarily if older siblings actually perform criminal offences, which was hardly the case in our sample. However, it is important to know whether the same processes are at work in different types of populations, so future research should examine these possible interaction effects in high-risk as well as low-risk populations.

Another limitation is that we measured adolescent delinquency with a relatively short questionnaire, and that aggregate scores were used. However, this delinquency questionnaire was reliable, and showed satisfactory concurrent validity (Deković & Buist, 2005). The decision to use composite scores was based on our opinion that using father, mother and sibling reports of delinquency in addition to self report provides a more reliable assessment of adolescent delinquency. Additionally, using only one informant would mean loss of information. To confirm the appropriateness of combining father, mother, sibling as well as self reports to assess adolescent delinquency, we performed confirmatory factor analyses and checked whether there were significant correlations or differences between informants and whether these aggregate scores produced reliable scales. The results of these checks were all satisfactory.

Our design precludes conclusions concerning causality or direction of effects. Based on previous studies (e.g., Dunn et al., 1994; Pomery et al., 2005; Stocker et al., 2002; White-

man et al., 2007), we assumed in our models that sibling relationship quality was associated with older and younger sibling delinquency and that older sibling delinquency was associated with younger sibling delinquency. Whereas examination of our models did not suggest that including paths to reflect the reverse direction (e.g., from younger sibling delinquency to older sibling delinquency) would provide a better fit to the data, it is likely that these sibling influences are bidirectional and that older siblings may also be influenced by their younger siblings, as has been found in other studies (Branje et al., 2004).

Our study also shows considerable strengths. First, by including sibling delinquency as well as sibling relationship quality in the same model we were able to identify the distinct associations of these two factors on adolescent delinquency. Second, not many studies have focused on the effects of *level* as well as *changes* in older sibling delinquency and sibling relationship quality on younger sibling delinquency. Third, we examined and statistically tested differences in these patterns for the four sibling gender combinations, providing insight into general and gender-specific patterns.

Concluding, our study showed that sibling relationship quality is associated with delinquency of older siblings. In addition, delinquency of older siblings is directly related to younger sibling delinquency two years later. Finally, for same-sex sibling pairs, over-time changes in older sibling delinquency were related to younger sibling delinquency two years later as well as the change pattern in younger sibling delinquency over time.

### Implications for Interventions

Our findings have tentative implications for interventions targeting juvenile delinquency. The findings of our study suggest that siblings may be a continuing source of influence on adolescent delinquency as the adolescents grow older (Duncan et al., 1996). This suggests that it is important for family-based intervention programs to include the sibling dyad. Ignoring the sibling effect on delinquency in interventions could be counterproductive, since attempts to address problem behavior of one adolescent within a family could be undermined by the continuing influence of other delinquent adolescents within the same family (Slomkowski et al., 2001).

Our study suggests that younger siblings seem to be less at risk for detrimental effects of bad sibling relationships than older siblings, and are especially vulnerable for high levels as well as increases of older sibling delinquency. Our results also indicate that younger brothers seem to be especially at risk for the influence of older siblings. The fact that we found different patterns for the four sibling gender combinations suggests that it may be fruitful to use specific intervention strategies for different sibling pairs. For example, to decrease younger brother delinquency, interventions

<sup>2</sup> Results of these additional analyses may be obtained from Kirsten Buist.

aimed at decreasing older brother delinquency may be effective for brother pairs, but for older sister/younger brother sibling pairs it seems more effective to also improve sibling relationship quality. However, more longitudinal research is needed comparing clinical and well-functioning samples in order to examine whether over-time sibling processes in these two populations are similar or qualitatively different, and thus attempt to bridge the gap between scientific research and clinical practice.

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**Call for Papers for a Special Section of the  
*Journal of Family Psychology*:  
U.S. Military Operations: Effects on Military Members'  
Partners and Children**

**Editors: Michelle Kelley and Ernest Jouriles**

The *Journal of Family Psychology* invites manuscripts for a special section on military families. The deployment of U.S. military personnel to global hot spots, whether as combatants or as peacekeepers, has prompted increased attention to the psychological well-being of those deployed and their families. A driving force behind this attention has been the high rates of posttraumatic stress disorder (PTSD) documented among military personnel exposed to combat. Yet, the influence of military deployment and combat exposure is much more far-reaching and complex. Presently, there is a dearth of theory and research on how the deployment and reintegration of military personnel influence family, couple, and child functioning. The intent of this special section is to provide a conceptual framework for understanding how U.S. military operations might influence family interactions and family members' mental health and to showcase new developments in the study of military families.

The deadline for receipt of papers for this special section is **October 31, 2010**. Review papers, theoretical papers, and empirical papers will be considered. Please follow the journal's Instructions to Authors for information about how to prepare an article, which can be found on the journal's web page ([www.apa.org/pubs/journals/fam](http://www.apa.org/pubs/journals/fam)). Manuscripts must be submitted electronically through the Manuscript Submission Web Portal of the *Journal of Family Psychology* ([www.apa.org/pubs/journals/fam](http://www.apa.org/pubs/journals/fam)). Please be sure to specify in the cover letter that the submission is intended for the special section on military families. All papers will be initially screened by the editors, and papers that fit well with the theme of this special section will be sent out for blind peer review.