

The role of deviant siblings in delinquency: A meta-analysis of longitudinal studies

Lorena Maneiro^{a,*}, Yassine Ziti^b, Mitch van Geel^c, Xosé Antón Gómez-Fraguela^a, Paul Vedder^c

^a Department of Clinical Psychology and Psychobiology, Universidade de Santiago de Compostela, Rúa Xosé María Suárez Núñez, s/n, Campus Vida, 15782 Santiago de Compostela, Spain

^b The Hague University of Applied Sciences, Johanna Westerdijkplein 75, 2521 EN The Hague, The Netherlands

^c Institute of Education and Child Studies, Leiden University, Wassenaarseweg, 52, 2333 AK Leiden, The Netherlands

ARTICLE INFO

Keywords:

Delinquency
Longitudinal
meta-analysis
Sibling

ABSTRACT

Deviant siblings have been considered as role models for future delinquent behavior; however, previous studies have led to inconsistent results in this regard. The goal of the current meta-analysis was to analyze the effect of deviant non-twin siblings on future delinquency. The potential moderation effects of birth order, sex dyad, age of siblings, publication year, study length, and sample size were analyzed. Six databases were searched for studies: PsycInfo, MEDLINE, Criminal Justice Abstracts, Web of Science, SCOPUS, and Google Scholar. To analyze the prospective interdependence of delinquent siblings, only longitudinal studies were considered for inclusion in the meta-analysis. Two authors independently went through all the retrieved studies and coded those eligible for inclusion, with good interrater agreement. A total of 18 studies were included, which provided 24 independent effect sizes. The meta-analysis showed a significant prospective association between deviant siblings and delinquency. A moderate effect size was found from older sibling to younger sibling and vice versa, as well as between siblings when birth order was not specified. Likewise, significant associations were found in brother pairs, sister pairs, and mixed-sex sibling pairs. No moderation effects were found for age of siblings, publication year, study length, or sample size. The results highlight the role of siblings as a risk factor for future delinquency.

The family microsystem and, specifically, criminality among family members, has been widely studied from a developmental perspective of juvenile delinquency (Bonta & Andrews, 2017; Bronfenbrenner & Morris, 2006). In those studies, it has been proposed that the risk of antisocial behavior and delinquency increases in those individuals who come from families in which a family member was convicted of or has carried out criminal acts (cf., Eichelsheim & Van de Weijer, 2018). And indeed, previous studies have shown a high concentration of crime in families, indicating that a vast majority of offenses are committed by a relatively small proportion of families (Beaver, 2013; Farrington et al., 1996, 2001; Frisell et al., 2011; Van de Rakt et al., 2009; Van de Weijer et al., 2015). Most of these studies focused on the intergenerational transmission of criminality from parents to children (Besemer et al., 2017; Murray et al., 2012). However, a growing body of research focuses on the role of siblings in the development of antisocial behavior, showing a strong association of criminal convictions and delinquency

between siblings (Huijsmans et al., 2019; Slomkowski et al., 2001; Van de Rakt et al., 2009).

1. Sibling influence on delinquency and antisocial behavior

Siblings are considered important socialization models within the family context given the emotional quality and the intimacy that characterize these relationships, particularly during childhood and adolescence (Dunn, 2007). Siblings play a role distinct from those of parents and friends (Tucker & Updegraff, 2009; Whiteman et al., 2011); they are inherent sources of reciprocal influence over the life-course development, affecting behavioral regulation in childhood (Van Berkel et al., 2020), but also antisocial behavior and delinquency as they grow older (Low, Sinclair, & Shortt, 2012). In addition to these direct influences, siblings often share the same family, personal history, neighborhood, and even specific community factors such as school or friends. Hence,

* Corresponding author at: Department of Clinical Psychology and Psychobiology, Universidade de Santiago de Compostela, Rúa Xosé María Suárez Núñez, s/n, Campus Vida, 15782 Santiago de Compostela, (Spain).

E-mail addresses: lorena.maneiro@usc.es (L. Maneiro), y.ziti@umail.leidenuniv.nl (Y. Ziti), mgeel@fsw.leidenuniv.nl (M. van Geel), xa.gomez.fraguela@usc.es (X.A. Gómez-Fraguela), vedder@fsw.leidenuniv.nl (P. Vedder).

<https://doi.org/10.1016/j.avb.2022.101780>

Received 23 December 2020; Received in revised form 5 July 2022; Accepted 3 August 2022

Available online 6 August 2022

1359-1789/© 2022 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

they are likely affected by these same contextual influences (East, 2009; Rowe & Gulley, 1992).

Previous research has found high similarity in offending between siblings in studies using either official records (e.g., Kendler et al., 2014; Van de Rakt et al., 2009) or self-reports (e.g., Craine et al., 2009; Rowe & Gulley, 1992). However, most of these studies were not longitudinal in nature, which clearly limits the establishment of antecedents and consequents of sibling delinquency and, hence, do not allow conclusions about having a delinquent sibling as a risk factor for future offending (Slomkowski et al., 2001). To overcome this limitation, some longitudinal studies have been carried out to test the association between having a delinquent sibling and one or more other siblings' delinquency over the life-course. However, these studies did not provide consistent results: whereas some studies suggested that sibling delinquency was among the strongest predictors of future convictions (Farrington et al., 2009), other studies suggested moderate to high (e.g., Brody et al., 2005; Slomkowski et al., 2001), low (e.g., Defoe et al., 2013), or even non-significant associations (Conger & Conger, 1994) between siblings in measures of delinquency.

1.1. Theoretical background

Several arguments have been proposed to explain the similarities in offending between siblings. From a behavioral genetic approach it has been proposed, based on twin studies, that genetic factors may account for between 40 % to 56 % of variance in delinquency between family members, although environmental factors – both shared (e.g., family socioeconomic status, parenting styles) and non-shared (e.g., differential treatment by parents) – may account for over half of the variance in antisocial behavior (Ferguson, 2010; Miles & Carey, 1997; Rhee & Waldman, 2002). Specifically, greater exposure to environmental risk factors such as family criminality may amplify the effects or manifestation of genetic influences on the development of antisocial behavior and delinquency (Azeredo et al., 2019; Beaver, 2011). Few of these studies have attempted to also investigate the contribution of delinquent singleton or non-twin siblings (i.e., full siblings, half-siblings) in future offending; they are focused more on genetic factors than on sibling influences in general. Those that did focus on singletons yielded inconsistent findings (Beijers et al., 2017).

The influence of sibling delinquency has also been explained using social theories, which highlight the role of sibling interactions and family relationships. The social learning theory (Bandura, 1977) has been one of the most widely cited theories for explaining the effect of sibling delinquency. The assumption is that delinquent siblings serve as behavioral role models that promote and reinforce the development of future delinquency (Bullock & Dishion, 2002). Building on this theory and assumption, the coercion theory (Patterson, 1982) proposes that sibling delinquency does not exert a direct effect on future delinquency, but it is the positive or negative experience of the relationships with significant others, that turns these others into learning models. In case these significant others engage in delinquent behavior, the relationship with this person could increase other siblings' likelihood of engaging in delinquent activities; they are lured in. Alternatively, the social control theory (Hirschi, 1969) posits that the lack of bonds with prosocial siblings may increase the risk of involvement in delinquent activities if it weakens the bonds to social norms. Inspired by these earlier notions or explanations, Thornberry (2014) suggests that an interactional theory integrating the previous theoretical perspectives best explains the development of delinquency. This interactional theory highlights the influence of social domains on delinquency developmental patterns through the weakness of bonds to conventional norms in conjunction with social environments that encourage deviant behaviors (Thornberry, 2014). As some authors have posited, the exposure to delinquent brothers or sisters may also enhance sibling collusion and increase the probability of acting as "partners in crime" (Bullock & Dishion, 2002; Rowe & Gulley, 1992).

1.2. Potential moderators

The potential influence of sibling delinquency also depends on individual differences such as birth order, age gap or gender dyad (Dunn, 2007). In this regard, a vertical effect has been proposed from older sibling to younger sibling's delinquency through both direct observations and interactions (Brody et al., 2005). As some authors have suggested, this effect would presumably be stronger because, on the one hand, older siblings reach adolescence earlier and are therefore more likely to engage in delinquent behavior prior to the younger siblings, and, on the other hand, the former are more likely to be viewed as "role models" by the younger siblings, especially when they are close in age (Low, Snyder, & Shortt, 2012). Previous research on birth order has supported unidirectional effects from older siblings to younger siblings but not the reverse (e.g., Buist, 2010; Craine et al., 2009), however, other studies have also shown bidirectional effects between older and younger sibling's delinquency (Defoe et al., 2013), and others even found that younger siblings' behaviors predicted more consistently older siblings' delinquency (Whiteman et al., 2017). In addition, findings revealed that the strength of the associations tends to decrease throughout the life span (Huijsmans et al., 2019; Whiteman et al., 2017) and increases for smaller age differences (Bank et al., 1996; Steele et al., 2013).

Furthermore, gender and sibling-sex composition may affect the magnitude of the influence of siblings' delinquency. Some studies found higher concordance in antisocial behavior and delinquency in same-sex sibling dyads than in opposite-sex sibling dyads, potentially because same-sex siblings may feel closer to each other and share more interests (Huijsmans et al., 2019; Rowe & Gulley, 1992). Concordantly, previous findings revealed strongest similarity in brother-brother pairs (Solmeyer et al., 2014) or in sister-sister pairs (Slomkowski et al., 2001), whereas others reported no differences of strength of similarity between brother pairs and sister pairs (Rowe & Farrington, 1997). Not all studies supporting that finding depend only on sibling gender similarity. Buist (2010) reported stronger effects in the level of older sibling delinquency on the level of younger sibling delinquency for mixed-sex sibling pairs, and Defoe et al. (2013) suggest that the association can occur similarly for both same-sex sibling dyads and mixed-sex sibling pairs.

In addition to sibling individual differences and sibling-dyad composition, there are some characteristics related to the methodology and the study design, such as the length of the longitudinal study, sample size, or publication year, which could also affect the magnitude of the relationship. Some authors have hypothesized about the potential stability of sibling influence on delinquency over the life-course regardless of the time span between assessments (Rowe & Britt, 1991). However, findings are contradictory. On the one hand, sibling similarity was found to be stronger the shorter the time span between assessments (e.g., Herrenkohl et al., 2000), and some studies evidenced a decrease in the magnitude of the relationships over a 10-year period (Whiteman et al., 2017). On the other hand, other studies showed high stability in the co-variation of sibling delinquency over a two-year period (Rowe & Britt, 1991), or even an increase in the magnitude of the associations in a four-year study (Slomkowski et al., 2001). Sample size may also have an impact on the precision of the effect sizes because studies with larger sample sizes tend to yield more precise estimates than studies using smaller sample sizes (Borenstein et al., 2009). Furthermore, earlier, or more precisely, the first publications of empirical studies about sibling delinquency, tend to produce relatively larger effect sizes compared to more recent studies (Rowe & Britt, 1991; Whiteman et al., 2015), although this tendency was not consistent across studies and some recent studies also found moderate associations between siblings' delinquency (Huijsmans et al., 2019; Kendler et al., 2014).

1.3. The current study

Given the inconsistencies found in previous studies regarding the

association of siblings' delinquency and its relevance for the development of prevention and intervention strategies with offenders and their families, the main goal of the current study is to prospectively analyze the link between having a delinquent sibling and future involvement in offending by using a meta-analysis. This will contribute not only to the understanding of the role of deviant siblings but also to a better understanding of the processes and mechanisms involved in the transmission of delinquency between family members. The results shed light on the role of siblings and how intervention programs can be adapted accordingly. A recent meta-analysis found that parenting programs improved the quality of sibling interactions but the elements of those interactions that are affected by the programs still remain unclear (Leijten et al., 2021). Regarding treatments for delinquency, research has shown that non-target siblings of delinquents seem to benefit indirectly from the intervention (Wagner et al., 2014). Yet, intervention with siblings in clinical or forensic settings is not common (Waid et al., 2020). Therefore, delving into the role of sibling delinquency may contribute to understanding sibling influences and then may be taken into account when adapting intervention programs at both the family and community level. Also, meta-analysis allows for the combination of the results of several primary studies into an overall effect size as well as the analysis of potential publication bias. Because non-significant results are less likely to be published compared to studies with higher effect sizes, it may cause an overestimation of the actual effect (Vevea et al., 2019). This limitation may be addressed in a meta-analysis because the effect size adjusted for publication bias may be estimated (Borenstein et al., 2009).

Furthermore, and given the inconclusive effects of birth order, sex composition of sibling dyads, and age, that were reported in previous studies (e.g., Huijsmans et al., 2019), the moderating role of these variables will be analyzed in the current meta-analysis. The high variability regarding different time spans in longitudinal studies of sibling delinquency (Herrenkohl et al., 2000; Rowe & Brittt, 1991; Slomkowski et al., 2001; Whiteman et al., 2017), leads to the consideration of length of study as a potential moderator in the current meta-analysis. Likewise, and because larger samples sizes tend to produce more precise estimates (Borenstein et al., 2009) and earlier publications of empirical studies may produce relatively larger effect sizes (Rowe & Brittt, 1991), both sample size and year of publication will be analyzed as potential moderators.

Given the high similarity in offending that was previously found between siblings (e.g., Rowe & Gulley, 1992; Van de Rakt et al., 2009), a significant and positive effect on the association in delinquency between siblings is expected. In addition, stronger relations are expected from older sibling to younger sibling than the reverse (Brody et al., 2005), as well as for same-gender sibling pairs as compared to mixed-gender siblings (Rowe & Gulley, 1992). Also, some authors have posited that sibling correlations appear to decline with age (Conger & Conger, 1994; Huijsmans et al., 2019); therefore, moderator effects of siblings' age are expected (Whiteman et al., 2017). Finally, because of the inconsistencies that were previously found in relation to length of study, no specific hypotheses are proposed in this regard. However, more precise estimates in larger sample sizes and larger effect sizes in earlier studies are expected.

2. Method

2.1. Search strategy

Firstly, a systematic search for longitudinal studies was carried out using four online databases: PsycInfo, MEDLINE, Criminal Justice Abstracts, and Web of Science. In addition, we used SCOPUS and Google Scholar, in order to gather relevant studies published until 2020 (February 20, 2020). No publication date limits were considered for the inclusion of studies in the meta-analysis. The search terms "longitudinal*", "prospective*", "follow-up*", "long-term*" and "repeated

measures" were used in combination with "sibling*", "brother*", "sister*", and "offense*", "offend*", "delinquen*", "crime*", "criminal*", "convict*", "antisocial*", "arrest*", "illig*", and "imprison*". Secondly, the reference list of the retrieved studies was scanned for further potential studies, as well as the list of articles which cited some of the most relevant longitudinal studies in the field (i.e., Slomkowski et al., 2001). Thirdly, several previous well-known studies about risk factors of delinquency were reviewed to find specific results on predictors related to sibling delinquency. The final search led to a total of 813 studies which were scanned for their inclusion in the meta-analysis. Two authors independently went through all the references to prevent potential mistakes in the coding of studies considered for their inclusion in the meta-analysis. The results of the search are presented in the Flow diagram in Fig. 1.

2.2. Inclusion and exclusion criteria

The studies had to meet a set of established criteria for their inclusion in the meta-analysis. Firstly, they should include enough information to compute an effect size between sibling delinquency (i.e., full-siblings, half-siblings, step siblings, adopted siblings) and target participant delinquency on at least two different time points of measurement. Studies assessing both sibling delinquency and target delinquency at the same time point and those that only included twin samples, were excluded. Secondly, studies were included if they provided information about delinquency, defined as behavior prohibited by the law. Although delinquency includes criminal behavior, such as homicide, robbery, theft, or assault, this concept also comprises a variety of actions that are illegal only because of the age of the individual, including running away from home, truancy, or disobedience of authority figures (Azeredo et al., 2019; McCord et al., 2001). Studies that referred to any of these delinquency categories were considered for inclusion in the meta-analysis. Moreover, studies were included if they reported information about delinquency obtained by means of official records (e.g., police records), self-reported delinquency, or delinquency reported by parents, teachers, peers, or others. The delinquency scales used in the primary studies often combine items of both delinquency and less severe problematic behavior. Taken this into account, studies in which delinquency was conceptualized as behavior prohibited by the law were included, even if the self-reported measures of delinquency integrated both delinquency and behavior problems. This conceptualization of delinquency is in line with previous reviews and meta-analyses in the field (Hoeve et al., 2012; Jolliffe et al., 2017). On the other hand, studies focusing exclusively on problematic behavior (e.g., temper tantrums, lie or cheat) which do not refer to behavior prohibited by the law were excluded. Studies which only focused on transmission of family violence (i.e., exposure to interparental violence and child maltreatment), or studies which only assessed the quality of the relationships between siblings (e.g., conflict, bullying, aggression, hostility) were excluded. Also, studies focusing on the frequency of drug use between siblings were excluded. The use of illegal drugs was not considered for its inclusion in the meta-analysis because there is still a debate surrounding the consideration of substance use as an outcome, included within the broad category of antisocial behavior (Le Blanc, 2015), or as a risk factor for future involvement in delinquency and criminal acts (White et al., 2018). Nevertheless, studies analyzing drug offenses were included (e.g., selling marijuana). Thirdly, the age of the participants and the language in which the study was written were not used as exclusion criteria. Finally, if two or more articles which met the criteria for inclusion were based on the same sample, we decided to select the study with the larger sample size or the study which provided more precise information to compute the effect sizes; if sample sizes were equal, we coded the study with the most detailed information provided or the study that used measures of delinquency instead of broad externalizing scales. Table 1 shows a summary of the 18 studies that met the inclusion criteria for the current meta-analysis.

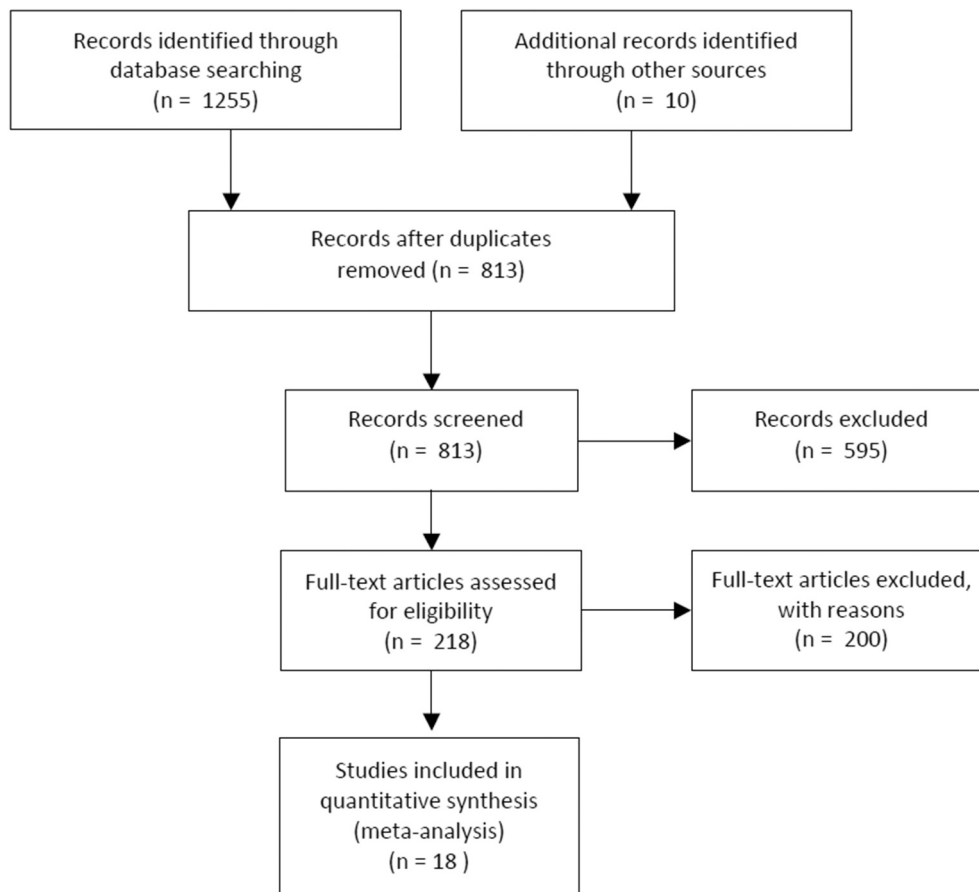


Fig. 1. Flow diagram of all the stages in the literature search.

2.3. Coding of studies

Longitudinal correlations between siblings' delinquency were used as a measure of the effect size. Correlations were coded in all studies but one (Mayer, 2004), which reported the results of multiple regression analysis. The beta coefficients reported in the study of Mayer (2004) were transformed into correlations following the recommendations of Peterson and Brown (2005) on the use of beta coefficients in meta-analyses. Authors of studies which did not report enough information to compute an effect size were e-mailed requesting extra information. This resulted in the inclusion of three more articles (Huijsmans et al., 2019; Whiteman et al., 2015; Whiteman et al., 2017). In those articles in which more than two time points were analyzed as part of the longitudinal study, the effect size corresponding to the two time points farthest apart was coded. For instance, if the article reported correlations between sibling's delinquency from T1-T2, T1-T3, and T1-T4, the latter was coded for its inclusion in the meta-analysis. If articles provided information about delinquency from multiple sources (e.g., maternal reports, child reports), from different type of siblings (e.g., biologically related, biologically unrelated), or from multiple delinquent outcomes (e.g., minor delinquency, major delinquency), these were averaged prior to the inclusion in the meta-analysis. If articles included multiple independent effect sizes (from older sibling to younger sibling, from younger sibling to older sibling; brothers, sisters), these were entered in the meta-analysis separately.

When articles provided information both for the full sample and independently by subgroup (e.g., birth order, sex composition sibling dyad), the latter was preferred for inclusion in the meta-analysis. Specifically, the studies of Whiteman et al. (2015) and Fagan and Najman (2003) reported effect sizes both for the full sample and then separately

for same-sex and mixed-sex sibling dyads, therefore, only the effect sizes for same-sex and mixed-sex sibling pairs were entered in the meta-analysis. In the same vein, Huijsmans et al. (2019) provided information about the link between sibling delinquency and target participant delinquency as well as the correlations according to birth order (from older sibling to younger sibling and vice versa) and according to sex sibling dyad. Given these effect sizes were independent but involved the same sample, we decided to include only the effect size related to birth order in the general meta-analysis and use the effect size of sex composition sibling dyad only for moderator analysis. Finally, Rowe and Britt (1991) detailed longitudinal correlations for brother pairs and sister pairs, as well as from older brother to younger sister and from older sister to younger brother. In this case, both the effect sizes from older brother to younger sister and from older sister to younger brother were averaged into a combined mixed-sex sibling pairs effect size. Two authors independently coded the articles and the relevant information for the meta-analysis (i.e., effect size, sample size, birth order, sex composition sibling dyad, mean sibling's age, delinquency measures, publication year and study length), and differences were resolved through discussion. Prior to discussion, the authors obtained a rate of 92.9 % in coding agreement.

2.4. Analyses

The analyses were performed using the Comprehensive Meta-analysis 3.0 software (Borenstein et al., 2014). Data were analyzed under a random-effects model, which allows for the variation across studies and do not assume that a common true effect size underlies all the studies in the analysis (Borenstein et al., 2009). Given the studies included in the meta-analysis differed in several aspects – including

Table 1
Summary of studies included in the meta-analysis.

Source	N (M age S1/ M age S2)	Country (% female)	Type of sibling dyad	Sibling delinquency measure	Target delinquency measure	Study length
Brody et al. (2005)	304 (12.7/ 10.2)	USA (51.5 %)	Older- younger/ Younger- older	TRF – Delinquent behavior scale	TRF – Delinquent behavior scale	3 y
Burt et al. (2010)	1181 (14–18)	USA (55 %)	Sibling 1-sib- ling 2	DBI	DBI	3.5 y
Compton et al. (2003)	279 (10/6.2)	USA (14 %)	Older- younger	CBCL and TRF (Delinquent behavior scale), self-reported antisocial activities	CBCL (Delinquent behavior scale), Delinquency Checklist (Elliott et al., 1985), self-reported gang involvement	10 y
Fagan and Najman (2003)	748 (11–14)	Australia (50 %)	Older- younger	CBCL – Delinquent behavior scale	CBCL – Delinquent behavior scale	3 y
Huijsmans et al. (2019)	299 (13.03/ 14.92)	Netherlands (44 %)	Older- younger/ Younger- older	Self-reported delinquency scale	Self-reported delinquency scale	6 y
Huizink et al. (2007)	664 (12.45)	Netherlands (54.5 %)	Sibling 1-sib- ling 2	CBCL – Externalizing	CBCL – Externalizing	13 y
Kendler et al. (2015)	136,420 (15–19/ 25–29)	Sweden	Sibling 1-sib- ling 2	Convictions (official records)	Convictions (official records)	10 y
Low, Sinclair, and Shortt (2012)	488 (10.87/ 13.33)	USA (50 %)	Older- younger	CBCL – Externalizing	CBCL – Externalizing	3 y
Low, Snyder, and Shortt (2012)	488 (10.87/ 13.33)	USA (50 %)	Younger- older	CBCL (Externalizing), Delinquency Checklist (Elliott et al., 1985)	CBCL (Externalizing), Delinquency Checklist (Elliott et al., 1985)	3 y
Mayer (2004)	428 (14)	USA (51 %)	Older- younger	Self-reported deviant and delinquent behavior	Self-reported deviant and delinquent behavior	3 y
Rowe and Britt (1991)	940 (11–17)	USA (49 %)	Older- younger/ Younger- older	Delinquency Checklist (Elliott et al., 1985)	Delinquency Checklist (Elliott et al., 1985)	3 y
Slomkowski et al. (2001)	328 (13.1/ 11.2)	USA (52 %)	Older- younger/ Younger- older	Delinquency Checklist (Elliott et al., 1985)	Delinquency Checklist (Elliott et al., 1985)	4 y
Walters (2018)	215 (12.15)	USA (0 %)	Sibling 1-sib- ling 2	Proportion of delinquent siblings	Self-reported serious offending	5 y
Walters (2019)	411 (10–11)	UK (0 %)	Older- younger	Official records and delinquency scale	Official records and self-reported delinquency	6 y
Whiteman et al. (2014)	190 (18.19/ 21.18)	USA/México (52 %)	Older- younger	Eccles and Barber's Risky Behavior Scale	Eccles and Barber's Risky Behavior Scale	2 y
Whiteman et al. (2015)	233 (10.39/ 14.03)	USA (50 %)	Older- younger/ Younger- older	Eccles and Barber's Risky Behavior Scale	Eccles and Barber's Risky Behavior Scale	3 y
Whiteman et al. (2017)	402 (13.88/ 16.46)	USA (50 %)	Older- younger/ Younger- older	Eccles and Barber's Risky Behavior Scale	Eccles and Barber's Risky Behavior Scale	10 y
Williams et al. (1999)	567 (12–13)	USA (49 %)	Sibling 1-sib- ling 2	Number of delinquent siblings	Self-reported delinquency	2 y

Note. Mean age of siblings is mean age of siblings in the first wave of study. TRF = Teacher Report Form (Achenbach & Rescorla, 2001); DBI = Delinquent Behavior Index (Burt et al., 2007; Farrington & West, 1971); CBCL = Child Behavior Checklist (Achenbach & Rescorla, 2001).

participants, measures, and procedures – a random-effects model was more appropriate to conduct the meta-analysis than a fixed-effects model (Borenstein et al., 2010). Two sensitivity analyses were performed to test whether the overall effect was affected by: 1) the exclusion of the study of Compton et al. (2003), which reported a relatively low mean age of the participants; and 2) the removal of the two studies which used official records to measure delinquency (i.e., Kendler et al., 2015; Walters, 2019). To analyze the heterogeneity within studies, the Q -test was used, with significant values indicating true heterogeneity between effect sizes. Furthermore, the I^2 statistic was used to quantify the proportion of variance that was due to real differences and, therefore, potentially explained by covariates (Higgins & Thompson, 2002). If I^2 is large, it makes sense to apply techniques such as subgroup analysis or meta-regression to try to explain the reasons for variance. Specifically, moderator analyses were conducted on sibling dyad (i.e., older-younger, younger-older, sibling-target), sex composition dyad (i.e., brothers, sisters, mixed-sex), mean age of siblings, and publication year.

Regarding the mean age of siblings, some studies only reported the age range of siblings; in those cases, we considered the median of the age. One study did not report a mean age and the age range was quite wide (Rowe & Britt, 1991), therefore, we decided to exclude this study from the moderator analyses on sibling's age. For the analysis of study length, the largest time span between waves of study was selected. Regarding the study of Huijsmans et al. (2019), the additional data reported independent information according to birth order (i.e., from older sibling to younger sibling and vice versa) and sex composition dyad (i.e., brothers, sisters, mixed-sex sibling pairs). In this case, we included only the effect sizes related to birth order in the general meta-analysis and the effect sizes of sex composition dyad exclusively in moderator analysis. Subgroup analysis was used to compare the effects of sibling delinquency by sibling dyad (i.e., older sibling-younger sibling, younger sibling-older sibling, sibling-target) and sex composition sibling dyad (i.e., brothers, sisters, mixed-sex). Furthermore, meta-regression was used to analyze the potential moderation effects of birth order (i.e., older vs.

younger), sex composition dyad, mean age of siblings, and publication year. Finally, cumulative analyses were applied to test the effects of length of study and sample size.

The jackknife procedure was used to reduce estimation bias. This procedure assesses the impact of each study on the combined effect size by repeatedly removing one effect size from the original meta-analysis (Borenstein et al., 2009). Publication bias was analyzed by using Funnel plots, Kendall's τ and the Duval and the Tweedie Trim and Fill methods. Funnel plots indicate the absence of publication bias when the studies are symmetrically distributed about the combined effect size. Kendall's τ is used to calculate the association between the standardized effect sizes and the variance. Specifically, a non-significant Kendall's τ suggests the absence of publication bias. Finally, the Duval and the Tweedie Trim and Fill methods (Duval & Tweedie, 2000) lays on the same assumption as the Funnel plots, that is, in absence of publication bias, the studies included in the meta-analysis would be symmetrically distributed around the combined effect size (Borenstein et al., 2009). This method imputes the number and outcomes of missing studies to estimate the potential effect that they may have had on the observed estimate (Duval & Tweedie, 2000).

3. Results

3.1. Meta-analysis on the longitudinal effects of deviant siblings on delinquency

A total of 18 studies were eligible for inclusion in the meta-analysis (Table 1), giving rise to a total of 24 independent effect sizes. These studies included a total of 140,934 participants and sample sizes ranged from 128 (Brody et al., 2005) to 134,560 subjects (Kendler et al., 2014). The mean age of the participants ranged from 6.2 to 28.68 years. The results showed a significant and positive relation between sibling delinquency and future involvement in delinquent behavior ($r = 0.241$ [95 % CI = 0.192, 0.289]). Sensitivity analysis excluding the study of Compton et al. (2003), which had the lowest mean age of the participants ($M_{\text{younger sibling}} = 6.2$ years), had little effect on the overall association between sibling delinquency and future target delinquency ($r = 0.240$ [95 % CI = 0.188, 0.290]). Similarly, the sensitivity analysis excluding the two studies that used official records to measure delinquency (i.e., Kendler et al., 2014; Walters, 2019), did not affect the overall effect size either ($r = 0.246$ [95 % CI = 0.196, 0.294]).

The jackknife procedure suggested that the overall effect size remained the same after repeatedly removing one study from the meta-

analysis, with values ranging from $r = 0.23$ to $r = 0.25$. The effect sizes were heterogeneous within these studies ($Q(23) = 175.399, p < .001$) and a high proportion of the observed variance was due to real differences in effect sizes ($I^2 = 86.89$). This evidenced a high variability in the effect sizes of the studies included in the current meta-analysis (Fig. 2). Regarding the publication bias analysis, a low non-significant estimate of Kendall's τ was found ($\tau = -0.07, p = .64$) and the Duval and Tweedie Trim and Fill method indicated that no studies were needed to be imputed. Both the Kendall's τ and the Duval and Tweedie Trim and Fill method suggested the absence of publication bias. However, the funnel plot displayed in Fig. 3 reflected a slight asymmetry in the distribution of the studies.

3.2. Moderators of the association between deviant siblings and delinquency

The subgroup analysis conducted by type of sibling dyad (i.e., older sibling-younger sibling, younger sibling-older sibling, sibling 1-sibling 2) reflected a significant effect from older sibling to younger sibling ($r = 0.249$ [95 % CI = 0.163, 0.317]); from younger sibling to older sibling ($r = 0.242$ [95 % CI = 0.142, 0.351]); and from sibling 1 to sibling 2 in those studies which did not specify the effect size by birth order ($r = 0.225$ [95 % CI = 0.110, 0.334]). The Q -value for the difference between subgroups was 0.099 ($df = 2$) with a corresponding p -value of 0.952, which indicates that the effect size of sibling delinquency did not differ by type of siblings. To further probe this effect, birth order (i.e., older sibling, younger sibling) was included as a predictor in the meta-regression analysis. The results of the moderator analysis are displayed in Table 2. Birth order showed no moderating effects on the association between sibling delinquency and future involvement in delinquent behavior.

The moderating effect of sex composition sibling dyad was also explored by means of subgroup analysis and meta-regression. Given the lack of studies which specifically addressed the influence of sex differences on the strength of association of sibling delinquency irrespective of birth order and given the earlier reported null effect for birth order, we decided to combine the scores based on birth order into a single effect size of sex composition dyad. For instance, if a study provided effects sizes from older brother to younger brother and vice versa, we decided to average the effect sizes into a single effect for brothers prior the inclusion in the meta-analysis. This led to the consideration of four studies which analyzed the associations in brother-pairs, sister-pairs and/or mixed-sex pairs, as well as one study which provided

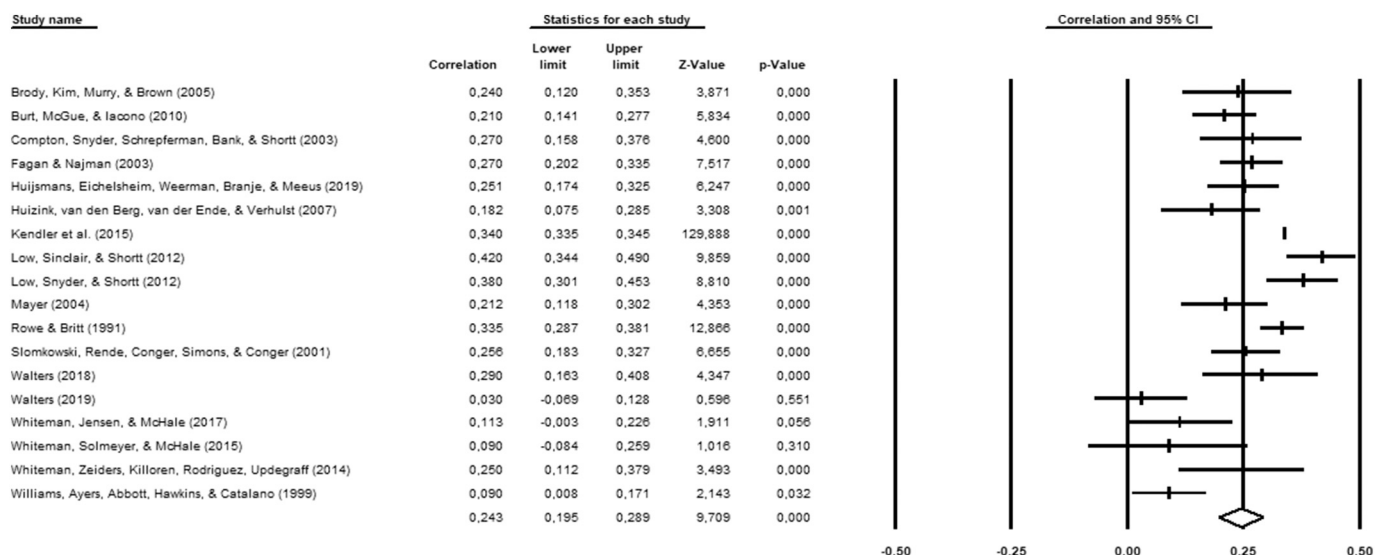


Fig. 2. Forest plot for the meta-analysis on sibling delinquency.

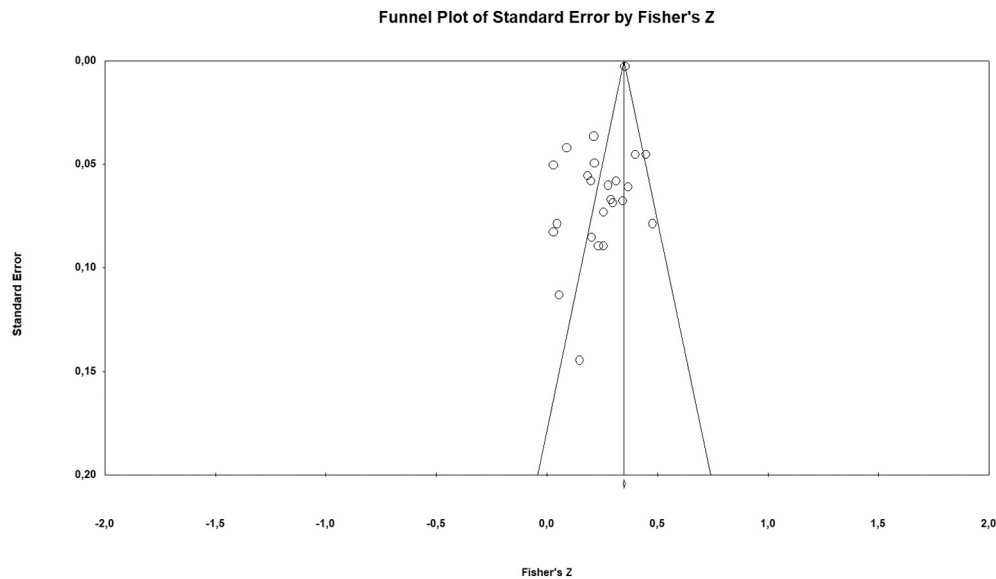


Fig. 3. Funnel plot for analyses on sibling delinquency.

Table 2

Moderator analysis on the effects of sibling delinquency on target sibling delinquency.

Moderator	<i>k</i>	<i>B</i> (SE)	95 % CI	Z-value	<i>Q</i> (<i>df</i>)	<i>p</i>
Birth order	13	-0.036 (0.07)	-0.17, 0.09	-0.54	0.29 (1)	0.59
Sex dyad (mixed)	4	-0.069 (0.05)	-0.17, 0.03	-1.41	2.19 (2)	0.33
Sex dyad (sisters)	4	-0.022 (0.06)	-0.13, 0.09	-0.39	2.19 (2)	0.33
Age sibling	14	-0.010 (0.01)	-0.03, 0.01	-0.98	0.97 (1)	0.33
Age target sibling	17	0.008 (0.01)	-0.00, 0.02	1.29	1.67 (1)	0.20
Publication year	18	-0.002 (0.00)	-0.01, 0.01	-0.52	0.28 (1)	0.60

information about mixed-sex sibling pairs. Subgroup analysis showed significant effects for transmission of delinquency between brothers ($r = 0.315$ [95 % CI = 0.245, 0.382]); sisters ($r = 0.295$ [95 % CI = 0.220, 0.367]); and in mixed-sex sibling pairs ($r = 0.251$ [95 % CI = 0.195, 0.306]). The *Q*-value for the difference between subgroups was 2.189 ($df = 2$) with a corresponding *p*-value of 0.335, which indicated that the effect size of sibling delinquency did not differ by gender of sibling dyad. Meta-regression analysis which included sex composition sibling dyad as predictor did corroborate this finding by showing no significant moderator effects of sex composition dyad.

The results reflected that the effect of sibling delinquency was not moderated either by age of sibling, age of target sibling, and publication year of the study (Table 2). Cumulative meta-analysis regarding sample size was performed, introducing first the studies with the smallest sample sizes. The results showed that the effect sizes tended to stabilize with larger sample sizes (Fig. 4). Cumulative meta-analysis as regards study length, including first the studies with the shorter time between waves, is displayed in Fig. 5. The results of the analysis suggested that the effects sizes stabilized the longer the time span between assessments in longitudinal studies.

4. Discussion

The transmission of delinquency and crime between family members has been addressed in several studies. To better understand the role of

deviant siblings in subsequent involvement in delinquency, the purpose of the current study was to conduct a meta-analysis of longitudinal studies to shed light on this association. Meta-analyses have been previously conducted to analyze the genetic contribution on delinquency by using twin and adoptive samples (Ferguson, 2010; Miles & Carey, 1997; Rhee & Waldman, 2002), however, to our knowledge, this is the first attempt to analyze the influence of deviant non-twin siblings on delinquency. Overall, the results reflect a positive and moderate association between siblings' delinquency, irrespective of birth order and sex composition sibling dyad. This effect remains unchanged even after removing the study with the lowest mean age of participants and after removing the two studies which used official records rather than questionnaires to measure delinquency. Specifically, bidirectional relations were found, that is, the effect size from older sibling to younger sibling resembles the effect size from younger sibling to older sibling, as well as the effect size between siblings in those studies in which birth order was not specified. This positive effect size was also observed in brother-pairs, sister-pairs, and mixed-sex sibling pairs. Although the results point to a high proportion of variance that was due to real differences between studies, no moderation effects were found regarding birth order, sex composition sibling dyad, age of sibling, age of target sibling, and publication year of the study. Also, the effects sizes tended to stabilize the longer the time span between assessments and the larger the sample sizes. The analysis suggests the absence of publication bias and the results of the jackknife procedure indicate that the overall effect size was not dependent on a single study, indicating that the results are quite robust.

4.1. Deviant siblings as a risk factor for future delinquency

The current findings support the first hypothesis, which proposed a significant and positive association between siblings' delinquency over the life course. According to previous studies, children and adolescents who exhibit antisocial or criminal behaviors may serve as role models for their siblings, increasing the probability of involvement in future delinquency (Aaron & Dallaire, 2010; Dunn, 2007). As some authors have pointed out, the engagement in such coercive and hostile behaviors would be the result of a learning process involving both direct observation and interpersonal interactions that take place between siblings (Brody et al., 2005). Observational learning is especially relevant in the relationship between siblings due to three characteristics that underlie these interactions, that is, power, nurturance, and similarity (Whiteman

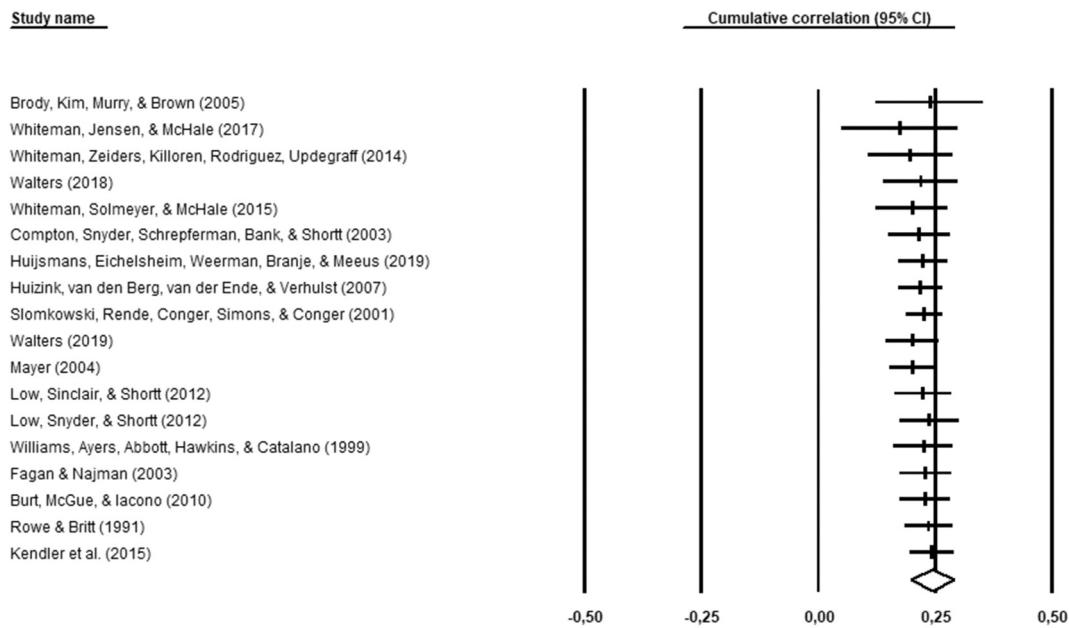


Fig. 4. A cumulative meta-analysis based on longitudinal studies of the effects on sibling delinquency. Studies with the smallest sample sizes were entered first.

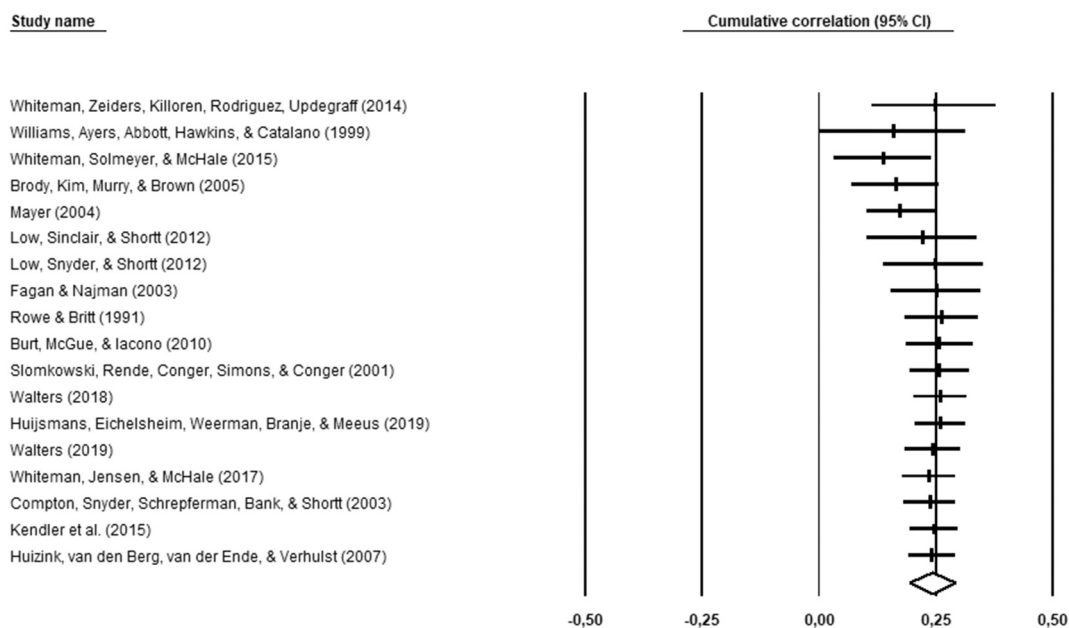


Fig. 5. A cumulative meta-analysis based on longitudinal studies of the effects on sibling delinquency. Studies with the shortest time between waves were entered first.

et al., 2007). Therefore, both siblings and parents may serve as role models for deviant behaviors that take place not only within the family, but they can also expand to other contexts outside the family (Patterson, 1984). Also, this deviant influence may be amplified whenever those delinquent acts are viewed as positive and the lack of prosocial bonds is manifested, both by talking openly about delinquency and by showing positive attitudes towards such behaviors in sibling interactions (Buist, 2010; Snyder, Schrepferman, et al., 2005). Hence, these mutual processes may reinforce the involvement in deviant behaviors (Defoe et al., 2013; Dishion et al., 1996). However, these results do not allow to test previously well-established theories in the explanation of sibling influence in delinquency, such as the coercion theory (Patterson, 1982), the social control theory (Hirschi, 1969), or the interactional theory proposed by Thornberry (2014). This meta-analysis indicates that the

association that was found between siblings' delinquency might be partially explained by third variables that could moderate this relationship, but any of the moderators included in the current analyses showed significant effects. Therefore, we could assume that the effect of sibling delinquency may be enhanced by certain environmental factors such as parenting, quality of sibling relationship, or neighborhood disorder, supporting thus the aforementioned theories (Azeredo et al., 2019; Beaver, 2011). Nevertheless, the limited number of studies which provide information about specific contexts prevent the consideration of specific environmental factors as moderators in the current meta-analysis.

4.2. Birth order and delinquency

The second hypothesis, which stated that the influence of older sibling on younger sibling would be stronger than the reverse, was not supported. The results of the current meta-analysis show relatively small differences in the summary effects regardless of type of sibling dyad (i.e., older sibling-younger sibling, younger sibling-older sibling, sibling 1-sibling 2). Hence, the vertical influence from older sibling to younger sibling that was outlined in previous studies (e.g., Buist, 2010; Craine et al., 2009; Defoe et al., 2013), was not supported by this meta-analysis. The findings from the current meta-analyses are in line with the social learning theory, which suggests reciprocal influences between people involved in interactions (Bandura, 1977). Thus, both older and younger siblings may serve as role models for delinquency and deviance training may occur bidirectionally in sibling dyads (Whiteman et al., 2017). Some authors have suggested that the influence of older siblings begins earlier in life than the influence of younger siblings. Younger siblings may have stronger effects in adolescence, leading to a high similarity in offending between siblings in this developmental period (Huijsmans et al., 2019; Slomkowski et al., 2001; Whiteman et al., 2017), especially if they are closer in age (Low, Snyder, & Shortt, 2012; Snyder, Bank & Burraston, 2005). From a developmental perspective, it has been proposed that sibling influence on delinquency peaks in adolescence and then tends to decline with age (Conger & Conger, 1994; Huijsmans et al., 2019). However, contrary to our expectations, no moderation effects of siblings' age were found in the current meta-analysis. Thus, delinquent siblings may act as role models for deviant behaviors regardless their age (Steele et al., 2013; Walters, 2020). However, it should be noted that siblings usually grow up together and, in turn, are influenced by the same shared environmental factors such as family socioeconomic status or parenting styles (East, 2009; Rowe & Gulley, 1992). These factors were traditionally considered as robust precursors of crime and delinquency for children (Bonta & Andrews, 2017). Notwithstanding, both older and younger siblings might be similarly affected by these environmental influences which might contribute to explain the finding of a lack of differences in the effects of birth order.

4.3. Sex composition sibling dyad and delinquency

The results of the meta-analysis do not support the hypothesis about the moderating effect of sex composition in sibling dyads. Specifically, the higher similarity in delinquency that was expected in same-sex sibling dyads (i.e., brother-brother, sister-sister) compared to mixed-sex dyads was not found. This hypothesis relies on the idea that same-sex siblings might show more resemblance in delinquent behavior because they share more interests, spend more time together, and the resulting similarity between them makes them more susceptible to deviant influences (Buist, 2010; Huijsmans et al., 2019; Low, Snyder, & Shortt, 2012; Rowe & Gulley, 1992). Despite the fact that effect sizes for brother-pairs and sister-pairs were close to 0.30, while in mixed-sex sibling pairs this estimate was around 0.25, differences among them were not significant and no moderation effect of sex composition was found in meta-regression analysis. Hence, the modelling of deviant behaviors seems comparable for male and female same-sex sibling pairs and for mixed-sex sibling pairs (Defoe et al., 2013; Fagan & Najman, 2003; Rowe & Britt, 1991; Snyder, Schrepferman, et al., 2005). However, it should be noted that the number of studies included in the meta-analysis which provided data on sex sibling dyads was relatively small and prevents, therefore, the analysis of the interplay between birth order and sex sibling dyad composition (Solmeyer et al., 2014). In addition, the lack of differences between same-sex and mixed-sex sibling dyads may be partly explained by the measures used for the assessment of delinquency. Measures that include less severe offenses or those which combine behaviors prohibited by the law with other problematic behaviors that do not constitute law-breaking behaviors, may artificially have led to the reported similarity between males and females. Using a

more selective definition might result in less similarity between same-sex and mixed-sex sibling pairs (Fagan & Najman, 2003).

4.4. Study characteristics and potential moderators

Finally, and contrary to our expectations, publication year showed no moderation effect on the relationship between deviant siblings and subsequent involvement in delinquency. Thus, the effect of sibling delinquency seems relatively consistent across earlier and recent studies. Also, cumulative analysis wherein we first entered studies with smallest sample sizes and shortest time spans between assessments, confirmed that studies with largest sample sizes and longest time spans tend to report the higher effect sizes. Although the study yielded a high variability in the effect size due to real differences between the studies included in the meta-analysis, this variability may be actually attributable to other variables that have not been considered in the current meta-analysis. Among them is the quality of siblings' relationships, which has been studied as a relevant factor in the explanation of delinquency (Buist, 2010; Scholte et al., 2007). High hostility-coercive and low warmth-supportive interactions in combination with sibling delinquency were found to be strong predictors of future involvement in delinquency (Slomkowski et al., 2001; Solmeyer et al., 2014). According to the coercion theory, sibling quality relationships would be one of the mechanisms by which coercive family environments influence the development of deviant behaviors (Bullock & Dishion, 2002; Patterson, 1982). On the other hand, from a behavioral genetics perspective it has been proposed that shared environmental factors, such as social class, family structure, or neighborhood conditions, may contribute to increased similarities between siblings in specific outcomes (Azaredo et al., 2019; Burt et al., 2010; Rowe & Farrington, 1997). Prior studies showed that delinquency may vary as a function of socio-economic environment, with more economically deprived families playing a stronger role in delinquency through the role of sibling interactions (Low, Sinclair, & Shortt, 2012). Within the broad category of shared environmental factors, the contribution of parental criminality has also been widely studied from an intergenerational perspective of transmission of crime and delinquency (Besemer et al., 2017; Murray et al., 2012). Accordingly, the influence of sibling delinquency may be amplified if parents have been previously arrested or incarcerated (Aaron & Dallaire, 2010; Beaver, 2013; Fagan & Najman, 2003; Farrington et al., 2001). Thus, it would be worthwhile for future studies to further analyze the social and environmental conditions and processes that contribute to similarity in sibling delinquency (Slomkowski et al., 2001).

4.5. Theoretical and practical implications

The study of the effect of deviant siblings in delinquency has theoretical and practical implications in the field of prevention and intervention. Disentangling the interplay between siblings' behavior contributes to understand similarities and differences in both shared and non-shared environmental influences. Typically, most studies include only one child per family in the explanation of delinquency, which neglects the consideration of the specific role of siblings and the mechanisms and factors that increase similarities and differences between them. Therefore, the role of siblings in the involvement in future delinquency is still unclear. Our results shed light on the inconsistencies that were found in previous studies regarding the transmission of delinquency between siblings. Accordingly, the relations between delinquency between siblings seem quite robust and not to be moderated by individual differences such as gender, age, or birth order, nor by specific characteristics of the study such as publication year, sample size, or study length. The positive effect size that was found between deviant siblings and delinquency, along with the high proportion of variance that was due to real differences between studies and the lack of moderation effects of the previously mentioned variables, lead to the

conclusion that the presence of distal factors might partially explain this result. These findings are in line with previous studies which found a high concentration of crime in families (e.g., Beaver, 2013; Farrington et al., 1996; Van de Rakt et al., 2009; Van de Weijer et al., 2015), supporting the hypothesis that specific contextual factors, such as neighborhood disorder or socioeconomic status in combination with negative family interactions, may increase the probability of involvement in future delinquency and crime (Azeredo et al., 2019; Low, Sinclair, & Shortt, 2012). Thus, crime transmission would occur through a cascade effect, reflecting the common dynamics among the macrosystem (e.g., cultural values), exosystem (e.g., community services), mesosystem (e.g., neighborhood), microsystem (e.g., family), and individual factors (Braithwaite, 2020). Despite no specific environmental factors were analyzed in the current meta-analysis, these results may lay the foundation for future research lines. Finally, these results could be used in the field of diagnostics, prevention and intervention, considering children with behavioral problems and their siblings at both community and youth care settings. Taking into account the strong similarity in delinquency that was found between siblings, preventive interventions must involve not only problematic children but also the whole family with a special focus on siblings and their interactions.

4.6. Limitations and future research lines

This study is not exempt of limitations which must be considered when interpreting the results. Firstly, even when we only included longitudinal studies in this meta-analysis, readers should be cautious when interpreting the results because prospective links are not equivalent to causality. Thus, having a delinquent sibling may be considered a risk factor for future delinquency, while being not the cause of such deviant behavior. Secondly, even though the current meta-analysis is focused on delinquency, it must be noted that several primary studies included in the analysis used measures that combined delinquency with items referring to less severe offenses and/or problematic behavior. For instance, some studies used the ASEBA system (Achenbach & Rescorla, 2001) in some of its versions: the parent-report form (CBCL), the teacher-report form (TRF), and/or the youth self-report (YSR). Specifically, the delinquent/rule breaking subscale includes items referring to behaviors such as stealing or running away from home, but also behaviors such as lying or cheating. Furthermore, the studies of Huizink et al. (2007) and Low, Sinclair, and Shortt (2012) used the broad Externalizing subscale of the CBCL, which combines items dealing with delinquent behavior as well as aggressive behavior. Combining different types of problematic behaviors may have contributed to increased similarities between siblings and reduce differences that might be attributable to other variables, such as gender or age. Thirdly, most of the primary studies included in the meta-analysis used measures reported by parents, teachers, and/or self-reported measures for the assessment of siblings' delinquency. Only one study provided information about siblings' delinquency solely by means of official records (Kendler et al., 2014), which prevents the moderator analysis of type of measure on the association between siblings' delinquency. It has been hypothesized that the magnitude of the associations between siblings' offending behavior may be affected to some extent by the use of official records or self-reports to measure delinquency (Gilman et al., 2014). Official records tend to underestimate less severe antisocial behaviors. However, albeit that self-reports may represent actual problematic behavior more precisely than official records, the former are affected by social desirability bias (Gómez-Fraguela et al., 2019). The inclusion of both types of measures in future studies will eventually allow to disentangle whether the severity of delinquent behavior increases to a higher extent the risk of deviant behaviors in siblings. Fourthly, the primary studies included in the meta-analysis used different siblings' degree of relatedness, such as full siblings, half-siblings, or adoptees, but the small number of studies which differentiated among them prevented the analysis of moderation effects. Given the genetic and environmental

influences – both shared and non-shared – that were found in previous meta-analysis as regards delinquency and antisocial behavior (Ferguson, 2010; Miles & Carey, 1997; Rhee & Waldman, 2002), the degree of siblings' relatedness must be considered in future studies. In addition, future studies must take into account the number of siblings and its influence on delinquency. In this regard, some authors have posited that children with more siblings tend to have fewer external controls, such as parental monitoring or parental attachment, and a higher probability to be exposed to antisocial siblings which, in turn, increases the risk for future delinquency (e.g., Fischer, 1984; Lauritsen, 1993). However, recent studies found the opposite pattern showing positive effects of having a greater number of siblings and larger families, to be associated with lower levels of delinquency (Adberhalden & Evans, 2019; Collier & Mears, 2022). Finally, the potential moderating role of specific relevant covariates, such as quality of sibling relationship, socio-economic environment, parental criminality, or individual factors, were not analyzed given the limited number of studies which addressed these variables. They may be considered in future studies trying to uncover the mechanisms and processes by which deviant siblings influence the development of antisocial behavior and delinquency (Azeredo et al., 2019; Burt et al., 2010; Rowe & Farrington, 1997).

4.7. Conclusions

The results of the current meta-analysis evidence a moderate positive relation of sibling delinquency of future delinquency, effect that remains regardless of birth order and sibling-sex composition. No moderation effects were found for age of siblings and publication year, although the effects sizes tended to stabilize the longer the time span between assessments and the larger the sample sizes. These findings support the hypothesis stressing the role of deviant siblings as a risk factor for future delinquency and open new possibilities for future research lines aimed to understand the underlying mechanisms that may contribute to explaining the variance in these problematic behaviors. The results have theoretical and practical implications in the field of diagnostics, prevention, and intervention of behavior problems. For instance, it highlights the need of considering sibling relationships when adapting intervention programs and use diagnostics that go beyond a more person-oriented approach.

Funding

This research was supported by Xunta de Galicia under the program Axudas á etapa posdoutoral (Consellería de Cultura, Educación e Ordenación Universitaria).

Declaration of competing interest

No potential conflict of interest was reported by the author(s).

References¹

- Aaron, L., & Dallaire, D. H. (2010). Parental incarceration and multiple risk experiences: Effects on family dynamics and children's delinquency. *Journal of Youth and Adolescence*, 39, 1471–1484. <https://doi.org/10.1007/s10964-009-9458-0>
- Achenbach, T., & Rescorla, L. (2001). *Manual for the ASEBA school-age forms & profiles*. Burlington: University of Vermont, Research Centre for Children, Youth, & Families.
- Adberhalden, F. P., & Evans, S. Z. (2019). An examination of sibling impact on frequency and type of arrest among chronic offenders. *Criminology, Criminal Justice, Law & Society*, 19, 27–45.
- Azeredo, A., Moreira, D., Figueiredo, P., & Barbosa, F. (2019). Delinquent behavior: Systematic review of genetic and environmental risk factors. *Clinical Child and Family Psychology Review*, 22, 502–526. <https://doi.org/10.1007/s10567-019-00298-w>
- Bandura, A. (1977). *Social learning theory*. Prentice-Hall.

¹ References marked with an asterisk indicate studies included in the meta-analysis.

- Bank, L., Patterson, G. R., & Reid, J. B. (1996). Negative sibling interaction patterns as predictors of later adjustment problems in adolescent and young adult males. In G. H. Brody (Ed.), *Advances in applied developmental psychology: Sibling relationships* (pp. 197–229). Norwood, NJ: Ablex.
- Beaver, K. (2011). Environmental moderators of genetic influences on adolescent delinquent involvement and victimization. *Journal of Adolescent Research*, 26, 84–114. <https://doi.org/10.1177/0743558410384736>
- Beaver, K. M. (2013). The familial concentration and transmission of crime. *Criminal Justice and Behavior*, 40, 139–155. <https://doi.org/10.1177/0093854812449405>
- Beijers, J., Bijleveld, C., van de Weijer, S., & Liefbroer, A. (2017). “All in the family?” The relationship between sibling offending and offending risk. *Journal of Developmental and Life-Course Criminology*, 3, 1–14. <https://doi.org/10.1007/s40865-017-0053-x>
- Besemer, S., Ahmad, S. I., Hinshaw, S. P., & Farrington, D. P. (2017). A systematic review and meta-analysis of the intergenerational transmission of criminal behavior. *Aggression and Violent Behavior*, 37, 161–178. <https://doi.org/10.1016/j.avb.2017.10.004>
- Bonta, J., & Andrews, D. A. (2017). *The psychology of criminal conduct* (6.a ed.). New York, NY: Routledge.
- Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2014). *Comprehensive meta-analysis (Version 3.3.070) [Computer software]*. Biostat. <https://www.meta-analysis.com/>.
- Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. R. (2010). A basic introduction to fixed-effect and random-effects models for meta-analysis. *Research Synthesis Methods*, 1, 97–111. <https://doi.org/10.1002/jrsm.12>
- Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Hoboken, NJ: John Wiley.
- Braithwaite, J. (2020). Crime as a cascade phenomenon. *International Journal of Comparative and Applied Criminal Justice*, 44, 137–169. <https://doi.org/10.1080/01924036.2019.1675180>
- *Brody, G. H., Kim, S., Murry, V. M., & Brown, A. C. (2005). Longitudinal links among parenting, self-presentations to peers, and the development of externalizing and internalizing symptoms in African American siblings. *Development and Psychopathology*, 17, 185–205. <https://doi.org/10.1017/S0954579405050108>
- Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In R. M. Lerner, & W. Damon (Eds.), *Theoretical models of human development: Vol. 1. Handbook of child psychology* (pp. 793–828). Hoboken, NJ, US: John Wiley & Sons Inc.
- Buist, K. L. (2010). Sibling relationship quality and adolescent delinquency: A latent growth curve approach. *Journal of Family Psychology*, 24, 400–410. <https://doi.org/10.1037/a0020351>
- Bullock, B. M., & Dishion, T. J. (2002). Sibling collusion and problem behavior in early adolescence: Toward a process model for family mutuality. *Journal of Abnormal Child Psychology*, 30, 143–153.
- *Burt, S. A., McGue, M., & Iacono, W. G. (2010). Environmental contributions to the stability of antisocial behavior over time: Are they shared or non-shared? *Journal of Abnormal Child Psychology*, 38, 327–337. <https://doi.org/10.1007/s10802-009-9367-4>
- Burt, S. A., McGue, M., Krueger, R. F., & Iacono, W. G. (2007). Environmental contributions to adolescent delinquency: A fresh look at the shared environment. *Journal of Abnormal Child Psychology*, 35, 787–800. <https://doi.org/10.1007/s10802-007-9135-2>
- Collier, N. L., & Mears, D. P. (2022). Delinquent by the dozen: Youth from larger families engage in more delinquency—Fact or myth? *Crime & Delinquency*. <https://doi.org/10.1177/0011287221088036>. Advance online publication.
- *Compton, K., Snyder, J., Schrepferman, L., Bank, L., & Shortt, J. W. (2003). The contribution of parents and siblings to antisocial and depressive behavior in adolescents: A double jeopardy coercion model. *Development and Psychopathology*, 15, 163–182. <https://doi.org/10.1017/S0954579403000099>
- Conger, K. J., & Conger, R. D. (1994). Differential parenting and change in sibling differences in delinquency. *Journal of Family Psychology*, 8, 287–302.
- Craine, J. L., Tanaka, T. A., Nishina, A., & Conger, K. J. (2009). Understanding adolescent delinquency: The role of older siblings' delinquency and popularity with peers. *Merrill-Palmer Quarterly*, 55, 436–453. <https://doi.org/10.1353/mpq.0.0036>
- Defoe, I. N., Keijsers, L., Hawk, S. T., Branje, S., Dubas, J. S., Buist, K., ... Meeus, W. (2013). Siblings versus parents and friends: Longitudinal linkages to adolescent externalizing problems. *Journal of Child Psychology and Psychiatry*, 54, 881–889. <https://doi.org/10.1111/jcpp.12049>
- Dishion, T. J., Spracklen, K. M., Andrews, D. W., & Patterson, G. R. (1996). Deviancy training in male adolescent friendships. *Behavior Therapy*, 27, 373–390. [https://doi.org/10.1016/S0005-7894\(96\)80023-2](https://doi.org/10.1016/S0005-7894(96)80023-2)
- Dunn, J. (2007). Siblings and socialization. In J. E. Grusec, & P. D. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 309–327). New York, London: The Guilford Press.
- Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, 56, 455–463.
- East, P. L. (2009). Adolescents' relationships with siblings. In R. M. Lerner, & L. Steinberg (Eds.), (3rd ed., *Contextual influences on adolescent development: Vol. 2. Handbook of adolescent psychology* (pp. 43–73). Hoboken, NJ: Wiley.
- Eichelsheim, V. I., & Van de Weijer, S. G. (Eds.). (2018). *Intergenerational continuity of criminal and antisocial behaviour: An international overview of studies*. Routledge.
- Elliott, D. S., Huizinga, D., & Ageton, S. S. (1985). *Explaining delinquency and drug use*. Beverly Hills: Sage Publications.
- *Fagan, A. A., & Najman, J. M. (2003). Sibling influences on adolescent delinquent behaviour: An Australian longitudinal study. *Journal of Adolescence*, 26, 546–558. [https://doi.org/10.1016/S0140-1971\(03\)00055-1](https://doi.org/10.1016/S0140-1971(03)00055-1)
- Farrington, D. P., Barnes, G. C., & Lambert, S. (1996). The concentration of offending in families. *Legal and Criminological Psychology*, 1, 47–63.
- Farrington, D. P., Coid, J. W., & West, D. J. (2009). The development of offending from age 8 to age 50: Recent results from the Cambridge Study in Delinquent Development. *Monatsschrift für Kriminologie und Strafrechtsreform*, 92, 160–173.
- Farrington, D. P., Jolliffe, D., Loeber, R., Stouthamer-Loeber, M., & Kalb, L. M. (2001). The concentration of offenders in families, and family criminality in the prediction of boys' delinquency. *Journal of Adolescence*, 24, 579–596. <https://doi.org/10.1006/jado.2001.0424>
- Farrington, D. P., & West, D. J. (1971). A comparison between early delinquents and young aggressives. *British Journal of Criminology*, 11, 341–358.
- Ferguson, C. J. (2010). Genetic contributions to antisocial personality and behavior: A meta-analytic review from an evolutionary perspective. *The Journal of Social Psychology*, 150, 160–180. <https://doi.org/10.1080/00224540903366503>
- Fischer, D. (1984). Family size and delinquency. *Perceptual and Motor Skills*, 58, 527–534. <https://doi.org/10.2466/pms.1984.58.2.527>
- Frisell, T., Lichtenstein, P., & Långström, N. (2011). Violent crime runs in families: A total population study of 12.5 million individuals. *Psychological Medicine*, 41, 97–105. <https://doi.org/10.1017/S0033291710000462>
- Gilman, A. B., Hill, K. G., Kim, B. E., Nevell, A., Hawkins, J. D., & Farrington, D. P. (2014). Understanding the relationship between self-reported offending and official criminal charges across early adulthood. *Criminal Behaviour and Mental Health*, 24, 229–240. <https://doi.org/10.1002/cbm.1934>
- Gómez-Fraguela, J. A., Cutrín, O., Maneiro, L., Luengo, M. A., Villar, P., Romero, E., ... Sobral, J. (2019). Valoración del Riesgo en Adolescentes Infractores (VRAI): Evaluación estructurada para la gestión del riesgo [Juvenile offender's risk assessment (VRAI): Structured assessment for risk management]. Santiago de Compostela: Andavira.
- Herrenkohl, T. I., Maguin, E., Hill, K. G., Hawkins, J. D., Abbott, R. D., & Catalano, R. F. (2000). Developmental risk factors for youth violence. *Journal of Adolescent Health*, 26, 176–186. [https://doi.org/10.1016/S1054-139X\(99\)00665-8](https://doi.org/10.1016/S1054-139X(99)00665-8)
- Higgins, J. P., & Thompson, S. G. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine*, 21, 1539–1558. <https://doi.org/10.1002/sim.1186>
- Hirschi, T. (1969). A control theory of delinquency. In F. P. Williams, III, & M. D. McShane (Eds.), *Criminology theory: Selected classic readings* (pp. 289–305). Cincinnati, OH: Anderson.
- Hoeve, M., Stams, G. J. J., Van der Put, C. E., Dubas, J. S., Van der Laan, P. H., & Gerris, J. R. (2012). A meta-analysis of attachment to parents and delinquency. *Journal of Abnormal Child Psychology*, 40, 771–785. <https://doi.org/10.1007/s10802-011-9608-1>
- *Huijsmans, T., Eichelsheim, V. I., Weerman, F., Branje, S. J., & Meeus, W. (2019). The role of siblings in adolescent delinquency next to parents, school, and peers: Do gender and age matter? *Journal of Developmental and Life-Course Criminology*, 5, 220–242. <https://doi.org/10.1007/s40865-018-0094-9>
- *Huizink, A. C., Van Den Berg, M. P., van der Ende, J., & Verhulst, F. C. (2007). Longitudinal genetic analysis of internalizing and externalizing problem behavior in adopted biologically related and unrelated sibling pairs. *Twin Research and Human Genetics*, 10, 55–65. <https://doi.org/10.1375/twin.10.1.55>
- Jolliffe, D., Farrington, D. P., Piquero, A. R., MacLeod, J. F., & Van de Weijer, S. (2017). Prevalence of life-course-persistent, adolescence-limited, and late-onset offenders: A systematic review of prospective longitudinal studies. *Aggression and Violent Behavior*, 33, 4–14. <https://doi.org/10.1016/j.avb.2017.01.002>
- *Kendler, K. S., Lönn, S. L., Maes, H. H., Morris, N. A., Lichtenstein, P., Sundquist, J., & Sundquist, K. (2015). A national Swedish longitudinal twin-sibling study of criminal convictions from adolescence through early adulthood. *Twin Research and Human Genetics*, 18, 227–233. <https://doi.org/10.1017/thg.2015.25>
- Kendler, K. S., Morris, N. A., Lönn, S. L., Sundquist, J., & Sundquist, K. (2014). Environmental transmission of violent criminal behavior in siblings: A Swedish national study. *Psychological Medicine*, 44, 3181–3187. <https://doi.org/10.1017/S0033291714000932>
- Lauritsen, J. L. (1993). Sibling resemblance on juvenile delinquency: Findings from the National Youth Survey. *Criminology*, 31, 387–407. <https://doi.org/10.1111/j.1745-9125.1993.tb01135.x>
- Le Blanc, M. (2015). Developmental criminology: Thoughts on the past and insight for the future. In J. Morizot, & L. Kazemian (Eds.), *The development of criminal and antisocial behaviour: Theory, research, and practical applications* (pp. 507–538). New York, NY: Springer.
- Leijten, P., Melendez-Torres, G. J., & Oliver, B. R. (2021). Parenting programs to improve sibling interactions: A meta-analysis. *Journal of Family Psychology*, 35, 703–708. <https://doi.org/10.1037/fam0000833>
- *Low, S., Sinclair, R., & Shortt, J. W. (2012). The role of economic strain on adolescent delinquency: A microsocial process model. *Journal of Family Psychology*, 26, 576–584. <https://doi.org/10.1037/a0028785>
- *Low, S., Snyder, J., & Shortt, J. W. (2012). The drift toward problem behavior during the transition to adolescence: The contributions of youth disclosure, parenting, and older siblings. *Journal of Research on Adolescence*, 22, 65–79. <https://doi.org/10.1111/j.1532-7795.2011.00757.x>
- *Mayer, K. A. C. (2004). The impact of parental resource dilution and older sibling modeling on younger sibling deviance [Doctoral dissertation, State University of New York at Buffalo]. In ProQuest dissertations and theses global.
- McCord, J., Widom, C. S., & Crowell, N. A. (2001). *Juvenile crime, juvenile justice. panel on juvenile crime: Prevention, treatment, and control*. National Academy Press.
- Miles, D., & Carey, G. (1997). Genetic and environmental architecture on human aggression. *Journal of Personality and Social Psychology*, 72, 207–217.
- Murray, J., Farrington, D. P., & Sekol, I. (2012). Children's antisocial behavior, mental health, drug use, and educational performance after parental incarceration: A

- systematic review and meta-analysis. *Psychological Bulletin*, 138, 175–210. <https://doi.org/10.1037/a0026407>
- Patterson, G. R. (1982). A social learning approach. In , Vol. 3. *Coercive family process*. Eugene, OR: Castalia Publishing.
- Patterson, G. R. (1984). Siblings: Fellow travelers in a coercive system. In R. J. Blanchard, & D. C. Blanchard (Eds.), Vol. 1. *Advances in the study of aggression* (pp. 173–215). New York: Academic Press.
- Peterson, R. A., & Brown, S. P. (2005). On the use of beta coefficients in meta-analysis. *Journal of Applied Psychology*, 90, 175–181. <https://doi.org/10.1037/0021-9010.90.1.175>
- Rhee, S. H., & Waldman, I. D. (2002). Genetic and environmental influences on antisocial behavior: A meta-analysis of twin and adoption studies. *Psychological Bulletin*, 128, 490–529. <https://doi.org/10.1037//0033-2909.128.3.490>
- *Rowe, D. C., & Britt, C. L. (1991). Developmental explanations of delinquent behavior among siblings: Common factor vs. transmission mechanisms. *Journal of Quantitative Criminology*, 7, 315–332. <https://doi.org/10.1007/BF01066586>
- Rowe, D. C., & Farrington, D. P. (1997). The familial transmission of criminal convictions. *Criminology*, 35, 177–202.
- Rowe, D. C., & Gulley, B. L. (1992). Sibling effects on substance use and delinquency. *Criminology*, 30, 217–234. <https://doi.org/10.1111/j.1745-9125.1992.tb01103.x>
- Scholte, R. H., Engels, R. C., de Kemp, R. A., Harakeh, Z., & Overbeek, G. (2007). Differential parental treatment, sibling relationships and delinquency in adolescence. *Journal of Youth and Adolescence*, 36, 661–671. <https://doi.org/10.1007/s10964-006-9155-1>
- *Slomkowski, C., Rende, R., Conger, K. J., Simons, R. L., & Conger, R. D. (2001). Sisters, brothers, and delinquency: Evaluating social influence during early and middle adolescence. *Child Development*, 72, 271–283.
- Snyder, J., Bank, L., & Burraston, B. (2005). The consequences of antisocial behavior in older male siblings for younger brothers and sisters. *Journal of Family Psychology*, 19, 643–653. <https://doi.org/10.1037/0893-3200.19.4.643>
- Snyder, J., Schrepferman, L., Oeser, J., Patterson, G., Stoolmiller, M., Johnson, K., & Snyder, A. (2005). Deviancy training and association with deviant peers in younger children: Occurrence and contribution to early-onset conduct problems. *Development and Psychopathology*, 17, 397–413. <https://doi.org/10.1017/S0954579405050194>
- Solmeyer, A. R., McHale, S. M., & Crouter, A. C. (2014). Longitudinal associations between sibling relationship qualities and risky behavior across adolescence. *Developmental Psychology*, 50, 600–610. <https://doi.org/10.1037/a0033207>
- Steele, F., Rasbash, J., & Jenkins, J. (2013). A multilevel simultaneous equations model for within-cluster dynamic effects, with an application to reciprocal parent–child and sibling effects. *Psychological Methods*, 18, 87–100. <https://doi.org/10.1037/a0029316>
- Thornberry, T. P. (2014). Interactional theory of delinquency. In G. J. N. Bruinsma, & D. Weisburd (Eds.), *Encyclopedia of criminology and criminal justice* (pp. 2592–2601). New York: Springer Science + Business Media.
- Tucker, C. J., & Updegraff, K. (2009). The relative contributions of parents and siblings to child and adolescent development. In L. Kramer, & K. J. Conger (Eds.), Vol. 126. *Siblings as agents of socialization. New directions for child and adolescent development* (pp. 13–28). San Francisco: Jossey-Bass.
- Van Berkel, S. R., Song, J. H., Gonzalez, R., Olson, S. L., & Volling, B. L. (2020). Don't touch: Developmental trajectories of toddlers' behavioral regulation related to older siblings' behaviors and parental discipline. *Social Development*. <https://doi.org/10.1111/sode.12440>. advanced online.
- Van de Rakt, M., Nieuwbeerta, P., & Apel, R. (2009). Association of criminal convictions between family members: Effects of siblings, fathers and mothers. *Criminal Behaviour and Mental Health*, 19, 94–108. <https://doi.org/10.1002/cbm.715>
- Van de Weijer, S. G. A., Besemer, S., Blokland, A. A. J., & Bijleveld, C. C. J. H. (2015). The concentration of sex offenses within British and Dutch families. In A. A. J. Blokland, & P. Lussier (Eds.), *Sex offenders: A criminal career approach* (pp. 321–348). Oxford: Wiley-Blackwell.
- Vevea, J. L., Coburn, K., & Sutton, A. (2019). Publication bias. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (pp. 383–429). New York: Russell Sage Foundation.
- Wagner, D. V., Borduin, C. M., Sawyer, A. M., & Dopp, A. R. (2014). Long-term prevention of criminality in siblings of serious and violent juvenile offenders: A 25-year follow-up to a randomized clinical trial of multisystemic therapy. *Journal of Consulting and Clinical Psychology*, 82, 492–499. <https://doi.org/10.1037/a0035624>
- Waid, J. D., Tanana, M. J., Vanderloo, M. J., Voit, R., & Kothari, B. H. (2020). The role of siblings in the development of externalizing behaviors during childhood and adolescence: A scoping review. *Journal of Family Social Work*, 23, 318–337. <https://doi.org/10.1080/10522158.2020.1799893>
- *Walters, G. D. (2018). Sibling delinquency as a risk factor for future offending: An exploratory analysis. *Youth Violence and Juvenile Justice*, 16, 343–357. <https://doi.org/10.1177/1541204017713255>
- *Walters, G. D. (2019). Tracing the delinquency acquisition sequence from older siblings, to friends, to self: A mediation analysis. *Journal of Adolescence*, 75, 113–122. <https://doi.org/10.1016/j.adolescence.2019.07.009>
- Walters, G. D. (2020). The sibling effect for delinquency: Mediation by proactive criminal thinking and moderation by age. *International Journal of Offender Therapy and Comparative Criminology*, 64, 265–288. <https://doi.org/10.1177/0306624X19872963>
- White, H. R., Conway, F. N., Buckman, J. F., & Loeber, R. (2018). Does substance use exacerbate escalation along developmental pathways of covert and overt externalizing behaviors among young men? *Journal of Developmental and Life-Course Criminology*, 4, 137–147. <https://doi.org/10.1007/s40865-017-0076-3>
- *Whiteman, S. D., Jensen, A. C., & McHale, S. M. (2017). Sibling influences on risky behaviors from adolescence to young adulthood: Vertical socialization or bidirectional effects? In N. Campione-Barr (Ed.), Vol. 156. *Power, control, and influence in sibling relationships across development. New directions for child and adolescent development* (pp. 67–85).
- Whiteman, S. D., McHale, S. M., & Crouter, A. C. (2007). Competing processes of sibling influence: Observational learning and sibling deidentification. *Social Development*, 16, 642–661. <https://doi.org/10.1111/j.1467-9507.2007.00409.x>
- Whiteman, S. D., McHale, S. M., & Soli, A. (2011). Theoretical perspectives on sibling relationships. *Journal of Family Theory & Review*, 3, 124–139. <https://doi.org/10.1111/j.1756-2589.2011.00087.x>
- *Whiteman, S. D., Solmeyer, A. R., & McHale, S. M. (2015). Sibling relationships and adolescent adjustment: Longitudinal associations in two-parent African American families. *Journal of Youth and Adolescence*, 44, 2042–2053. <https://doi.org/10.1007/s10964-015-0286-0>
- *Whiteman, S. D., Zeiders, K. H., Killoren, S. E., Rodriguez, S. A., & Updegraff, K. A. (2014). Sibling influence on Mexican-origin adolescents' deviant and sexual risk behaviors: The role of sibling modeling. *Journal of Adolescent Health*, 54, 587–592. <https://doi.org/10.1016/j.jadohealth.2013.10.004>
- *Williams, J. H., Ayers, C. D., Abbott, R. D., Hawkins, J. D., & Catalano, R. F. (1999). Racial differences in risk factors for delinquency and substance use among adolescents. *Social Work Research*, 23, 241–256. <https://doi.org/10.1093/swr/23.4.241>