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Sibling Relationship and Behavioral Adjustment in Families of Disabled Children: Cross-Lagged Associations

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Abstract

Cross-lagged panel designs were used to examine longitudinal and potential (bi)directional relationships between primary caregiver reported sibling relationship quality and the behaviors of children with intellectual disability ($n = 297$) and their closest in age siblings. The behavioral and emotional problems of the child with intellectual disability positively predicted sibling conflict over time. When accounting for control variables, this relationship was no longer present. Sibling warmth positively predicted the prosocial behaviors of the child with intellectual disability over time. When accounting for control variables, both sibling warmth and sibling conflict positively predicted the prosocial behaviors of the child with intellectual disability over time. Future research directions and clinical implications are discussed.

Keywords: sibling relationship, behavioral adjustment, family systems, cross-lagged analysis intellectual disability

Introduction

The sibling relationship is important and unique, encompassing experiences including, for example, conflict as well as warmth (Buist et al., 2013). This relationship is one of crucial importance throughout an individual's life, with younger children typically spending more time with their siblings than they do anyone else (Dunifon et al., 2017). Family systems theories suggest that all individuals and subsystems in the family influence one another (Cox & Paley, 1997). Children are embedded within several family subsystems that have direct and indirect effects on their behavior and relationships. Family systems theories also have a strong connection with ecological systems theory (Bronfenbrenner, 1977), which describes a child's development being influenced by daily interactions with immediate family members as part of the child's microsystem (Padilla-Walker et al., 2010). As young children spend much of their time with their sibling, the sibling relationship is an important aspect of the microsystem to explore. This is especially relevant for sibling pairs where one has intellectual or developmental disabilities, as siblings can provide support, advocacy, and companionship in a disablist society (Hayden & Hastings, 2022).

The significance of the sibling relationship for nondisabled children's outcomes is well established. For example, Natsuaki et al. (2009) used multilevel modeling to explore the prospective links between sibling aggression and externalizing behavior in a sample of 390 sibling pairs. Sibling aggression predicted adolescents' externalizing behaviors 3 years later, after accounting for earlier externalizing behavior and maternal parenting. In a 3-year longitudinal study examining trajectories of externalizing behavior problems in 119 preschool children, Meunier et al. (2011) found that children who had a good relationship with their sibling tended to show lower average levels of externalizing behavior problems over time. Additionally, a meta-analysis summarizing data from 34 research studies found that more warmth and less conflict in the sibling relationship were associated with fewer externalizing and internalizing problem behaviors for children and adolescents (Buist et al., 2013). Maintaining a strong sibling relationship can contribute

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to positive behavioral and emotional outcomes for children.

The association between sibling relationship quality and children's behavior problems may be partially explained by Bandura's (1977) social learning theory, which describes children as acquiring their behaviors through reinforcement and observations of others. Hostile and aggressive behaviors may be learnt whilst children fight with their siblings or observe their behavior (Stauffacher & DeHart, 2006), with older and same-sex siblings being more likely to be imitated by the younger same-sex sibling (Whiteman et al., 2011). This suggests that sibling gender combination and whether the sibling is older or younger than their brother or sister may alter the dynamic in which the siblings interact. Moreover, children could also develop prosocial and positive behaviors through observing their sibling engaging in voluntary behavior intended to help others.

The putative association between sibling relationship quality and the prosocial behaviors of siblings has been given less research attention. Harper, Padilla-Walker and Jensen (2014), for example, measured the effect of sibling affection and hostility on 308 adolescent sibling pairs' positive and negative outcomes. Harper et al. found that sibling affection was longitudinally and positively associated with adolescents' prosocial behaviors over a 3-year period, even after accounting for the variance attributed to parent and peer relationship quality. Although this study used longitudinal methods to suggest a directional relationship from sibling relationship quality to adolescents' prosocial behavior, family systems perspectives and social learning theory would suggest that these effects could be reciprocal as both siblings learn from and influence one another. With these theories in mind, Pike and Oliver (2017) used cross-lagged models across a 3-year period to test bidirectional relationships between 2,043 target children's prosocial and conduct behaviors and their relationship quality with their older sibling. Sibling relationship quality predicted children's prosocial behaviors and conduct problems and vice versa, supporting the hypothesized reciprocity between sibling relationship quality and siblings' developmental outcomes.

Cross-sectional studies exploring developmental outcomes for children with intellectual or developmental disabilities confirm an association between sibling relationship quality and behavioral and emotional problems. For example, Hastings and Petalas (2014) collected data from 94 families of autistic children, with mothers reporting on sibling relationship quality and the behavioral and emotional problems of their autistic child. Additionally, a nondisabled sibling aged between 7 and 17 years reported on the quality of their relationship with their autistic brother or sister. Higher levels of behavior problems in autistic children predicted lower levels of sibling reported warmth/closeness and more conflict in the sibling relationship.

From previous research investigating sibling pairs where one child has intellectual or developmental disabilities, there has been less recognition of the need to consider both children's outcomes, with outcomes for the child with intellectual or developmental disabilities often overlooked. In a rare study addressing outcomes for the child with intellectual disability, Begum and Blacher (2011) collected cross-sectional data from 70 sibling dyads, each consisting of one 12-year-old adolescent with ($n = 23$) or without intellectual disability ($n = 47$), and their closest in age sibling. Employing multiple regression analysis, and using mother reported sibling relationship quality and behavior problems, they found that sibling conflict was associated with externalizing behavior problems in adolescents with intellectual disability, and with internalizing behavior problems for nondisabled siblings. Additionally, using structural equation modeling with a cross-sectional sample, Hayden, Hastings, and Bailey (2023) found that the behavioral and emotional problems and prosocial behaviors displayed by both the child with intellectual disability and their sibling were associated with intimacy-companionship and antagonism-quarrelling in the sibling relationship in 500 sibling pairs. Although considering both children in the sibling dyad, Hayden et al. (2023) did not have longitudinal data to establish the direction of the relationship between sibling relationship quality and sibling developmental outcomes.

To build on existing research and theoretical perspectives, the primary aim of the current longitudinal study was to explore the potential bidirectional relationships between sibling relationship quality and both the prosocial behaviors and behavioral and emotional problems of children with intellectual disability and their siblings. We anticipated that more conflict in the sibling relationship would be associated with both the child with intellectual disability and their sibling

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displaying more behavior problems; whereas, we hypothesized more warmth in the sibling relationship would be associated with fewer behavior problems exhibited by both children. Additionally, we anticipated that higher levels of sibling conflict in the relationship would be associated with fewer prosocial behaviors exhibited by both children, and higher levels of sibling warmth would be associated with more prosocial behaviors demonstrated by the child with intellectual disability and their sibling.

Method

Participants

Participants were primary caregivers from 297 families of children with intellectual disability from the 1000 Families Study (Hastings et al., 2020). The children were aged between 4 and 15 years and 11 months (190 boys and 106 girls: mean age at Wave 1 = 8.46 years, *SD* = 2.31 years). The primary caregiver was also asked to report on a sibling within the same age range (150 boys, 142 girls: mean age at Wave 1 = 8.58 years, *SD* = 2.49 years). When the child with intellectual disability had more than one sibling, the primary caregiver was asked to report on the sibling closest in age to the child with intellectual disability. Descriptive statistics for the sample are presented in Tables 1 and 2.

Measures

Primary caregivers completed an adapted and reduced version of the Sibling Relationship Questionnaire–Short Form (SRQ-SF; Furman & Buhrmester, 1985) to assess sibling relationship quality. The adapted version of the questionnaire included six items measuring affection, companionship, and intimacy between siblings (e.g., "How much do the sibling and the child go places and do things together?"). These items were summed to create a warmth and closeness subscale score. Additionally, the SRQ-SF included four items that measured antagonism and quarreling in the sibling relationship (e.g., "How much do the sibling and the child insult and call each other names?"), used to represent conflict between siblings. Primary caregivers responded to the items enquiring about the sibling relationship on a 5-point Likert-type scale which ranged from one (*hardly at all*) to five (*extremely much*). McDonald's omega coefficients (Hayes & Coutts, 2020) for the current sample at study Wave 1 were: Warmth and Closeness = .823, Conflict = .869; and coefficients for the sample at Wave 2 were: Warmth and Closeness = .866, Conflict = .889.

Parental caregiver reported Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) ratings were used to measure the prosocial behaviors and the behavioral and emotional problems of both the child with intellectual disability and their sibling. The SDQ includes 25 items rated on a 3-point scale ranging from zero (*not true*) to two (*certainly true*). The children's prosocial behaviors were measured using five items (e.g., "Kind to younger children"; "Shares readily with other children"), whilst the remaining 20 items were used to measure the children's behavioral and emotional problems (e.g., "Often fights with other children or bullies them"; "Many fears, easily scared") via the SDQ Total Difficulties score.

According to data obtained from a representative sample of British children aged 5-15, the SDQ has good psychometric properties (Goodman, 2001). Additionally, the SDQ effectively measures behavioral and emotional problems in children with intellectual or developmental disabilities (Murray et al., 2020). McDonald's omega coefficients for the current sample of children with intellectual disability at study Wave 1 were: Total Difficulties = .810, prosocial behavior = .839; and coefficients for the sample at Wave 2 were: Total Difficulties = .808, prosocial behavior = .852. McDonald's omega coefficients for the current sample of siblings of the children with intellectual disability at Wave 1 were: Total Difficulties = .919, prosocial behavior = .854; and coefficients for the siblings at Wave 2 were Total Difficulties = .906, prosocial behavior = .854.

Procedure

To reduce potential bias in the research process, the current study was preregistered on Open Science Framework (OSF; https://osf.io/5bpmu). Preregistering the current study facilitated transparency around the development of the study plan and the analysis of the data, increasing the replicability of the analysis and results (Nosek et al., 2018).

Data were obtained from Wave 1 and Wave 2 of the 1000 Families Study; an ongoing longitudinal cohort study, following families of children with intellectual disability living in the United Kingdom (Hastings et al., 2020). Recruitment to Wave 1 involved a multipoint method, including contacting special

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Table 1
*Primary Caregiver and Family Demographic Information at Wave 1 (*n = *297)*

Relationship to child (%)	
Biological mother	266 (89.6%)
Biological father	9 (3%)
Adoptive mother	12 (4%)
Stepmother	1 (.3%)
Foster mother	1 (.3%)
Grandmother	6 (2%)
Grandfather	1 (.3%)
Other	1 (.3%)
Gender (%)	
Female	286 (96.3%)
Male	10 (3.4%)
Prefer not to answer	1 (.3%)
Ethnicity (%)	
White British	266 (89.6%)
White other (Irish, Traveling community, Other)	12 (4%)
Asian/Asian British	6 (2%)
Black (African/Caribbean/Black British)	3 (1%)
Remaining ethnic groups (mixed/multiple ethnicity, Arabic, etc)	6 (2%)
Missing information	4 (1.3%)
Employment status (%)	
In a job working for an employer	98 (33%)
Looking after home and family	123 (41.4%)
Self-employed	26 (8.8%)
Voluntary work	15 (5.1%)
Full-time student	4 (1.3%)
Maternity/ paternity leave from a job	5 (1.7%)
Doing something else	21 (7.1%)
Unemployed	4 (1.3%)
Missing information	1 (.3%)
Qualifications (%)	
Degree level	154 (51.9%)
Below degree level	130 (43.8%)
No qualifications	1 (.3%)
Missing information	12 (4%)
UK median weekly household income (%)	
Above median (more than £700)	105 (35.4%)
Below median (less than £700)	182 (61.3%)
Missing information	10 (3.4%)

Note. All responses for the employment status question were mutually exclusive. Primary caregivers selected their main occupation.

schools and parent support organizations, as well as the use of websites, social media, and advertisements in family support organizations' newsletters. Inclusion criteria were that all families taking part had to be living in the United Kingdom and live with at least one child with intellectual disability, as reported by the primary caregiver, aged between 4 years and 15 years 11 months. Informed consent was obtained from the primary caregiver.

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Table 2
*Sibling and Child With Intellectual Disability Descriptive Information at Wave 1 (*n = *297)*

	Child With Intellectual Disability	Sibling
Mean age (*SD*)	8.46 (2.31)	8.45 (2.47)
Birth order (%)		
Sibling older	143 (48.2%)	
Sibling younger	145 (48.8%)	
Missing information	9 (3%)	
Gender (%)		
Male	190 (64%)	150 (50.5%)
Female	106 (35.7%)	142 (47.8%)
Missing information	1 (.3%)	5 (1.7%)
Additional diagnoses (%)		
Autism	159 (53.5%)	
Down syndrome	48 (16.2%)	
Sibling has longstanding illness or disability		73 (24.6%)
Missing information		3 (1%)

Note: *SD* = standard deviation.

The primary caregiver completed two online surveys, approximately 2 years and 9 months apart. A total of 1,184 primary caregivers completed the survey at Wave 1, whilst 650 of these caregivers completed the survey for a second time at Wave 2 follow-up. The 1000 Families Study was granted full ethical approval by the UK National Health Service (NHS) West Midlands–South Birmingham Research Ethics Committee (REC reference number: 15/WM/0267).

The sample size for the current study was achieved by excluding families where the child with intellectual disability did not have a sibling aged between 4 years and 15 years at Wave 1 ($n = 266$) or Wave 2 ($n = 64$), and when the primary caregiver reported on a different sibling at Wave 2 ($n = 18$). Additionally, five responses were removed from Wave 1 as the child with intellectual disability was under 4 years old and so did not meet the original inclusion criteria. The final sample size included 297 families of children with intellectual disability.

Statistical Analysis

Two cross-lagged panel designs were preregistered and used to examine the longitudinal and (bi)directional relationships between sibling relationship quality and both the prosocial behaviors and behavioral and emotional problems of the child with intellectual disability and their sibling. The first cross-lagged panel design examined the relationships between the sibling relationship and the behavioral and emotional problems of the children, whilst the second examined sibling relationship quality and its relationship with the children's prosocial behavior.

First, autoregressive models were developed without cross-lagged paths. The autoregressive models account for the stability of the caregiver reported variables over time. Cross-lagged models were then developed including both autoregressive and cross-lagged effects from Wave 1 to Wave 2. These cross-lagged models determined whether the behaviors of both children causally precede sibling relationship quality or vice versa. Likelihood ratio tests were performed comparing the autoregressive models to their cross-lagged counterparts to determine which models better fit the data (Kenny & Harackiewicz, 1979). Bootstrapped standard errors for all parameter estimates are also reported.

Model fit indices were generated for all autoregressive and cross-lagged models, including the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), standardized root mean squared residual (SRMR), and root mean square error of approximation (RMSEA). A good/close model fit is demonstrated when CFI and TLI are $>.95$, RMSEA is $<.06$ and SRMR is $<.08$ (Hu & Bentler, 1999; Schreiber et al., 2006). Our preregistration specified that bootstrapped 95% confidence intervals (CI) would be used when reporting the CFI and RMSEA. However, Yuan, Hayashi and Yanagihara (YHY; 2007) suggest that bootstrapped confidence

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intervals became artificially skewed when a high proportion of bootstrap iterations of model fit are poor. Therefore, YHY bootstrapped confidence intervals were not reported with the model fit indices, but we do include 90% confidence intervals for the RMSEA.

As complex models require larger sample sizes (Hair et al., 2014), an iterative set of sensitivity analyses were performed after the construction of the initial autoregressive and cross-lagged models. The sensitivity analyses were specified in the preregistration and involved inserting three groups of control variables in a theoretically justified order. The groups were: Group one–Whether the sibling also has a disability; Group two–Whether the child with intellectual disability is autistic and whether the child has an additional diagnosis of Down syndrome; and Group three–Whether the sibling is older or younger than the child with intellectual disability and sibling dyad combination (e.g., whether both the children are female, male, or differing genders). Research suggests that autistic children display more behavior problems than children with intellectual disability alone (Hastings, Beck & Hill, 2005; Herring et al., 2006) and siblings of children with Down syndrome report closer sibling relationships (Hastings & Petalas, 2014; Petalas et al., 2012). Therefore, co-occurring developmental disabilities, such as autism and Down syndrome, may account for some variation in sibling relationship quality.

The analyses were conducted using R version 4.1.1; a free software environment for statistical analysis, utilizing the Lavaan package (Rosseel, 2012). Missing data for the sample was proportionately small (1.2%), so any associated bias would be negligible. In addition, standardized model parameter estimates were reported throughout.

Results

Behavioral and Emotional Problems: Autoregressive Model

The preregistered autoregressive model including the behavioral and emotional problems of both children and their sibling relationship quality, displayed good model fit (χ^2 [12] =12.309; p = .421; CFI = 1.000; TLI = .999; SMSR = .030; RMSEA = .009 [90% CI .000-.060], AIC = 14096.172). The behavior and relationship variables showed stability across the two time points.

Behavioral and Emotional Problems: Cross-Lagged Model

The preregistered cross-lagged model including the behavioral and emotional problems of both children and their sibling relationship quality, displayed good model fit (χ^2 [4] = 4.711; p = .318; CFI = .999; TLI = .995; SMSR = .015; RMSEA = .024 [90% CI .000-.094], AIC = 14104.574). The behavior and relationship variables continued to show stability across the two time points. Sibling conflict (β = .69, p < .001), sibling warmth (β = .75, p < .001), and the child (β = .77, p < .001) and siblings' behavioral and emotional problems (β = .73, p < .001) at Wave 1 positively predicted caregivers' reports on the same outcomes at Wave 2. The cross-lagged model included a statistically significant path demonstrating that the behavioral and emotional problems of the child with intellectual disability at Wave 1 positively predicted sibling conflict at Wave 2 (β = .10, p = .034).

Prosocial Behavior: Autoregressive Model

The preregistered autoregressive model including the prosocial behaviors of both children and their sibling relationship quality, displayed good model fit (χ^2 [12] =31.263; p = .002; CFI = .983; TLI = .960; SMSR = .039; RMSEA = .074 [90% CI .042-.106], AIC = 11673.255). The prosocial behavior and relationship variables showed stability across the two time points.

Prosocial Behavior: Cross-Lagged Model

The preregistered cross-lagged model including the prosocial behaviors of both children and their sibling relationship quality, displayed good model fit (χ^2 [4] = 7.679; p = .104; CFI = .997; TLI = .977; SMSR = .022; RMSEA = .056 [90% CI .000-.115], AIC = 11665.671). The prosocial behavior and relationship variables continued to show stability across the two time points. Sibling conflict (β = .72, p < .001), sibling warmth (β = .69, p < .001), and the child (β = .73, p < .001) and sibling's prosocial behavior (β = .63, p < .001) at Wave 1 positively predicted caregivers' reports on the same outcomes at Wave 2. The cross-lagged model included a statistically significant path demonstrating that sibling warmth at Wave 1 positively predicted the child with intellectual disability's prosocial behavior at Wave 2 (β = .10, p = .014).

Exploratory Analysis

Introducing the control variables in a theoretically justified order as described in the preregistration resulted in poor model fit for both the

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behavioral and emotional problems and prosocial behavior models (see Supplementary Material Tables S1-S2 on OSF, https://osf.io/u2qnm/). Therefore, the models containing the control variables were refined by including additional paths and/or residual covariances indicated by modification indices (see Supplementary Material Tables S3-S4, https://osf.io/u2qnm/). The value of a modification index shows the value to which the chi-square statistic would improve if a suggested path between parameters was introduced or removed from the model (Whittaker, 2012). It is important to note that modifications were only introduced into the model if they were theoretically meaningful (Whittaker, 2012).

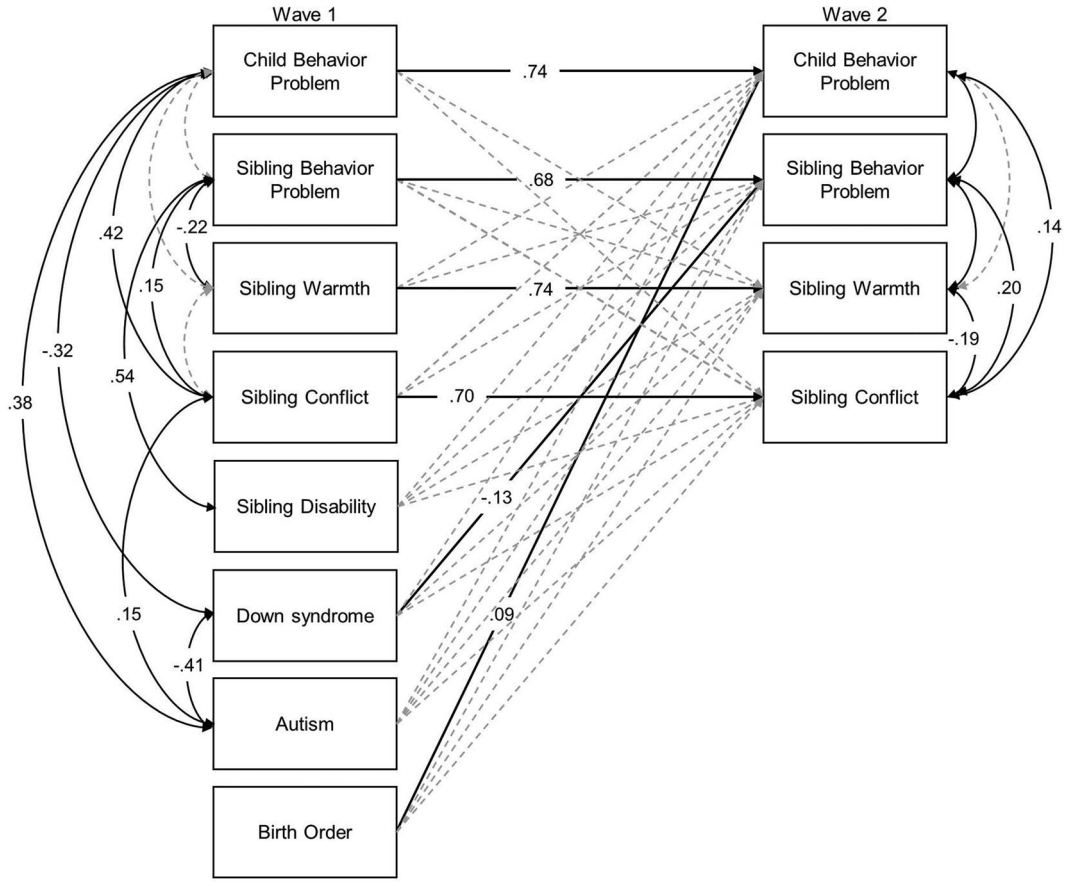
Behavioral and Emotional Problems: Autoregressive Model Including Control Variables

The autoregressive model including the behavioral and emotional problems of both children, their sibling relationship quality and relevant control variables displayed good model fit (χ^2 [43] = 68.086; p = .009; CFI = .981; TLI = .961; SMSR = .067; RMSEA = .045 [90% CI .023-.065], AIC = 14292.372). The behavior and relationship variables showed stability across the two time points.

Behavioral and Emotional Problems: Cross-Lagged Model Including Control Variables

The cross-lagged model (see Figure 1) including the behavioral and emotional problems of both

Figure 1
Cross-Lagged Model With Control Variables (Behavioral and Emotional Problems)



Note. The cross-lagged model including the behavioral and emotional problems of both children, their sibling relationship quality, and the significant control variables. Single-headed arrows between the same variables measured at Wave 1 and Wave 2 represent autoregressive dependence relationships, whilst single-headed arrows between different variables at Wave 1 and Wave 2 represent cross-lagged dependence relationships. Two-headed arrows represent correlational relationships between variables measured at the same time point. Dashed arrows indicate paths that were estimated in the final cross-lagged model but were nonsignificant.

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children, their sibling relationship quality and relevant control variables displayed good model fit (χ^2 [35] = 63.237; p = .002; CFI = .978; TLI = .946; SMSR = .065; RMSEA = .053 [90% CI .031-.074], AIC = 14303.523). The behavior and relationship variables continued to show stability across the two time points. Sibling conflict (β = .70, p < .001), sibling warmth (β = .74, p < .001), and the child (β = .74, p < .001) and sibling's behavioral and emotional problems (β = .68, p < .001) at Wave 1 positively predicted caregivers' reports on the same outcomes at Wave 2. In terms of the covariates, if the child with intellectual disability had an additional diagnosis of Down syndrome, their sibling exhibited lower levels of behavioral and emotional problems (β = −.13, p = .005). If the sibling was older than the child with intellectual disability, the child with intellectual disability exhibited more behavioral and emotional problems (β = .09, p = .009). With control variables accounted for, there were no significant associations between either child's behavior and their sibling relationship quality.

Prosocial Behavior: Autoregressive Model Including Control Variables

The autoregressive model including the prosocial behaviors of both children, their sibling relationship quality, and significant control variables, displayed satisfactory model fit (χ^2 [44] =110.276; p < .001; CFI = .949; TLI = .898; SMSR = .075; RMSEA = .073 [90% CI .056-.090], AIC = 12022.306). The prosocial behavior and relationship variables showed stability across the two time points.

Prosocial Behavior: Cross-Lagged Model Including Control Variables

The cross-lagged model (see Figure 2) including the prosocial behaviors of both children, their sibling relationship quality, and significant control variables displayed satisfactory model fit (χ^2 [36] =84.378; p < .001; CFI = .963; TLI = .909; SMSR = .072; RMSEA = .069 [90% CI .050-.088], AIC = 12012.408). The prosocial behavior and relationship variables continued to show stability across the two time points. Sibling conflict (β = .71, p < .001), sibling warmth (β = .68, p < .001), and the child (β = .68, p < .001) and siblings' prosocial behavior (β = .58, p < .001) at Wave 1 positively predicted caregivers' reports on the same outcomes at Wave 2. In terms of the covariates, if the child with intellectual disability had an additional diagnosis of Down syndrome, they exhibited more prosocial behaviors (β = .17, p < .001). Additionally, if the sibling also had a disability, they showed fewer prosocial behaviors (β = −.18, p = .001). The cross-lagged analysis included two statistically significant paths, with sibling warmth (β = .11, p = .014) and sibling conflict (β = .10, p = .011) at Wave 1 positively predicting the child with intellectual disability's prosocial behavior at Wave 2.

Discussion

We explored the associations between sibling relationship quality and both the prosocial and the behavioral and emotional problems of children with intellectual disability and their siblings. Our findings indicate that if a child with intellectual disability displayed more behavioral and emotional problems at Wave 1, there was more conflict in the sibling relationship at Wave 2. However, when accounting for control variables in the model, no significant associations were found between either child's behavioral and emotional problems and sibling relationship quality from Wave 1 to Wave 2 (Figure 1). This change in findings may be explained by confounding, if sibling conflict and at least one of the predictor variables were correlated with the control variable introduced into the model (van Stralen et al., 2010). Some of the variation in sibling conflict at Wave 2 may be due to one of the control variables, but incorrectly associated with the behavioral and emotional problems of the child with intellectual disability at Wave 1 in the model without control variables included.

In addition, we found that more warmth in the sibling relationship at Wave 1 predicted more prosocial behaviors displayed by the child with intellectual disability at Wave 2. After introducing theoretically supported control variables, having more warmth and more conflict in the sibling relationship at Wave 1 predicted more prosocial behaviors displayed by the child with intellectual disability at Wave 2 (Figure 2). Previous literature exploring outcomes for nondisabled siblings has found an association between warmer sibling relationships and prosocial behavior (Harper et al., 2014; Pike & Oliver, 2017). However, this existing research did not find a positive relationship between sibling conflict and prosocial behavior. Additionally, we did not find bidirectionality between sibling relationship quality and behavioral outcomes as reported by Pike and Oliver (2017), potentially

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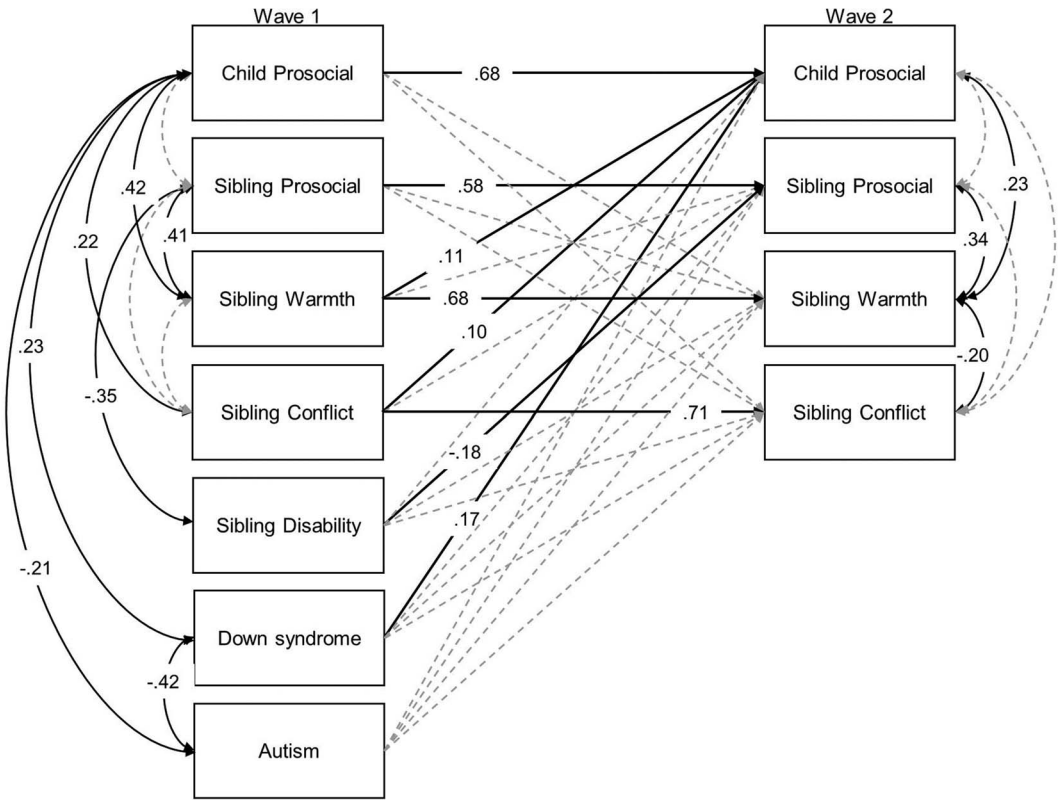
Figure 2
Cross-Lagged Model With Control Variables (Prosocial Behaviors)



Note. The cross-lagged model including the prosocial behaviors of both children, their sibling relationship quality, and the significant control variables. Single-headed arrows between the same variables measured at Wave 1 and Wave 2 represent autoregressive dependence relationships, whilst single-headed arrows between different variables at Wave 1 and Wave 2 represent cross-lagged dependence relationships. Two-headed arrows represent correlational relationships between variables measured at the same time point. Dashed arrows indicate paths that were estimated in the final cross-lagged model but were nonsignificant.

due to the difference in study design (i.e., two wave vs. three wave analyses).

The findings from the current study support previous cross-sectional research suggesting that higher levels of behavior problems in children with intellectual and developmental disabilities are associated with poorer sibling relationship quality (Hastings & Petalas, 2014; Hayden et al., 2023; Jones et al., 2019). However, unlike research with nondisabled children (Bank et al., 2004; Buist et al., 2013; Meunier et al., 2011), we found no longitudinal associations between closer sibling relationships and fewer behavioral and emotional problems. Moreover, finding that higher levels of conflict in the sibling relationship predicted more prosocial behaviors displayed by the child with intellectual disability over time was unexpected. It was anticipated that more sibling conflict would result in fewer prosocial behaviors exhibited by both children. However, children who exhibit more prosocial behaviors may have a milder intellectual disability and, therefore, more social skills (although it is important to note that this was not directly tested in the current study). In this case, siblings may spend more alone time together, interacting with one another in a way that may be expected of nondisabled siblings, including in terms of antagonism and quarrelling. This finding offers support to the notion that children can experience both positive and negative emotions towards their sibling, and that intimacy-companionship and antagonism-quarrelling are not competing components on a positive/negative spectrum of sibling relationship quality (Hayden et al., 2023).

The results of the current study support a family systems perspective, demonstrating that

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both positive and negative interactions within the sibling subsystem can influence the prosocial behaviors of the child with intellectual disability. The quality of the sibling relationship at Wave 1 did not influence the prosocial behaviors, or the behavioral and emotional problems, exhibited by the nondisabled sibling at Wave 2. From the perspective of Bandura's (1977) social learning theory, children will learn behaviors through reinforcement and observations of those who are high in power (e.g., older sibling, parental authority), and similar to themselves (e.g., same sex, similar interests). Therefore, it is possible that other subsystem relationships such as peer relationships or marital relationship quality may influence the developmental outcomes of the nondisabled sibling beyond their relationship with the child with intellectual disability. For example, Wieland and Baker (2010) examined the relationship between marital relationship quality and behavior problems in children with, and without, intellectual disability. They found that marital relationship quality predicted the children's behavior problems 2 years later, but only when the child did not have intellectual disability.

Limitations

Although preregistration is a clear strength, along with using longitudinal data to determine directional effects, there are limitations to be aware of when interpreting the results. First, the data collected were collected solely from the primary caregiver. Parents' and children's accounts regarding the sibling relationship vary (Cebula et al., 2019), possibly because the parent does not witness how the siblings interact with one another without the parent being present. Additionally, parents may subjectively interpret the siblings' interactions differently to how the siblings perceive the interaction themselves. Therefore, future research could involve child and sibling self-reports as well as parent-reported data. Second, the adapted version of the SRQ-SF may not be the most appropriate measure for sibling pairs where one has intellectual or developmental disabilities (Hayden et al., 2023). Third, models were refined by introducing additional paths and/or residual covariances indicated by modification indices. Modification indices are purely data driven and, therefore, exploratory in nature (Whittaker, 2012). However, modifications to the model were only introduced based on relevant theory and empirical data.

Future Research Directions

Considering the limitations, future research could ensure to collect data directly from sibling pairs regarding their sibling relationship quality and consider alternative measures of sibling relationship quality. Additional waves of data would also be useful. For example, having at least three data points creates the opportunity to develop higher quality scientific longitudinal research, involving exploration of trajectories of family well-being, as well as the ability to consider mediating and moderating variables in analyses. For example, self-regulation was found to partially mediate the relationship between sibling relationship quality and typically developing adolescents' behavioral outcomes (Padilla-Walker et al., 2010). Concerning children with intellectual disability, the relationship between sibling relationship quality and children's outcomes could be mediated by family variables such as parental distress, parenting practices, or marital stress.

In terms of practical implications from this research, if the key finding is replicated, interventions focusing on fostering closer sibling relationships between the child with intellectual disability and their sibling may support the development of prosocial behaviors in children with intellectual and developmental disabilities.

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