

**Parental Differential Warmth, Hostility, and Sibling Differences in Internalizing and  
Externalizing Behavior Problems: A Meta-Analysis**

**Abstract**

Parental differential treatment of siblings is associated with differences in children's behavioral adjustment. The current meta-analysis examined the extent to which associations between relative parental differential treatment and sibling differences in behavior problems differ by type of parenting behavior (i.e., differential hostility versus differential warmth) and type of behavior problems (i.e., differential externalizing versus internalizing behavior problems). In September 2021, we systematically searched PsycINFO and Web of Science, yielding 2,259 unique hits with 19 eligible publications reporting on 215 effect sizes from 13 unique samples. The overall association between relative parental differential treatment (i.e., receiving less warmth and more hostility than one's sibling) and sibling differences in behavior problems was small but significant. Associations were stronger for differential hostility compared to differential warmth and for differential externalizing compared to differential internalizing behavior problems. Particularly marked was the finding that siblings who received more hostility from their parents showed higher levels of externalizing problems. Future research investing in further dismantling the association between within-family parental differential treatment and sibling differences in adjustment is warranted to better understand why parents treat siblings differentially and to guide family support initiatives.

*Keywords:* parental differential treatment; child externalizing problems; child internalizing problems; parenting; siblings.

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Parents play an important role in the development of children's behavior problems (Lightfoot et al., 2013). For example, parental warmth (e.g., acceptance, sensitivity, affection) can help children to develop a positive internal working model, helping children develop healthy self-esteem and secure relationships with others (Bowlby, 1969; Kerns et al., 2011). In contrast, parental hostility (e.g., harsh coercion, aggression, anger, criticism) can create an environment of insecurity and rejection, putting children at risk for behavior problems (Patterson, 1982; Couchenour & Chrisman, 2016). Importantly, although the majority of this research focuses on one child in the family, siblings growing up in the same family can have very different experiences with their parents – termed 'parental differential treatment' (PDT) – in ways that may contribute to differences in their developmental outcomes (Plomin & Daniels, 1987), including behavior problems (Oliver & Pike, 2018). These within-family differences may be pertinent for intervention yet are difficult to address, and often neglected in both research and practice. We synthesized associations between relative PDT (i.e., indications of which sibling receives more or less parental warmth or hostility, and the magnitude of this difference) and sibling differences in behavior problems (i.e., indications of which sibling has more behavior problems) and test whether associations differ by type of PDT (warmth versus hostility) and by type of behavior problems (externalizing versus internalizing problems).

PDT is a complex construct, not least because, while it may suggest parental preference towards one child over another, it may simply reflect parental adjustments to age differences and developmental or physical needs of siblings in the home. For example, parents may set different bedtimes for children at different ages (Kowal et al., 2006) or provide more guidance and support to younger siblings, because older siblings are generally more

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autonomous (Lightfoot et al., 2013). This ‘appropriate’ PDT seems to have minimal influence on children’s outcomes (Kowal et al., 2002; Brody, 2004). Yet, where it is not needs-based or ‘inappropriate’ (e.g., hugging one sibling more than the other, while performing the same task and accomplishing the same goal) (Kowal et al., 2006), evidence suggests that PDT associates with sibling differences in behavior problems and wellbeing (Padilla et al., 2016; Oliver & Pike, 2018). In part, this is likely to reflect sibling differences in temperament (e.g., negative affect) or behavior problems (e.g., oppositional behavior) that elicit differences in parenting (e.g., Jenkins et al., 2003; Serbin et al., 2015). In addition, this association is also likely to be partly due to social comparison, since children tend to compare themselves with their siblings in order to develop a sense of self, with consequences for their self-esteem and behavior problems (Feinberg et al., 2000; Festinger, 1954).

PDT is considered in two main related but distinct ways, favoritism and PDT, each of which provide rather different information. Favoritism generally reflects parents’ differential treatment in terms of preference towards one of the children, while PDT reflects parents’ differential treatment of children in the family relating to sibling behavioral differences (Suitor et al., 2008). PDT is further delineated as absolute or relative levels of PDT. Absolute PDT indicates the magnitude but not the direction of the difference in parental treatment of siblings and has been shown to correlate with children’s externalizing and internalizing problems, such that a greater amount of parental differential treatment associates with a greater amount of behavior problems (e.g., see Buist et al., 2013, for a meta-analysis). In contrast, relative PDT provides information about both the magnitude and the direction of these within-family differences. Specifically, relative PDT tells us about which child is receiving more or less parental hostility (or warmth) relative to their sibling and to what extent. This is pertinent because children who are treated relatively more negatively or relatively less positively by their parents than their sibling could be more susceptible to

developing more behavior problems (e.g., more externalizing or internalizing behavior problems). Further, associating within-family differences in parenting with within-family differences in behavior is informative for understanding the extent to which these differences matter. That is, correlating relative PDT scores with sibling differences in behavior problems allows us to examine whether children who, relative to their sibling, receive less warmth or more hostility from their parents also experience more behavior problems than their sibling. Importantly, this association may equally imply that within-family differences in parental treatment impact children's behavioral outcomes, or that siblings with more behavior problems than their sibling elicit more negative parental treatment. Insights into relative differences, rather than only the magnitude of the difference (i.e., absolute differences), can help us to provide more targeted help to those children who need it the most. Although previous meta-analyses highlight the importance of PDT (e.g., by focusing on the association between sibling differences and PDT) (Jensen et al., 2022), to date only one meta-analysis investigated the link between PDT and child outcomes (i.e., absolute differences) (Buist et al., 2013).

### **Parental Warmth and Hostility**

While various different aspects of parenting have been considered in the literature, broad categories of warmth and hostility are commonly seen as one of the most impactful aspects of parenting for children's behavior problems (Khaleque, 2021). There are reasons to assume that receiving more hostility than one's sibling has even more detrimental effects on children's behavior problems than receiving less warmth than one's sibling. For example, hostility may be more behavioral in manifestation, and thus more visible to children in the home. In addition, from an evolutionary perspective it may be adaptive for children to respond more to hostile parenting behavior than to warm parenting behavior, because humans have an attentional bias towards negative stimuli (e.g., Veerapa et al., 2020). Indeed, there is

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some evidence that parenting has stronger associations when it has negative valence (e.g., Hovee et al., 2009; McLeod et al., 2007; Van Dijk et al., 2020). The present study aimed to shed light on whether the commonly seen dominance of hostility also pertains to PDT.

Some studies have tried to explain PDT by identifying child characteristics that predict PDT. Jenkins and colleagues (2003), for example, show that older siblings receive more warmth and less hostility than younger siblings. These findings are in line with previous research on the role of birth order in PDT, suggesting older siblings are generally more affected by PDT (McHale et al., 2000; Shanahan et al., 2008; Rolan & Marceau, 2018). In addition to birth order, these age effects may reflect developmental differences between children, such that older siblings are generally more autonomous and therefore may need less parental discipline. Additionally, child age may also function as a moderator, for example because cognitive and social skills of older children are better developed (Shanahan et al., 2008), and therefore older siblings may better ‘understand’ why they are treated differently. However, the strongest predictor of PDT was children’s temperament (Jenkins et al., 2003): children more likely to express negative affect generally received more hostility from parents.

Furthermore, the age gap between siblings may also explain why children are treated differently by their parents. While parents may justify PDT because of different ages (Buist et al., 2013), Rolan and Marceau (2018) suggest there may be less reason to treat siblings differently when they are closer in age. Their findings support this hypothesis for maternal PDT, where more PDT (i.e., parental affection and control) was associated with more externalizing behavior problems for siblings closer in age. However, they found the opposite for paternal PDT – more PDT was associated with more externalizing behavior for siblings with a wider age range (i.e., three years) (Rolan & Marceau, 2018).

### **Children’s Externalizing and Internalizing Problems**

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Parental warmth and hostility have been shown to associate with both externalizing and internalizing problems (Olson et al., 2017; Cooke et al., 2022). Externalizing problems are considered to be behaviors directed towards others, including symptoms of aggression or rule-breaking, whereas internalizing problems are inward-directed and include symptoms such as depression and anxiety (Achenbach & Edelbrock, 1978; Zeigler-Hill & Shackelford, 2020). There is some consideration in the literature of specificity in parenting associations for these distinct behavior problems. For example, harsh and inconsistent parenting is often more associated to the development and maintenance of externalizing behavior problems (e.g., Furlong et al., 2013; Sanders et al., 2014). On the other hand, parenting approaches of overinvolvement, overprotection, overcontrol or less warmth are commonly seen as more influential for the development of internalizing behavior problems (Yap & Jorm, 2015; Möller et al., 2016). For the most part, however, there is little evidence for the specificity in parenting associations for distinct behavior problems (e.g., Pinquart 2017a, 2017b). While bidirectional effects between parents and children are acknowledged for both types of problems (Serbin et al., 2015), theoretical models commonly conceptualize parent-centrality for externalizing behavior problems and child-centrality for internalizing behavior problems. For example, influential theories of externalizing behavior problems broadly conceive parent-child interactions as drivers of coercive and transactional processes with early parental approaches holding the key (Bell, 1971; Patterson, 1982; Fontaine & Dodge, 2009; Furlong et al., 2013; Sanders et al., 2014). Contrastingly, in the development of internalizing behavior problems, influential models lean more towards child-centered constructs (Rapee et al., 2009), such as temperamental factors and cognitive appraisal. These theoretic differences between externalizing and internalizing behavior problems imply that different mechanisms may contribute to differences in expressions of behavior problems.

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In addition to these considerations, a stronger association between PDT and externalizing behaviors may also be apparent because internalizing behaviors are more difficult to observe, or even seen as less problematic, than externalizing behaviors (Youngstrom et al., 2000; Tandon et al., 2009). For example, differential externalizing behavior may ‘pull’ parents into more PDT, such that the sibling expressing more externalizing behaviors may get more negative attention. Furthermore, PDT may also have a stronger impact on externalizing behavior problems because of coercive and transactional patterns (Patterson, 1982), wherein the behaviors of children and parents bidirectionally reinforce each other (e.g., more externalizing behaviors elicits negative parenting behaviors, which in turn, reinforces externalizing behaviors, or vice versa). Contrary, a sibling withdrawing more is less visible. In other words, siblings that show more internalizing behavior problems may ‘pull’ negativity less and be less noticed, for example, if they withdraw more because of differential negativity.

### **The Present Study**

The aim of this meta-analysis was to investigate the overall association between relative PDT (i.e., warmth and hostility) and sibling differences in behavior problems (i.e., externalizing and internalizing behavior problems) (RQ1). We hypothesized that children who receive less warmth and more hostility than their sibling experience more behavior problems than their sibling. Second, we investigate whether the overall association differs by type of PDT (RQ2). We hypothesized that this association is stronger for parental differential hostility than for parental differential warmth. Last, we examined whether the overall association differs by type of behavior problems (RQ3) and hypothesized that this association is stronger for differential externalizing than for differential internalizing behavior problems.

The present study contributes to the field of PDT in three ways. First, evidence regarding associations between relative PDT and sibling differences in behavior problems is



inconsistent, both within and between studies. For example, Deater-Deckard (1996) found that relative PDT (i.e., negative affect, physical and verbal control) predicted differential behavior problems, while Mekos and colleagues (1996) found a similar association only for paternal PDT and not for maternal PDT. Statistically integrating the evidence and using pure, basic correlations, allowed us to draw a more accurate conclusion about the role of relative PDT in sibling differences in behavior problems. Second, individual studies have rarely compared the role of parental differential warmth with that of parental differential hostility. Comparing the associations between different types of relative PDT allows for a more precise understanding of the aspects of differential parenting that are most strongly associated with sibling differences in behavior problems. Third, comparing the role of relative PDT in siblings' differential externalizing versus internalizing behavior problems will shed light on the extent to which children may be more likely to respond to PDT with externalizing or internalizing behavior problems, or indeed to which problems parents are most likely to respond with differential treatment.

## **Method**

### **Information Sources and Search Strategy**

We preregistered our study on PROSPERO prior to data coding on March 8, 2021 ([https://www.crd.york.ac.uk/prospero/display\\_record.php?ID=CRD42021240910](https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42021240910)) and followed PRISMA guidelines (Moher et al., 2009). In September 2021, we searched for publications in PsycINFO and Web of Science, combining search terms relating to parents (e.g., fathers, mothers, parent-child relations), differential treatment (e.g., fairness, differential treatment, warm, harsh), and children and youth (e.g., infant, toddler, preschool age, school age, adolescence). Our full search string is included as Supplemental Material A. In addition to searching databases, we searched the reference lists of the publications and

relevant systematic reviews. The first author reviewed the titles and abstracts in Rayyan and the full-text publications for final inclusion. Uncertainties were discussed in the author team.

### **Eligibility Criteria and Selection Process**

We included publications that (a) used cross-sectional or prospective designs, to avoid retrospectivity bias; (b) reported relative difference scores of parental warmth and/or parental hostility; (c) reported relative difference scores of sibling's behavior problems (i.e., internalizing and/or externalizing behavior problems); and (d) included children between 0-18 years old. If a sample's maximum age exceeded 18 years old, the sample was included only if the maximum age of the children was younger than 20 years old. Samples with a mean age of  $\geq 18$  years old were excluded. Data from all informants were included (e.g., parent, child, sibling, teacher, or an independent observer), because each informant brings a unique contribution to the association of relative PDT and sibling differences in behavior problems. There were no restrictions placed on the publication period.

We excluded (a) conference papers, because they usually do not contain sufficient information about effect sizes; (b) masters or doctoral theses, because theses have been found to have little impact on the results of meta-analyses (Hartling et al., 2017); (c) book chapters, because they typically provide an overview of the literature rather than unique effect sizes; (d) publications about monozygotic twins, because their biological development is more similar than the biological development of regular siblings. Other reasons for excluding twin samples are because age is considered a confound (Jenkins et al., 2003) and (mixed) evidence shows twins may be differently treated as compared to non-twins (e.g., more PDT and more emotional warmth) (Mönkediek et al., 2020); (e) publications on disabled children, because the perception of PDT tends to be different in these families (e.g., needs-based PDT; McHale & Pawletko, 1992); and (f) attentional problems as the sole indicator of children's externalizing behavior problems, because hyperactive, impulsive, and inattentive behavior is

less driven by parenting behaviors than are other aspects of externalizing behavior problems (Faraone & Larsson, 2019).

### **Data Collection Process**

For each publication we extracted (a) publication characteristics (e.g., country, year, name of the first author), (b) sample characteristics (e.g., number of children, ethnicity, mean age siblings), (c) type of parental differential treatment (i.e., warmth, hostility or combined), (d) type of differential behavior problems (i.e., externalizing, internalizing behavior problems or combined), and (e) effect sizes (e.g., basic Pearson  $r$  correlation or regression coefficient). The coding manual is included as Supplemental Material B.

Publications were independently coded by two researchers. Inter-rater reliability ranged from 80% to 100% for qualitative variables (e.g., country, PDT instruments), substantial to almost perfect ( $\kappa = 0.71$  to  $1.00$ ) for categorical variables (e.g., developmental stage, informant), and moderate to excellent ( $ICC = 0.63$  to  $1.00$ ) for continuous variables (e.g., number of children in the family, correlation coefficients). Because of the variance in reporting across different publications, ethnicity proved to be relatively difficult to code in detail ( $\kappa = 0.42$ ). The percentage of ethnic majority children in the sample was therefore agreed through discussion. Although risk of bias detail categories were also less reliably coded ( $\kappa = 0.44$ ), both coders generally agreed on whether publications were categorized as low risk of bias or not. Differences mainly arose between high or unclear risk of bias. Consensus was reached through discussion.

### **Data Items**

For parental warmth, we included all measures of parental expressions of warmth (e.g., love), physical and verbal affection (e.g., hugging, positive praise), positive affect/feelings (e.g., joy, smile, pride), positive involvement (e.g., interest, involvement in child's activities), acceptance (e.g., understanding the child), support (e.g., emotional support) and sensitivity.

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We also included indicators of a positive parent-child relationship (e.g., enjoying spending time together) and closeness to the child (e.g., intimacy). We excluded indicators of parental involvement that did not necessarily reflect positive affect (e.g., degree of help during a task) or discipline that did not necessarily reflect physical or verbal affection (e.g., explaining rules). As a rule of thumb,  $\geq 50\%$  of the items in a scale had to reflect parental warmth.

For parental hostility, we included all measures of expressions of aggression (physical and/or verbal), disapproval (e.g., criticism), negative feelings (e.g., irritation, disfavoring, anger), authoritarian parenting, and any harsh or hostile form of control, discipline or conflict: harsh physical (e.g., physical punishment, fighting), harsh verbal (e.g., yelling, insulting) and harsh emotional (e.g., humiliation, withdrawal of affect). We excluded parental monitoring, supervision, and indicators of control that did not necessarily reflect harsh control and discipline (e.g., directive comments, setting limits). We also excluded indicators of conflict that did not necessarily reflect harsh conflict (e.g., disagreements). As a rule of thumb,  $\geq 50\%$  of the items in a scale had to reflect parental hostility.

For siblings' behavior problems, we defined externalizing problems as acting-out or antisocial behaviors that are directed towards others (e.g., aggressive or rule-breaking behavior) or are victimless (e.g., substance use) (Achenbach & Edelbrock, 1978; Zeigler-Hill & Shackelford, 2020). We defined internalizing problems as inward-directed feelings or feelings of overcontrol (e.g., symptoms of depression, anxiety and somatic complaints) (Achenbach & Edelbrock, 1978; Zeigler-Hill & Shackelford, 2020). As a rule of thumb,  $\geq 50\%$  of the items in a scale had to reflect child behavior problems.

### **Calculation of Relative Difference Scores**

Publications computed relative difference scores in various ways. Some publications used simple difference scores and others used child-specific scores. If one sibling scores 7 on parental warmth and the other sibling scores 5, the simple difference score is  $7 - 5 = 2$  for the

first sibling and  $5 - 7 = -2$  for the second sibling. Because in this case the family-wide parental warmth would be  $(7 + 5) / 2 = 6$ , the child-specific score for the first sibling is  $7 - 6 = 1$  and for the second sibling  $6 - 7 = -1$ . Also, some publications subtracted the score of the older sibling from the score of the younger sibling, while other publications subtracted the score of the younger sibling from the score of the older sibling. In all cases, a higher score means the difference in PDT between siblings is more pronounced (i.e., the magnitude) and a lower score means that siblings are treated more equally. The sign reflects the direction of the difference: a positive score indicates the sibling received more parental warmth, and a negative score indicates the sibling received less parental warmth, relative to their sibling.

Although individual sibling scores were computed in different ways, the correlations between these scores can be directly compared. This is because correlation coefficients are standardized effect sizes and their strength or sign is not affected by using either simple difference or child-specific scores, or by sibling order, provided that individual sibling scores are computed in the same way for the independent and dependent variable. This allowed us to include all correlations in our meta-analysis.

### **Risk of Bias Assessment**

We used three items adapted from the Quality Assessment of Observational and Cross-Sectional studies by National Heart, Lung and Blood Institute (2013): 1) Clearly defined, valid, reliable and consistently implemented measures of parental warmth, hostility and behavior problems across all participants; 2) Statistical power was taken into account into the design and/or the interpretation of the findings; and 3) Drop-out rates were reported and missing data were accounted for in the analyses. If one or none of the items were answered with “yes”, we categorized the level of risk as low risk. If two or three items were answered with “yes”, we categorized the level of risk as high risk. Items were categorized as unclear if

most of the answers were considered unclear, or if there was no majority in the answers at all (“yes”, “no”, and “unclear”).

## **Statistical Analysis**

### ***Effect Measures***

We extracted basic Pearson  $r$  correlation as an estimate of the association between relative PDT and sibling differences in behavior problems. If available, we used effect sizes without covariates, to increase comparability. If publications did not report basic correlations and authors were unable to provide them, we converted regression coefficients to Pearson  $r$  by multiplying the coefficient with the standard deviation of PDT divided by the standard deviation of sibling’s behavior problems (Agresti et al., 2018; Moeyaert et al., 2017). In some cases, different publications reported on one unique sample, only contributing unique effect sizes.

### ***Synthesis Methods***

Most unique samples contributed multiple effect sizes. To account for this dependency, we conducted a three-level random effects meta-analysis (Assink & Wibbelink, 2016) using the metafor package (Viechtbauer, 2010) in R version 4.1.1. Three different variance components were modelled: sampling variance of the extracted effect sizes (level 1), within-study variance that refers to variance between effect sizes from the same unique sample (level 2) and between-study variance that reflects the variance between unique samples (level 3) (Assink & Wibbelink, 2016). Prior to analysis, we transformed correlations to Fisher’s  $z$  and back to Pearson  $r$  to interpret the results in line with Cohen (1992):  $< 0.1$  as negligible,  $\geq 0.1$  and  $< 0.3$  as small,  $\geq 0.3$  and  $< 0.5$  as moderate, and  $\geq 0.5$  as large.

Model parameters were estimated using the REstricted Maximum Likelihood estimation method (REML). Results were considered significant at  $p < .05$ . Rather than the  $z$ -distribution that often leads to an increase in Type I errors, we used the Knapp and Hartung’s

adjustment (2003) to test the model coefficients: a *t*-distribution to test the individual coefficients (e.g., associations between relative PDT and sibling differences in behavior problems) and the *F*-distribution for the omnibus test to compare the associations for different types of PDT and types of behavior problems. A log-likelihood ratio test was performed to determine the significance of the level 2 and level 3 variance, by comparing 1) the deviance of the full three-level model with the model without within-study variance at level 2, and 2) the deviance of the full three-level model with the model without between-study variance at level 3. By reason of a small number of unique samples and/or effect sizes, we additionally applied the rule of Hunter and Schmidt (1990) to test whether there is heterogeneity in our sample: if less than 75% of the total variance was attributed to random sampling error (level 1), heterogeneity of the effect sizes at level 2 and level 3 was present and considered substantial.

First, we estimated the overall association between relative PDT (i.e., warmth and hostility combined) and sibling differences in behavior problems (i.e., externalizing and internalizing behavior problems combined) (RQ1). Because parental warmth was defined as ‘more warmth towards the child’ and higher scores of parental hostility were defined as ‘more hostility towards the child’, we changed the sign of the effect sizes for parental warmth. This way, positive correlations indicated that less warmth and more hostility were associated with more behavior problems. Furthermore, to test whether the association differs by type of PDT (i.e., differential warmth and differential hostility) (RQ2) and type of behavior problems (i.e., differential externalizing and differential internalizing behavior problems) (RQ3), we conducted moderation analysis.

### ***Sensitivity Analysis***

Two sensitivity analyses were planned. First, repeating the primary meta-analysis with outliers (Cook’s distance rule:  $4 / n$ , where  $n$  equals the total number of effect sizes)

replaced by the strongest Pearson  $r$  value that was not an outlier. Second, comparing findings from unique samples contributing Pearson  $r$  correlations with unique samples contributing regression coefficients, to test whether findings are driven by the type of effect size used.

### ***Publication Bias***

We visually inspected potential publication bias with a funnel plot. Egger's regression test or the Trim-and-fill method (Harrer et al., 2021) cannot reliably be used for multilevel meta-analyses (Dowdy et al., 2022).

### **Transparency and Openness**

To promote transparency and openness, we 1) preregistered our study on PROSPERO, 2) followed PRISMA guidelines for conducting and reporting meta-analyses, 3) include our coding manual as Supplemental Material, and 4) provide our data and statistical code available upon request.

## **Results**

### **Sample Selection**

Our systematic literature review identified 2,529 publications (Figure 1). Their titles and abstracts were examined, resulting in 63 potentially eligible publications, including five detected through citation tracking. The full-texts of these 63 publications were examined, of which 28, reporting on 19 unique samples, met inclusion criteria. Eight samples reported the required statistics (i.e., correlation or regression coefficients) to be included in our meta-analyses. We e-mailed the authors of 10 of the remaining 11 samples, sent them at least one reminder and contacted co-authors in cases of no replies; the authors of five samples sent us the requested correlations. The other samples were not received and thus excluded.

### **Sample Characteristics**

Our final sample consisted of 19 publications reporting on 13 unique samples, contributing 215 effect sizes of the association between relative PDT and sibling differences



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in behavior problems. The data came from 14,418 children (7,209 sibling pairs; see Table 1). Samples were published between 1993 and 2017 with a median year of 2008. More than half of the samples were from the United States ( $k = 8$ ). Other samples were from the United Kingdom ( $k = 2$ ), Canada ( $k = 1$ ), The Netherlands ( $k = 1$ ) and Belgium ( $k = 1$ ). Samples included either cross-sectional data ( $k = 10$ ) or both cross-sectional and longitudinal data where assessment of PDT preceded assessment of sibling's behavior problems ( $k = 3$ ). Children's age ranged from one to 19 years old, reflecting different developmental stages. Samples reported primarily on children aged  $< 12$  years old ( $k = 5$ ), adolescents of 12 years and older ( $k = 2$ ) or both developmental groups ( $k = 6$ ). From the samples that reported gender of the sibling pairs ( $k = 9$ ), percentages ranged from 40 to 54% for same-sex sibling pairs (i.e., boy-boy and girl-girl pairs). The number of boys in each sample ( $k = 7$ ), compared to the total number of children, ranged from 49 to 56%. Of the samples that reported parental marital status ( $k = 8$ ), more than 88 percent of the parents were married or living together. Only two samples reported  $< 5\%$  ethnic majority; for the other samples ( $k = 11$ ) percentages ranged from 83 to 100 percent. More than half of the samples included families with a middle-class socioeconomic status (SES) ( $k = 8$ ), two samples included families with a high SES ( $k = 2$ ), and family SES was unknown in the remaining samples ( $k = 3$ ).

Unique samples differed widely in how they assessed PDT. Questionnaires included the Parental Discipline Interview (Scarr et al., 1994) and Relational Support Inventory (Scholte et al., 2001). PDT was reported by parents, spouse, children, or coded by observers. In the majority of the samples the method used for measuring relative PDT was the simple difference score ( $k = 11$ ), one sample used both methods ( $k = 1$ ) and one sample ( $k = 1$ ) used a child-specific score.

The most frequently used instruments for child externalizing and internalizing behavior problems were the Strengths and Difficulties Questionnaire (Goodman, 1997) and

the Child Behavior Checklist (Achenbach, 1991). Although for many samples it was unclear, the majority of the samples seemed to target community sample children. Behavior problems was reported by parents, spouse, teachers or children themselves.

Regarding the 19 unique samples that reported on our moderators (type of PDT and type of behavior problems), six samples were excluded, primarily due to missing values on the effect sizes. For the remaining 13 samples, there were no missing values on type of PDT and type of behavior problems (i.e., externalizing and internalizing behavior problems). In general, the only missing values were related to information on the type of differences scores (i.e., simple difference score or child-specific score).

### **Risk of Bias**

Four unique samples (30.77%) were considered to have low risk of bias, eight samples high risk of bias (61.54%) and for one sample the risk of bias was unclear (7.69%). In most samples with high risk of bias, the measures of parental warmth, hostility and sibling's behavior problems were clearly defined, valid, reliable, and consistently implemented. However, statistical power was usually not taken into account into the design of the sample and drop-out rates and missing data were not reported or accounted for in the analyses.

### **Results of Synthesis**

#### ***Overall Association Between Relative PDT and Sibling Differences in Behavior problems***

The overall effect size between relative PDT and sibling differences in behavior problems was  $r = .141$ , 95% CI [.077, .205],  $p < .001$ , indicating that relative differences in parental warmth and hostility are associated with sibling differences in behavior problems. More specifically, children who received less warmth and more hostility than their sibling experienced more internalizing and externalizing behavior problems than their sibling. According to Cohen's guidelines (1992) this is a small effect.

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Only 6.12% of the total variance reflected sampling variance of the effect sizes (level 1). The remaining variance reflected variation between effect sizes from the same unique sample and between effect sizes from different unique samples (level 2, 48.94%,  $\chi^2(1) = 1075.864$ ,  $p < .001$ ; level 3, 44.94%,  $\chi^2(1) = 56.475$ ,  $p < .001$ ). This means that the overall effect size should be interpreted with caution and that our moderator analyses by type of PDT (differential warmth versus hostility) and type of behavior problems (differential externalizing versus internalizing problems) are justified.

### *Associations by Type of Relative PDT and Type of Differences in Behavior problems*

The overall association between relative PDT and sibling differences in behavior problems was stronger for parental differential hostility than for parental differential warmth ( $F(1,213) = 6.618$ ,  $p = .011$ ) and stronger for differential externalizing than for differential internalizing behavior problems ( $F(1,195) = 23.140$ ,  $p < .001$ ). The effect size with sibling differences in behavior problems were small and significant for both relative warmth ( $r = .122$ , 95% CI [.055; .190],  $p < .001$ ) and hostility ( $r = .176$ , 95% CI [.106; .244],  $p < .001$ ). The effect size for relative PDT and differential internalizing behavior problems was significant but negligible ( $r = .084$ , 95% CI [.016, .151],  $p = .015$ ); the effect size for relative PDT with differential externalizing behavior problems was more than twice the size of the effect with differential internalizing behavior problems, albeit still small ( $r = .183$ , 95% CI [.117, .248],  $p < .001$ ).

There was evidence that the stronger effect for parental differential hostility was particularly pronounced for its association with differential externalizing behavior problems (Figure 2): the association with differential internalizing behavior problems was not significant ( $r = .084$ , 95% CI [-.048, .213],  $p = .209$ ) and the association with differential externalizing behavior problems ( $r = .216$ , 95% CI [.090, .334],  $p = .001$ ) was almost three times as strong as the association with differential internalizing behavior problems. The

association between parental differential warmth did not differ by type of behavior problems ( $r_{\text{internalizing}} = .091$ , 95% CI [.021, .160],  $p = .012$ ;  $r_{\text{externalizing}} = .143$ , 95% CI [.074, .211],  $p < .001$ ). See Supplemental Material C for an overview of all analyses in full Tables (see Table 2 to 4).

### **Publication Bias**

To assess likely publication bias, we visually examined the funnel plot with standard errors on the y-axis plotted against Fisher's  $z$  effect sizes on the x-axis (Figure 3). The distribution looked relatively symmetrical, suggesting that the overall effect size between relative PDT and sibling differences in behavior problems is not driven by publication bias. We did not conduct an Egger's test or Trim-and-fill analysis because these are considered unreliable for multilevel meta-analyses (Dowdy et al., 2022).

### **A Priori Sensitivity Analysis**

Our study included ten outliers above the Cook's distance value of  $4 / 215 = .019$  for the overall association between relative PDT and sibling differences in behavior problems. We substituted these effect sizes with the highest value that was not an outlier for differential warmth ( $r = .430$ ) and differential hostility ( $r = .350$ ). Re-analyzing our models after correcting the outliers slightly changed our results. The overall association between relative PDT and sibling differences in behavior problems became somewhat smaller, but remained significant ( $r = .131$ , 95% CI [.077, .184],  $p < .001$ ). The overall association between relative PDT and sibling differences in behavior problems was not significantly stronger for differential hostility than for differential warmth ( $F(1,213) = 3.828$ ,  $p = .052$ ), but our finding that the association between differential hostility was stronger for differential externalizing than for differential internalizing behavior problems remained significant, ( $F(1,68) = 40.083$ ,  $p < .001$ ).

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Our study included 11 samples reporting on Pearson  $r$  correlations (182 effect sizes) and two samples (Tamrouti-Makkink et al., 2004; Boisvert & Wright, 2008) reporting regression coefficients (33 effect sizes). Effect sizes derived from regression coefficients were generally smaller, often non-significant (Figure 4). The number of effect sizes from regression coefficients was, unfortunately, too small to test whether patterns by type of PDT and type of behavior problems differed by reporting of Pearson  $r$  correlations or regression coefficients.

### Discussion

We synthesized evidence on the role of PDT in siblings' behavior problems. We found a significant overall association between relative PDT and sibling differences in behavior problems, with the association strongest between parental differential hostility and siblings' differential externalizing problems. Our findings support theories that suggest PDT of siblings may have negative consequences for children's well-being (e.g., Feinberg et al., 2000) and extend them by suggesting that the impact of PDT depends on the type of PDT (stronger for differential hostility than for differential warmth) and type of siblings' behavior problems (stronger for differential externalizing than for differential internalizing behavior problems).

The strength of the overall association between relative PDT and sibling differences in behavior problems was similar to that of associations found in a meta-analysis of absolute PDT (i.e., affection and control combined) and siblings' behavior problems (Buist et al., 2013). Although relative difference scores for parental treatment and sibling behavior problems provide unique information on the direction of PDT (e.g., clarifying which child receives less warmth or more hostility of the siblings) and behavior problems (e.g., indicating which child has more externalizing or internalizing problems than their sibling), our overall findings suggested that the magnitude of PDT may be similar in importance for siblings'

behavior problems as the specific direction of PDT. However, the direction of PDT was apparent when distinguishing between type of PDT and type of behavior problems.

In line with between-family evidence for stronger associations for negative parenting dimensions such as rejection and psychological control (Hoeve et al., 2009; McCleod et al., 2007), we found a stronger association with sibling differences in behavior problems for differential hostility than for differential warmth. In addition to evolution-based positions that ‘bad is stronger than good’ (Baumeister et al., 2001), it may be that differential hostility is more visible to children, since expressions of hostility may be more overt (e.g., negative comments, yelling) than expressions of warmth (e.g., acceptance).

Relative PDT, and differential hostility in particular, seems to play a greater role in differential externalizing than in differential internalizing behavior problems. Arguably, this confirms theories stressing the role of children’s interactions with parents for the development of externalizing problems specifically (Patterson, 1982). However, importantly, we cannot draw causal conclusions from our data about the direction of effects. Children are known to influence their parents, including in eliciting parental treatment, as well as parents influencing their children, and transactional dynamics are crucial for both internalizing and externalizing problems (Sameroff, 2009; Serbin et al., 2015). Indeed, we speculate that our associative findings suggest both that parents respond more in their parenting to sibling differences in externalizing behavior problems than they do to internalizing behavior problems, *and* that children respond to PDT more with externalizing behavior problems than internalizing ones.

Both moderators (i.e., type of PDT and type of behavior problems) explained heterogeneity in effect sizes within and between unique samples, but much heterogeneity was left unexplained. This suggests that the association between relative PDT and sibling differences in behavior problems might depend on additional other sample and publication

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characteristics, such as child characteristics or informants. For example, some studies suggest that same-sex siblings may be more affected by PDT because children naturally compare themselves more with others who are more similar to themselves (Wills, 1991; Feinberg et al., 2000). For example, the meta-analysis of Buist et al. (2013) found a stronger association between absolute PDT and internalizing behavior problems, specifically for studies with more boy-boy pairs. In addition, discrepancies between parent and children's reports of PDT are common (Atzaba-Poria & Pike, 2008, Kowal et al., 2006), and parents and children are likely to differ in their experience of PDT. In the present meta-analysis, we included scores from all informants on PDT (i.e., parents, spouses, and children), but we were unable to differentiate between informants in our analyses due to issues of power. Another potential explanation for this heterogeneity lies in (genetic) differences in how children within the same family experience parental differential treatment. For example, some children may be more susceptible or vulnerable to adversity than other children (i.e., differential susceptibility) (Belsky et al., 2007; 2017). These differences can also appear because of reactive/evocative gene-environment interactions: children who are genetically more likely to show externalizing behavior problems, as compared to their sibling, may evoke more negative parenting behaviors than children who show less externalizing behavior problems than their sibling (Marceau & Horwitz et al., 2013). Last, differences may also reflect sibling differences in characteristics, such as birth order, age differences, developmental differences and temperament, especially because of the large age range in our sample (i.e., siblings aged one to 19 years old). More specifically, Jenkins and colleagues (2003) show that each year in child age corresponded to a decrease in parental negativity. One explanation may lie in developmental differences such that older siblings being more autonomous and therefore needing less parental discipline (e.g., rules, strictness). Another reason may be that older siblings' cognitive and social skills are generally better developed and therefore understand

why they are treated differently (Shanahan et al., 2008). In line with this rationale, the study by Kowal and Kramer (1997) shows that older siblings are more likely to view PDT as "fair" compared to their younger siblings, which could potentially explain the decrease in parental negativity with increasing child age. Regarding temperamental differences, even when accounting for genetic influences, differential child irritability may drive differential parental negativity in the early years (Oliver, 2015). Moreover, although evidence is mixed, some findings suggest that children who perceive PDT as more "unfair", even though differences between siblings may be small, are the ones who have poorer outcomes (Kowal et al., 2002).

### **Study Strengths and Limitations**

This study has various strengths. First, we specifically included associations between relative PDT and sibling differences in behavior problems. Studies examining these associations are comparatively rare, which could be why a previous meta-analysis used absolute difference scores for PDT (Buist et al., 2013). However, we argue that relative difference scores provide robust information on the magnitude of differences between siblings as well as being informative for unpicking the effects of PDT by understanding the specific direction of sibling differences in behavior problems. Second, our multilevel approach allowed us to include all effect sizes from all eligible unique samples. Third, we compared in one model the role of parental differential warmth versus hostility, allowing for a direct comparison of their respective weight in predicting siblings' differential externalizing and internalizing behavior problems.

Several limitations, however, should be considered. Our interest in relative differences meant that only 19 publications reporting on 13 unique samples could be included. Although there is no clear guideline of the minimum number of studies in multilevel meta-analysis, the Cochrane Handbook recommends at least 10 studies in each subgroup (Higgins et al., 2019). In our case, we had 19 publications that reported on 13



unique samples in total, with 11 samples on differential warmth and eight samples on differential hostility (and eight samples for internalizing and nine samples for externalizing behavior problems). Although the differences in associations that we found were significant, the limited number of samples may have impeded the reliability of our findings (Harrer et al., 2021). In addition, as discussed above, we analyzed Pearson  $r$  correlation coefficients, reflecting relations between variables rather than the direction of effects or causality (Bryman, 2016). Last, due to the small sample size in our meta-analyses, and the presence of two moderators already (differential warmth versus hostility, and differential externalizing versus internalizing behavior problems), we were unable to test additional moderators such as age differences, developmental differences and birth order effects.

### **Future Directions**

Our analyses yield new insights into the importance of relative PDT for sibling differences in behavior problems, yet other questions on the role of relative PDT in sibling differences in behavior problems remain unanswered. In particular, we recommend further examination of potential moderators, such as gender constellation, age differences, developmental differences, birth order of the sibling pairs, differential susceptibility, reactive gene-environment interactions and informants of PDT, to potentially explain heterogeneity in effect sizes within and between unique samples. Additionally, because there are studies showing that PDT influences differ between twin and non-twin samples (e.g., Mönkediek et al., 2020), we recommend future scholars to examine twin data to further unpack relative PDT influences on sibling differences in behavior problems. Furthermore, we focused on the broad categories of differential warmth and hostility, and we recommend studying the specificity in parenting behaviors which may be of interest, such as differential parental control and sibling differences in externalizing and internalizing behavior problems (e.g., Dunn et al., 1990; McGuire et al., 1995). Lastly, our meta-analyses suffered from a lack of

reporting of basic correlations in sample reports. Recent developments to increasingly publicly share data and materials with other researchers (e.g., on Open Science Framework) will benefit future endeavors to meta-analyze findings on PDT.

### **Implications**

For policy and practice, our finding that parental differential hostility seems to play a particularly pertinent role in siblings' differential externalizing behavior problems could raise awareness for professionals and parents alike. Children's externalizing problems are one of the most common reasons for which parents to seek professional help, and they have important implications for diverse behavior problems into adulthood (Fairchild et al., 2019). Our findings suggest that, since the majority of children grow up with siblings, the implications of addressing relative PDT in the context of intervention is self-evident, yet largely ignored (Oliver & Pike, 2018). In conveying this message, it will be important to explain not only the possible consequences of children who receive more, or perceive that they receive more, hostility from their parents than their sibling, but also the possibility that siblings with more externalizing behavior elicit hostility in their parents (e.g., Patterson, 1982), making it hard for both parents and children to break patterns of negative interaction. Importantly, we highlight that with current intervention focus almost always on a 'target' child, the results of the current meta-analysis emphasize the importance of taking care in attempts to change family dynamics for all children in the home.

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**Table 1**

*Characteristics of Included Samples*

Sample	Authors (year)	<i>N</i>	% male	% ethnic majority	<i>M</i> age younger ( <i>SD</i> )	<i>M</i> age older ( <i>SD</i> )	Type of PDT	Type of behavior problems
1	Boisvert & Wright (2008)	1,758	49	100	10.5 (3.0)	13.8 (2.1)	Warmth	Ext
2	Coldwell et al. (2008); Mark & Pike (2017); Pike & Kretschmer (2009); Pike et al. (2016)	346	49	92	5.2	7.4	Warmth, Hostility	Total
3	Deater-Deckard (1996)	224	53	97	-	-	Warmth, Hostility	Ext, Int
4	Deater-Deckard (2003); Oliver et al. (2018)	7006	-	96	-	6.1 (3.1)	Warmth, Hostility	Total, Ext
5	Deater-Deckard (2005)	972	-	95	-	-	Warmth, Hostility	Ext

PARENTAL DIFFERENTIAL TREATMENT AND DIFFERENTIAL BEHAVIOR PROBLEMS

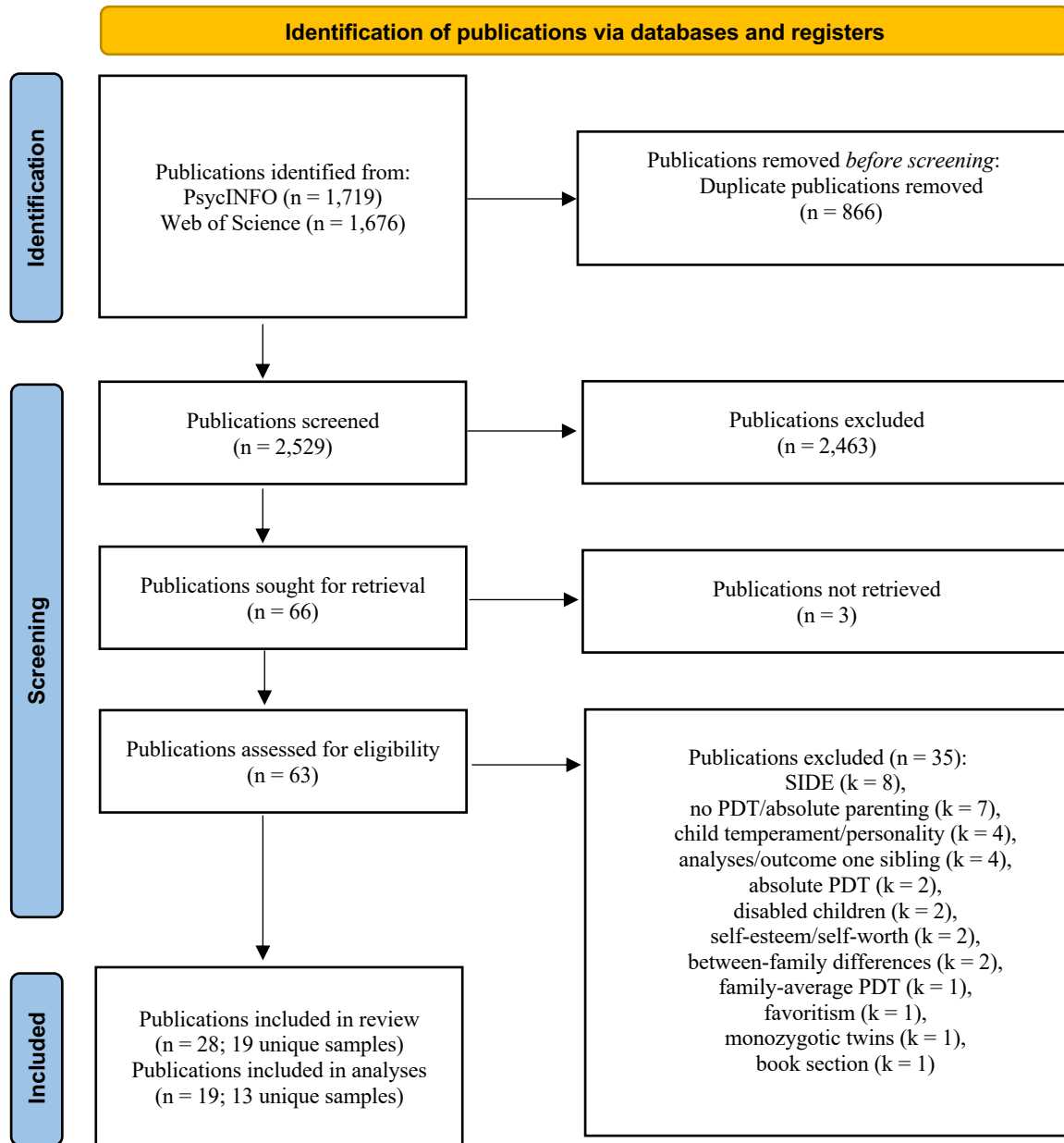
6	Jeannin & Van Leeuwen (2015)	870	50	100	9.4 (0.7)	11.4 (0.7)	Warmth, Hostility	Ext, Int
7	Mekos et al. (1996)	1,032	-	95	-	-	Warmth, Hostility	Ext
8	Padilla et al. (2016; 2021)	492	50	3.5	12.6 (0.6)	15.5 (1.6)	Warmth	Int
9	Richmond et al. (2009)	228	56	83	13.9 (0.5)	16.2 (0.9)	Hostility	Ext, Int
10	Shanahan et al. (2008)	402	-	> 94	9.2 (0.9)	11.8 (0.6)	Warmth	Int
11	Solmeyer et al. (2017)	358	-	0	10.4 (1.1)	13.8 (1.7)	Warmth	Int
12	Stocker et al. (1993); Dunn et al. (1990)	154	-	-	4;5	7;6	Warmth	Ext, Int
13	Tamrouti-Makkink et al., (2004)	576	49	100	-	-	Warmth, Hostility	Ext, Int

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*Note.* Ext = Externalizing problems, Int = Internalizing problems, Total = total problems (externalizing and internalizing combined).

Figure 1

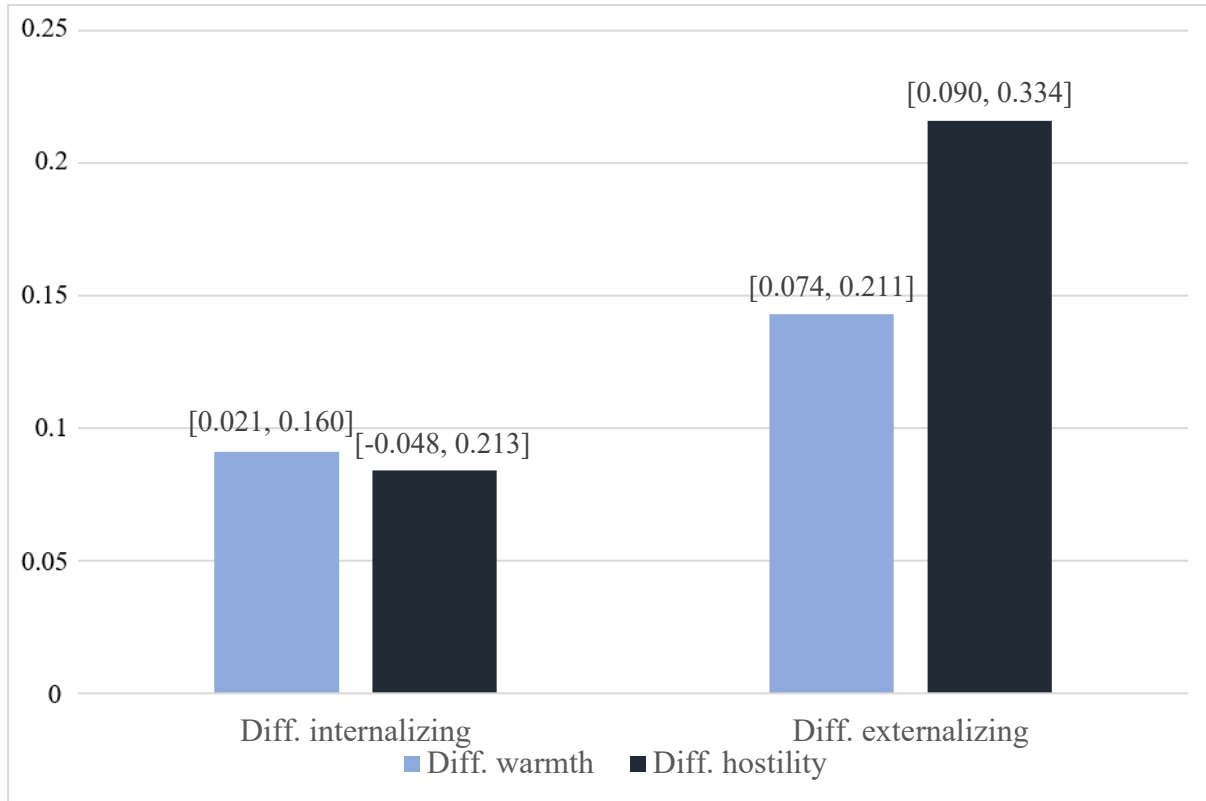
PRISMA Flow Diagram of the Selection Process



PARENTAL DIFFERENTIAL TREATMENT AND DIFFERENTIAL BEHAVIOR PROBLEMS

**Figure 2**

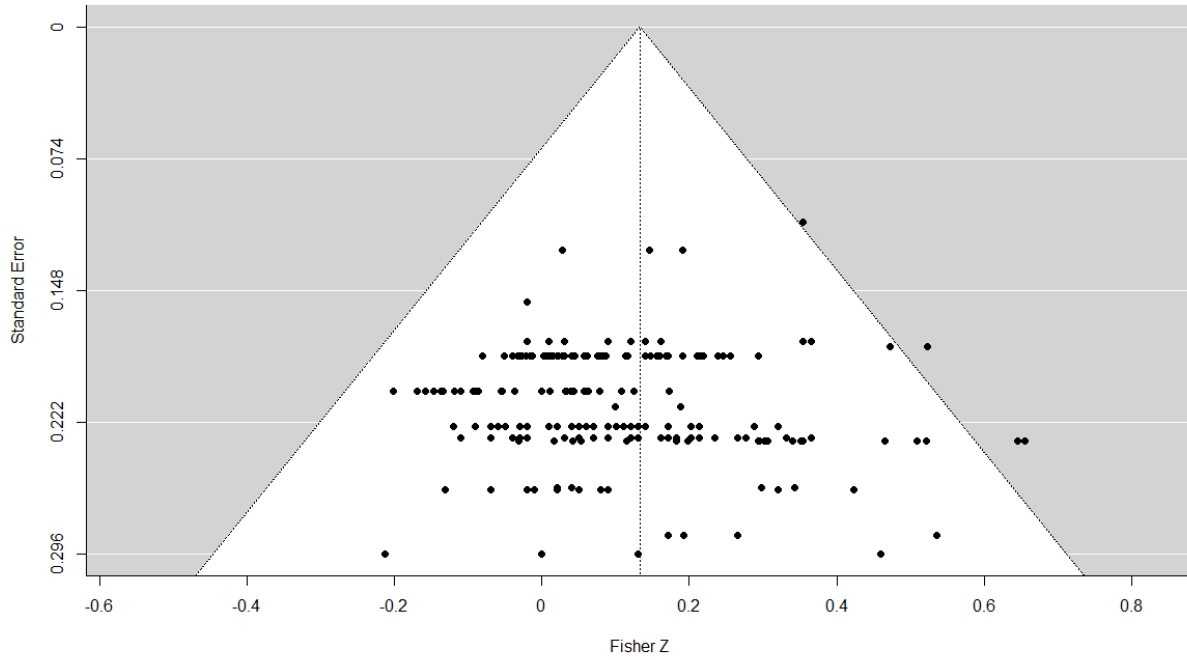
*The Association Between relative PDT and Sibling Differences in Behavior problems is Strongest for Differential Hostility and Differential Externalizing Problems*





**Figure 3**

*Funnel Plot*



**Figure 4**

*Forest Plot of Average Effect Size per Sample (for Visualization Purposes Only)*

