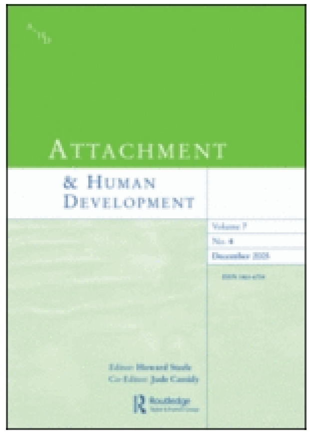

Early childhood attachment stability and change: A meta-analysis and evidence of publication bias.

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Early childhood attachment stability and change: A meta-analysis and evidence of publication bias

Examining degrees of stability in attachment throughout early childhood is important for understanding developmental pathways and for informing intervention. Updating and building upon all prior meta-analyses, this study aimed to determine levels of stability in all forms of attachment classifications across early childhood. Attachment stability was assessed between three developmental epochs within early childhood: infancy, toddlerhood, and preschool/early school. To ensure data homogeneity, only studies that assessed attachment with methods based on the strange situation procedure were included. Results indicate moderate levels of stability at both the four-way (secure, avoidant, resistant, and disorganised; $\kappa = 0.23$) and secure/insecure ($r = 0.26$) levels of assessment. Meta-regression analysis indicated security to be the most stable attachment organisation. This study also identified clear publication bias, highlighting a concerning preference for the publication of significant findings.

Keywords: attachment; stability; publication bias; early childhood; meta-analysis.

Introduction

Amidst an array of modifiable risk factors for later social-emotional adaption, early attachment is widely regarded as central (Thoits, 2011). As a result, modification of early attachment insecurity has become the focus of interventions aiming to promote social-emotional regulation (Groh, Fearon, van IJzendoorn, Bakermans-Kranenburg, & Roisman, 2017; Wallin, 2007). Progressing empirical evidence on the likelihood of stability of attachment in the absence of intervention may aid the understanding of this developmental pathway and inform the timing and targeting of early interventions.

Individual differences in attachment organisation are recognisable by the end of the first year of life (Beebe et al., 2010; Grossmann & Grossmann, 2006), by which time the infant has formed expectations about their relationship with their caregiver. Following Bowlby (1969), these are often referred to as internal working models

(IWMs). From infancy onwards, IWMs are believed to inform and structure interactions between the child and their caregiver based on the dyad's interactional history.

Secure attachment is a preferable primary strategy wherein children are free to connect with their attachment figure, comfortably displaying all emotional states and exploring their surroundings (Ainsworth, Blehar, Waters, & Wall, 1978). Contrastingly, insecure attachments (i.e., avoidant, ambivalent, & disorganised) are functional adaptations that enable children to cope with variant or suboptimal caregiving environments. Infants classified with an avoidant attachment use a less desirable secondary attachment strategy aimed at minimising affect, manifest in a masking of or distraction from their distress. Infants classified with an ambivalent attachment also use a secondary strategy, engaging in forms of affective maximisation when alarmed and in need of care, although are not easily soothed by their caregiver's affectional bids. The fourth grouping, disorganisation, was identified in response to a proportion of dyads consistently not fitting within Ainsworth's original three-group classification system (Main & Solomon, 1990). Children in a disorganised dyad lack an organised, coherent, and predictable interactional response strategy when in need of care in the presence of their attachment figure.

Bowlby anticipated that attachment would be relatively stable over time, due to the hardiness of expectations about relationships. Given their hypothesised evolutionary purpose for fitness for survival, he also believed that attachment forms would shift slowly in response to changes in the sensitivity and contingency of caregiving provision. However, since Bowlby, others have emphasised the role of changing context and associated variation in stability of early attachment forms and subsequent IWMs. In 1998, Thompson observed that "virtually all attachment theorists agree that the consequences of a secure or insecure attachment arise from an interaction between the emergent internal representations and personality processes that attachment security may initially influence, and the continuing quality of parental care that fosters later sociopersonality growth."

To date, attachment stability has been examined in three published meta-analyses (Fraley, 2002; Pinquart, Feußner, & Ahnert, 2013; van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999) and one unpublished meta-analysis (Vice, 2004). Of these, only van IJzendoorn et al. (1999) focused specifically on the formative early childhood period, while Fraley (2002) and Vice (2004) reported results for early childhood-specific subsets of their lifecourse samples. In line with the majority of existing primary research on attachment stability, both Fraley (2002) and Pinquart et al. (2013) dealt with the secure versus insecure attachment dichotomy. At this level of assessment, the avoidant, resistant, and disorganised attachment patterns are pooled into a single insecure class, as shown in Figure 1. In contrast, van IJzendoorn et al. (1999) assessed the organised (secure, avoidant, & resistant) versus disorganised attachment dichotomisation, while Vice (2004) presented meta-analytic results for the complete disaggregated four-way (secure, avoidant, resistant, & disorganised) classification system.

[Insert Figure 1 here]

Findings from these prior meta-analyses suggested moderate levels of secure-insecure attachment stability in early childhood (12-72 months; $r = .37$, $N = 1188$; Fraley, 2002). Similar levels of stability were also reported for the organised-disorganised dichotomy ($r = .34$, $N = 840$; van IJzendoorn et al., 1999). A marginally lower level of stability was found when assessed at the four-way level ($\kappa = .27$, $N = 1329$; Vice, 2004). These differences suggest a good deal of movement *between* the typically pooled insecure (i.e., secure, avoidant, & disorganised) or organised (secure, avoidant, & resistant) attachment patterns. However, differences between two- and four-way findings may also be attributed to substantial differences in the primary studies used for syntheses (van IJzendoorn et al., 1999; Fraley, 2002; Vice, 2004).

As such, the utility of existing meta-analytic research on attachment stability is limited in three key ways. First, each of the existing three published meta-analyses have pooled attachment patterns together prior to conducting statistical analyses. This has the effect of simplifying and improving the statistical power of these analyses, but obscures potentially relevant differences between categories with distinct behavioural and relational characteristics. Even if the insecure classes are more similar to each other than they are to the secure class, their unique associations with different developmental outcomes supports their disaggregation (Groh et al., 2017; Sroufe, Egeland, Carlson, & Collins, 2009).

Second, all prior meta-analyses and most primary studies on attachment stability have drawn conclusions from aggregated correlation effect-sizes, such as Pearson's *r* and Cohen's *κ*. Although these measures provide an advantageous single, interpretable value of attachment stability, they do not provide information about the contribution of each attachment pattern. In the present study, in addition to established correlation analyses, we endeavoured to establish estimates of stability for each individual attachment pattern.

Third, to date, the examination of publication bias has been confined to qualitative appraisal, without rigorous statistical analysis (Fraley, 2002). Most commonly, when publication bias exists, it is the result of non-significant results being excluded from publication, either by journal rejection or the author choosing not to submit their findings (Borenstein, Hedges, Higgins, & Rothstein, 2009; Dickersin, 2007; Johnson & Dickersin, 2007). This has the effect of swaying the pool of evidence away from null findings, which may otherwise be important to understand, particularly in the consideration of finer developmental intervals than have previously been examined.

In light of the above literature and informed by its methodological limitations, this study presents an updated meta-analytic review of attachment stability across early childhood. Meta-analytic results are based on all available data at the time of analysis, both published and unpublished. Analyses address stability and movement within and between the four attachment classifications (i.e., secure, avoidant, ambivalent, disorganised), with comparisons to two-way findings (i.e., secure/insecure and organised/disorganised) within the same sample of data. Analyses are conducted across the span of early childhood in addition to a number of nested developmental intervals (e.g., infancy-toddlerhood). To reduce heterogeneity among the primary studies, and to more accurately assess potential moderators and publication bias, only studies that assessed attachment classifications using the observational Strange Situation Procedure (SSP) or age-appropriate modifications were included.

Methods

Data collection

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Moher, Liberati, Tetzlaff, & Altman, 2009) and Meta-Analyses of Observational Studies in Epidemiology (MOOSE; Stroup et al., 2000) guidelines were followed in conducting this meta-analysis. See Figure 2 for a PRISMA diagram outlining the identification, screening, eligibility, and inclusion process of all examined literature.

[Insert Table 1 here]

[Insert Figure 2 here]

The EBSCO Host (PsycINFO, Academic Search Complete, MEDLINE Complete and CINAHL) and the Embase platform electronic databases were last searched on March 30th, 2019. Articles were screened by title, keywords, and abstract. The search was completed with the following search concepts: 1) attachment, 2) developmental period of interest, 3) (in)stability of attachment classifications, and 4) type of observational attachment measure. A detailed description of the search strategy is provided in Figure 3.

[Insert Figure 3 here]

Reference lists of all pertinent review papers, identified papers, and book chapters were then searched in Scopus and Web of Science. Conference papers, unpublished research, and dissertations were identified via Google, Proquest, and email communication with authors. This resulted in an additional 62 records. A total of 1005 records were identified. Duplicate articles were removed with the EndNote software program, with 666 papers remaining. Title, abstract, and keyword screening was undertaken for relevance to attachment stability in early childhood. A second independent coder screened a random subset of 33.3% of the 666 included papers (222 papers), with an inter-rater inclusion agreement of 93%. Disagreements were resolved through conferencing.

This method resulted in the final set of 42 included studies and 56 independent samples. Of these 42, 38 were published works and 4 were unpublished. Stability data were extracted at the two and/or four-way levels (secure/insecure or organised/disorganised and B/A/C/D, respectively), determined by the form of the data reported in the study. Included studies are described in Table 1.

Inclusion and exclusion criteria

Measures

To be included, studies had to assess attachment at least twice between 12-75 months (inclusive). Only observational measures of attachment were included. The search was restricted to studies employing the SSP and age-appropriate modifications of the SSP (e.g., Ainsworth et al, 1978; Cassidy & Marvin, 1992; Crittenden, 1992; Main & Cassidy, 1988) in order to reduce potential methodological confounders. The SSP is the most widely used and accepted observational attachment assessment and provides greater specificity of classification than alternative measures (George & Solomon, 2016). Studies using alternative dyadic observational behavioural measures or parent-reported attachment measures at any assessment time point were excluded from the synthesis.

Sample characteristics

As the focus of this synthesis was on continuity of attachment within specific child-caregiver dyads, both male and female caregivers anticipated to be attachment figures were included in the synthesis. All intervention studies were excluded, confining this analysis to normative stability or movement of the attachment relationship. No restrictions were applied to study by country or language. Studies were confined by date to those conducted post-1978, with the publication of the protocols for coding the Strange Situation (Ainsworth et al, 1978).

Measurement intervals

Short test-retest intervals of less than 7 months, such as those that occur in measurement reliability studies, were excluded. This period was anticipated to be sufficient to allow for change and development in parental sensitivity, change in caregiving circumstances, cognitive advancements in the child, and associated flow-on effects to attachment organisation.

Finally, included studies were grouped into the following developmental intervals: infancy-toddlerhood (I-T), infancy-preschool/school entry (I-PS), and toddlerhood-preschool/school entry (T-PS). Infancy was defined as 12-20 months; toddlerhood as 21-35 months; and preschool/school entry as 36-75 months. Preschool and school entry periods were aggregated as there were few studies in each group. There were two studies (Kreppner, Rutter, Marvin, O'Connor, & Sonuga-Barke, 2011; Moss, Cyr, Bureau, Tarabulsy, & Dubois-Comtois, 2005) that assessed across the preschool-school entry interval. Due to the aggregation of preschool and school entry in this analysis, these samples were therefore only included in analyses of early childhood overall.

Reported data

To be included in the primary analysis, studies had to report cross-tabulations of the dichotomous secure/insecure attachment classifications, dichotomous organised/disorganised attachment classification, or B/A/C/D attachment classifications. For analyses that required only a single correlation coefficient per sample, some additional studies were incorporated that reported correlations but not cross-tabulations. Where references reported individual results for different samples, these were entered individually and included separately in the meta-analysis (while accounting for inter-sample dependencies, see below). When the above criteria were applied to the remaining 666 articles, 608 articles were excluded from the review. Of the remaining 58 studies reviewed by full-text, further exclusion was made when full-text was not available after exhausting all available options, including searching Bonus+, the assistance of a specialist librarian, and contacting authors and their associates,

Where information from the same sample data was identified in published form and an additional form (e.g., published paper and dissertations), the published peer reviewed paper was selected. Additional information was sought from the alternate form when information was missing from the published data. Based on the above, an additional 16 records were excluded, leaving 42 records for quality assessment. Following the Systematic Assessment of Quality in Observational Research (Ross et al., 2011) guidelines, no further studies were excluded due to poor quality assessment rating.

The data extraction process included collection of the following information from each of the 42 included references: (1) author name, (2) study name, (3) publication year, (4) sample risk-status (social or medical), (5) sample location, (6) sample size at time one and time two, (7) attachment coding method at time one and two, (8) inter-rater agreement between coders at time one and/or time two (if two scores were given then these were averaged), (9) publication status, (10) attachment stability correlation, and (10) attachment stability cross-tabulations or contingency tables, if available.

Correlational measures of effect

When studies reported attachment stability at the two-way level, both Pearson's product-moment correlation (*r*) and Cohen's kappa (*κ*) were calculated/extracted from contingency tables (i.e., attachment cross-tabulations). Studies that reported on stability at the four-way (B/A/C/D) level were converted to Cohen's *κ* only, as Pearson's *r* is not meaningful for non-dichotomous categorical classifications. The use of Pearson's *r* ensures comparability of two-way stability results between this synthesis and that of prior attachment stability meta-analyses (e.g., Fraley, 2002). Cohen's κ ensures effect-size consistency throughout the current paper, allowing meaningful contrasts between the two and four-way levels of stability. The rules for effect size identification were:

(1) If raw data or cross tabulations were available (including after requesting directly from authors) this was used to calculate effect-sizes (r and/or κ), to ensure consistency in the calculation method.

(2) If the original paper reported an effect-size, r and/or κ, these were used.

(3) If a prior meta-analysis had reported a stability effect-size (r), this value was used. Note that to the author's knowledge, prior meta-analyses that report the effects of included studies have only examined attachment stability at the two-way level, all reporting effect-sizes in terms of Pearson's r.

(4) If an effect-size that was not r or κ was reported, this reported effect-size was converted to r and/or κ if possible.

Proportional measures of effect

Attachment organisation-specific proportions were calculated for all studies for which four-way contingency table data could be obtained. This process involved the conversion of each cell in a study's contingency table into a proportion for that row. For example, the B-B proportion for a study was calculated by dividing the number of dyads who were stable at B by the total number classified as B at time 1. The B-A proportion was calculated by dividing the number of dyads who transitioned from B to A by the total number classified as B at time 1. Hence, for each study, proportions could be calculated for each of the 16 cells in the four-way contingency table.

Statistical Analysis

The findings related to each level of attachment stability assessment (secure/insecure, organised/disorganised, and four-way) were synthesised using statistical software R v3.4.4 (R Core Team, 2018). Statistical analyses were performed with the aid of third-party R packages *robumeta* (Fisher & Tipton, 2015) and *metafor* (Viechtbauer, 2010). Data loading and transformation was performed using the third-party R packages *data.table* (Dowle, Srinivasan, Gorecki, et al., 2019) and *dplyr* (Wickham, François, Henry, & Müller, 2018).

All syntheses of effect-size (correlations or proportions) were conducted using robust variance estimation (RVE) techniques (Hedges, Tipton, & Johnson, 2010; Tipton, 2015), as explained below. To ensure the robustness and accuracy of the performed analyses, a series of tests and adjustments were performed.

Independence of effect sizes

In order to minimise the dependence between estimation variance and effect-size, all correlation coefficients (Pearson's r or Cohen's κ) were converted to the Fisher's z scale using the Fisher transformation prior to model fitting (Fisher, 1915).

Heterogeneity

The assumption of heterogeneity was tested for each meta-analysis using Cochran's Q, τ^2, and I^2 metrics. Given the expected (and confirmed) heterogeneity between studies, a random-effects model was used to compute the aggregate level of attachment for each developmental interval (Borenstein et al, 2009).

The I^2 statistic indicates the amount of variation across studies due to true differences (heterogeneity) rather than chance (sampling error) and is expressed as a proportion of the total observed variance. This statistic ranges from 0-100%, where a higher percentage suggests greater heterogeneity.

Multiple dependent samples

To account for intra-study sample correlations, meta-analytic estimates were calculated using RVE (Hedges, Tipton, & Johnson, 2010; Tipton, 2015). RVE requires the approximation or assumption of the intra-study correlations between samples, ρ. As these correlations are unknown, the default value suggested by Fisher and Tipton (2015) of 0.8 was used initially. Subsequently, the sensitivity of the main results to the choice of ρ was tested by varying it between 0 and 1.

Small sample adjustment

As suggested by Tipton (2015), a small-sample adjustment was applied to improve estimation robustness. This adjustment applies a modification to the residuals and degrees of freedom used by the statistical test to account for the potential for excess Type I error.

Description of summary analyses

To obtain two-way and four-way estimates of stability, RVE meta-analyses were performed to synthesise Fisher-transformed correlation values.

In contrast to correlations, proportions are not a *chance-adjusted* measure. Correlations are adjusted according to expectation, making zero the baseline, or expected value. Proportions, however, do not have this feature, meaning that the expected value varies per effect-size. Since we typically want to perform statistical analyses that indicate whether an effect is significantly different from expectation, attachment organisation-specific meta-analyses were instead performed on the *proportion residuals* of the primary studies (i.e., the difference between the observed proportion and the expected proportion).

Challenges also arise in comparing the stability of two specific attachment patterns (e.g., is B more stable than D?), since both the expected stability proportions and the variance of the proportion residuals are different for each attachment pattern. Hence, a statistical test that compares the stability of B to the stability of D, for instance, must account both for the influence of the expected proportion on observed proportion and the differences in the samples for B and D. To achieve this, meta-regression (with RVE) was used with expected proportion and attachment pattern category (e.g., B or D) as regressors. The result is an estimation of the impact of attachment pattern on stability, after adjusting for expectation.

Sensitivity analysis

Sensitivity analyses were performed to investigate the influence of key study-level sources of heterogeneity. Factors or variables chosen for this analysis are those that could be expected to modify the attachment stability effect-size, including both methodological (e.g., attachment coding tool used) and population-based (e.g., social or medical risk) moderators of stability. The assessed moderators are listed in Table 2.

[Insert Table 2 here]

Presence of publication bias

We assessed for publication bias by visual inspection of the funnel plots of the meta-analyses and by using Egger's regression test, which determines if there is a trend between effect-size and sample size or variance (Egger, Smith, & Phillips, 1997). Furthermore, as a number of studies included in this meta-analysis are unpublished, a meta-regression analysis was conducted to determine if a relationship exists between attachment stability and publication status.

Data and code availability statement

All code and data used to generate results for this publication are publicly available on GitHub (https://github.com/timesler/AttachmentStabilityMetaAnalysis_Opie2019). This repository includes files for running all statistical analyses and generating visualisations.

Results

Overall levels of attachment stability in early childhood are presented before an examination of the infancy-toddlerhood (I-T), infancy-preschool/school entry (I-PS), and toddlerhood-preschool/school entry (T-PS) intervals. Stability findings for specific attachment patterns and a comparison between them are then reported. Finally, findings for publication bias and results relating to the moderation of attachment by various factors are described.

Attachment stability throughout early childhood

To facilitate comparison with previous attachment stability meta-analyses, stability was first measured by synthesising correlation effect-sizes, either Pearson's r or Cohen's κ, from the collected primary studies. Figure 4 shows a correlation forest plot for data assigned by the four-way attachment classification using Cohen's κ. Figure 5 and Figure 6 show the same for two-way secure/insecure and organised/disorganised data using Pearson's r.

[Insert Figure 4 here]

[Insert Figure 5 here]

[Insert Figure 6 here]

Examination of Figure 4, combined with specific significance testing, shows that four-way attachment is significantly stable for early childhood overall ($\kappa = 0.23$, $p < 0.001$, $df = 23.6$). Significant four-way stability was also observed for each developmental interval examined (I-T: $\kappa = 0.11$, $p = 0.02$, $df = 4.20$; I-PS: $\kappa = 0.26$, $p = 0.02$, $df = 7.82$; T-PS: $\kappa = 0.33$, $p = 0.003$, $df = 2.88$). Comparison of the adjacent developmental intervals, I-T and T-PS, provides an indication of the change in attachment stability over the course of early childhood. The non-overlapping confidence intervals for these periods suggests that four-way attachment stability increases over the course of early childhood, with significantly lower stability in the earlier interval.

For comparison to four-way stability results, the same analysis was performed using correlations based on two-way secure/insecure attachment classifications, yielding a similar overall level of stability ($r = 0.26$, $p < 0.001$, $df = 46.2$). Interestingly, the trend of increasing stability from I-T to T-PS observed in the four-way results was not mirrored in the two-way secure/insecure analysis (I-T: $r = 0.19$, $p = 0.004$, $df = 21.7$; T-PS: $r = 0.21$, $p = 0.02$, $df = 8.58$). More data were available for secure/insecure analysis (as a proportion of studies did not collect, report, or provide four-way data). As a result, this discrepancy could be due to either (1) an inherent difference in the information contained in four-way and two-way attachment aggregations or (2) sampling noise introduced by differences in available studies for each analysis. To determine which, the secure/insecure analysis was repeated using only the samples for which four-way data was available, as shown in the "Matched studies" column in Figure 5. This analysis showed a similar increasing trend for adjacent (non-overlapping) developmental transitions to that observed in the four-way analysis (I-T: $r = 0.11$, $p = 0.03$, $df = 4.48$; T-PS: $r = 0.39$, $p = 0.004$, $df = 2.88$), suggesting that variability in the sample of primary studies is the likely explanation for any difference between four- and two-way correlation results.

Aligned findings appeared when the attachment stability of the organised/disorganised analysis was examined for both the early childhood overall (r = 0.20, $p < 0.001$, $df = 23.8$) and for each developmental period (I-T: $r = 0.10$, $p = 0.09$, $df = 7.12$; I-PS: $r = 0.19$, $p = 0.052$, $df = 6.81$; T-PS: $r = 0.32$, $p = 0.02$, $df = 3.30$), as shown in Figure 6. However, in contrast to the secure/insecure and four-way results, stability was not significant for I-T and I-PS. This is presumably due to the larger amount of sample variation introduced by the lower number of disorganised dyads that are typically identified.

Stability of individual attachment patterns

Attachment stability estimates for each individual attachment pattern (secure, avoidant, resistant, and disorganised) were calculated using stability percentages from primary studies. Unlike correlations, percentages are not a chance-adjusted measure, and so cannot be used directly to determine the significance of an observed effect (see the Methods section for a detailed description). To account for this, meta-analyses were instead performed using percentage residuals: measures that have been adjusted to account for chance or expectation. The following analyses attempt to determine attachment stability for subsets of the population that were initially assessed as having a specific type of attachment. This enables us to answer questions such as "are dyads who were initially classed as secure significantly stable?"

Figure 7 shows forest plots summarising the results of these analyses for each of the four primary attachment organisations. To complement this analysis, a meta-analytic contingency table was constructed from the primary study contingency table data. To achieve this, sample weights obtained using RVE were used to aggregate each contingency table proportion. The final meta-analytic contingency table for the early childhood period is shown in Table 3. From both inspection of confidence intervals around summary effects in Figure 7 and using adjusted standardised residuals reported in Table 3, each of the four attachment patterns was shown to be significantly stable across the early childhood period overall (see 'Overall RE Model' in Figure 7). To account for the many simultaneous statistical tests performed when using adjusted standardised residuals to analyse a contingency table, a Bonferroni correction was applied before checking for significance. By adjusting the critical α-value to 0.05/16 = 0.003125, the corresponding critical value for standardised residuals becomes approximately 2.95.

[Insert Figure 7 here]

[Insert Table 3 here]

Due to the separation of data into the four attachment classes, we did not undertake analysis of the specific developmental intervals (I-T, T-PS, and I-PS) using disaggregated stability proportions to avoid drawing spurious statistical conclusions from insufficient data.

As described in the Methods, summary proportions and residual proportions cannot be directly compared due to differences in the residual variance and the expected proportion between different attachment patterns. However, it is possible to perform a comparison that accounts for these factors using meta-regression.

Comparison of individual attachment patterns

In order to compare the stability of individual attachment patterns to each other, RVE meta-regression analysis was performed to solve the following relation:

$$\textit{stability proportion} = \beta_0 + \beta_1 \times (\textit{attachment pattern}) + \beta_2 \times (\textit{expected proportion})$$

The estimated *p*-value associated with β_1 in the equation above indicates whether there is a significant difference in the stability of two attachment patterns, while adjusting for the varying expected proportions associated with each sample. The results of this analysis for each pair-wise comparison of attachment patterns are shown in Table 4.

[Insert Table 4 here]

The results of this analysis reveal that security is significantly more stable than the resistant ($p = 0.017$) and disorganised ($p = 0.006$) insecure attachment patterns. Interestingly, a similar result was not found when comparing avoidance to security, suggesting that avoidance is the more stable of the three insecure attachment patterns. In general, no significant difference was found in the stability of the different insecure attachment patterns when compared directly.

Evidence for publication bias

Evidence for publication bias was first assessed using funnel plot analyses, as shown in Figure 8. Funnel plots depict the correlation effect-sizes (Pearson's r and Cohen's κ) and associated standard errors for each included study at the four-way and two-way (secure/insecure) levels of analysis. Those studies included in this meta-analysis that are unpublished are indicated by filled circles; when assessing publication bias via funnel plots and Egger's regression tests, these unpublished studies were ignored. Visual inspection of these plots shows few studies falling in the bottom left-hand-side of the funnel, which suggests the existence of marked publication bias. This was confirmed by Egger's regression test, which demonstrates significant publication bias for both levels of analysis.

[Insert Figure 8 here]

Sensitivity and moderator analyses

Each of the potential moderator variables listed in Table 2 was assessed for its influence on stability correlations using meta-regression. No significant sensitivities were found.

Discussion

The purpose of this meta-analysis was to examine stability and change in attachment across early childhood. Our study extends previously published research (Fraley, 2002; Pinquart et al., 2013; van IJzendoorn et al., 1999) by providing fully disaggregated data at the level of each main attachment classification. This provides more detailed information than previously available, enabling articulation of important differences in stability. We found moderate stability ($\kappa = 0.23$) across childhood, at the four-way level, and for both dichotomous groupings: secure/insecure ($r = 0.26$) and organised/disorganised ($r = 0.20$). Although a complete ordering of individual attachment patterns could not be identified statistically, results suggest security as the most stable pattern, followed by avoidant, disorganised, and resistant, respectively. Below, we outline key methodological questions underpinning differences in findings, as well as clinical implications, and consider their implications in turn for future research and practice.

Comparison to prior meta-analyses

Three previous meta-analyses have reported early childhood-specific attachment stability findings: a published report on the two-way secure/insecure level (Fraley, 2002), a published report on the two-way organised/disorganised level (van IJzendoorn et al., 1999), and an unpublished report at the four-way level (Vice, 2004). Comparing the present results to these reveals that a similar overall effect-size at the four-way level ($\kappa = 0.23$ in the present study; $\kappa = 0.27$ in Vice, 2004). A greater discrepancy is seen at the two-way level for both the secure/insecure dichotomy ($r = 0.26$ in the present study; $r = 0.37$ in Fraley, 2002) and the organised/disorganised dichotomy ($r = 0.20$ in the present study; $r = 0.34$ in van Ijzendoorn et al., 1999). This may be due to differences in inclusion criteria and in the included studies. Specifically, Fraley (2002) included studies with test-retest intervals as low as 1 month, contributing to a higher estimate of early childhood attachment stability. The greater number of unpublished studies included in the present synthesis compared to Fraley (2002) and van IJzendoorn et al. (1999) likely reduced our overall effect size.

Relative to estimates of stability across the lifecourse, attachment stability in early childhood appears to be substantially lower, with a lower secure/insecure stability correlation for early childhood compared to the correlation values reported by Pinquart et al. (2013, $r = 0.39$) and Fraley (2002, $r = 0.39$) for the lifecourse. These differences are likely partly explained by the profound neuro-developmental growth and malleability that occurs in early childhood, during which time IWMs and attachment patterns are under development. Differences may also have their basis in the substantially greater sample heterogeneity in these studies, introduced by the mixing of multiple time-points and both observational and representational measures. This includes, for example, questionnaire assessments of attachment, which tend to produce much higher estimates of stability. These issues make a direct comparison between childhood and later life attachment stability challenging.

Relative to prior meta-analyses, a defining point of difference in the current study is our focus on the Strange Situation Procedure, selected to reduce the effect of measurement heterogeneity on classification stability. The aggregation of heterogeneous attachment measures and coding instruments risks introducing error into estimates of stability, given that each assessment instrument has its unique conceptual underpinnings, reliability and validity (George & Solomon, 2016). In turn, this makes it challenging to thoroughly assess sensitivity to potential confounders, and is likely a key reason that evidence of publication bias has not been detected until now.

Attachment stability throughout early childhood

Although an increasing trend in attachment stability was initially observed at the four-way level of assessment by comparing the stability of I-T and T-PS, this was shown to be a function of variability in the group of primary studies aggregated, rather than a true difference in stability. Specifically, since the difference in stability between I-T and T-PS was not observed in the larger two-way sample, there is no strong evidence that attachment stability increases over the course of early childhood. Comparison of the “Pearson’s *r*” and “Matched Studies” columns in **Error! Reference source not found.** demonstrates that seemingly significant differences in stability between two-way and four-way analyses can be attributed simply to differences in the set of aggregated samples. This has ramifications for the comparison of prior meta-analyses. For instance, the difference between the four-way finding of Vice (2004, $\kappa = 0.27$) and the two-way finding of Fraley (2002, $r = 0.37$) may in fact be due to differences in the set of synthesised primary studies rather than any fundamental differences in the measure of effect. Findings such as these highlight the existence of sampling error in meta-analyses of attachment stability.

Comparison of individual attachment patterns

This is the first study to identify differing degrees of attachment stability beyond simple proportions among the disaggregated insecure attachment patterns. After adjusting for expected levels of stability, meta-regression results highlight that secure attachment is significantly more stable than resistant and disorganised insecure attachments, a result consistent with Vice (2004). These results paint a positive picture of potential malleability of the insecure classifications and the place of attachment-based interventions in early childhood. Interestingly, a similar finding has been identified in the case of intergenerational attachment stability (Verhage et al., 2015), where transmission of attachment security across generations was more likely than transmission of insecure attachment. It may be that the same underlying factors that enable security to endure from one developmental epoch to another are also responsible for the transmission of security from parent to child across generations.

Evidence for the non-determinative nature of early insecure attachment was further demonstrated by our observation of greater movement toward security than toward insecurity across early childhood (see Table 3). Since intervention samples were excluded in this study, this observed effect is likely to be a lawful movement. Conditions conducive to *earned security* include the impact of external stabilising forces such as growing skill and rhythmicity in caregiving interactions and growth of family and social resources through the early childhood years (Stern, Kirst, & Bargmann, 2017).

Beyond the statistical significance of a stability measurement, it is important for intervention researchers, clinicians, and commissioners of interventions, to know the relevant size of a population that will be impacted by a program and the proportion of that population that is expected to develop in a particular way. As shown in Table 3, the stability proportions for security, avoidance, resistance, and disorganisation are 64.65%, 36.10%, 27.27%, and 35.91%, respectively. Interestingly, these values mirror the stability ordering (B > A > D > C) implied by the pair-wise meta-regression analyses. These proportions may suggest that, given limited resources, interventions are best targeted toward avoidant and disorganised dyads as these attachment patterns are the *least* likely to change naturally. This implication is also suggested by the proportion of each insecure classification that transitions to security, with avoidance and disorganisation least likely to transition to security in the absence of intervention (A: 34.94%, C: 43.72%, D: 36.46%).

The higher stability of security we report suggests that security is the normative homeostatic state. With optimal facilitation, human infants are instinctively inclined to deploy the most efficient, primary strategies for protection from threat and to expect reinforcing relief from fear and restoration of affective balance. This is consistent with Bowlby's evolutionary reasoning, wherein continuing insecurity and, even more so, disorganisation, may be thought of as steady adaptations from the developmental norm, occurring in response to ongoing affective dysrhythmia in the dyad. Stability of insecure attachments may reflect failed adaptive attachment efforts by the child (Wray, 2017), habituated to and over time incorporated within the young child's rapidly consolidating brain circuitry.

Publication bias

A striking finding of the current paper was evidence of publication bias, identified via Egger's regression test for both two-way secure/insecure (p = 0.038) and four-way attachment stability (p = 0.005). This finding is further supported by asymmetry evident in each funnel plot in Figure 8.

No past attachment stability meta-analysis has examined the influence of publication bias in a statistically rigorous way, although some brief discussion of the matter has been included. In fact, Fraley (2002) stated that "there do not appear to be any file drawer studies on the stability of attachment". The conclusion seems to reflect the challenge at that time of identifying all relevant unpublished studies, which with the benefit of advanced search strategies have been included now in the present meta-analysis. The failure to find evidence of publication bias may also have been due to greater sample heterogeneity in Fraley's study. No analysis or discussion of publication bias was present in any of the other prior attachment stability meta-analyses (van IJzendoorn, 1999; Vice, 2004; Pinquart, 2013). The implications of this new finding seem especially important for the field to consider.

Of note, Verhage et al. (2015) also identified publication bias in a meta-analysis of intergenerational attachment transmission, wherein effect sizes for published studies were larger than those of unpublished studies. Verhage et al. (2015) proposed the 'decline effect' as a possible explanation for this finding, where overestimation of effect sizes results from inclusion of studies with small non-representative samples, and the finding is later overturned as larger and more diverse samples yield lower effects.

Publication bias in attachment stability research may have arisen in part due to widespread acceptance of Bowlby's early theoretical stance. This emphasised the foundational influence of early attachment and IWMs in enhancing stability at an early age. Current thinking emphasises instead the probability of movement given change in relationship conditions (Duschinsky, 2020). Acceptance of Bowlby's early position by the research community may have acted as an additional tacit or implicit disincentive for authors to publish, or editors to accept, null findings, beyond the standard disincentives in psychological research. Similar evidence has been shown clearly in a number of other fields (Dwan et al., 2008; Ioannidis, Munafò, Fusar-Poli, Nosek, & David, 2014). Relatively few references exist in the attachment stability literature to non-significant findings. Indeed, the earliest study with non-significant findings identified during the literature search (Goldberg et al., 1998) was rejected on the basis on null findings (personal communication, Atkinson, 2016), remained unpublished, and could not be obtained despite contacting all authors, colleagues and relevant institutions.

Limitations

A number of additional complexities inherent to attachment development in early childhood are not reflected in this study. The role of other key attachment figures (e.g., second parent, grandparents, & teachers) and of wider socio-familial context could not be explored in the current study. So too the developmental boundary cut-points established for this study may result in variations from other findings, but given the majority of findings summarise results across several developmental intervals, they are unlikely to be overly sensitive to the specific age groupings used. A further limitation applicable to all studies of this nature is small sample sizes for ambivalent groups.

Future research

We note that future research will be strengthened and refined through the inclusion of all observational and representational attachment methodologies, permitting additional sensitivity analyses that may be instructive. Studies involving three or more attachment assessment intervals create potential to understand non-linear developmental trajectories of attachment.

Furthermore, while the present meta-analysis assessed attachment categorically, it would be possible to conduct this analysis, or a modification of it, by treating developmental interval as a continuous measure. This would allow for patterning of attachment stability to be examined in greater depth and with greater statistical power. Finally, examination of attachment at its most nuanced level of attachment stability (the sub-classification level, e.g., B1, B2, A1) would allow finer analysis still, though substantially more primary data would be required than is currently available.

Conclusion

This study presented the first childhood-specific meta-analysis of attachment stability, with examination being performed at each of the two-way, four-way, and classification-specific levels of analysis. Studies were screened using strict inclusion criteria to eliminate sources of methodological heterogeneity, highlighting otherwise undetectable or obscured results. Of critical importance to the study of attachment stability and attachment-informed interventions, this study identified clear evidence of publication bias in the existing literature. This highlights a preference for the publication of studies with significant findings, and raises questions regarding currently held views on the degree of stability. Study findings further identified that childhood attachment stability is lower than later in life, presumably due to dramatic neurodevelopmental and environmental changes. Via a meta-regression analysis, secure attachment was found to be the most stable attachment organisation. In supporting an ecology of attachment organisation at each developmental epoch in early childhood, maintenance of early security may be enhanced and the movement from insecurity toward security supported. The results presented indicate the potential for positive outcomes through investment of resources in attachment-specific public health promotional activities and in earliest intervention for disorganised parent-child relationships.

References

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Hillsdale, Lawlence Erlbaum Associates.

Atkinson, L. (2016, January 22). Personal communication.

Atkinson, L. (2016). Unpublished attachment stability raw data. Personal Communication.

Barnett, D., Ganiban, J., & Cicchetti, D. (1999). Maltreatment, negative expressivity, and the development of Type D attachments from 12 to 24 months of age. *Monographs of the Society for Research in Child Development*, *64*(3), 97-118. doi:10.1111/1540-5834.00035

Beebe, B., Jaffe, J., Markese, S., Buck, K., Chen, H., Cohen, P., ... & Feldstein, S. (2010). The origins of 12-month attachment: A microanalysis of 4-month mother–infant interaction. *Attachment & Human Development*, *12*(1-2), 3-141.

Belsky, J., Campbell, S. B., Cohn, J. F., & Moore, G. (1996). Instability of infant–parent attachment security. *Developmental Psychology*, *32*(5), 921-924. doi:10.1037/0012-1649.32.5.921

Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. R. (2009). *Introduction to Meta-Analysis* (1st ed.). West Sussex, UK: John Wiley & Sons.

Bowlby, J. (1969), *Attachment and loss, Vol. 1: Attachment.* New York: Basic Books.

Cassidy, J., Marvin, R. S., & The MacArthur Working Group. (1992). *Attachment organization in preschool children: Procedures and coding manual.* Unpublished manuscript, University of Virginia, 125-131.

Cicchetti, D., & Barnett, D. (1991). Attachment organization in maltreated preschoolers. *Development and Psychopathology*, *3*(4), 397-411. doi:10.1017/S0954579400005009

Cicchetti, D., Rogosch, F. A., & Toth, S. L. (2006). Fostering secure attachment in infants in maltreating families through preventive interventions. *Development and Psychopathology*, *18*(3), 623-649. doi:10.1017/S0954579406060329

Crittenden, P. M. (1992). Quality of attachment in the preschool years. *Development and Psychopathology*, *4*, 209 –241. doi:10.1017/S0954579400000110

Dickersin, K., Straus, S. E., & Bero, L. A. (2007). Evidence based medicine: increasing, not dictating, choice. *British Medical Journal* (Clinical Research Ed.), *334*(Suppl 1), s10.

Dowle, M., Srinivasan, A., Gorecki, J., Chirico, M., Stetsenko, P., Short, T., ... & Ritchie, S. (2019). Package 'data.table'. Extension of 'data.frame'.

Duschinsky, R. (2020) *Cornerstones of Attachment Research*, Oxford: Oxford University Press.

Dwan K, Altman DG, Arnaiz JA, Bloom J, Chan AW, et al. (2008) Systematic review of the empirical evidence of study publication bias and outcome reporting bias. *PLOS ONE*, *3*(8): e3081. https://doi.org/10.1371/journal.pone.0003081

Egger, M., Smith, G. D., & Phillips, A. N. (1997). Meta-analysis: principles and procedures. *British Medical Journal*, *315*(7121), 1533-1537. doi:10.1136/bmj.315.7121.1533

Fish, M. (2004). Attachment in infancy and preschool in low socioeconomic status rural Appalachian children: Stability and change and relations to preschool and kindergarten competence. *Development and Psychopathology*, *16*(2), 293-312. doi:10.1017/S0954579404044529

Fisher, R. A. (1915). Frequency distribution of the values of the correlation coefficient in samples from an indefinitely large population. *Biometrika*, *10*(4), 507-521.

Fisher, Z., & Tipton, E. (2015). robumeta: An R-package for robust variance estimation in meta-analysis. arXiv:1503.02220.

Fraley, R. C. (2002). Attachment stability from infancy to adulthood: Meta-analysis and dynamic modeling of developmental mechanisms. *Personality and Social Psychology Review*, *6*(2), 123-151. doi:10.1207/S15327957PSPR0602_03

Ganiban, J., Barnett, D., & Cicchetti, D. (2000). Negative reactivity and attachment: Down syndrome's contribution to the attachment–temperament debate. *Development and Psychopathology*, *12*(1), 1-21. doi:10.1017/S0954579400001012

George, C., & Solomon, J. (2016). *The Handbook of Attachment* (J. Cassidy & P. R. Shaver Eds. 3rd ed.). New York, NY, USA: Guilford Press.

Goldberg, S., Washington, J., Myhal, N., Janus, M., Simmons, R. J., MacLusky, I., & Fowler, R. S. (1998). *Stability and change in attachment from infancy to preschool.* Unpublished manuscript, Hospital for Sick Children and University of Toronto.

Groh, A. M., Fearon, R. M. P., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Roisman, G. I. (2017). Attachment in the early life course: Meta-analytic evidence for its role in socioemotional development. *Child Development Perspectives*, *11*(1), 70-76. doi:10.1111/cdep.12213

Grossmann, K. E., & Grossmann, K. (2006). Attachment quality as an organizer of emotional and behavioral responses in a longitudinal perspective. In *Attachment across the life cycle* (pp. 101-122). Routledge.

Hedges, L. V., Tipton, E., & Johnson, M. C. (2010). Robust variance estimation in meta-regression with dependent effect size estimates. *Research Synthesis Methods*, *1*(1), 39-65. doi:10.1002/jrsm.5

Ioannidis, J. P., Munafò, M. R., Fusar-Poli, P., Nosek, B. A., & David, S. P. (2014). Publication and other reporting biases in cognitive sciences: detection, prevalence, and prevention. *Trends in Cognitive Sciences*, *18*(5), 235–241. doi:10.1016/j.tics.2014.02.010

Jacobsen, T., Huss, M., Fendrich, M., Kruesi, M. J. P., & Ziegenhain, U. (1997). Children's ability to delay gratification: Longitudinal relations to mother–child attachment. *The Journal of Genetic Psychology*, *158*(4), 411-426. doi:10.1080/00221329709596679

Johnson, R. T., & Dickersin, K. (2007). Publication bias against negative results from clinical trials: Three of the seven deadly sins. *Nature Clinical Practice*. Neurology, *3*(11), 590–591.

Kreppner, J., Rutter, M., Marvin, R., O'Connor, T., & Sonuga-Barke, E. (2011). Assessing the concept of the 'insecure-other' category in the Cassidy–Marvin scheme: Changes between 4 and 6 years in the English and Romanian adoptee study. *Social Development*, *20*(1), 1-16. doi:10.1111/j.1467-9507.2009.00569.x

Levendosky, A. A., Bogat, G. A., Huth-Bocks, A. C., Rosenblum, K., & von Eye, A. (2011). The effects of domestic violence on the stability of attachment from infancy to preschool. *Journal of Clinical Child and Adolescent Psychology*, *40*(3), 398-410. doi:10.1080/15374416.2011.563460

Main, M., & Cassidy, J. (1988). Categories of response to reunion with the parent at age 6: Predictable from infant attachment classifications and stable over a 1-month period. *Developmental Psychology*, *24*(3), 415-426. doi:10.1037/0012-1649.24.3.415

Main, M., Hesse, E., & Hesse, S. (2011). Attachment theory and research: Overview with suggested application to child custody. *Family Court Review*, *49*(3), 426-463. doi:10.1111/j.1744-1617.2011.01383.x

Main M., & Solomon J. (1990). Procedures for identifying infants as disorganised/disoriented during the Ainsworth Strange Situation In Greenberg M. T., Cicchetti D., & Cummings E. M. (Eds.), *Attachment in the preschool years* (pp. 121–160). Chicago, IL: University of Chicago Press

Meins, E., Bureau, J. F., & Fernyhough, C. (2017). Mother–child attachment from infancy to the preschool years: Predicting security and stability. *Child Development*, *89*(3), 1022-1038. doi:10.1111/cdev.12778

Milentijevic, I., Altan, S., & Ward, M. J. (1995). Adolescent mothers and their children: Stability of attachment organization from 1 to 3.5 years. In *Biennial Meeting of the Society for Research in Child Development*.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *British Medical Journal*, *339*(7716), 332-336. doi:10.1136/bmj.b2535

Moss, E., Cyr, C., Bureau, J.-F., Tarabulsy, G. M., & Dubois-Comtois, K. (2005). Stability of attachment during the preschool period. *Developmental Psychology*, *41*(5), 773-783. doi:10.1037/0012-1649.41.5.773

NICHD. (2001). Child-care and family predictors of preschool attachment and stability from infancy. *Developmental Psychology*, *37*(6), 847-862. doi:10.1037/0012-1649.37.6.847

Pinquart, M., Feußner, C., & Ahnert, L. (2013). Meta-analytic evidence for stability in attachments from infancy to early adulthood. *Attachment & Human Development*, *15*(2), 189-218. doi:10.1080/14616734.2013.746257

Rauh, H., Ziegenhain, U., Müller, B., & Wijnroks, L. (2000). Stability and change in infant–mother attachment in the second year of life: Relations to parenting quality and varying degrees of day-care experience. In P. M. Crittenden, A. H. Claussen, P. M. Crittenden, & A. H. Claussen (Eds.), *The Organization of Attachment Relationships: Maturation, Culture, and Context* (pp. 251-276). New York, NY, USA: Cambridge University Press.

Ross, L. E., Grigoriadis, S., Mamisashvili, L., Koren, G., Steiner, M., Dennis, C. -L., … Mousmanis, P. (2011). Quality assessment of observational studies in psychiatry: an example from perinatal psychiatric research. International *Journal of Methods in Psychiatric Research*, *20*(4), 224–234. https://doi.org/10.1002/mpr.356

R Core Team. (2018). R: A language and environment for statistical computing; 2018.

Seifer, R., LaGasse, L. L., Lester, B., Bauer, C. R., Shankaran, S., Bada, H. S., . . . Liu, J. (2004). Attachment status in children prenatally exposed to cocaine and other substances. *Child Development*, *75*(3), 850-868. doi:10.1111/j.1467-8624.2004.00710.x

Sroufe, L. A., Egeland, B., Carlson, E. A., & Collins, W. A. (2009). *The development of the person: The Minnesota study of risk and adaptation from birth to adulthood.* Guilford Press.

Steele, H., Steele, M., & Fonagy, P. (1996). Attachment in the sixth year of life. In *International Congress of Psychology*.

Stern, S., Kirst, C., & Bargmann, C. I. (2017). Neuromodulatory control of long-term behavioral patterns and individuality across development. *Cell*, *171*(7), 1649-1662.

Stevenson-Hinde, J. (2016). Unpublished attachment stability raw data. Personal Communication.

Stroup, D. F., Berlin, J. A., Morton, S. C., Olkin, I., Williamson, G. D., Rennie, D., . . . Thacker, S. B. (2000). Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. *Journal of the American Medical Association*, *283*(15), 2008-2012.

Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior*, *52*(2), 145–161. https://doi.org/10.1177/0022146510395592

Thompson, R. (1998). Early sociopersonality development. In W. Damon & N. Eisenberg (Eds), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development*, 5th ed. (pp 25–104). New York: Wiley, p.58

Tipton, E. (2015). Small sample adjustments for robust variance estimation with meta-regression. *Psychological Methods*, *20*(3), 375-393. doi:10.1037/met0000011

Toth, S. L., Rogosch, F. A., Manly, J. T., & Cicchetti, D. (2006). The efficacy of toddler-parent psychotherapy to reorganize attachment in the young offspring of mothers with major depressive disorder: A randomized preventive trial. *Journal of Consulting and Clinical Psychology*, *74*(6), 1006-1016. doi:10.1037/0022-006X.74.6.1006

van IJzendoorn , M. H., Schuengel, C., & Bakermans-Kranenburg, M. J. (1999). Disorganized attachment in early childhood: Meta-analysis of precursors, concomitants, and sequelae. *Development and Psychopathology*, *11*(2), 225-249. doi:10.1017/S0954579499002035

Verhage, M. L., Schuengel, C., Madigan, S., Fearon, R. M. P., Oosterman, M., Cassibba, R., Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2015,). Narrowing the Transmission Gap: A Synthesis of Three Decades of Research on Intergenerational Transmission of Attachment. *Psychological Bulletin, 142*(4), 337–366.http://dx.doi.org/10.1037/bul0000038

Vice, G. C. (2004). *A meta-analysis of the stability of attachment styles from birth to adulthood*. (Doctor of Psychology), University of Hartford, US.

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*, *36*(3), 1-48. doi:10.18637/jss.v036.i03

Vondra, J. I., Shaw, D. S., Swearingen, L., Cohen, M., & Owens, E. B. (2001). Attachment stability and emotional and behavioral regulation from infancy to preschool age. *Development and Psychopathology*, *13*(1), 13-33. doi:10.1017/S095457940100102X

Wartner, U. G., Grossmann, K., Fremmer-Bombik, E., & Suess, G. (1994). Attachment patterns at age six in south Germany: Predictability from infancy and implications for preschool behavior. *Child Development*, *65*(4), 1014-1027. doi:10.2307/1131301

Waters, E., & Valenzuela, M. (1999). Explaining disorganized attachment: Clues from research on mild-to-moderately undernourished children in Chile. In J. Solomon & C. George (Eds.), *Attachment Disorganization* (pp. 265-287). New York, NY, USA: Guilford Press.

Wickham, H., Francois, R., Henry, L., & Müller, K. (2018). dplyr: A Grammar of Data Manipulation. Package 'dplyr'.

Wray, L. L. (2017). *Developmental risk in young children: The contributions of mothers' empathy, attachment, trauma, and caregiving dysregulation* (Doctoral dissertation, Mills College).

Table 1. Descriptive information of included studies (natural history studies).

Study Name (Year)	T1/T2 (mo)	Interval	Coding Method	Social Risk	Medical Risk	Published	Prior Inclusion	Country	IRR (%)	Parent Sex	Data Level	*N*
Aikins, Howes, & Hamilton (2009)	12/48	I-P	A-CM	No	No	Yes	S/IS	USA	-	M,F	2S	83
Ammaniti, Speranza, & Fedele (2005)	12/64	I-E	A-CM	No	No	Yes	S/IS	Italy	-	F	2S,3	35
Atkinson et al. (1999)	26/42	T-P	A-A	No	Yes	Yes	S/IS	Canada	73	F	2S	53
Bar-Haim et al. (2000)	14/24	I-T	A-A	No	No	Yes	S/IS	USA	82	F	2S,3	42
	24/58	T-P	A-CM	No	No	Yes	S/IS	USA	82	F	2S,3	45
	14/58	I-P	A-CM	No	No	Yes	S/IS	USA	82	F	2S,3	43
Barnett et al. (2006)	25/41	T-P	A/CM-CM	No	Yes	Yes	S/IS	USA	94	F	2S	50
Barnett, Ganiban & Cicchetti (1999)	12/24	I-T	A-A	No	No	Yes	S/IS	USA	90	F	2S,4,2D	20
	12/24	I-T	A-A	Yes	No	Yes	S/IS	USA	90	F	2S,4,2D	16
Belsky, Campbell, Cohn & Moore (1996)	13/20	I-T	A-A	No	No	Yes	S/IS	USA	96	M	2S,3	120
Cicchetti & Barnett (1991)	30/48	T-P	CM-CM	Yes	No	Yes	S/IS	USA	-	M,F	2S,4,2D	18
	36/48	T-P	CM-CM	Yes	No	Yes	S/IS	USA	-	M,F	2S,4,2D	25
Cicchetti & Barnett (1991)	30/48	T-P	CM-CM	Yes	No	Yes	S/IS	USA	-	M,F	2S,4,2D	20
	36/48	T-P	CM-CM	Yes	No	Yes	S/IS	USA	-	M,F	2S,4,2D	15
Cicchetti, Rogosch & Toth (2006)	12/26	I-T	A-SR	Yes	No	Yes	S/IS	USA	88	F	2S,4,2D	54
Cicchetti, Rogosch & Toth (2006)	12/26	I-T	A-SR	No	No	Yes	S/IS	USA	88	F	2S,4,2D	44
Easterbrooks (1989)	13/20	I-T	A-A	No	No	Yes	S/IS	USA	-	M	2S	59
Easterbrooks (1989)	13/20	I-T	A-A	No	No	Yes	S/IS	USA	-	F	2S	57
Fargot & Pears (1996)	18/30	I-T	A-CM	No	No	Yes	S/IS	USA	83	F	2S,3	96
Fish (2004)	15/48	I-P	A-CM	Yes	No	Yes	S/IS	USA	77	F	2S,4,2D	82
Frodi, Bridhes & Grolnick (1985)	12/20	I-T	A-A	No	No	Yes	S/IS	USA	79	F	2S,3	38
Ganiban, Barnett & Cicchetti	19/27	I-T	A-A	No	Yes	Yes	S/IS	USA	100	F	2S,4,2D	30

Study Name (Year)	T1/T2 (mo)	Interval	Coding Method	Social Risk	Medical Risk	Published	Prior Inclusion	Country	IRR (%)	Parent Sex	Data Level	*N*
(2000)												
Hautamaki et al. (2010)	12/36	I-T	A-CM	No	No	Yes	S/IS	Finland	98	M,F	2S,3	33
Howes & Hamilton (1992)	12/48	I-P	A-CM	No	No	Yes	S/IS	USA	-	F	2S,3	89
Jacobsen et al. (1997)	12/72	I-E	A-MC	No	No	Yes	S/IS, D/O	Germany	-	F	2S,4	32
Jacobsen et al. (1997)	18/72	I-E	A-MC	No	No	Yes	S/IS	Germany	-	F	2S,4	32
Jacobsen et al. (2014)	23/36	T-P	A-CM	Yes	No	Yes	NA	Norway	82	F	2S,2D	55
Jacobsen et al. (2014)	23/36	T-P	CM-CM	No	No	Yes	NA	Norway	82	F	2S,2D	40
Korntheuer, Lissmann & Lohaus (2010)	12/24	I-T	A-G	No	No	Yes	S/IS	Germany	-	F	2S	81
Kreppner et al. (2011)	48/72	P-E	CM-CM	No	No	Yes	NA	UK	82	F	2S,4,2D	106
Kreppner et al. (2011)	48/72	P-E	CM-CM	Yes	No	Yes	NA	Romania	81	F	2S,4,2D	31
Levendosky et al. (2011)	12/48	I-P	A-CM	Yes	No	Yes	S/IS	USA	83	F	2S,4,2D	150
Lounds et al. (2005)	12/60	I-P	A-CM	Yes	No	Yes	S/IS	USA	-	F	2S,2D	78
Main & Cassidy (1988)	12/70	I-E	A-MC	No	No	Yes	S/IS, D/O	USA	83	F	2S,4,2D	40
	12/70	I-E	A-MC	No	No	Yes	S/IS, D/O	USA	77	M	2S,4,2D	40
Main & Weston (1981)	12/20	I-T	A-A	No	No	Yes	S/IS	USA	94	F	2S	15
Main & Weston (1981)	12/20	I-T	A-A	No	No	Yes	S/IS	USA	94	M	2S	15
Maris et al. (2000)	12/24	I-T	A-CM	No	Yes	Yes	S/IS	USA	83	F	2S	24
Maris et al. (2000)	12/24	I-T	A-CM	No	No	Yes	S/IS	USA	83	F	2S	61
Maris et al. (2000)	12/24	I-T	A-CM	No	Yes	Yes	S/IS	USA	83	F	2S	22
Meins, Bureau & Fernyhough (2017)	15/44	I-P	A-CM	No	No	Yes	NA	UK	88	F	2S,4	164
Meins, Bureau & Fernyhough (2017)	15/51	I-P	A-CM	No	No	Yes	NA	UK	87	F	2S,4	128
Milentijevic, Altman & Ward (1995)	14/42	I-P	A-CM	Yes	No	No	D/O	USA	80	F	2S,4,2D	86
Moss et al. (2005)	44/67	P-E	CM-CM	No	No	Yes	S/IS	Canada	90	F	2S,4,2D	120
Nakano (1984)	12/23	I-T	A-A	No	No	No	NA	Japan	-	F	,3	7
NICHD (2001)	15/36	I-T	A-CM	No	No	Yes	S/IS	USA	79	F	2S,4,2D	1,060

Study Name (Year)	T1/T2 (mo)	Interval	Coding Method	Social Risk	Medical Risk	Published	Prior Inclusion	Country	IRR (%)	Parent Sex	Data Level	*N*
Owens et al. (1984)	12/20	I-T	A-A	No	No	Yes	S/IS	USA	95	F	2S,3	59
Owens et al. (1984)	12/20	I-T	A-A	No	No	Yes	S/IS	USA	95	M	2S,3	53
Rauh et al. (2000)	12/21	I-T	A-A	No	No	Yes	S/IS, D/O	Germany	94	F	2S,4,2D	75
	12/21	I-T	MC-MC	No	No	Yes	S/IS	Germany	94	F	2S,4,2D	75
	12/21	I-T	MC-A	No	No	Yes	S/IS	Germany	94	F	2S,4,2D	75
	12/21	I-T	A-MC	No	No	Yes	S/IS	Germany	94	F	2S,4,2D	75
	12/21	I-T	MC-C	No	No	Yes	S/IS	Germany	94	F	2S,4,2D	75
	12/21	I-T	A-CM	No	No	Yes	S/IS	Germany	94	F	2S,4,2D	75
Seifer et al. (2004)	18/36	I-T	A-CM	Yes	No	Yes	S/IS	USA	90	F	2S,4,2D	601
Steele, Steele & Fonagy (1996)	12/60	I-P	A-CM	No	No	No	D/O	UK	91	F	2S,4,2D	88
Steele, Steele & Fonagy (1996)	12/72	I-E	A-CM	No	No	No	D/O	UK	91	M	2S,4,2D	68
Stevenson-Hinde & Shouldice (1990)	30/54	T-P	A-CM	No	No	Yes	S/IS	UK	88	F	2S,4,2D	72
Takahashi (1990)	12/23	I-T	A-A	No	No	Yes	S/IS	Japan	-	F	2S	60
Thompson, Lamb & Estes (1982)	13/20	I-T	A-A	No	No	Yes	S/IS	USA	94	F	2S,3	43
Toth et al. (2006)	20/36	T-P	A-CM	No	No	Yes	NA	USA	92	F	2S,4,2D	63
Toth et al. (2006)	20/36	T-P	A-CM	Yes	No	Yes	NA	USA	92	F	2S,4,2D	54
Vondra et al. (2001)	12/24	I-T	A-CM	Yes	No	Yes	NA	USA	70	F	2S,4,2D	198
Wartner et al. (1994)	15/72	I-E	A-MC	No	No	Yes	D/O	Germany	97	F	2S,3,4,2D	39
Waters & Valenzuela (1999)	18/28	I-T	A-A	Yes	No	Yes	NA	Chile	86	F	2S,4,2D	34
Waters & Valenzuela (1999)	18/28	I-T	A-A	Yes	Yes	Yes	NA	Chile	86	F	2S,4,2D	37
Xue (2015)	13/42	I-P	A-CM	No	No	No	NA	Canada	89	F	2S,4,2D	61

Note. Several studies included multiple non-independent samples. In these cases, descriptions of each non-independent sample are aggregated in the Study Name (Year) column heading. T1/T2 (mo) – Child age in months at time one/time two. Dev. Interval – developmental interval. IRR – interrater reliability. F – Female. M – Male. I-T – Infancy-toddlerhood. I-P – Infancy-preschool. I-E – Infancy- school entry. T-P – Toddlerhood-preschool. P-E – Preschool- school entry. A – Ainsworth SSP. CM – Cassidy-Marvin SSP. MC – Main-Cassidy SSP. C – Crittenden SSP. G – Grossman SSP. SR – Schneider-Rosen SSP. S/IS (D/O) – Previously included in a two-way secure/insecure (organised/disorganised) meta-analysis. 2S – Two-way secure/insecure classifications. 2D – Two-way organised/disorganised. 3 – Three-way secure/avoidant/ambivalent. 4 – Four-way secure/avoidant/ambivalent/disorganised. N – Number of participants in each study.

Table 2. Coding of variables used in meta-analysis.

Variable	Continuous/Discrete	Example	Description
Publication year	Continuous	2002	
Attachment coding tool employed	Discrete	Ainsworth (time 1), Crittenden (time 2)	
Included in prior meta-analysis	Discrete	Yes/No	
Publication status	**Discrete**	**Published/Not published**	
Country	Discrete	USA/Non-USA	
Social and medical risk	Discrete	Yes/No	Risk status based on factors such as socioeconomic position, race & ethnicity, and medical risk.
Interrater reliability (IRR)	Discrete	<80% / >80%	If both four- and two-way IRR was available, the four-way value was used. If reported for both time points, these values were averaged.

Table 3. Meta-analytic contingency table for early childhood.

		B	A	C	D	Count
B	Count	1259	168	235	226	1888
	Proportion	64.646	13.398	9.708	12.247	
	Expected Proportion	57.611	12.064	13.613	16.711	
	Adj. Stand. Residual	**12.06**	**-6.385**	-2.234	**-8.347**	
A	Count	240	125	58	86	509
	Proportion	34.936	36.099	10.329	18.636	
	Expected Proportion	57.611	12.064	13.613	16.711	
	Adj. Stand. Residual	**-5.184**	**9.395**	-1.585	0.121	
C	Count	163	32	87	36	318
	Proportion	43.72	9.705	27.265	19.31	
	Expected Proportion	57.611	12.064	13.613	16.711	
	Adj. Stand. Residual	-2.41	-1.152	**7.512**	-2.708	
D	Count	272	80	77	213	642
	Proportion	36.46	16.577	11.051	35.912	
	Expected Proportion	57.611	12.064	13.613	16.711	
	Adj. Stand. Residual	**-8.691**	0.343	-1.331	**12.435**	
	Count	1934	405	457	561	3357

Note. Significant cells indicated by bolded adjusted standardised residuals (adj. stand. residual). Following the Bonferroni correction, the critical significance value for adjusted standardised residuals is approximately 2.95.

Table 4. Comparison of stability between different attachment patterns.

	B vs. A	B vs. C	B vs. D	A vs. C	A vs. D	C vs. D
β_1	0.732	1.611	1.118	0.278	0.294	-0.420
df	16.68	16.36	19.09	11.50	21.32	21.32
p-value	0.113	**0.017**	**0.006**	0.464	0.524	0.347
Direction	-	B > C	B > D	-	-	-

Note. B > C indicates that B was found to be significantly more stable than C after adjusting for expected levels of stability.

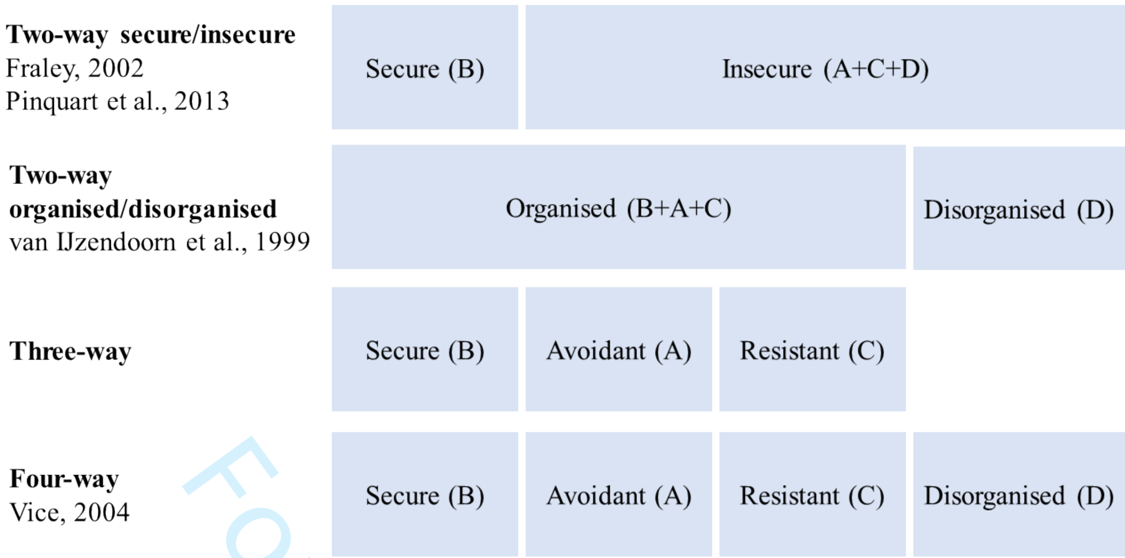

Figure 1. Levels of attachment examination. The most detailed subclassification level is not shown.

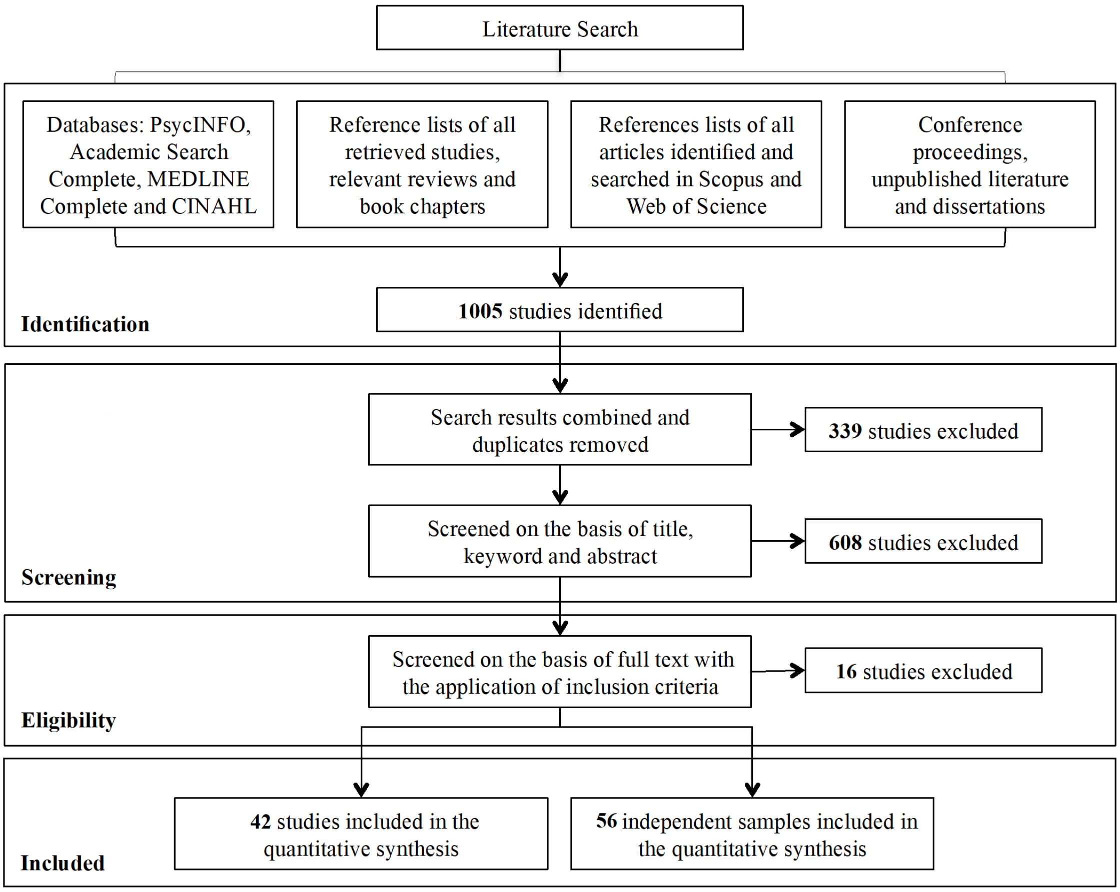

Figure 2. PRISMA diagram of data identification process.

Concept 1: (*attachment**)

AND

Concept 2: (*child** OR *infant** OR *mother-infant* OR *toddler** *toddler-parent* OR *parent-child* OR *child-caregiver* OR *infant-parent* OR *pre-school** OR *preschool** OR *kindergarten** OR *"school*"*)

AND

Concept 3: (*continuit** OR *discontinu** OR *stability* OR *stable* OR *instability* OR *varia** OR *chang** OR *unstable* OR *consisten** OR *inconsisten**)

AND

Concept 4: ("*strange situation*")

Figure 3. Meta-analytic search criteria for data collection. The use of the wildcard sign (*) at the end of a word enables databases to find words with alternative spelling and/or word variations, while the use of quotation marks ensures that multiple words are searched as a complete phrase and not as the individual words that comprise it. All search concepts, search terms, and databases were selected and developed with the assistance of a specialist health-science librarian.

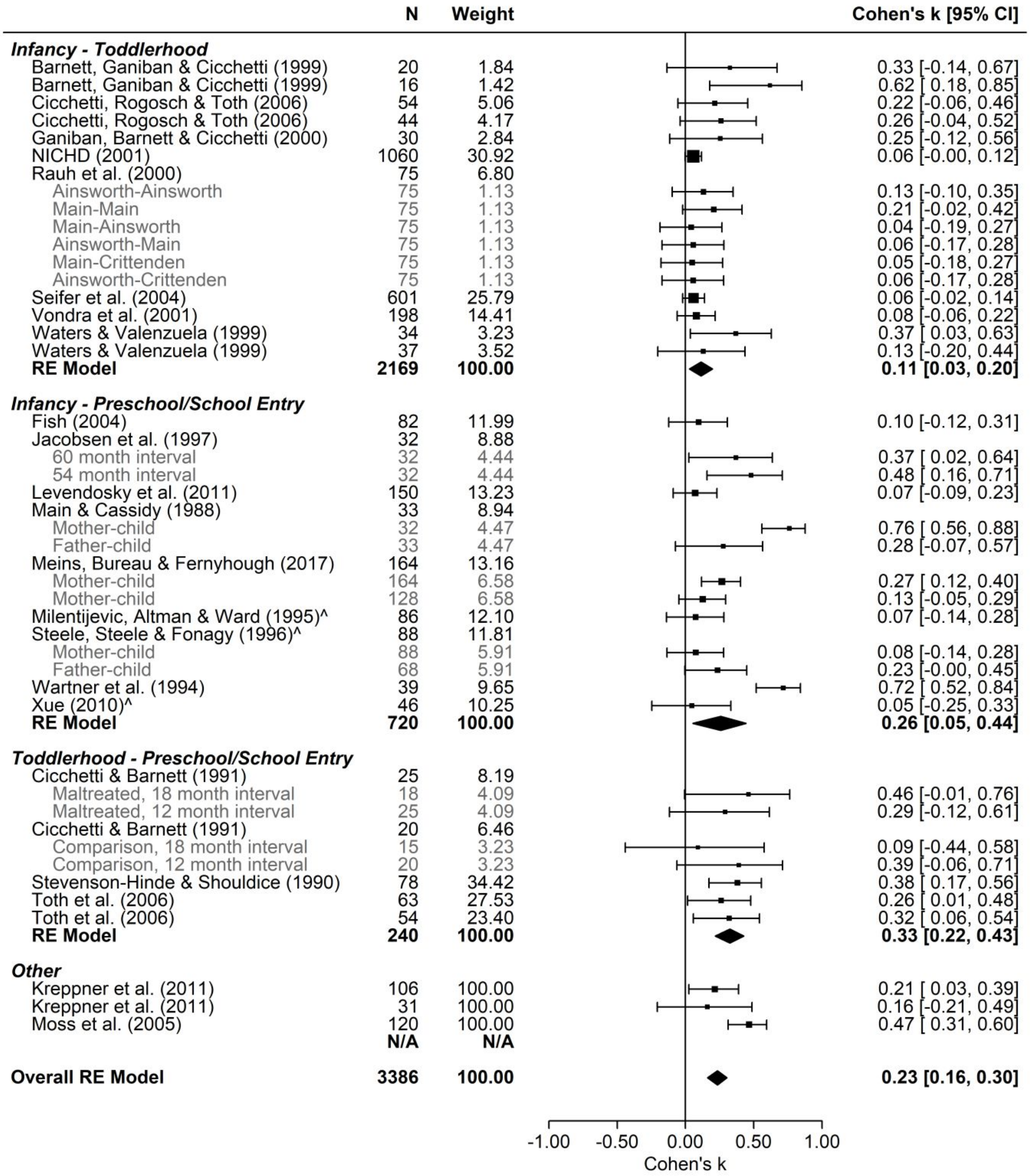

Figure 4. Attachment stability forest plots for the four-way attachment classification for early childhood. Cohen's κ correlations are shown for all included studies and their subsamples. Meta-analytic summaries are presented for each developmental interval and for the early childhood period overall. Summary stability correlations and associated 95% confidence intervals are presented for each group. For studies with multiple dependent samples, descriptions of each different sample are listed in grey below the study name, along with sample sizes and model weights. Where studies

provided multiple independent samples, these were included separately. In calculating the summary sample size for each random-effects model presented, the largest sample from each set of non-independent samples was used. Due to the aggregation of preschool and school entry in this analysis, those studies that examined the preschool-school entry interval contributed only to the overall early childhood summary effect, and are listed under “Other”.

	N	Weight	Pearson's r [95% CI]	Matched studies	k
Infancy - Toddlerhood					
Bar-Haim, Sutton, Fox & Marvin (2000)	42	3.92	0.37 [0.08, 0.61]		0.36
Barnett, Ganiban & Cicchetti (1999)	20	2.63	0.33 [-0.13, 0.67]	matched	0.31
Belsky et al. (1996)	120	5.25	-0.06 [-0.23, 0.12]		-0.06
Cicchetti, Rogosch & Toth (2006)	54	4.30	0.00 [-0.27, 0.27]	matched	0.00
Cicchetti, Rogosch & Toth (2006)	44	3.99	0.23 [-0.07, 0.50]	matched	0.23
Easterbrooks (1989)	59	4.41			
Father-child	59	2.20	0.00 [-0.26, 0.26]		
Mother-child	57	2.20	0.11 [-0.16, 0.36]		
Fargot & Pears (1996)	96	5.03	0.71 [0.59, 0.80]		0.69
Frodi, Grolnick & Bridges (1985)	38	3.76	0.13 [-0.20, 0.43]		0.13
Ganiban, Barnett & Cicchetti (2000)	30	3.35	0.41 [0.06, 0.67]	matched	0.41
Hautamaki et al. (2010)	33	3.52	0.78 [0.60, 0.89]		0.78
Korntheuer, Lissmann & Lohaus (2010)	81	4.84	0.26 [0.04, 0.45]		0.26
Main & Weston (1981)	15	2.12			
Mother-child	15	1.06	0.46 [-0.07, 0.79]		
Father-child	15	1.06	0.73 [0.35, 0.90]		
Maris et al. (2000)	24	2.96	-0.24 [-0.59, 0.18]		-0.21
Maris et al. (2000)	61	4.48	0.19 [-0.07, 0.42]		0.18
Maris et al. (2000)	22	2.80	-0.33 [-0.66, 0.11]		-0.27
NICHD (2001)	1060	6.17	0.04 [-0.02, 0.10]	matched	0.04
Owen et al. (1984)	59	4.35			
Mother-child	59	2.18	0.11 [-0.15, 0.35]		0.11
Father-child	53	2.18	0.14 [-0.14, 0.39]		0.14
Rauh et al. (2000)	75	4.74			
Ainsworth-Ainsworth	75	0.79	0.18 [-0.05, 0.39]	matched	0.17
Main-Main	75	0.79	0.21 [-0.01, 0.42]	matched	0.21
Main-Ainsworth	75	0.79	0.13 [-0.10, 0.34]	matched	0.09
Ainsworth-Main	75	0.79	0.14 [-0.09, 0.36]	matched	0.14
Main-Crittenden	75	0.79	0.29 [0.06, 0.48]	matched	0.25
Ainsworth-Crittenden	75	0.79	0.16 [-0.07, 0.37]	matched	0.10
Seifer et al. (2004)	601	6.07	0.08 [-0.00, 0.16]		0.08
Takahashi (1990)	60	4.45	0.18 [-0.08, 0.41]		
Thompson, Lamb & Estes (1982)	43	3.96	-0.03 [-0.32, 0.28]		-0.03
Vondra et al. (2001)*	198	5.63	0.17 [0.03, 0.30]	matched	0.14
Waters & Valenzuela (1999)*	34	3.57	0.31 [-0.03, 0.59]	matched	0.29
Waters & Valenzuela (1999)*	37	3.71	-0.18 [-0.48, 0.15]	matched	-0.14
RE Model	**2906**	**100.00**	**0.19 [0.07, 0.31]**	**0.11 [0.02, 0.20]**	**0.19**
Infancy - Preschool/School Entry					
Aikins, Howes, & Hamilton (2009)	83	7.67	0.51 [0.33, 0.65]		
Ammaniti, Speranza, & Fedele (2005)	35	5.98	0.47 [0.16, 0.69]		0.46
Bar-Haim, Sutton, Fox & Marvin (2000)	43	6.45	0.01 [-0.29, 0.31]		0.01
Fish (2004)	82	7.65	0.24 [0.02, 0.43]	matched	0.24
Howes & Hamilton (1992)	89	7.77	0.45 [0.27, 0.60]		0.44
Jacobsen et al. (1997)	32	5.76			
60 month interval	32	2.88	0.34 [-0.01, 0.62]		
54 month interval	32	2.88	0.54 [0.24, 0.75]		
Levendosky et al. (2011)	150	8.39	0.12 [-0.04, 0.27]	matched	0.12
Lounds et al. (2005)	78	7.58	0.29 [0.07, 0.48]		0.28
Main & Cassidy (1988)	40	6.29			
Mother-child	40	3.15	0.76 [0.59, 0.87]	matched	
Father-child	40	3.15	0.30 [-0.01, 0.56]	matched	
Meins, Bureau & Fernyhough (2017)*	164	8.35			
Mother-child	164	4.18	0.35 [0.21, 0.48]	matched	0.34
Mother-child	128	4.18	0.23 [0.06, 0.38]	matched	0.22
Milentijevic, Altman & Ward (1995)*^	86	7.72	0.01 [-0.20, 0.22]	matched	0.01
Steele, Steele & Fonagy (1996)*^	88	7.55			
Mother-child	88	3.77	0.07 [-0.14, 0.27]	matched	0.07
Father-child	68	3.77	0.28 [0.04, 0.48]	matched	0.28
Wartner et al. (1994)*	39	6.23	0.79 [0.64, 0.89]	matched	0.79
Xue (2010)*^	46	6.60	0.16 [-0.14, 0.43]	matched	0.21
RE Model	**1055**	**100.00**	**0.34 [0.19, 0.47]**	**0.32 [0.05, 0.55]**	**0.29**
Toddlerhood - Preschool/School Entry					
Atkinson et al. (1999)	53	10.98	0.20 [-0.07, 0.45]		
Bar-Haim, Sutton, Fox & Marvin (2000)	45	10.25	-0.19 [-0.45, 0.11]		-0.18
Barnett et al. (2006)	47	10.45	-0.09 [-0.36, 0.21]		-0.01
Cicchetti & Barnett (1991)	25	6.55			
Maltreated, 18 month interval	18	3.27	0.48 [0.01, 0.77]	matched	0.47
Maltreated, 12 month interval	25	3.27	0.12 [-0.29, 0.49]	matched	0.12
Cicchetti & Barnett (1991)	20	5.60			
Comparison, 18 month interval	20	2.80	0.49 [0.06, 0.77]	matched	0.47
Comparison, 12 month interval	15	2.80	0.35 [-0.19, 0.73]	matched	0.33
Jacobsen et al. (2014)*	55	11.14	0.09 [-0.18, 0.35]		0.09
Jacobsen et al. (2014)*	40	9.70	0.16 [-0.16, 0.45]		0.16
Stevenson-Hinde & Shouldice (1990)	78	12.55	0.46 [0.26, 0.62]	matched	0.49
Toth et al. (2006)*	63	11.71	0.31 [0.06, 0.52]	matched	0.30
Toth et al. (2006)*	54	11.06	0.39 [0.14, 0.60]	matched	0.39
RE Model	**480**	**100.00**	**0.21 [0.04, 0.36]**	**0.39 [0.25, 0.51]**	**0.22**
Other					
Kreppner et al. (2011)*	106	100.00	0.24 [0.05, 0.41]	matched	0.23
Kreppner et al. (2011)*	31	100.00	0.22 [-0.15, 0.53]	matched	0.20
Moss et al. (2005)	120	100.00	0.55 [0.41, 0.66]	matched	0.53
	N/A	**N/A**			
Overall RE Model	**4613**	**100.00**	**0.26 [0.18, 0.33]**	**0.27 [0.18, 0.35]**	**0.24**

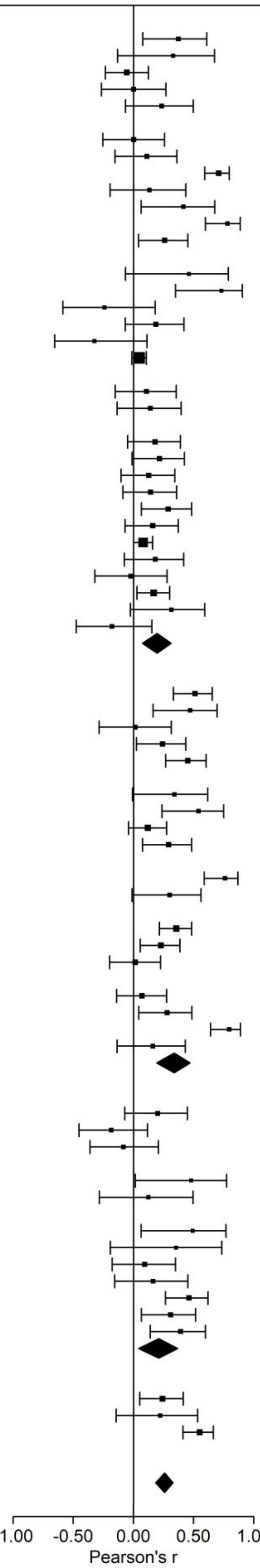

Figure 5. Attachment stability forest plots for the two-way secure/insecure attachment classification for early childhood. Pearson's *r* correlations are shown for all included studies and their subsamples. Meta-analytic summaries are presented for each developmental interval and for the early childhood period overall. Summary stability correlations and associated 95% confidence intervals are presented for each group. For studies with multiple dependent samples, descriptions of each different sample are listed in grey below the study name, along with sample sizes and model weights. Where studies provided multiple independent samples, these were included separately. In calculating the summary sample size for each random-effects model presented, the largest sample from each set of non-independent samples was used. Due to the aggregation of preschool and school entry in this analysis, those studies that examined the preschool-school entry interval contributed only to the overall early childhood summary effect, and are listed under "Other".

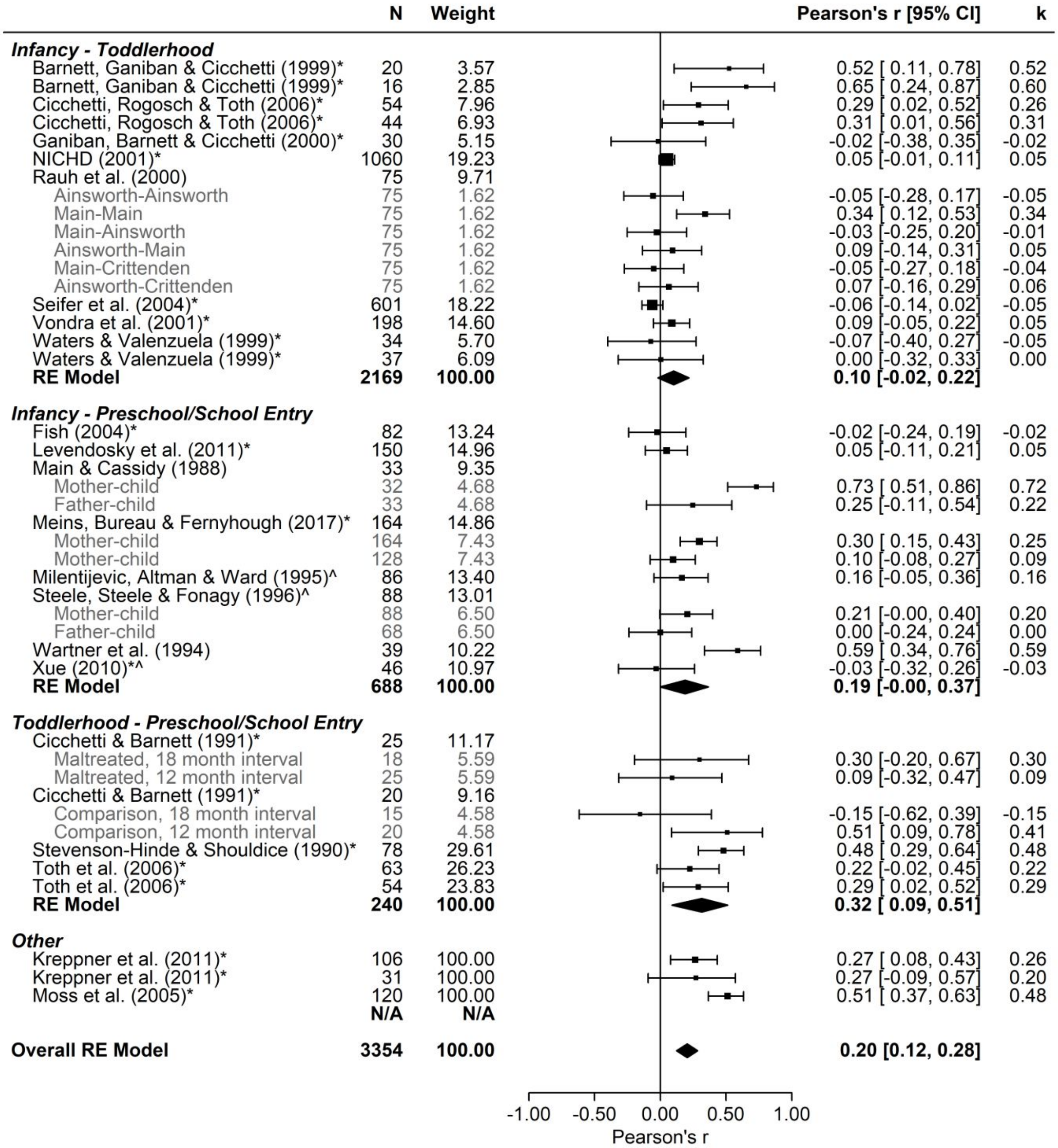

Figure 6. Attachment stability forest plots for the two-way organised/disorganised attachment classification for early childhood. Pearson's *r* correlations are shown for all included studies and their subsamples. Meta-analytic summaries are presented for each developmental interval and for the early childhood period overall. Summary stability correlations and associated 95% confidence intervals are presented for each group. For studies with multiple dependent samples, descriptions of each different sample are listed in grey below the study name, along with sample sizes and model weights. Where studies provided multiple independent samples, these were included separately. In calculating the summary sample size for each random-effects model

presented, the largest sample from each set of non-independent samples was used. Due to the aggregation of preschool and school entry in this analysis, those studies that examined the preschool-school entry interval contributed only to the overall early childhood summary effect, and are listed under "Other".

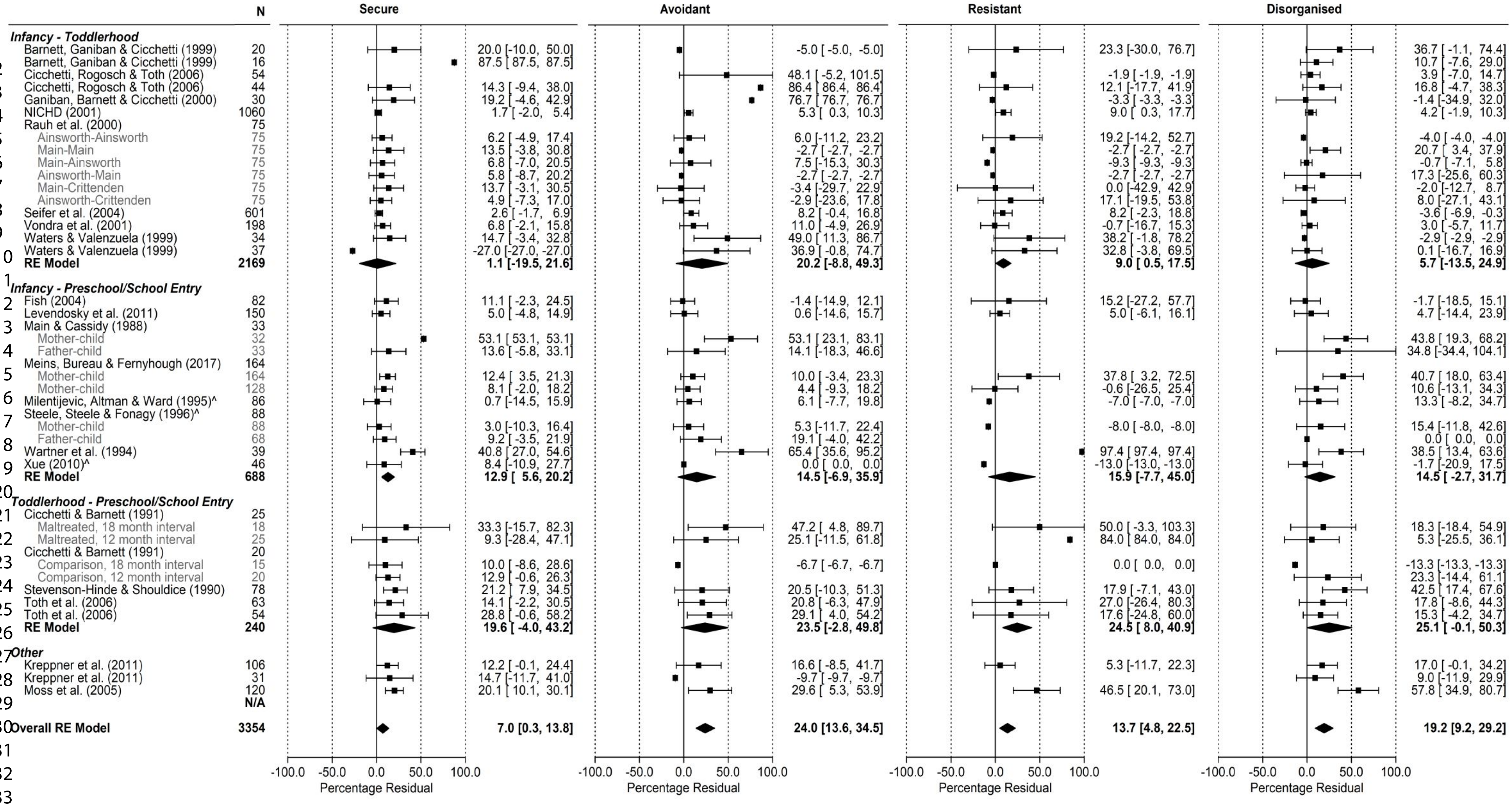
N
Secure
Avoidant
Resistant
Disorganised
Infancy - Toddlerhood
Barnett, Ganiban & Cicchetti (1999) 20 20.0 [-10.0, 50.0] -5.0 [-5.0, -5.0] 23.3 [-30.0, 76.7] 36.7 [-1.1, 74.4]
Barnett, Ganiban & Cicchetti (1999) 16 87.5 [87.5, 87.5] 10.7 [-7.6, 29.0]
Cicchetti, Rogosch & Toth (2006) 54 48.1 [-5.2, 101.5] -1.9 [-1.9, -1.9] 3.9 [-7.0, 14.7]
Cicchetti, Rogosch & Toth (2006) 44 14.3 [-9.4, 38.0] 86.4 [86.4, 86.4] 12.1 [-17.7, 41.9] 16.8 [-4.7, 38.3]
Ganiban, Barnett & Cicchetti (2000) 30 19.2 [-4.6, 42.9] 76.7 [76.7, 76.7] -3.3 [-3.3, -3.3] -1.4 [-34.9, 32.0]
NICHD (2001) 1060 1.7 [-2.0, 5.4] 5.3 [0.3, 10.3] 9.0 [0.3, 17.7] 4.2 [-1.9, 10.3]
Rauh et al. (2000) 75
Ainsworth-Ainsworth 75 6.2 [-4.9, 17.4] 6.0 [-11.2, 23.2] 19.2 [-14.2, 52.7] -4.0 [-4.0, -4.0]
Main-Main 75 13.5 [-3.8, 30.8] -2.7 [-2.7, -2.7] -2.7 [-2.7, -2.7] 20.7 [3.4, 37.9]
Main-Ainsworth 75 6.8 [-7.0, 20.5] 7.5 [-15.3, 30.3] -9.3 [-9.3, -9.3] -0.7 [-7.1, 5.8]
Ainsworth-Main 75 5.8 [-8.7, 20.2] -2.7 [-2.7, -2.7] -2.7 [-2.7, -2.7] 17.3 [-25.6, 60.3]
Main-Crittenden 75 13.7 [-3.1, 30.5] -3.4 [-29.7, 22.9] 0.0 [-42.9, 42.9] -2.0 [-12.7, 8.7]
Ainsworth-Crittenden 75 4.9 [-7.3, 17.0] -2.9 [-23.6, 17.8] 17.1 [-19.5, 53.8] 8.0 [-27.1, 43.1]
Seifer et al. (2004) 601 2.6 [-1.7, 6.9] 8.2 [-0.4, 16.8] 8.2 [-2.3, 18.8] -3.6 [-6.9, -0.3]
Vondra et al. (2001) 198 6.8 [-2.1, 15.8] 11.0 [-4.9, 26.9] -0.7 [-16.7, 15.3] 3.0 [-5.7, 11.7]
Waters & Valenzuela (1999) 34 14.7 [-3.4, 32.8] 49.0 [11.3, 86.7] 38.2 [-1.8, 78.2] -2.9 [-2.9, -2.9]
Waters & Valenzuela (1999) 37 -27.0 [-27.0, -27.0] 36.9 [-0.8, 74.7] 32.8 [-3.8, 69.5] 0.1 [-16.7, 16.9]
RE Model 2169 1.1 [-19.5, 21.6] 20.2 [-8.8, 49.3] 9.0 [0.5, 17.5] 5.7 [-13.5, 24.9]
Infancy - Preschool/School Entry
Fish (2004) 82 11.1 [-2.3, 24.5] -1.4 [-14.9, 12.1] 15.2 [-27.2, 57.7] -1.7 [-18.5, 15.1]
Levendosky et al. (2011) 150 5.0 [-4.8, 14.9] 0.6 [-14.6, 15.7] 5.0 [-6.1, 16.1] 4.7 [-14.4, 23.9]
Main & Cassidy (1988) 33
Mother-child 32 53.1 [53.1, 53.1] 53.1 [23.1, 83.1] 43.8 [19.3, 68.2]
Father-child 33 13.6 [-5.8, 33.1] 14.1 [-18.3, 46.6] 34.8 [-34.4, 104.1]
Meins, Bureau & Fernyhough (2017) 164
Mother-child 164 12.4 [3.5, 21.3] 10.0 [-3.4, 23.3] 37.8 [3.2, 72.5] 40.7 [18.0, 63.4]
Mother-child 128 8.1 [-2.0, 18.2] 4.4 [-9.3, 18.2] -0.6 [-26.5, 25.4] 10.6 [-13.1, 34.3]
Milentijevic, Altman & Ward (1995)^ 86 0.7 [-14.5, 15.9] 6.1 [-7.7, 19.8] -7.0 [-7.0, -7.0] 13.3 [-8.2, 34.7]
Steele, Steele & Fonagy (1996)^ 88
Mother-child 88 3.0 [-10.3, 16.4] 5.3 [-11.7, 22.4] -8.0 [-8.0, -8.0] 15.4 [-11.8, 42.6]
Father-child 68 9.2 [-3.5, 21.9] 19.1 [-4.0, 42.2] 0.0 [0.0, 0.0]
Wartner et al. (1994) 39 40.8 [27.0, 54.6] 65.4 [35.6, 95.2] 97.4 [97.4, 97.4] 38.5 [13.4, 63.6]
Xue (2010)^ 46 8.4 [-10.9, 27.7] 0.0 [0.0, 0.0] -13.0 [-13.0, -13.0] -1.7 [-20.9, 17.5]
RE Model 688 12.9 [5.6, 20.2] 14.5 [-6.9, 35.9] 15.9 [-7.7, 45.0] 14.5 [-2.7, 31.7]
Toddlerhood - Preschool/School Entry
Cicchetti & Barnett (1991) 25
Maltreated, 18 month interval 18 33.3 [-15.7, 82.3] 47.2 [4.8, 89.7] 50.0 [-3.3, 103.3] 18.3 [-18.4, 54.9]
Maltreated, 12 month interval 25 9.3 [-28.4, 47.1] 25.1 [-11.5, 61.8] 84.0 [84.0, 84.0] 5.3 [-25.5, 36.1]
Cicchetti & Barnett (1991) 20
Comparison, 18 month interval 15 10.0 [-8.6, 28.6] -6.7 [-6.7, -6.7] 0.0 [0.0, 0.0] -13.3 [-13.3, -13.3]
Comparison, 12 month interval 20 12.9 [-0.6, 26.3] 23.3 [-14.4, 61.1]
Stevenson-Hinde & Shouldice (1990) 78 21.2 [7.9, 34.5] 20.5 [-10.3, 51.3] 17.9 [-7.1, 43.0] 42.5 [17.4, 67.6]
Toth et al. (2006) 63 14.1 [-2.2, 30.5] 20.8 [-6.3, 47.9] 27.0 [-26.4, 80.3] 17.8 [-8.6, 44.3]
Toth et al. (2006) 54 28.8 [-0.6, 58.2] 29.1 [4.0, 54.2] 17.6 [-24.8, 60.0] 15.3 [-4.2, 34.7]
RE Model 240 19.6 [-4.0, 43.2] 23.5 [-2.8, 49.8] 24.5 [8.0, 40.9] 25.1 [-0.1, 50.3]
Other
Kreppner et al. (2011) 106 12.2 [-0.1, 24.4] 16.6 [-8.5, 41.7] 5.3 [-11.7, 22.3] 17.0 [-0.1, 34.2]
Kreppner et al. (2011) 31 14.7 [-11.7, 41.0] -9.7 [-9.7, -9.7] 9.0 [-11.9, 29.9]
Moss et al. (2005) 120 20.1 [10.1, 30.1] 29.6 [5.3, 53.9] 46.5 [20.1, 73.0] 57.8 [34.9, 80.7]
N/A
Overall RE Model 3354 7.0 [0.3, 13.8] 24.0 [13.6, 34.5] 13.7 [4.8, 22.5] 19.2 [9.2, 29.2]
-100.0 -50.0 0.0 50.0 100.0
Percentage Residual

Figure 7. Attachment stability forest plots for disaggregated attachment classifications: security, avoidance, resistance, and disorganisation. For each classification, percentage residuals are presented, defined as the difference between the observed stability proportion and the expected value (or the value expected due to chance). Meta-analytic summaries are presented for each developmental interval and for the early childhood period overall. Summary stability percentage residuals and associated 95% confidence intervals are presented for each group. For studies with multiple dependent samples, descriptions of each different sample are listed in grey below the study name, along with sample sizes and model weights. Where studies provided multiple independent samples, these were included separately. In calculating the summary sample size for each random-effects model presented, the largest sample from each set of non-independent samples was used. Due to the aggregation of preschool and school entry in this analysis, those studies that examined the preschool-school entry interval contributed only to the overall early childhood summary effect, and are listed under "Other".

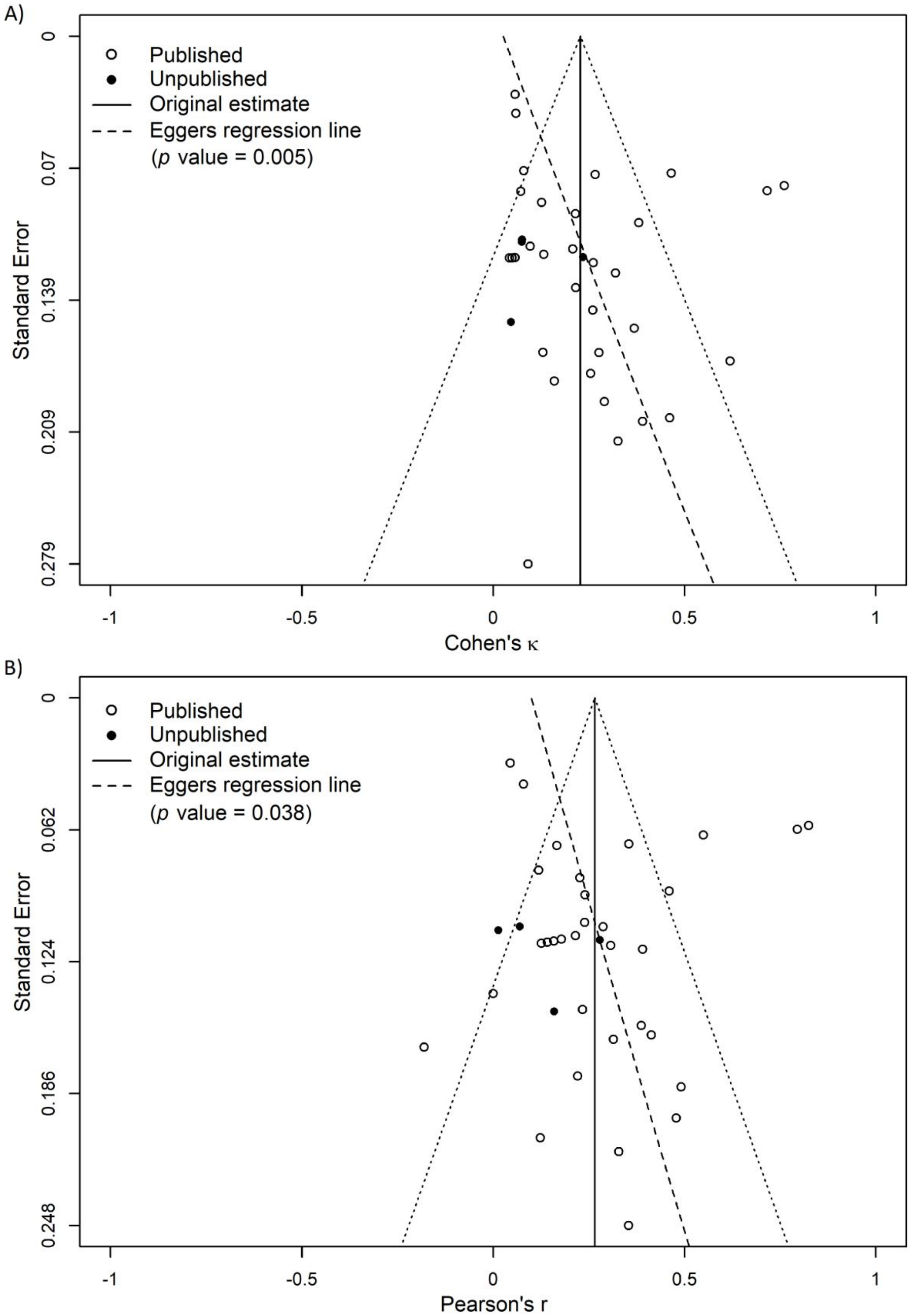

Figure 8. Funnel plots for A) four-way and B) two-way secure/insecure attachment stability correlation effect sizes. Published studies are marked by open circles and unpublished studies by filled circles. The Egger's regression line for each plot is indicated by the dashed line, with the associated *p*-value shown in the figure legend.

Dotted lines indicate the expected 95% confidence bounds in the absence of publication bias.