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Review

Attachment and attention problems: A meta-analysis☆

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HIGHLIGHTS

- We examined evidence regarding the association between attachment and attention problems.
- A modest positive relation between quality of children's attachment and attention problems was found.
- Children with an insecure attachment were higher in attention problems than those with a secure attachment.
- Children with disorganized attachments were higher in attention problems than those with organized attachments.
- Effects were sometimes moderated by risk status, measure of attachment, and timing of assessing the constructs.

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ABSTRACT

Attachment theorists have argued that securely attached children tend to exhibit flexible attention; the attention of children with resistant attachments is centered on attachment-related worries; children with avoidant attachments defensively focus attention away from attachment-related emotions/thoughts; and children with disorganized attachments exhibit the collapse of attention and disorientation. In this meta-analysis, a relation between attachment security status and attention problems (APs) in children (18 years and younger) was found. In total, 62 studies (67 samples) met the inclusion criteria. Children with insecure attachments were higher in APs than those with a secure attachment (r = 0.21); those with avoidant or resistant attachments were higher than securely attached children (rs = 0.10 and 0.21, respectively); children with disorganized attachments were higher than those with organized attachments (r = 0.27). Effects were larger when attachment and APs were measured concurrently/closer in time (for secure versus all; disorganized versus organized attachment); for representational versus observational measures of attachment, non-parental reports of APs, and attachment assessed at an older age (for disorganized versus organized attachment); for samples with proportionally fewer boys (secure versus resistant attachment); in recent studies (secure versus avoidant attachment); and when disorganized children were in a high-risk sample or resistant children were in a low-risk condition.

Consistent with John Bowlby's theoretical focus on the role of children's attachment in the development of psychopathology (1973; 1980; 1988), some attachment researchers have focused on the associations of insecure and disorganized attachment status to behavioral problems (DeKlyen & Greenberg, 2016), including internalizing (Madigan, Atkinson, Laurin, & Benoit, 2013; Madigan, Brumariu, Villani, Atkinson, & Lyons-Ruth, 2016) and externalizing problems (Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman, 2010; Madigan et al., 2016). Although attention problems (APs) are conceptually involved in some behavioral problems, the potential role of attachment quality in attention problems has infrequently been discussed. This is unfortunate for several reasons: the frequency of the APs, theoretical and empirical observations derived from attachment theory, and the potential relevance of children's interactions with parents for APs.

The American Psychiatric Association (APA, 2013) refers to attention problems as easy distractibility or difficulty in finishing tasks or in concentrating on work. One of the most commonly diagnosed and

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widely studied psychiatric disorder in children is Attention and Hyperactivity Disorder (ADHD). Children with ADHD display activity levels that are far in excess of their age group, and they have difficulty sustaining attention and maintaining persistence to tasks (APA, 2000). The prevalence rate of ADHD is relatively high across different language and cultural groups (5% according to the Diagnostic and Statistical Manual of Mental Disorders [DSM-5], APA, 2013).

APs have been operationalized with multiple measures; the most used is certainly the Child Behavior Checklist (CBCL; Achenbach, 1992). The subscale referring to attention problems typically includes items such as inattentive and easily distracted, can't concentrate, or can't pay attention for long. Among the items referring to attention problems on the CBCL, Carlson (1998), Ogawa, Sroufe, Weinfield, Carlson, and Egeland (1997), Shields and Cicchetti (1998), and Smeekens, Riksen-Walraven, and Van Bakel (2009) created a sub-dimension of the attention problems scale using those items referring specifically to a particular attention problem—subclinical dissociation (such as daydreaming, blank states, or appearance of being in a fog).

The goal of this meta-analysis was to examine the relation of attachment status in childhood and adolescence to attention problems. A recent meta-analysis found a relation between attachment status and children's effortful control (i.e., effortful self-regulation; Pallini et al., 2018). Although the Pallini et al. meta-analysis included both attentional and behavioral indices of dispositional self-regulation, it did not include measures of attention problems. The fact that attachment security has been related to effortful control does not necessarily indicate that attachment is related to more severe symptoms of APs. Dispositional (temperamental) effortful control and APs are interrelated but theoretically distinct constructs (e.g., measures of effortful control generally do not tap dissociation). Effortful control is generally viewed as the top-down, cognitive component of self-regulation; it is viewed as partially or highly overlapping with executive functioning (defined as top-down cognitive functions involved in top-down control of behavior, emotion, and cognition; Nigg, 2017; also see Eisenberg, 2017). It is likely that a low level of effortful control is a necessary but not sufficient risk factor for the development of APs. Indeed, APs also are likely affected by reactive aspects of self-regulation—that is, “bottom-up or relatively automatic responses that suppress behavior or alter regulatory state, such as anxious interruption of behavior in response to novelty, change in arousal level in response to potential reward, or spontaneous estimation of reward value; and spontaneous attentional capture by salient stimuli” (Nigg, 2017, p. 364). Consistent with this perspective, Derryberry and Rothbart (1997) suggested that behavior problems, such as APs, could occur with both under- and over-modulated motivational systems. Thus, the demonstrated relation between effortful control and attachment quality does not guarantee a relation between APs and attachment quality. Indeed, Kissgen and Franke (2016) asserted in a recent review that the link between attachment and ADHD is still not demonstrated: Further studies are necessary to investigate if the problems in attention could be related not only to an impaired relationship with the parent, but to an insecure representation of attachment relationships.

1. The relation of attentive processes to attachment: theoretical justification

In the past, attachment theorists have focused more on the relation of attachment insecurity to emotion regulation/dysregulation than on attentional dysregulation (e.g., the discussions of Cassidy, 1994; Thompson, Lewis, & Calkins, 2008). Attachment figures are believed to be organizers of their children's emotional life (see Brumariu, 2015, for a review) and different types of attachment security/insecurity have been linked to individual differences in emotion regulation (Sroufe, 2005) and to a flexible, enduring capacity for affect-regulation in specific situations (Diamond & Fagundes, 2008). However, emotion and attention regulation are related processes: Optimal modulation of emotional arousal, including related physiological processes, could affect children's ability to regulate their attention and behavior because high emotional arousal is believed to undermine attentional and behavioral self-regulation (see Blair & Ursache, 2011; Diamond & Fagundes, 2008). Conversely, strategies for regulating attention and deploying attention away from negative stimuli are believed to be fundamental processes of affect regulation (see Gross & Thompson, 2007). Consistent with an association between emotion regulation and attentional problems, high levels of negative emotionality have been associated with compromised attention regulation in empirical studies (e.g., Eisenberg, Fabes, & Guthrie, 1997; Nozadi, Spinrad, Johnson, & Eisenberg, 2018), and in a longitudinal study from primary to secondary education, children's negative emotionality predicted low attention focusing (Moed et al., 2017). Moreover, problems in attention regulation relate to impaired self-regulation as evidenced in disorders such as ADHD (see Barkley, 1997).

The role of attachment in attentional problems can be explored by considering three aspects of attachment theory: The regulatory role played by caregivers, the balance between attachment and exploration that characterizes secure attachment relationships, and the regulatory role played by Internal Working Models (IWMs) of attachment relationships. In regard to the first point, the attachment system is a security regulation system that is activated primarily in emotionally evocative situations that pose a threat or elicit distress (Bowlby, 1980; Polan & Hofer, 2016). Secure attachment relationships are viewed as providing a safe, orderly, and relational context in which children gradually learn to master the top-down, self-regulated thought and action (Thompson, 2015; also see Zimmermann & Iwanski, 2015). Nordling, Boldt, O'Bleness, and Kochanska (2016) found evidence that caregivers of securely attached children act as external regulators for children's emotion and behavior, thereby facilitating and encouraging children's emerging capacities for self-regulation (also see Sroufe, 1996).

Second, the balance between attachment and exploration in the secure relationships is believed to influence children's flexibility of attention and concentration (see Main, 2000). Children who are securely attached to a caregiver can readily alter the focus of their attention as circumstances demand and direct attention to either an attachment-related figure (in time of need) or exploration (when the need for proximity is satisfied). As suggested by some authors (Bretherton, 1985; Main, 2000), perhaps this is because their confidence in the availability of a secure base (Bowlby, 1980) allows for such flexible switching of attentional foci. Consistent with this view, Muris, Meesters, Merckelbach, and Hulsenbeck (2000) found that securely attached children reported fewer worries about attachment during exploration than did insecure children.

Finally, the differences in the attachment behaviors of secure, insecure and disorganized children are believed to be reflected in individual differences in the children's Internal Working Models of their attachment relationship(s). IWMs are characterized by both conscious and unconscious rules “for the direction and organization of attention and memory, rules that permit or limit the individual's access to certain forms of knowledge regarding the self, the attachment figure, and the relationship between the self and the attachment figure” (Main, Kaplan, & Cassidy, 1985, p. 77). Empirical findings suggest that IWMs influence perceptual processes by directing the allocation of attention toward or away from certain features of the environment (e.g., looking away versus being unable to look away from threats) or selecting certain features of the environment (e.g., emotional faces) (Peltola, Forssman, Puura, van IJzendoorn, & Leppänen, 2015). For insecurely attached children, certain attentional processes may become relatively rigid and resistant to modulation in situations that activate the attachment system: likely, insecure children's lack of confidence in a secure base results in partial attention devoted to monitoring both their safety and the relationship with a (potentially unreliable) caregiver. In contrast, securely attached children appear to be relatively skilled in the effortful

control of attention to attachment-relevant cues (see Pallini et al., 2018), and this effortful regulation of attention might also help them to modulate reactive (more involuntary) emotional and regulatory processes that could be associated with APs.

Attachment theorists and empirical findings suggest that the APs of insecurely attached children vary somewhat for children with different types of insecure attachments. Main (2000) asserted that both insecure-avoidant children (labeled A) and insecure-resistant children (labeled C) cope with emotional distress in the Strange Situation Procedure (SSP; a commonly used procedure for observing children's attachment behavior) by maintaining rigid attention. Insecurely attached A babies appear to regulate affect by allocating attention to the environment (e.g., play) rather than to the caregiver (Main, 2000; Main et al., 1985), likely because their caregivers reject and discourage children's closeness and expressions of need or vulnerability (see Ainsworth, Blehar, Waters, & Wall, 1978; Cassidy, 1994). However, although they minimize and/or suppress the expression of negative emotions by shifting attention from fear- or distress-eliciting cues to play, children with A attachments do not appear to be very successful in down-regulating distress (Spangler & Grossmann, 1993; Zimmermann & Iwanski, 2015).

In contrast to A children, C children appear to up-regulate the normative strategies of calling, crying, and clinging (Ainsworth, Bell, & Stayton, 1971). This is likely because their caregivers are unreliable, unpredictable, or insufficiently responsive (Ainsworth et al., 1978; Cassidy, 1994), and consequently, C children tend to maintain their attentional focus on the caregiver, at the expense of exploration (Main, 2000). Although these modes of dealing with attention may be adaptive for attracting their caregiver's attention (Cassidy, 1994), over time they may result in the development of maladaptive patterns of attention.

The contributions of Mikulincer and Shaver (2016), and related empirical research on attachment in adulthood, highlight important constructs and mechanisms to consider in regard to the potential role of attachment in children's attention problems. According to Mikulincer and Shaver (2016), specific attentional and behavioral strategies correspond to defensive mechanisms: Resistant individuals use hyperactivated defenses that imply persistence and vigilance to threats and continuous attachment-related worries, whereas avoidant individuals use deactivation defenses that imply the suppression of awareness of need and vulnerability (also see Bowlby, 1980; Cassidy & Kobak, 1988). Dykas and Cassidy (2011) argued that individuals with insecure IWMs defensively exclude attachment-relevant social information if it is painful, a strategy that could possibly be involved in APs.

Several investigators have examined the implications of these defenses for attention processes. For example, using the Emotional Stroop (ES) Task, Warren et al. (2010) found that adults' attachment insecurity was related to a vulnerability to distraction by negative emotional clues. Using the Experiences in Close Relationship inventory (ECR), Edelstein and Gillath (2008) reported that the higher adults' scores on attachment avoidance were, the lower the interference by attachment-related words, suggesting that the inhibition or deactivation of attachment-relevant meanings affected their tendency to focus on attachment-tinged stimuli. Indeed, Gillath, Giesbrecht, and Shaver (2009), when examining the associations between ECR scores and performance on attachment-unrelated attention tasks, found that avoidance predicted better ability to switch attention rapidly and to resist distracters. However, there is evidence that the high attentive control of avoidant individuals is fragile and collapses when cognitive tasks become more complex (Chun, Shaver, Gillath, Mathews, & Jorgensen, 2015; Edelstein & Gillath, 2008). Regarding the resistant pattern, in a selective attention task, anxiously attached adults (corresponding to C children) showed clear interference by the emotional distracters (Silva, Soares, & Esteves, 2012). Attention in the resistant pattern of attachment seems easily impaired by attachment-related worries (Muris et al., 2000).

Similarly, alterations in attentive processes are observable in disorganized/disoriented children (labelled D). The term *disorganized* reflects a failure in the regulating properties of the attachment relationship, and the term *disoriented* implies a failure in the orienting of their attention (Main & Solomon, 1990). Whereas goal-corrected attachment strategies organize securely attached children's attention toward a specific focus (e.g. Bowlby, 1988), the difficulty that disorganized children have in simultaneously pursuing two incompatible goals, i.e., escaping from and seeking proximity to caregiver (see Hesse & Main, 2000), is believed to cause, among the anomalous behaviors observed in children with D attachments, strategical and attentional collapse (Hesse & Main, 2000; Main & Hesse, 1990). In fact, D toddlers appear limp, still, detached, and disoriented in the SSP, with blank and staring eyes (Hesse & Main, 2000; Main & Solomon, 1990). Global disorganization on the Adult Attachment Interview (AAI) appears to be related to attentional difficulties: Interviews from disorganized adults are characterized by lapses in the monitoring of discourse, and inappropriate attention to details and absorption, suggestive of a diminished awareness of the surroundings (Main & Goldwyn, 1998). Thus, attachment theory, including relatively recent updates, suggests that insecure and disorganized patterns of attachment (i.e., A, C, and D) are related to different types of APs. In specific, resistant children's attention is easily disrupted by attachment-related worries and negative emotions; avoidant children's attention is rigid and diverted by attachment concerns; and disorganized children's attention easily collapses and reflects a tendency for low vigilance and high absorption. The latter may show the particular attention problem that is related to subclinical dissociation in infancy (Ogawa et al., 1997), adolescence (Carlson, 1998), and young adulthood when they have had traumatic experiences (Smeekens et al., 2009).

The potential relevance of children's interactions with parents in the development and maintenance of APs is suggested, for example, by effective behavioral training programs that offer parents emotional support and foster their involvement in the treatment (see DuPaul et al., 2018). The quality of attachment relationships could contribute to APs, or the lack thereof, in multiple ways. For example, it is possible that the lower parental sensitivity associated with an insecure attachment has biological consequences that increase the risk for APs (see the meta-analysis of Wolff & van Ijzendoorn, 1997). In a review, Chen and Baram (2016) suggested that unpredictable (e.g., as for resistant attachment), stress-provoking early life experiences can affect children's cognitive and emotional functioning by disrupting the maturation of relevant brain networks (also see Schore, 2002). Consistent with this view, high quality maternal behavior, operationalized in part as sensitive, non-intrusive parenting interactions, predicted brain development in a sample of typically developing infants (Bernier, Calkins, & Bell, 2016).

In a review of the relation of attachment to cognitive functioning, van IJzendoorn, Dijkstra, and Bus (1995) argued that the parental responsivity that promotes secure attachments also affects the development of children's cognitive and linguistic abilities; these presumably would include problems with executive attention. Parents of securely attached children appear to be better at informal teaching and at providing appropriate scaffolding during teaching tasks, including using techniques to direct children's attention (e.g., the research of Dubois-Comtois, Cyr, & Moss, 2011; West, Mathews, & Kerns, 2013). Moreover, as discussed by van IJzendoorn et al. (1995), children's attachments likely affect the quality of their relationships with peers (see meta-analysis of Pallini, Baiocco, Schneider, Madigan, & Atkinson, 2014) and non-parental adults, which could hamper or stimulate children's cognitive skills, including those related to attention.

2. Moderation of the relation between attachment status and APs

Although there is reason to expect attachment status to relate to children's APs (as assessed in commonly used measures of symptoms), a variety of factors could affect the strength of this relation. For example, in a meta-analysis, Madigan et al. (2016) found that the combined effect size for the association between attachment and externalizing

behavior was higher for questionnaire measures of attachment, compared with behavioral measures, whereas there was no difference for representational compared to behavioral measures. Pallini et al. (2018) found a similar result for the relation of secure versus avoidant (B vs A) attachment status. In addition, Pallini et al. (2018) found that continuous indices of attachment were more strongly positively related to effortful control than were categorical indices, and that the relation was stronger when the same person reported on both attachment and effortful control. Moreover, the type of measure of APs could affect the strength of the attachment—APs relation. For example, teachers' ratings of APs could be related to the child's relationship with the teacher (e.g. Berry, 2012) and, consequently, may not be associated to the attachment relationship with the parent. In some analyses, Pallini et al. (2018) found that the attachment—effortful control relation was stronger when the constructs were assessed at older ages and/or the time gap between assessment of the two constructs was smaller. Thus, a variety of features of study design could moderate the relation between attachment status and APs.

Demographic variables could also moderate the attachment—APs relation. Gender differences in attachment research have not been found consistently (see Bakermans-Kranenburg & van IJzendoorn, 2009), whereas boys have typically exhibited more APs than girls (see Arnett, Pennington, Willcutt, DeFries, & Olson, 2015). Nonetheless, gender generally did not moderate the relation of attachment to effortful control in the Pallini et al. (2018) meta-analysis. Socioeconomic status (SES) has been related to APs and disorganized attachment. For example, Russell, Ford, Williams, and Russell (2016) found a direct association between SES disadvantage and risk of ADHD, and van IJzendoorn, Schuengel, and Bakermans-Kranenburg (1999) reported that the percentage of disorganized infants was higher in low SES than in middle-class samples. Thus, it is possible that the relation of attachment status to APs varies as function of demographic factors.

3. The present study: aims and hypotheses

The primary aim of this paper was to examine existing empirical evidence regarding the association between attachment and APs in childhood and adolescence, and to quantify this association using meta-analytic methods. As such, our focus was on APs and attention deficit disorder, rather than broader aspects of attention such as joint attention or temperamental effortful control, which assess dispositional differences in the abilities to focus and/or move attention in an adaptive manner. Such a meta-analysis is timely and could inform emerging prevention and intervention programs for APs that involve parent-training programs (see DuPaul et al., 2018).

We expected children with a secure (B) attachment to be lower in APs than children with avoidant (A), resistant (C), and disorganized (D) attachments. C children's continuous attachment-related worries (Joormann, 2004; Silva et al., 2012) were expected to result in impaired attention, particularly in the presence of attachment-related negative emotions. It was less clear if children with A and C attachments would differ in APs, although the literature reviewed suggests that children with A attachments might have fewer APs than children with C attachments. Finally, disorganized/disoriented children might be expected to be characterized by more APs than children with organized attachments (i.e., A, B, and C attachments; Hesse & Main, 2000).

A secondary aim was to identify moderators of the association between attachment status and APs. Several moderators reflected the type of measure of attachment: behavioral, representational, and self-report measures. Behavioral tasks include, for example, the SSP (Ainsworth et al., 1978) and the attachment Q-sort (AQS, Waters, 1995). Representational measures include both semi-projective techniques (e.g., Attachment Story Completion Task [ASCT], Bretherton, Ridgeway, & Cassidy, 1990; Separation Anxiety Test [SAT], Klagsbrun & Bowlby, 1976) and narrative discourse measures such as the Child Attachment Interview (CAI, Target, Fonagy, & Shmueli-Goetz, 2003). Self-report questionnaires include, among others, the Security Scale (SS, Kerns, Klepac, & Cole, 1996). We tentatively predicted that reports (especially self-reports) of attachment would relate most strongly to attention problems. Moreover, it seemed logical to expect a somewhat stronger relation for continuous measures of attachment because continuous indices typically have greater statistical power than categorical measures.

Measures of APs include parent-report, teacher-report, and other-report measures (no observational measures were found for APs). Teachers' reports of attention difficulties, in comparison to parents' report, reflect frequent observation and evaluation of students' attentive performance in a learning setting compared to at home; in addition, teachers view multiple children so they have a broad base of comparison when making ratings. Thus, teachers' judgements regarding attention problems might be more valid than those of parents. However, as previously noted, teachers' ratings of APs could be related to the child's relationship with the teacher (e.g. Berry, 2012) and not the child's attachment relationship with the parent. Given the two aforementioned considerations, we did not have a clear prediction regarding the strength of the effect size for parent- versus teacher-reported attention problem measures. In regard to self-reported APs, it seemed likely that biases or the inability of youths to judge their own APs would result in a relatively weak relation of self-reported APs to attachment status.

Other features of the study design were also examined as moderators. Due to halo effects or other biases (as well as the findings of Pallini et al., 2018), we predicted that relations between attachment status and APs would be stronger when the source of information was the same versus when different reporters or methods were used to assess attachment status and APs.

Both cross-sectional and longitudinal studies were used to calculate the overall relation between attachment status and APs; thus, measures of the two constructs could be either concurrent or from different assessments across time. Given that both attachment status and attention problems can change over time, we hypothesized that if the two aspects were measured at the same time, the relation would be stronger.

In regard to demographic variables, we could identify no theoretical reason to expect a gender difference in the relation of attachment status to APs. With regard to SES, it is possible that disorganized attachment status (versus organized attachment) is a weaker predictor of APs in low than higher SES environments because the development of APs could be affected by a number of other factors associated with low-SES contexts. Finally, it is general practice to examine the year of publication of data as a moderator in meta-analyses, although we did not expect it to moderate the pattern of results. In contrast, due to the file drawer effect (i.e., the tendency for nonsignificant findings not to be published), we expected the relation between attachment status and APs to be stronger for published studies.

4. Method

4.1. Literature search

We performed this meta-analysis according to the MARS guidelines of APA (2010). Therefore, we provide information regarding each step of the meta-analysis process, starting from the search for papers (e.g., providing keywords) to the methods section in which we specify the coding and the choice of moderators. Furthermore, we delineate the analyses run.

Published and unpublished records were located in four ways in accordance with the PRISMA statement regarding the systematic reporting the collection of the data (see the flow diagram in Fig. 1; Moher, Liberati, Tetzlaff, & Altman, 2009). The search included (1) a comprehensive search of the PsychINFO, Social Sciences Index, Medline, and Google Scholar database; (2) a search of the articles of the authors in this field of research; (3) attempts to contact 40 authors working in

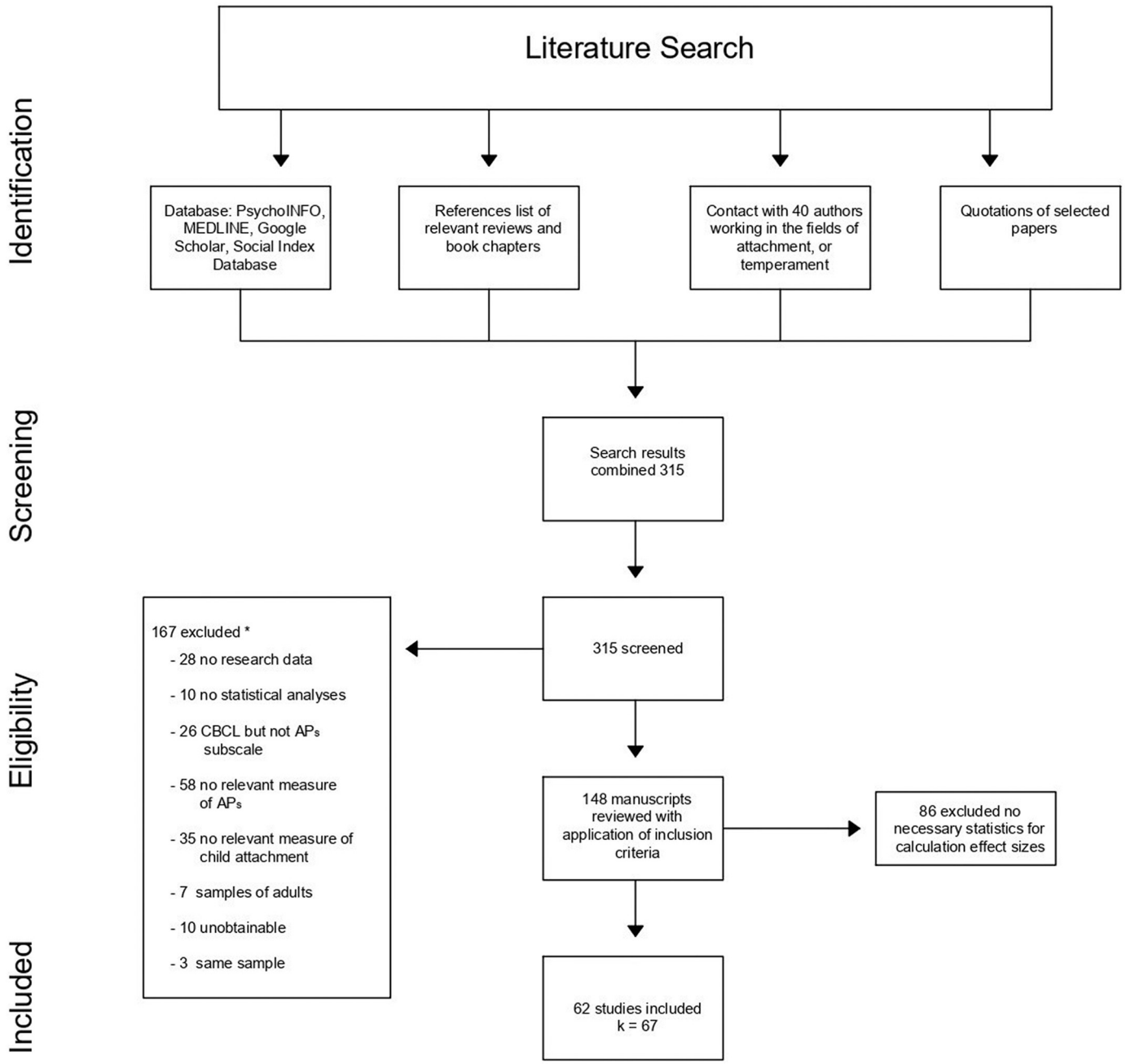

Fig. 1. PRISMA flow used to identify studies for detailed analysis of attachment and attention problems.
* Some documents were excluded for multiple reasons.

the fields of attachment and/or temperament to solicit published and unpublished studies (choices were based on the relevance and number of published studies and authorship in highly relevant books, e.g., *Handbook of Attachment*, Cassidy & Shaver, 1999, 2008, 2016); and (4) an examination of the citations from selected papers.

Searches were conducted using all variations of the following major keywords in the title or the abstract in separate and/or combined searches: *Attachment* in conjunction with *attention problems* or *inattention or Attention Deficit Hyperactivity Disorder, attention difficulties,* and *attention deficits*, as well as searches of the names of the various attention problems measures used in childhood and adolescence (e.g., CBCL). We had no restriction on the year of publication and collected articles from the beginning of database through February, 2019, in English, Italian, Spanish, and French. A total of 315 potentially relevant empirical records, including journal articles, theses, and dissertations, were located and each paper was reviewed to determine its eligibility for inclusion. At the first screening, 167 records were excluded for the following reasons (some documents were excluded for multiple reasons): no research data (28), no statistical analyses (10), the CBCL but no APs subscale (26), no relevant measure of APs (58), no relevant measure of child attachment (35), samples of adults (7), unobtainable (10), or same sample (3).

4.2. Inclusion and exclusion criteria

A record was included if it met the following four criteria. First, the record included a sample of only children and/or adolescents (through age 18). Second, the record included attachment measures that allowed us to formulate a categorical (secure/insecure or A, B, C D) or continuous (e.g., SS, Attachment Q Set) classification of attachment; studies

with measures of maternal sensitivity or other constructs associated with attachment (but not direct measures of attachment) were not included. Third, the studies included data on the association between attachment and APs.

Lastly, inclusion required that the study's statistics could be transformed into an effect size (ES). When researchers did not report sufficient information for an ES (e.g., no means or *SD*s, or the measures of APs were aggregated into externalizing problems), corresponding authors were contacted. Authors were contacted for 87 articles and 30 dissertations; 31 (26.5%) replied with the necessary statistics and the remaining studies (n = 86) were subsequently excluded.

In addition, three studies from the National Institute of Child Health and Development (NICHD) childcare study contained attention problem and attachment measures; however, only one reported sufficient information for an ES. Thus, only one study was included. Two other sets of studies were each considered as dependent samples and data were synthesized and combined together using CMA software (see statistical analysis). One set included two articles that used the same sample from an ongoing longitudinal project investigating the relation of parent-child relationships to developmental adaptation (Dubois-Comtois, Moss, Cyr, & Pascuzzo, 2013; Lecompte, Moss, Cyr, & Pascuzzo, 2014) and the other set included two articles from a longitudinal study on the development of problem behaviors (Salari, Bohlin, Rydell, & Thorell, 2017; Thorell, Rydell, & Bohlin, 2012).

4.3. Moderation analyses

We tested categorical and continuous moderators. Categorical moderators were as follows:

1. **Research design:** cross-sectional or longitudinal.
2. **Attachment method:** (a) behavioral measures, (b) representational measures, or (c) self-report questionnaires.
3. **Attachment categorization**: categorical or continuous.
4. **Attention problems method:** A variable was created to represent the various types of measures of children's APs.
5. **Source of information:** same rater versus different raters/method.
6. **Risk Status**: no risk versus at-risk.
7. **Family SES**: low SES versus middle to upper SES (based on the SES of the majority of the participants' families).
8. **Publication status:** published versus unpublished studies (coded to assess potential publication bias).

Continuous moderators were as follows:

1. **Age for measurement of attachment:** the mean age of the child at the time of the assessment of attachment, expressed in months.
2. **Age for measurement of APs:** the mean age of the child at the time of the assessment of APs, expressed in months.
3. **Time interval:** time between the age of assessment of attachment status and age of assessment of APs.
4. **Percentage of males**.
5. **Year of publication.**

Eight records reported measures of attachment to only fathers. For these cases, we calculated a subset of separate analyses.

4.4. Coding of studies

A standard data coding system was developed to extract the relevant information from each study. The first and the second author coded all the articles. A standard coding form was developed by the authors to rate each study.

4.4.1. Attachment measure

Attachment measure was examined in two ways: (a) a three category variable including questionnaire, representational, or observational measures of attachment; and (b) a category variable to contrast categorical (e.g., in discrete attachment groups) or continuous (i.e., continuous scores for security versus insecurity or organization versus disorganization). Note that the latter moderator could be used in only some comparisons; in the B versus A, B versus C, and A versus C contrasts, attachment was always coded categorically.

4.4.2. APs method

Four categories were used to represent the various informants of APs: (a) parents' reports, (b) teachers' reports (e.g., the ADHD Rating Scale [ADHD-RS, DuPaul, Thomas, & Anastopoulos, 1998]), (c) other reporters such as clinicians, peer reports, or self-reports (e.g., the Youth Self Report [YSR; Achenbach, 1991, for attention problems]), and (d) mixed reporters (the average scores of different reporters, often teachers and parents). Experimental/observation tasks were not found.

4.4.3. Source of information

Same rater of the constructs versus different raters/methods: This categorical index indicated whether the same person rated both attachment status and APs versus measures of the two constructs being derived from different people and/or different methods (e.g., observations for one measure and a rater for the other).

4.4.4. Child gender

Child gender was the percent of males in each sample. When the gender composition of the sample was not precisely reported, we assumed a 50% split.

4.4.5. Child age

Mean age at the time of the assessment of attachment **a**nd at the time of assessment of attention problems (two continuous variables through 18 years) were coded. The majority of studies provided the mean age of study participants. In cases where the age was not directly provided, we estimated age using valid indicators (e.g., range, median age).

4.4.6. Time interval

Time between the age of assessment of attachment status and APs was coded.

4.4.7. SES

All studies provided indices of SES either explicitly through quantitative methods (e.g., statement of low, middle, or upper SES; sample income average) or less directly (e.g., education levels); the former was most frequent. Based on this information, SES was coded categorically in two groups: (a) low SES, or (b) middle to upper SES and mixed SES. When SES was not reported, a default of high /middle class was coded.

4.4.8. Risk status

A two-category variable was created to represent the child's exposure to either zero (no known) or one or more risks. Risk was coded when children had clinical problems, suffered maltreatment/abuse, were adopted, or were children of adolescent parents, addicted parents, and/or parents with a previous stillbirth.

4.4.9. Research design

Design was coded as cross-sectional or longitudinal or combined.

4.4.10. Publication status

Publication was coded as published versus unpublished studies.

4.4.11. Year of publication

A sample of 25% of the documents was independently double-coded to assess reliability. For continuous measures, reliability between two coders ranged from r = 0.99 (attachment age) to 1.00 (year of

publication and number of subjects). For most categorical variables, Cohen's k ranged from $k = 0.81$ (outcome method) to 1.00 (source of information, SES, and publication status). For the variable categorical versus continuous measure of attachment, Cohen's k was unsatisfactory ($k = 0.39$) due to one coder initially not realizing that in a few studies the authors used a continuous code for SSP data (which typically is coded for different attachment groups). Moreover, when this moderator was recoded by the first author and a different coder, reliability was very satisfactory ($k = 0.89$). Disagreements were resolved by joint re-examination of the data and consensus coding.

4.5. Statistical analyses

Several meta-analyses were conducted. First, one main meta-analysis assessed the relation of secure versus insecure attachment to APs. Tests of moderators of this relation were also conducted. In addition, separate meta-analyses (and tests for moderators when possible) were conducted with subsets of studies to examine the relation of APs to each of the following attachment comparisons: (1) avoidant versus secure attachment status (A vs. B); (2) resistant versus secure attachment status (C vs. B); (3) avoidant versus resistant attachment status (A vs. C); and (4) disorganized group versus organized attachment status (D vs. organized). Because there were only eight studies involving fathers as attachment figures, one additional meta-analysis was calculated comparing secure versus insecure attachment in relation to APs for these eight studies.

4.5.1. Computation of ESs

The meta-analyses were performed using the software Comprehensive Meta-Analysis (CMA) Version 2 (Borenstein, Rothstein, & Cohen, 2005). ESs were calculated and were weighted according to the inverse of their variance (see Hedges & Olkin, 1985). When ESs between attachment and APs at different time points were present, they were combined using CMA software and following the approaches suggested by Borenstein, Hedges, Higgins, and Rothstein (2009) and Card (2012).

As for ESs, Pearson's r was computed when continuous attachment scores were correlated with APs scores (e.g., for studies that reported the AQS). When the measure of attachment was categorical, the ES was calculated as the standardized difference (d) between the two pertinent groups (e.g., secure versus insecure, A versus B). In those cases, the statistic d was subsequently transformed into a Pearson's r (Borenstein et al., 2009). A positive ES indicated that the first of the two groups listed was higher in APs, whereas a negative ES indicated that the first group was lower in APs.

We based ES calculations on a random-effects model rather than a fixed-effects model. Fixed effects models rely on the assumption that all studies included in the meta-analysis have a common ES: The differences between ESs of the studies are assumed to be caused by error (Rosenthal, 1995). In contrast, in random-effects models, this assumption is not made (Hedges & Olkin, 1985) and each study is considered to have a separate ES relative to its own population (Rosenthal, 1995). For fixed-effect models, inferences can be made only about the sample of ESs used, whereas for random-effects models, unconditional inferences about the general population can be made. Moreover, a random-effects model is more appropriate when a given ES is significantly heterogeneous. Therefore, we conducted the current meta-analyses using random-effects models because they appear to be more appropriate for psychological studies (Cooper, Hedges, & Valentine, 2009).

4.5.2. Assessing publication bias

Publication bias refers to the tendency to publish studies with large sample sizes and/or studies that report significant findings (which is more likely in larger samples; the so-called “file-drawer” problem). Because of such biases, meta-analyses often tend to overestimate the mean ES (Borenstein et al., 2009; Lipsey & Wilson, 2001).

To examine the generalizability of our results, we estimated the potential influence of publication bias. First, to obtain as many relevant papers as possible, we searched multiple databases and requested unpublished or missing data from primary authors. Multiple sources, including published literature, grey literature (e.g., conference reports and dissertations), and personal sources (Kepes, Banks, McDaniel, & Whetzel, 2012) were checked. In this way, a sizable number of unpublished sources could be examined for inclusion in the meta-analyses.

Secondly, the most common statistical methods were used to check for publication bias (Rothstein, Sutton, & Borenstein, 2005). Publication bias was evaluated using the Duval and Tweedie's (2000) trim-and-fill method. Moreover, the symmetry of the funnel plot was tested via the Egger's linear regression method (Egger, Smith, Schneider, & Minder, 1997). Tests for funnel plot asymmetry and trim-and-fill method were applied only when there were at least 10 studies included in a meta-analysis because the power of these tests is generally too low when there are fewer studies (Higgins & Green, 2008). Finally, publication bias was assessed using the Begg and Mazumdar (1994) adjusted rank correlation method to examine the association between the effect estimates and their sampling variances. Nonsignificance of Egger's method and Begg and Mazumdar rank correlation test support the absence of bias.

4.5.3. Moderation analyses

The Q statistic was computed to test the heterogeneity of ESs and the significance of categorical moderators (Borenstein et al., 2009; Rosenthal, 1995). In addition, the 95% confidence interval (CI) around the point estimate of each set of ESs was computed. We based CIs on the random-effects model estimates. Contrasts for categorical moderators were tested only for subgroups with four or more studies (Borenstein et al., 2009) and when there were at least ten studies available for the meta-analysis (Higgins & Green, 2008).

The impact of continuous moderators on ESs was assessed using meta-regression (Method of Moments Model; Borenstein et al., 2009). Meta-regression is a regression-based technique that is commonly applied to investigate the relation between a continuous moderator and the ES of studies. Continuous moderators were examined when there were at least ten eligible studies (Higgins & Green, 2008).

5. Results

Based on the aforementioned inclusion criteria, 62 records were used in the analyses. Among them, the samples of Barone et al. (2016), Hornstra, Bosmans, van den Hoofdakker, De Meyer, and Van der Oord (2019), Niederhofer (2009), Pace, Di Folco, and Guerriero (2018), and Sempio, Fabio, Tiezzi, and Cedro (2016) were each split into two independent subsamples. The study of Audet (2003) included three independent subsamples. As noted above, in two additional instances, two separate papers included data from the same sample and the results were combined. Thus, the final data set included 67 independent samples including 57 published peer-reviewed articles, 2 dissertations/theses, and 3 unpublished data sets sent by authors. Documents contributing to the meta-analysis are listed in an online supplement. Study characteristics are presented in Table 1.

We computed the following comparisons: (a) the securely attached (B) group versus all other groups (insecurely attached groups); (b) the A versus B attachment group; (c) the C versus B attachment group; (d) the A versus C attachment group; and (e) the D versus all other attachment groups (organized attached groups).

5.1. The relation of secure versus insecure attachment status to attention problems

The first set of meta-analysis concerned the association of secure versus insecure attachment status with APs. When the attachment classification was categorical, we included participants designed as

Table 1
Reviewed studies, sample characteristics, and methods of assessment.

		Child's characteristics			Attachment measure			APs measure		Family						
Study	N	Age Att	Age EC	% male	Method	Measure	Categ	Method	Measure	Inf	SES	Risk	Type of risk	Time attachment APs	Res. Design	Pub
AttentionProblems																
Abrines et al. (2012)	58	89.8	89.8	34.5	R	FFI	Cat.	P	BASC	DC	O	Y	Adopted	0	C	Pub
Al Yagon (2009)	118	121.0	121.0	69.5	S	SS	Cont.	P	CBCL	DC	O	Y	ADHD (50%)	0	C	Pub
Al Yagon et al. (2017)	100	186.0	186.0	49.0	S	SS	Cont.	S	CASS	SC	O	Y	ADHD (50%)	0	C	Pub
Audet (2003)_sample 1 (Canadian born)	33	54.0	126.0	47.2	B	PAAS	Cat.	P	CBCL	DC	O	Y	Adopted	72	L	Un
Audet (2003)_sample 1 (Canadian born)	33	54.0	126.0	47.2	B	PAAS	Cat.	T	CBCL-TRF	DC	O	Y	Adopted	72	L	Un
Audet (2003)_sample 2 (early-adopted)	31	54.0	126.0	47.2	B	PAAS	Cat.	P	CBCL	DC	O	Y	Adopted	72	L	Un
Audet (2003)_sample 2 (early-adopted)	31	54.0	126.0	47.2	B	PAAS	Cat.	T	CBCL-TRF	DC	O	Y	Adopted	72	L	Un
Audet (2003)_sample 3 (Romanian orphanage)	31	54.0	126,.0	47.2	B	PAAS	Cat.	P	CBCL	DC	O	Y	Adopted	72	L	Un
Audet (2003)_sample 3 (Romanian orphanage)	31	54.0	126.0	47.2	B	PAAS	Cat.	T	CBCL-TRF	DC	O	Y	Adopted	72	L	Un
Baiocco & Carone	37	99.3	99.3	51.4	S	SS	Cont	P	SDQ	DC	O	N	No risk	0	C	Un*
Balenzano et al. (2018)	33	174.0	174.0	50.8	R	AAI	Cat.	S	YSR	DC	O	Y	Foster	0	C	Pub*
Barnett et al. (1991)	65	12.0	60.0	nr	B	SSP	Cat.	T	CBCL-TRF	DC	O	N	No risk	48	L	Pub
Barone et al. (2016)_sample 1	64	117.6	117.6	46.5	S	SS	Cont	P	CBCL	DC	O	Y	Children's headache	0	C	Pub*
Barone et al. (2016)_sample 2	64	110.0	110.0	54.9	S	SS	Cont	P	CBCL	DC	O	N	No risk	0	C	Pub*
Beaudoin et al. (2013)	116	57.6	57.6	11.2	R	ASCT	Cat.	P	CBCL	DC	L	Y	Sexual abuse	0	C	Pub*
Bohlin et al. (2012)	65	65.0	90.0	83.1	R	ASCT	Cont	M	ADHDRS	DC	O	Y	ADHD (mixed)	25	L	Pub
Borelli et al. (2010)	97	121.0	121.0	56.7	R	CAI	Cat.	P	CBCL	DC	O	N	No risk	0	C	Pub*
Bosmans et al. (2007)	40	128.0	128.0	50.0	S	RQC	Cat.	P	CBCL	DC	O	N	No risk	0	C	Pub
Brown & Wright (2003)	30	204.0	204.0	31.3	R	SAT	Cat.	S	YSR	DC	O	Y	Mixed (clinical)	0	C	Pub
Clarke et al. (2002)	30	102.0	102.0	100.0	R	SAT	Cont.	P	CPRS-R Conners	DC	O	Y	ADHD (50%)	0	C	Pub
Dawson et al. (2014)	175	168.0	168.0	45.7	R	AAI	Cat.	Peer	CBCL	DC	O	N	No risk	0	C	Pub*
Dawson et al. (2014)	175	168.0	168.0	45.7	R	AAI	Cat.	T	CBCL	DC	O	N	No risk	0	C	Pub*
Dubois-Comtois et al. (2013)	243	72.0	102.0	49.8	B	PAAS	Cat.	S	DQ	DC	O	N	No risk	30	L	Pub
Forsulund et al. (2016)	184	82.0	82.0	49.0	R	SAT	Cat.	P	ADHDRS	DC	O	N	No risk	0	C	Pub
Franke et al. (2017)	74	88.0	88.0	52.7	R	ASCT	Cat.	M	ADHD-DSM	DC	O	Y	ADHD mixed	0	C	Pub
Gentzler et al. (2014)	55	143.0	143.0	55.3	S	SS	Cat.	P	CBCL	DC	O	N	No risk	0	C	Pub*
Goldwyn et al. (2000)	31	75.0	75.0	47,.2	R	MCAST	Cont	T	CBCL	DC	O	N	No risk	0	C	Pub
Greenberg et al. (2001)	160	57.2	57.2	100.0	B	PAAS	Cat.	P	CBCL	DC	O	Y	clinical_mixed	0	C	Pub*
Guarino et al. (2012)	21	172.0	172.0	100.,0	R	CAI	Cat.	P	CPRS-R	DC	O	Y	ADHD	0	C	Pub
Guttmann-Steinmetz et al. (2011)	50	106.8	106.8	72.0	R	ASA	Cat.	P	CBCL	DC	O	Y	ADHD	0	C	Pub
Hornstra et al. (2019) _sample 1	45	129.24	129.24	62.0	S	ECR	Cont	P	DBDRS	DC	O	Y	ADHD	0	C	Pub
Hornstra et al. (2019) _sample 2	57	120.6	120.6	47.0	S	ECR	Cont	P	DBDRS	DC	O	N	No risk	0	C	Pub
Huber et al. (2015)	48	49.2	49.2	58.0	B	PAAS	Cont	P	CBCL	DC	O	Y	Behavioral problems	0	C	Pub*
Huber et al. (2015)	48	49.2	49.2	58.0	B	PAAS	Cont	T	CBCL	DC	O	Y	Behavioral problems	0	C	Pub*
Jacobsen et al. (1994)	85	91.0	108.0	51.4	R	SAT	Cat.	T	Comp	DC	O	N	No risk	17	L	Pub
Katsurada et al. (2017)	29	76.8	76.8	41.4	R	ASCT	Cat.	T	CBCL	DC	L	Y	Institutionalized	0	C	Pub*
Keller et al. (2005)	167	12.0	54.0	55.1	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	42	L	Pub*
Keller et al. (2005)	160	12.0	72.0	56.3	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	60	L	Pub*
Keller et al. (2005)	165	12.0	84.0	55.2	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	72	L	Pub*
Keller et al. (2005)	161	12.0	126.0	54.7	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	114	L	Pub*
Keller et al. (2005)	164	12.0	138.0	53.7	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	126	L	Pub*
Keller et al. (2005)	163	12.0	150.0	54.0	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	138	L	Pub*
Keller et al. (2005)	160	12.0	162.0	53.8	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	150	L	Pub*
Kokkinos (2007)	433	132.0	132.0	49.3	S	AQ-C	Cat.	S	YSR	SC	O	N	No risk	0	C	Pub
Lavigne et al. (2011)	679	53.2	53.2	49.8	B	AQS	Cont	P	DISC	DC	O	N	No risk (7% pregnancy smoking i)	0	C	Pub*
Lecompte et al. (2014)	136	61.2	160.8	46.3	B	PAAS	Cat.	S	YSR	DC	O	N	No risk	99	L	Pub*
Lee & Han (2018)	90	60.0	60.0	42	R	ASCT	Cat.	P	CBCL	DC	O	N	No risk	0	C	Pub

(*continued on next page*)

Table 1 (*continued*)

		Child's characteristics			Attachment measure			APs measure		Family						
Study	N	Age Att	Age EC	% male	Method	Measure	Categ	Method	Measure	Inf	SES	Risk	Type of risk	Time attachment APs	Res. Design	Pub
Lonigro	367	118.2	118.2	51.0	S	SS	Cont	T	SDQ	DC	O	N	No risk	0	C	Un*
Min et al. (2014)	189	144.0	144.0	87.0	S	ALEXSA	Cont	S	YSR	SC	L	Y	50% prenatal exposition cocaine	0,0	L	Pub*
Min et al. (2014)	182	144.0	180.0	87,0	S	ALEXSA	Cont	S	YSR	SC	L	Y	50% prenatal exposition cocaine	36	L	Pub*
Nakash-EisiKovits et al. (2002)	225	192.0	192.,0	47.1	S	RQ	Cat.	Clinician	CBCL	SC	O	Y	Clinic sample	0	C	Pub
Nelson et al. (2014)	84	23.0	102.8	48.7	B	SSP	Cat.	T	HBQ	DC	L	Y	Foster	79	L	Pub*
Niederhofer (2009)_sample 1	22	111.6	111.6	68.2	B	PCRI	Cat.	M	Hypescheme	DC	O	Y	ADHD clinic	0,	C	Pub
Niederhofer (2009)_sample 2	79	111.6	111.6	91,.1	B	PCRI	Cat.	M	Hypescheme	DC	O	Y	ADHD clinic	0	C	Pub
Nunes et al. (2013)	179	126.0	126.0	51.8	S	SS	Cont	P	CBCL	DC	O	N	No risk	0	C	Pub*
Pace et al. (2018)_sample 1	46	166.68	166.9	50	R	FFI	Cat.	P	CBCL	DC	O	Y	Foster	0	C	Pub*
Pace et al. (2018)_sample 2	24	166.56	166.6	58.8	R	FFI	Cat.	P	CBCL	DC	O	N	No risk	0	C	Pub*
Pinto et al. (2006)	100	12.0	84.0	52.8	B	SSP	Cat.	P	ADHDRS-I	DC	O	Y	Stillbirth mothers	72	L	Pub
Pinto et al. (2006)	100	12.0	84.0	52.8	B	SSP	Cat.	T	ADHDRS-I	DC	O	Y	Stillbirth mothers	72	L	Pub
Qu & Leerkes (2018)	170	12.0	54.0	nr	B	SSP	Cat.	P	CBCL	DC	O	N	No risk	42	L	Pub*
Rochford (2005)	98	31.0	31.0	51.2	B	AQS	Cat.	P	ADHDRS-I	SC	O	Y	Extern. problems	0	C	Un
Rochford (2005)	98	56.0	31.0	51.2	B	AQS	Cat.	P	ADHDRS-I	SC	O	Y	Extern. problems	25	L	Un
Rochford (2005)	98	31.0	56.0	51.2	B	AQS	Cat.	T	ADHDRS-I	DC	O	Y	Extern. problems	0	C	Un
Rochford (2005)	98	56.0	56.0	51.2	B	AQS	Cat.	P	ADHDRS-I	SC	O	Y	Extern. problems	0	C	Un
Rochford (2005)	98	56.0	56.0	51.2	B	AQS	Cat.	P	BASC	SC	O	Y	External. problems	0	C	Un
Rochford (2005)	98	56.0	56.0	51.2	B	AQS	Cat.	T	BASC	DC	O	Y	External. problems	0	C	Un
Rochford (2005)	98	90.0	31.0	51,.2	R	SAT	Cat.	P	ADHDRS-I	DC	O	Y	Externali. problems	59	L	Un
Rochford (2005)	98	90.0	56.0	51.2	R	SAT	Cat.	P	ADHDRS-I	DC	O	Y	External. problems	34	L	Un
Rochford (2005)	98	90.0	90.0	51.2	R	SAT	Cat.	P	ADHDRS-I	DC	O	Y	External. problems	0	C	Un
Rochford (2005)	98	90.0	56.0	51.2	R	SAT	Cat.	P	BASC	DC	O	Y	External. problems	34	L	Un
Rochford (2005)	98	90.0	90,.0	51.2	R	SAT	Cat.	P	BASC	DC	O	Y	External. problems	0	C	Un
Rochford (2005)	98	90.0	56.0	51.2	R	SAT	Cat.	T	ADHDRS-I	DC	O	Y	External. problems	34	L	Un
Rochford (2005)	98	90.0	90.0	51.2	R	SAT	Cat.	T	ADHDRS-I	DC	O	Y	External. problems	0	C	Un
Rochford (2005)	98	90.0	56.0	51,.2	R	SAT	Cat.	T	BASC	DC	O	Y	External. problems	34	L	Un
Rochford (2005)	98	90.0	90.0	51,.2	R	SAT	Cat.	T	BASC	DC	O	Y	External. problems	0	C	Un
Salari et al. (2017)	105	96.0	96.0	50.0	R	ASCT	Cat.	P	ADHDRS-I	DC	O	Y	ADHD	0	C	Pub
Salari et al. (2017)	105	96.0	216.0	50.0	R	ASCT	Cat.	P	ADHDRS-I	DC	O	Y	ADHD	120	L	Pub
Scharf et al. (2014)	508	164.4	164,.4	48.2	S	ECR	Cat.	S	CASS Conners	SC	O	N	No risk	0	C	Pub
Scholtens et al. (2014)	89	99.0	99.0	73.0	R	ASCT	Cat.	M	ADHDRS	DC	O	Y	ADHD	0	C	Pub
Schwebel et al. (2002)	155	57.0	57.0	100.0	B	PAAS	Cat.	P	DISC	DC	O	Y	Clinic referred	0	C	Pub*
Sempio et al. (2016)_sample 1	24	54.1	54.1	75.0	R	SAT	Cont	T	ADHDRS-I	DC	O	Y	ADHD (50%)	0	C	Pub
Sempio et al. (2016)_sample 2	24	84.2	84.2	70.8	R	SAT	Cont	T	ADHDRS-I	DC	O	Y	ADHD (50%)	0	C	Pub
Smeekens et al. (2007)	111	15.0	60.0	53.4	B	SSP	Cat.	T	CBCL-TRF	DC	O	N	No risk	48	L	Pub*
Smeekens et al. (2007)	115	15.0	60.0	53.4	B	SSP	Cat.	S	CBCL	DC	O	N	No risk	48	L	Pub*
Stefan & Avram (2017)	212	56.3	56.3	48.0	R	ASCT	Cont	T	CBCL-TRF	DC	O	N	No risk	0	C	Pub*
Stefan & Avram (2017)	212	56.3	56.3	48.0	R	ASCT	Cont	P	CBCL	DC	O	N	No risk	0	C	Pub*
Tharner et al. (2012)	559	14.0	36.0	50.0	B	SSP	Cat.	P	CBCL	DC	O	N	No risk	22	L	Pub
Thorell et al. (2012)	100	102.0	114.0	45.0	R	ASCT	Cont	T	ADHDRS-I	DC	O	Y	Hyperactivity	12	L	Pub*
Torres et al. (2012)	90	73.4	73.4	48.0	R	ASCT	Cont	P	CBCL	DC	O	Y	50% institutionalized	0	C	Pub*
Toussaint et al. (2018)	40	81.0	81.0	70.0	R	ASCT	Cont	T	CBCL	DC	L	Y	Institutionalized	0	C	Pub*
Vando et al. (2008)	102	12.0	54.0	46.1	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	42	L	Pub*
Vando et al. (2008)	95	12.0	72.0	47.4	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	60	L	Pub*
Vando et al. (2008)	99	12.0	84,0	46.5	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	72	L	Pub*
Vando et al. (2008)	102	12.0	96.0	47.1	B	SSP	Cat.	P	CBCL	DC	L	Y	Adolescents mothers	84	L	Pub*
Vecchio et al.	488	189.8	189.8	50.6	S	RQ	Cat.	S	YSR	SC	O	N	No risk	0	C	Un*
Venta et al. (2014)	194	192.0	192.0	40.7	R	CAI	Cat.	S	YSR	DC	O	Y	Psychiatric disorders	0	C	Pub
Venta et al. (2014)	194	192.0	192.0	40.7	R	CAI	Cat.	P	CBCL	DC	O	Y	Psychiatric disorders	0	C	Pub
Volling et al. (2014)	216	31.1	47.1	45.6	B	AQS	Cont	P	CBCL	SC	O	N	No risk	16	L	Pub*
Wan et al. (2007)	15	72.0	72.0	50.0	R	MCAST	Cat.	P	SDQ	DC	O	Y	Psychiatric mother 50%	0	C	Pub

(*continued on next page*)

Table 1 (*continued*)

Study	Child's characteristics				Attachment measure			APs measure		Family				Time attachment APs	Res. Design	Pub
	N	Age Att	Age EC	% male	Method	Measure	Categ	Method	Measure	Inf	SES	Risk	Type of risk			
Wan et al. (2007)	15	72.0	72.0	50.0	R	MCAST	Cat.	T	SDQ	DC	O	Y	Psychiatric mother 50%	0	C	Pub
Waters et al. (2015)	50	124.8	124.8	46.0	R	ASA	Cont	P	CBCL	DC	O	N	No risk	0	C	Pub*
Webster et al. (2009)	38	172.0	172.0	28,.9	R	AAP	Cat.	P	BASC	DC	L	Y	Maltreatment	0	C	Pub*
Zephir et al. (2015)	96	58,.0	58.0	12.5	B	AQS	Cont	P	CBCL	SC	L	Y	Abuse	0	C	Pub*
Willoughby et al. (2014)	1081	36.0	36.0	53.0	B	PAAS	Cat.	P	CBCL	DC	O	N	No risk	0	C	Pub

Note. For characteristics of children. Age att = age at attachment assessment; Age APs = age at APs assessment. For Attachment method. B = behavioral; R = representational; S = self-report questionnaire. For Attachment categorization (Categ), Cat. = categorical; Cont. = continuous. For Attachment measures. AAI = Adult Attachment Interview; AAP = Adult Attachment Projective Pictures System; ALEXSA = Assessment of Liability and Exposure to Substance use and Antisocial behavior; AQ-C= Attachment Questionnaire for Children; AQS = Attachment Q-Sort; ASA = Attachment Script Assessment; ASCT = Attachment Story Completion Task; CAI = Child Attachment Interview; ECR = Experiences in Close Relationships; FFI = Friends and Family Interview; MCAST = Manchester Child Attachment Story Task; PAAS = Preschool Assessment of Attachment System; PCRI= Parent Child Reunion Inventory; RQ = Relationship Questionnaire; RQC = Relationship Questionnaire for Children; SAT = Separation Anxiety Test; SS = Security Scale; SSP = Strange Situation Procedure.

For APs Method. P = Parent; T = Teacher; S = Self-report; M = Mixed-Other. For APs measures. ADHD-DSM = ADHD-DSM scale; ADHDQ = ADHD Questionnaire; BASC = Behavioral Assessment System for Children Checklist; ADHDRS = ADHD Rating Scale; ADHDRS-I = ADHD Rating Scale (Inattention subscale); Comp = Composite Measure; CASS = Conners-Wells Adolescent Self-Report Scale; CBCL = Child Behavior Checklist; CBCL-TRF = Child Behavior Checklist (CBCL), Teacher Report Form (TRF); Comp = Composite Measure (Kohn Competence Scale; Schaefer Classroom Inventory; Quay and Peterson Behavior problem Checklist); CPRS-R = Conners' Parents Rating Scale; DBDRS = Disruptive Behavior Disorder Rating Scale; DQ = Dominique Questionnaire; DISC = Diagnostic Interview Schedule for Children – Parent Scale; DISC = Diagnostic Interview Schedule for Children – Parent Scale; HBQ = Health and Behavior Questionnaire; Hypescheme = Hypescheme; SDQ = Strengths and Difficulties Questionnaire; YSR = Youth Self-report.

For Source of information (Info). DC = Different Coders; SC = Same Coder. For Research design. C = Cross-sectional; L = Longitudinal. For risk status, Y = Yes; N = Not. For socioeconomic status. L = Low; O = Other.

For publication status. P = Published; Un = Not published; * = Additional data retrieved from the authors.

having avoidant, resistant, or disorganized (if coded) attachments in the insecure category. For this comparison, we had 60 independent samples, including 7,664 participants, from which a set of 96 ESs could be calculated. A significant combined effect size was found, $r = -0.21$, $p < .001$ (see Table 2 for details). Children designated as secure were lower in APs than children designated as insecurely attached.

In regard to publication bias, the Duvall and Tweedie's trim-and-fill method showed that 11 studies had to be trimmed and filled. However, the resulting significant combined effect size without these studies was $r = -0.16$, 95% CI: $[-0.21, -0.12]$, which was not statistically different from the one obtained including those studies. The Begg and Mazumdar rank correlation, $tau = 0.13$, $p = .15$, also was not significant, supporting the lack of publication bias. However, the Egger's test using linear regression method was significant, intercept = 0.98, $SE = 0.47$, $p = .04$, indicating that the funnel plot was not perfectly symmetrical and that there were fewer studies than expected with low or nonsignificant ESs. This pattern of findings suggests that the overall ES might be partly due to publication bias but probably is still significant when this bias is taken into account.

The set of studies for the relation of secure versus insecure attachment to APs exhibited significant heterogeneity, $Q(59) = 165.04$, $p < .001$, $I^2 = 64.25$. Thus, we examined potential moderators that might account for between-study variability in ESs. For moderators coded as categorical variables, the tests assessed how the ES varied as a function of the level of the moderator (see Table 3 for detailed statistics regarding all categorical moderators; sometimes only some levels of a potential moderator could be tested). Research design was a significant moderator: Studies with cross-sectional designs had higher ESs, $r = -0.23$, $p < .01$, compared to those studies with a longitudinal design, $r = -0.14$, $p < .01$, although both ESs were significant. Risk status, SES, and publication status were not significant moderators. Only subsets of groups for attachment method, attachment categorization, and source of information could be tested and the contrasts were not significant (see Table 3).

Moderation by continuous moderators was tested with the meta-regression procedure (Table 4). Time interval was a significant moderator, $b = -0.002$, $p = .049$: The ES was stronger when the time difference between the assessment of attachment and APs was less, that is, when attachment and APs were assessed closer in time. Age at the assessment of attachment or APs, gender, and year of publication were not significant moderators.

5.2. The relation of avoidant (A) versus secure (B) attachment status to APs

The relation of avoidant versus secure (A versus B) attachment groups to APs was tested using 35 ESs calculated from 24 independent samples, including 3,148 participants. A significant combined effect size was found, $r = 0.10$, $p = .005$ (see Table 2 for detailed statistics): Avoidant children were higher in APs than were secure children.

In the evaluation of publication bias, neither the Egger test, intercept = -0.43, $SE = 0.81$, $p = .60$, nor the Begg and Mazumdar rank correlation, $tau = -0.004$, $p = .98$, was significant. Moreover, the Duvall and Tweedie's trim-and-fill method showed that no studies had to be trimmed and filled. Publication bias did not appear to be a problem for this comparison.

Because there was significant heterogeneity in this sub-set of studies, $Q(23) = 71.56$, $p < .001$, $I^2 = 67.86$, we tested for moderators that might account for between-study variability in ESs (Table 5). Method of attachment, source of information, risk status, research design, and SES were not significant moderators (Table 5). For APs method, only parents' reports and other reporters could be compared, and the contrast was not significant. Publication status could not be examined because all studies except one were published. All except two studies used categorical measures of attachment, so moderation could not be tested.

In regard to continuous moderators, ESs were lower in those studies

Table 2
Relations of different attachment status comparisons to attention problems (APs).

Comparisons	K	N	*ES*	95% CI	*z*	*p*
Secure vs. insecure (B vs. A + C + D)	60	7664	−0.21	[−0.25; −0.17]	9.80	< .001
Avoidant vs. secure (A vs. B)	24	3148	0.10	[0.03; 0.17]	2.84	.005
Resistant vs. secure (C vs. B)	15	2580	0.21	[0.11; 0.30]	3.95	< .001
Resistant vs. avoidant vs. (C vs. A)	10	619	0.10	[−0.01; 0.22]	1.72	.09
Disorganized vs. organized (D vs. A + B + C)	22	3722	0.27	[0.20; 0.34]	7.08	< .001

Note. k = number of studies; N = total number of participants; ES = Effect size; CI = 95% Confidence Interval.

more recently published, $b = -0.001$, $p = .03$ (Table 6). Age at the assessment of attachment, age at the assessment of APs, time interval, and gender were not significant moderators.

5.3. The relation of resistant (C) versus secure (B) attachment status to APs

The hypothesis that resistant (C) children would have more APs than securely attached (B) children was tested using 23 ESs calculated from 15 independent samples including 2,580 participants. The combined ES was $r = 0.21$, $p < .001$ (see Table 2), supporting the prediction.

The Egger test was not significant, intercept = −0.65, $SE = 1.40$, $p = .64$, nor was the Begg and Mazumdar rank correlation, $tau = -0.08$, $p = .69$. Moreover, the Duvall and Tweedie's trim-and-fill method showed that no studies had to be trimmed and filled. Therefore, publication bias did not appear to be a problem for this comparison.

The set of studies for resistant versus secure attachment and APs exhibited significant heterogeneity, $Q(14) = 79.33$, $p < .001$, $I^2 = 82.35$. Only risk status was a significant moderator (Table 7). In studies with no at-risk children, the ES was higher, $r = 0.27$, $p < .001$, than in studies with at-risk children, $r = 0.04$, $p = .42$. Method of assessing attachment, source of information, and research design were not significant moderators (Table 7); subgroups for APs method with at least 4 studies did not differ significantly; and SES and publication status could not be examined as moderators due to lack of a sufficient number of studies with low SES or unpublished papers.

Only gender was a significant continuous moderator, $b = -0.001$, $p = .03$. ESs were lower as percentage of males increased (Table 8). Age at assessment of attachment, age at assessment of APs, time interval, and year of publication were not significant moderators.

5.4. The relation of resistant (C) versus avoidant (A) attachment status to APs

In exploratory analyses, we examined if resistant (C) children exhibited more APs than avoidant (A) children with a set of 18 ESs calculated from 10 independent samples including 619 participants. The combined ES was nonsignificant, $r = 0.10$, $p = .09$ (Table 2). The Egger test was not significant, intercept = 1.00, $SE = 1.01$, $p = .35$; nor was the Begg and Mazumdar rank correlation, tau = 0.24, $p = .32$. Moreover, the Duvall and Tweedie's trim-and-fill method showed that only one study had to be trimmed and filled but the resulting ES, $r = 0.09$, was not significantly different so publication bias did not appear to be a problem.

This set of studies did not show significant amount of heterogeneity, $Q(9) = 15.90$, $p = .07$, $I^2 = 43.40$. That means that the studies were sufficiently homogeneous among each other and that the average ES was unlikely to be affected by moderators. We checked anyway for possible moderating effects but there were indeed no significant moderators.

Table 3
Analyses of categorical moderators for the relation of secure (B) attachment status versus all other groups (A, C, and D) to attention problems (APs).

Categorical moderators	K	*r*	95% CI	Q	*p*
Attachment method[a]				= =	= =
Combined	1	−0.31**	[−0.48; −0.12]		
Observational	19	−0.21**	[-.29; -.12]		
Representational	27	−0.21**	[−0.27; −0.15]		
Self-report	13	−0.21**	[−0.25; −0.17]		
Attachment categorization[b]				= =	= =
Combined	1	−0.20*	[−0.38; −0.02]		
Categorical	39	−0.20**	[−0.26; −0.14]		
Continuous	20	−0.21**	[−0.25; −0.17]		
APs method				5.15	.16
Mixed reporters	16	−0.26**	[−0.37; −0.14]		
Other reporters	8	−0.17**	[−0.24; −0.10]		
Parents' reports	28	−0.18**	[−0.23; −0.13]		
Teachers' reports	8	−0.26**	[−0.33; −0.19]		
Source of information[c]				= =	= =
Combined	1	−0.31**	[−0.48; −0.12]		
Different coders	52	−0.20**	[−0.25; −0.15]		
Same coder	7	−0.23**	[−0.29; −0.17]		
Risk status				3.45	.06
No	23	−0.17**	[−0.22; −0.11]		
Yes	37	−0.24**	[−0.30; −0.18]		
Research design[d]				= =	= =
Combined	2	−0.26**	[−0.38; −0.12]		
Cross-sectional	43	−0.23**	[−0.28; −0.18]		
Longitudinal	15	−0.14**	[−0.21; −0.07]		
Socioeconomic status				0.17	.68
Low	9	−0.19**	[−0.29; −0.08]		
Other	51	−0.21**	[−0.25; −0.17]		
Publication				1.61	.20
Published	53	−0.21**	[−0.25; −0.16]		
Not published	7	−0.25**	[−0.31; −0.20]		

Note. k = number of independent samples; CI = 95% confidence interval; Q = heterogeneity across studies.
Contrasts were tested only for subgroups with four or more studies.
[a] Contrasting observational vs. representational vs. self-report categories did not yield a significant result, $Q(2) = 0.02$, $p = .99$.
[b] Contrasting categorical vs. continuous attachment categorizations did not yield a significant result, $Q(1) = 0.05$, $p = .82$.
[c] Contrasting different vs. same coders did not yield a significant result, $Q(1) = 0.47$, $p = .49$.
[d] Contrasting cross-sectional vs. longitudinal research design yielded a significant result, $Q(1) = 4.27$, $p = .04$.
* $p < .05$.
** $p < .01$.

Table 4
Meta-regressions of continuous moderators for the relation of secure (B) versus all other groups (A, C, and D) to attention problems (APs).

Continuous moderators	Slope	*SE*	*z*	*p*
Age at attachment	0.0001	0.0004	0.37	.71
Age at APs	−0.0002	0.0005	−0.40	.69
Time between attachment and APs assessment	−0.002	0.001	−1.961	.05
Gender (% males)[a]	−0.0006	0.005	−1.31	.19
Year of publication	−0.004	0.003	−1.27	.20

[a] The study by Barnett et al. (1991) and by Qu & Leerkes (2018) were not included because the percentage of males was not reported in the paper.

5.5. The relation of disorganized (D) versus organized (A, B, and C) attachment status groups to APs

Consistent with the hypothesis that disorganized children (D) would exhibit higher APs than organized children (A, B and C), in an analysis of 35 ESs from 22 independent samples including 3,722 participants, a significant combined ES of $r = 0.27$, $p < .001$, was found (see Table 2). The Duvall and Tweedie's trim-and-fill method showed that nine studies

Table 5
Analyses of categorical moderators for the relation of avoidant (A) versus secure (B) attachment groups to attention problems (APs).

Categorical moderators	K	*r*	95% CI	Q	*p*
Attachment method				4.75	.09
Observational	6	0.02	[−0.07; 0.11]		
Representational	12	0.14	[−0.01; 0.29]		
Self-report	6	0.15**	[0.07; 0.23]		
Attachment categorization				= =	= =
Categorical	21	0.13**	[0.06; 0.20]		
Continuous	2	−0.05	[−0.24; 0.15]		
APs Method[a]				= =	= =
Mixed reporters	1	0.04	[−0.11; 0.19]		
Other reporters	8	0.15**	[0.06; 0.23]		
Parents' reports	12	0.05	[−0.06; 0.16]		
Teachers' reports	3	0.28*	[0.01; 0.51]		
Source of information				3.19	.07
Different coders	20	0.08	[−0.01; 0.16]		
Same coder	4	0.18**	[0.11; 0.25]		
Risk status				.19	.66
No	12	0.09	[−0.04; 0.18]		
Yes	12	0.12*	[0.01; 0.23]		
Research design				.16	.69
Cross-sectional	17	0.11**	[0.03; 0.19]		
Longitudinal	7	0.08	[−0.05; 0.21]		
Socioeconomic status				0.00	.99
Low	5	0.10	[−0.003; 0.20]		
Other	19	0.10*	[0.02; 0.18]		
Publication				= =	= =
Published	23	0.09*	[0.02; 0.16]		
Not published	1	0.25**	[0.16; 0.33]		

Note. k = number of independent samples; CI = 95% confidence interval; Q = heterogeneity. Contrasts were tested only for subgroups with four or more studies.

[a] Contrasting only parents' reports vs. other reporters did not yield a significant result, $Q(1) = 1.89$. $p = .17$.

* $p < .05$.

** $p < .01$.

had to be trimmed and filled and the resulting significant combined effect size without these studies was $r = 0.15$, 95% CI: [0.07, 0.23], which was lower from the one obtained including these studies, but still significant. Moreover, both the Egger's test, intercept = 3.42, $SE = 0.48$, $p < .001$, and the Begg and Mazumdar rank correlation were significant, $tau = 0.54$, $p < .001$. It appears that publication bias could be an issue for the comparison between disorganized and organized children's APs, although the adjusted ES was still significant.

Studies regarding disorganized versus organized attachment and APs showed significant heterogeneity, $Q(21) = 90.19$, $p < .001$, $I^2 = 76.72$ (see Table 9). Risk status was a significant moderator: The ES for at-risk disorganized children was higher than that for not at-risk disorganized children, $rs = 0.35$ and .15, $ps < .001$, respectively. Moreover, observational studies showed a lower ES, $r = 0.09$, $p = .001$, than representational ones, $r = 0.38$, $p < .001$. Method of assessing APs indicated that studies using parents' reports had a lower ES, $r = 0.17$, $p < .001$, than studies that using mixed reporters, $r = 0.40$, $p < .001$, or teachers' reports, $r = 0.46$, $p < .001$ (contrasting teachers' reports vs. mixed reporters did not yield a significant result). Finally, cross-sectional studies had a higher ES, $r = 0.34$, $p < .001$, than longitudinal ones, $r = 0.15$, $p < .001$. Other categorical moderators were not significant or could not be tested due to few studies (see Table 9).

In regard to continuous moderator, age at assessment of attachment was a significant moderator, $b = 0.01$, $p = .04$. ESs were higher as age of assessment of attachment was higher. Moreover, the ES significantly decreased as the time interval between the assessment of attachment and APs increased, $b = -0.005$, $p = .02$ (see Table 10). Age at assessment of APs, gender, and year of publication were not significant moderators.

Table 6
Meta-regression of continuous moderators for the relation of avoidant (A) versus secure (B) attachment groups to attention problems (APs).

Continuous moderators	Slope	*SE*	*z*	*p*
Age at attachment	0.0008	0.0005	1.49	.14
Age at APs	0.001	0.0007	1.46	.14
Time between attachment and APs assessment	−0.001	0.002	−0.94	.35
Gender (% males)[a]	−0.001	0.0005	1.59	.11
Year of publication	−0.01	0.006	−2.14	.03

[a] The study by Qu & Leerkes (2018) was not included because the percentage of males was not reported in the paper.

Table 7
Analyses of the categorical moderators for the relation of resistant (C) versus secure (B) attachment groups to attention problems (APs).

Categorical moderators	K	*r*	95% CI	Q	*p*
Attachment method				1.37	.50
Observational	5	0.13	[−0.06; 0.32]		
Representational	4	0.26**	[0.12; 0.39]		
Self-report	6	0.25**	[0.11; 0.37]		
APs method[a]				= =	= =
Mixed reporters	1	0.29**	[0.11; 0.45]		
Other reporters	6	0.30**	[0.25; 0.34]		
Parents' reports	6	0.08*	[0.01; 0.15]		
Teachers' reports	2	0.10	[−0.14; 0.33]		
Source of information				1.36	.24
Different coders	11	0.17**	[0.05; .28]		
Same coder	4	0.28**	[0.13; 0.42]		
Risk status				7.70	.006
No	9	0.27**	[0.16; 0.38]		
Yes	6	0.04	[−0.07; 0.16]		
Research design				1.26	.26
Cross-sectional	10	0.25**	[0.15; 0.35]		
Longitudinal	5	0.13	[−0.06; 0.32]		
Socioeconomic status				= =	= =
Low	3	−0.03	[−0.21; 0.14]		
Other	12	0.24**	[0.14; 0.34]		
Publication				= =	= =
Published	14	0.18**	[0.09; 0.28]		
Not published	1	0.43**	[0.34; 0.51]		

Note. k = number of independent samples; CI = 95% confidence interval; Q = heterogeneity. Contrasts were tested only for subgroups with four or more studies. All studies coded attachment as a categorical variable except one.

[a] Contrasting parents' reports vs. other reporters did not yield a significant result, $Q(1) = 3.06$. $p = .08$.

* $p < .05$.

** $p < .01$.

5.6. The relation of secure versus insecure attachment status to father only to APs

In a set of seven independent samples, including 1,144 children, it was possible to calculate 8 ESs for the association of secure versus insecure attachment with APs when children's attachment to the father was assessed. Secure children were lower in APs than insecure children

Table 8
Meta-regressions of continuous moderators for the relation of resistant (C) versus secure (B) attachment groups to attention problems (APs).

Continuous moderators	Slope	*SE*	*Z*	*p*
Age at attachment	0.001	0.0007	1.73	.08
Age at APs	0.001	0.0008	1.82	.07
Time between attachment and APs assessment	−0.002	0.002	−1.01	.31
Gender (% males)	−0.001	0.006	−2.22	.03
Year of publication[a]	0.01	0.008	1.80	.07

[a] The study by Qu & Leerkes (2018) was not included because the percentage of males was not reported in the paper.

when the attachment figure was the father, $r = -0.22$, 95%, CI: [0.15, 0.29], $p < .001$. This set of studies was not heterogeneous, $Q(6) = 7.90$, $p = .25$, $I^2 = 24.04$. Due to the limited number of studies (less than 10), publication bias and moderation were not examined.

6. Discussion

As discussed in the introduction, some researchers have argued that differences in attention and APs can be observed in children who differ in the quality of their attachment (see, e.g., Main, 2000). Moreover, many researchers have discussed the relation between attachment and APs when referring to the association of ADHD disorders and insecure/disorganized attachment. Despite these considerations, and the considerable amount of relevant research on the topic, to our knowledge there has been no meta-analysis exploring the relations of attachment status to APs. Thus, the goal of the current meta-analysis was to determine the magnitude of this association, as well as moderators of the aforementioned relations.

6.1. Attachment status and APs

Overall, as predicted, our results support an association between secure (versus insecure) attachment status and lower levels of APs. The ES for this comparison was modest but robust (-.21). Although there was some indication that publication bias might have contributed to the ES, the corrected ES was still significant, albeit smaller (-.16). The ESs for the secure versus insecure attachment status contrast were larger when assessments of the constructs were closer in time and when studies were cross-sectional rather than longitudinal. Both levels of latter moderator were significant (the former was a continuous variable), suggesting that the relation between attachment status and APs was robust. A similar significant direct relation was found for studies that assessed the relation of APs to attachment status with fathers only (ES = −0.22).

The association between a secure attachment and low APs is likely due to the variety of factors discussed above. In particular, attachment figures in secure attachment relationships appear to be efficacious in regulating emotions of children and, consequently, might enhance adaptive attentional self-regulation and reduce the development of APs. In a previous meta-analysis, Pallini et al. (2018) found a similar relation between attachment status and children's effortful self-regulation using primarily measures of temperamental attentional regulation, inhibitory control, persistence, and composite measures of effortful control (recall they did not use indices of APs, which tend to be more diverse in their content than measures of attentional effortful control). Moreover, the inverse association between secure attachment status and APs is consistent with the body of research regarding the inverse relation of secure attachment status to aspects of psychopathology believed to frequently involve APs, such as externalizing and internalizing problems (Fearon et al., 2010; Madigan et al., 2013, 2016; van IJzendoorn et al., 1999). Nonetheless, given the mixed evidence suggesting possible publication bias, this relation should be re-examined when more studies are available for consideration.

Avoidant (A) children were modestly higher in APs than securely attached children (ES = 0.10); this relation was lower in more recent studies. The defensive use of inflexible focusing of attention, likely to avoid attachment-related thoughts and emotions, could be responsible for A children having more severe attentional problems.

Children with a C (versus B) attachment status were modestly higher on APs (ES = 0.21). The finding that C children have more APs in comparison to B children is consistent with aspects of functioning associated with a resistant attachment (e.g., inflexible attention, emotional dysregulation, involvement in and preoccupation about their attachment relationships, with consequent difficulty moving their attention away from attachment-related anxieties and worries). The ES for this comparison was moderated by risk status (i.e., there was a significant effect only when C children were not at risk) and by gender (the pattern of findings was lower for studies with a higher proportion of males).

Of interest, children with A and C attachments did not differ in their APs. Thus, it appeared that these two types of insecure attachment might confer equal risk for APs. However, the number of ESs was relatively small and the difference was near significant, so this relation should be re-examined when additional relevant studies are available.

In the comparison of disorganized children versus organized (A, B, and C) children, the former had higher levels of APs (ES = 0.27). Although there was some indication that publication bias might have contributed to the ES, the corrected ES was still significant, albeit smaller (.15). Moderational analyses suggested that the ESs were higher when attachment was assessed with representational measures compared to observational measures, when APs were teacher-reported or

Table 9
Analyses of the categorical moderators for the relation of disorganized (D) versus organized (A, B, and C) attachment groups to attention problems (APs).

Categorical moderators	K	*R*	95% CI	Q	*p*
Attachment method[a]				= =	= =
Observational	7	0.09**	[0.04; 0.14]		
Representational	14	0.38**	[0.30; 0.45]		
Self-report	1	0.15*	[0.02; 0.27]		
Attachment categorization				= =	= =
Combined	1	0.45**	[0.28; 0.59]		
Categorical	18	0.22**	[0.15; 0.29]		
Continuous	3	0.49**	[0.34; 0.61]		
APs method[b]				= =	= =
Mixed reporters	5	0.40**	[0.28; 0.50]		
Other reporters	3	0.15**	[0.06; 0.24]		
Parents' reports	10	0.17**	[0.09; 0.24]		
Teachers' reports	4	0.46**	[0.22; 0.64]		
Source of information				= =	= =
Different coders	21	0.28**	[0.20; 0.35]		
Same coder	1	0.15*	[0.02; 0.27]		
Risk status				10.97	.001
No	9	0.15**	[0.08; 0.22]		
Yes	13	0.35**	[0.25; 0.45]		
Research design[c]				= =	= =
Combined	1	0.45**	[0.28; 0.59]		
Cross-sectional	13	0.34**	[0.22; 0.45]		
Longitudinal	8	0.15**	[0.09; 0.21]		
Socioeconomic status				1.64	.20
Low	6	0.37**	[0.18; 0.53]		
Other	16	0.24**	[0.16; 0.32]		

Note. k = number of independent samples; CI = 95% confidence interval; Q = heterogeneity. Contrasts were tested only for subgroups with four or more studies. All studies were published.

[a] Contrasting only observational vs. representational categories yielded a significant result, $Q(1) = 35.73$. $p < .001$.

[b] Contrasting only parents' reports vs. mixed reporters yielded a significant result, $Q(1) = 10.12$. $p = .001$; contrasting teachers' reports vs. mixed reporters did not yield a significant result, $Q(1) = 0.24$. $p = .62$; contrasting parents' reports vs. teacher' reports yielded a significant result, $Q(1) = 5.17$. $p = .02$.

[c] Contrasting only cross-sectional vs. longitudinal research design yielded a significant result, $Q(1) = 7.62$, $p = .006$.

* $p < .05$.

** $p < .01$.

Table 10
Meta-regressions of continuous moderators for the relation of disorganized (D) versus organized (A, B, & C) attachment groups to attention problems (APs).

Continuous moderators	Slope	*SE*	*z*	*p*
Age at attachment	0.001	0.0007	2.05	.04
Age at APs	0.001	0.0009	1.27	.20
Time between attachment and APs assessment	−0.005	0.002	−2.38	.02
Gender (% males)	0.0002	0.0005	0.36	.71
Year of publication	0.008	0.007	1.21	.23

mixed reporters rather than solely parent-reported, when attachment was measured at an older age, when the research design was cross-sectional in comparison to longitudinal (with measurements closer in time), and when children were at-risk. However, all levels of the categorical moderators were significant, suggesting that the relation between attachment status and APs was robust.

In disorganized attachment relationships, children's dazed, trance-like behavior and low reactivity to the environment suggest the inability to regulate attention and organize behavior in a specific attachment relationship (Hesse & Main, 2000). These behaviors are present throughout the development of D children, and have been considered clues of detachment or subclinical dissociation (see Liotti, 2004). The high scores on the CBCL scale (and similar measures) found for children with D attachments could be due in part to the contribution of subclinical dissociation (Carlson, 1998; Ogawa et al., 1997; Shields & Cicchetti, 1998; Smeekens et al., 2009) that reflects a form of attentional collapse or dissociation of attention.

An open issue in the field of attachment theory is whether attachment disorganization can be ascribed exclusively to the disrupted attachment relationship or is influenced by genetics. On the one hand, disorganized behaviors cannot be ascribed strictly to genetic influences because the same child can exhibit disorganized attachment behavior with one caregiver (e.g., demonstrates low reactivity to the environment) while exhibiting a secure attachment behavior with another caregiver (Hesse & Main, 2000). On the other hand, several authors have identified a role of the DRD4.7 allele in the disorganization of attachment. van IJzendoorn and Bakermans-Kranenburg (2006) found that infant disorganization was predicted by their parents' unresolved loss and frightening behavior (Main & Hesse, 1995) significantly more often if the infant also carried the DRD4.7 allele. We can speculate that heredity can enhance susceptibility to assume a disorganized pattern of attachment (and associated APs) when the attachment relationship is confusing and frightening (see Belsky & Pluess, 2009).

In addition, research supports the high heritability of attention disorders (e.g., see the meta-analysis by Nikolas & Burt, 2010). Consequently, parents with a limited ability to regulate their attention may confer genetic risk of APs to their children. Moreover, one could speculate that caregivers with APs foster an insecure attachment in their children, in part because they are inattentive to their children's needs. Thus, their children's attention could be affected by both genetic and environmental factors, including insecurity of attachment.

6.2. Moderation of the relation of attachment status to APs across analyses

Across the various sets of analyses, most of the moderators that were significant pertained to the method of assessing attachment, the difference in the age of the children at the assessment of attachment and APs, whether the study was concurrent (cross-sectional) or longitudinal, and if the children were from a higher risk sample. Recall that some moderators could not be tested for some contrasts due to an insufficient number of studies.

In two sets of analyses (secure versus all other groups and D versus organized attachment status), the ESs were larger when the time between the assessment of attachment status and APs was shorter. Similarly, in the same two analyses, the ESs were stronger when the data were concurrent rather than longitudinal, although in both cases, the associations were significant for both cross-sectional and longitudinal studies. It is reasonable to expect relations between two variables to be larger when measured concurrently and closer together, given that both attachment status and APs can change with their development. Indeed, this result corresponds to the view that APs are affected by the attachment relationship that the child experiences when APs are measured.

In two sets of analyses (C versus B, and D versus organized attachment status), individual or familial risk (i.e., if children have been institutionalized, adopted, or abused, or if mothers were adolescents, addicted to substances, or had previously had previously still-births, if the sample was high in ADHD/hyperactivity) moderated the relation between attachment and APs. High risk was associated with a lower ES for C than B children (i.e., the ES was significant only in sample that were not at risk), whereas high risk was associated with a higher ES for D children than for organized children. The variable of risk, which included abuse and/or institutionalization in the relevant samples, implies the experience of trauma. Consequently, the present results are in line with clinical observations (Liotti, 2004) and research (Smeekens et al., 2009) indicating that disorganized children, especially in the presence of traumatic experiences, show the particular impairment of attention involving dissociation. In addition, in five studies of D children, the risk was the clinical status of ADHD, and the ESs were relatively high in four of the five studies (i.e., .41 or higher). Among children with ADHD, disorganization may increase the risk for especially severe APs.

For resistant children, six studies included at-risk samples. In three samples, the risk condition was adolescent mothers and adoption (and the ESs ranged from .08 to .22). Being the child of an adolescent mother may not be a risk *per se*, but children of adolescent mothers may have different trajectories of behavior problems than do children of older mothers, in part depending on the presence of other risk factors such as maternal anxiety and depression or poor behavior management skills (Huang, Costeines, Kaufman, & Ayala, 2014; Spieker, Larson, Lewis, Keller, & Gilchrist, 1999). Perhaps, paradoxically, attachment-related worries are less relevant for children of adolescent mothers in light of other difficult experiences and, consequently, resistant children are less distracted by them or these worries have a lesser influence. Three additional samples were at risk because participants were children with ADHD or clinical sample, but only one of these studies had a significant ES (.37). Thus, in general, clinical and familial risk did not appear to make C children especially vulnerable to APs, although the relation between C (versus B) attachment status and APs was significant for samples in this comparison that were not at risk. However, given the small number of studies and the diverse types of risk, this finding may not be robust.

For the D versus organized attachment status contrast, the ES for observational measures of attachment was weaker than for representational measures. Observational measures, which often reflect the use of the SSP, are used mostly with toddlers, whereas representational measures (believed to tap IWMs) tend to be used at somewhat older ages. APs tend to be assessed when children are preschool age and older. Consequently, the difference in age between the assessment of attachment and the assessment of APs is likely higher for observational than representational measures, which likely decreases the strength of the association. In fact, in our overall sample of studies, the average age difference between the assessment of attachment and APs was 10.9 months for representational measures and 72.1 months for observational measures of attachment, with APs assessed 22 to 150 months after observational studies.

In addition, for disorganized children only, it appears that measures of attachment obtained at older ages and measures of APs using teachers' reports or mixed reporters were superior to parents' reports for detecting relations of attachment status to APs, although ESs for all AP measures were significant. Perhaps parents of disorganized children, who generally are believed to be impaired in their parenting, have more difficulty accurately perceiving their children's APs than do other reporters. As previously suggested, teachers' reports of attention are based on observation and, thus, their reports of APs might be less biased than those of parents. Even if teachers' ratings of APs are based partly on the relationship of children with their teacher (e.g., Berry, 2012), it appears children's disorganized attachment status is associated with teachers' reports of children's APs.

Regarding age, perhaps the relation between attachment status and APs becomes more stable and stronger with age for children with disorganized attachments. In addition, older children's attachment was

more often assessed with representational measures (attachment average age in the D versus organized meta-analysis was 96 months) than observational measures (average age was 20 months). Representational measures (but not observational measures) of attachment were assessed mostly at the same age as APs, which could partly account for a stronger relation between attachment status and APs at an older age.

A attachment status was less strongly related to APs in more recent than older studies. It is unclear why this single effect for year of publication was found; perhaps design characteristics have changed over time. Surprisingly, sex moderated the ES between attachment status and APs for resistant (versus secure) children; however, this effect was not very strong and may not be reliable if other characteristics of the samples were taken into account. The moderators of categorical versus continuous measures of attachment status and the source of information were not significant, indicating that regardless of variation on these aspects of the design, the results were similar. In addition, whether the same reporter provided information on attachment and APs was not a significant predictor of ESs (although the test of this moderator was fairly weak in some contrasts with fewer studies). The moderator of whether a study was published or unpublished was tested only for secure children, and it did not moderate the ES. In the future, it will be useful to examine this ES for the other contrasts as more studies become available.

6.3. Limitations and future directions

In this meta-analysis, we examined the relation of attachment status to individual differences in attention problems (APs). APs were operationalized with commonly used measures of attention problems. Despite the strengths of the meta-analyses, the results should be considered in the context of several limitations. First, we did not investigate the association between attachment and APs in adults; thus, it cannot be assumed that our findings apply to adulthood or would be replicated using measures of adult attachment status. Second, the limited number of studies available limited the power to examine some of the contrasts and also reduced the statistical power in the analyses of moderation. Consequently, our findings regarding moderating variables are sometimes preliminary. Third, because a number of moderators are confounded—for example, different study designs (e.g., longitudinal versus concurrent) and the difference in the age of assessment of attachment and APs —it is difficult to identify the precise factors that affected whether or not attachment status and APs were related.

Finally, we considered attachments to parents only, and did not include any data on attachment relationships with professional caregivers and particularly teachers, even though APs are probably more clearly displayed in class than in other contexts. Future studies could investigate whether the association between APs and attachment status is stronger if the attachment relationship (e.g., with teachers) in which children exhibits APs is specifically considered. For example, it could be meaningful to investigate whether APs observed in class relate more to the relationship children have with their teachers than the relationship they have with their parents. This question is complex because the student-teacher relationship likely is influenced by IWMs based on attachment relationships with primary caregivers.

With development, the susceptibility of attentive behavior to the influence of the different attachment figures might decrease. As a consequence, although attentive behavior and affect regulation in infants and toddlers could be considered to be properties of the dyadic relationship, over time they might become stable characteristics of the child because they are related to IWMs that are not strongly tied to specific situations or people. Unfortunately, with correlational data, we can only speculate on cause-and-effect relations and how they change with age. Furthermore, one could speculate that for children with disorganized attachments, the effect of attachment quality on APs could also be partially explained by their enhanced susceptibility to poor parental rearing practices, consistent with the hypothesis of Belsky and Pluess (2009). This possibility could be explored in future research.

Furthermore, researchers might examine if movement from insecure attachment status to secure attachment status is systematically followed by a decrease in APs. In addition, APs as potential outcomes might be examined by attachment intervention researchers using methods such as the Circle of Security (see Woodhouse, Powell, Hoffman, & Cassidy, 2018), the Connect program (see Moretti & Braber, 2013) or attachment-based compassion therapy (see Navarro-Gil et al., 2018).

Our findings suggest that it is important in the future to clarify the mechanisms that account for the relation of attachment security/insecurity to APs. For example, investigators could examine if the relation between attachment and APs is mediated by emotion regulation. It could be hypothesized that securely attached children, who are more aware of their emotions and better able to regulate them than are insecurely attached children (see Calkins & Hill, 2007; Sroufe, 1996), are less preoccupied and distracted by interpersonal worries, and thus can better pay attention to events. Conversely, future studies could test the possibility that attention is a property of attachment relationship regardless of mediation by emotion regulation. Secure attachment implies *per se* a freedom in considering interpersonal relationships and consequently awareness of attachment-related emotions and thoughts, as can be observed in the AAI (Main & Goldwyn, 1998), whereas insecure attachment implies a restriction, an uncertainty, or an inability to consider attachment-related themes. Consequently, securely attached children may be better able to be attentive to their inner world and to interpersonal relationships, whereas insecurely attached children's attention may be restricted or dysregulated. For disorganized children, the potential influence of traumatic experiences that foster dissociation and consequently impair attention, with the eventual co-occurrence of emotion dysregulation, could be further explored.

Despite the limitations of this set of meta-analyses, the findings support a modest relation between attachment quality and children's APs: Secure attachment status, in comparison to A, C, and D status, was related to lower APs. The finding that the ES was higher when attachment and APs were assessed concurrently, or closer in time, suggests that attention behavior is not an enduring characteristic of the child but a property of the current relationship. A better understanding of the relation between attachment status and APs could have implications for parenting interventions wherein fostering attachment quality might reduce children's APs.

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Contributors

SP drafted the protocol with NE, MM, RB and FL. NE, SP, MM, and RB assessed the eligibility of the studies for inclusion, and extracted data. AC developed the statistical code and did the analyses. All authors contributed to the interpretation of the findings and to the drafting and editing of the manuscript, with SP providing initial drafts on some sections.

Declaration of competing interest

The authors declare that they have no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cpr.2019.101772.

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