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Attachment & Human Development

ISSN: 1461-6734 (Print) 1469-2988 (Online) Journal homepage: www.tandfonline.com/journals/rahd20

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To cite this article: William Trottier-Dumont, Eve-Line Bussières, Audrey-Ann Deneault, Sheri Madigan & Chantal Cyr (2025) Attachment in autistic children as measured with the strange situation procedure: a systematic review and a meta-analysis, Attachment & Human Development, 27:4, 634-656, DOI: 10.1080/14616734.2025.2541232

To link to this article: https://doi.org/10.1080/14616734.2025.2541232

ATTACHMENT & HUMAN DEVELOPMENT
2025, VOL. 27, NO. 4, 634–656
https://doi.org/10.1080/14616734.2025.2541232

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RESEARCH ARTICLE

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Attachment in autistic children as measured with the strange situation procedure: a systematic review and a meta-analysis

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ABSTRACT

Since the inception of attachment theory, parent-child relationships has been examined in different populations, including autistic children. Attachment in autistic children has been measured using inconsistent separation-reunion procedures, making it difficult to examine whether autistic children are more or less likely to develop a secure attachment compared to non-autistic children. This study aims to meta-analyze data from studies that have assessed attachment in autistic children using a standardized version of the Strange Situation Procedure. Using the CASCADE catalogue, we identified six studies (n = 202). Results revealed that 45.6% were classified as secure, 18.7% as avoidant, 8.5% as resistant, and 27.2% as disorganized, which was statistically similar to the proportions of attachment categories in general population. Moderator analyses revealed a higher proportion of secure attachment among older children and more recently published studies. Future research should focus on unifying methodological approaches to studying attachment in autistic children.

ARTICLE HISTORY
Received 13 February 2025
Accepted 26 July 2025

KEYWORDS
Autism; strange situation procedure; attachment; meta-analysis; parent-child relationships

Autism is a neurodevelopmental condition characterized by special interests, repetitive behaviors, and challenges in social interaction (APA, 2013). Autistic children[1] often exhibit sensory differences that may shape how they approach physical contact. Some children tend to seek physical proximity more than the average child, while others actively avoid any physical contact. They may also engage in atypical play, which is frequently misinterpreted as a lack of interest in sharing or playing with other children. Some autistic children may also have challenges in socioemotional reciprocity related to social interactions and greeting behaviors, including atypical nonverbal communication behaviors, such as gaze avoidance and the tendency not to share emotions or to do so in unusual contexts (e.g. holding someone's hands face to face without looking at them). Autistic children may also exhibit stereotypical behaviors, such as hand flapping and body

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/14616734.2025.2541232

rocking. All these behaviors and social difficulties can significantly impair interactions between autistic children and parents in the infancy period onward. Although these characteristics are common across the broad spectrum of autism, autism is also a remarkably heterogeneous diagnosis that includes a wide range of developmental and functioning levels and autistic traits.

Despite these distinctive social traits, autistic children can and do form attachment relationships with their parents (Rutgers et al., 2004). However, research on child-parent attachment in autistic children faces a unique challenge within the field of attachment theory: the wide variation in observational assessment methods used to measure child-parent attachment. This methodological heterogeneity could limit the robustness, validity, and comparability of findings. Specifically, researchers tend to adopt one of three approaches to assess child-parent attachment in autistic children: (a) an unmodified Strange Situation Procedure (SSP; Ainsworth et al., 1978) or the Attachment Q-Set (AQS; Waters, 1995) (Bauminger-Zvieli & Kugelmass, 2013; Naber et al., 2007a), (b) a modified SSP and classification system, such as removing stereotypical movements from the attachment disorganization criteria (Capps et al., 1994),; or (c) the development of a new scoring system to account for autism-specific characteristics, such as social behaviors scales (e.g. Akdemir, 2009; Grzadzinski et al., 2014). Although these autism-specific attachment assessments are rooted in good intentions, their validity and psychometric properties have not been established.

The lack of consistency in attachment measurement in autistic children complicates cross-study comparisons of attachment distributions. It makes it difficult to draw firm conclusions about attachment patterns in this population. Without a standardized approach, it remains unclear whether observed differences in attachment distributions (e.g. a lower proportion of security in autistic vs. normative samples) reflect actual differences in attachment among autistic children or simply methodological inconsistencies.

However, comparing attachment distributions can provide important insights into how developmental level and autistic characteristics influence the quality of parent-child relationships (Beurkens et al., 2013;Naber et al., 2007a). Moreover, such findings could help to inform interventions aimed at fostering secure child-parent attachment in autistic children. Thus, the goal of this study was to identify studies using standardized methodologies of child-parent attachment in autistic children and to estimate the meta-analytical proportions of attachment security, avoidance, resistance, and disorganization in these studies.

Assessing attachment with the SSP

Attachment refers to the relationship a child develops with primary caregivers, such as parents (Bowlby, 1969/1982; 1988). For more than 45 years, child-parent attachment has been assessed with the SSP (Ainsworth et al., 1978), a gold standard measure comprising two separation-reunion episodes between the infant and the parent. Children classified as having secure attachment (B) use parents as a secure base for exploring their environment and as a safe haven when seeking proximity and comfort to regulate their distress. In contrast, children classified as insecure-avoidant (A) do not seek proximity and contact when distressed and focus more on the exploration of their environment than securely

attached children, however this exploration tends to be of lower quality and less effective. Children classified as insecure-resistant (C) seek proximity to the parent and show resistance and anger, or passivity towards their parent, resulting in a lack of exploration of the environment in comparison to securely attached children. Children classified as A, B, or C are considered to display organized attachment behaviors, that is a coherent strategy to interact with the parent during a state of distress. Children classified as insecure-disorganized (D) exhibit contradictory, confused, or apprehensive behaviors toward the parent and appear to lack a coherent strategy to access and seek comfort from their parents when distressed (Main & Solomon, 1990). These children also receive a secondary organized classification (either secure, avoidant, or resistant, but this information is rarely reported in studies). A meta-analysis synthesizing SSP data from 20,720 infant-parent dyads from the general population (including high and low-risk samples) reported that 51.6% of infants have a secure attachment, 14.7% avoidant, 10.2% resistant, and 23.5% disorganized (Madigan et al., 2023).

The SSP has also been extended to assess attachment during the preschool years (Cassidy et al., 1992). The modified SSP procedure (SSP-M) is consistent with the SSP in that children's behaviors during the SSP-M are also coded using ABCD categories. However, the SSP-M includes changes to make the procedure more applicable to older children, such as longer separations without strangers and a distinct coding scheme that accounts for children's growing language skills. Consistent with the decreasing importance of physical contact in preschool, the SSP-M coding focuses on several modalities, such as eye contact, physical orientation, type of play, the greeting, the verbal communication, the affective sharing, to determine whether the child uses the parent as a secure base and safe haven (Cassidy et al., 1992). The SSP and SSP-M nevertheless share the same classification system for attachment disorganization (Main & Solomon, 1990), except that the SSP-M additionally includes the subcategories disorganized controlling-caregiving and disorganized controlling-punitive. A meta-analysis by Deneault et al. (2023) examining attachment distributions in preschool-aged children from the general population (including high- and low-risk samples) found strikingly similar patterns to those observed in infancy with the SSP. Specifically, in 97 studies and 8,186 children, 53.5% of children were classified as secure, 14.0% avoidant, 11.0% resistant, and 21.5% disorganized (Deneault et al., 2023).

Assessing attachment in autistic children

While much of the original work on attachment focused on normative dyads, recent decades have seen an uptick in studies assessing attachment in specific populations, including autistic children. The first studies on autistic children examined whether they exhibited attachment behaviors similar to those of non-autistic children, such as having a clear preference for their parent over a non-familiar person. These studies showed that autistic children do have a clear preference for their parents over strangers, supporting the idea that autistic children can indeed form attachment relationships with their parents (Dissanayake & Crossley, 1996; Sigman & Mundy, 1989, Spencer, 1993; Sigman & Ungerer, 1984).

However, early research on autistic children also revealed that their attachment behaviors were qualitatively different from those of non-autistic children (for a review,

see Buitelaar, 1995). For instance, compared to non-autistic children, autistic children were described as expressing less distress during separation, being less involved with their parent during exploration, showing a lower tendency to seek help from their parent, and being less engaged in mutual gaze (Sigman & Mundy, 1989; Sigman & Ungerer, 1984; Sigman et al., 1986). Although these behaviors can be interpreted as signs of attachment insecurity, some authors suggested that they may reflect autistic children's different ways of expressing attachment needs to their parents (Oppenheim et al., 2019). Attachment behaviors of autistic children may not follow conventional patterns. Autistic children can use their parents as a secure base and a safe haven, though they may do so in unique or nontraditional ways (for example, see the case study by Oppenheim et al., 2019).

These different manifestations of attachment behaviors have prompted researchers to adapt standard SSP procedures and coding systems when assessing attachment in autistic children. For example, some researchers have modified the SSP procedure itself, such as implementing a single child-parent separation instead of two (Capps et al., 1994; Shapiro et al., 1987; Willemsen-Swinkels et al., 2000). Others have adapted the coding system to better account for autistic characteristics (Koren-Karie et al., 2009; Rozga et al., 2018). For instance, stereotypies that are considered markers of disorganization are also well-known behaviors of autistic children. Thus, some authors have removed stereotypical movements from assessing attachment disorganization in autistic children (Capps et al., 1994; Willemsen-Swinkels et al., 2000). Notably, despite these methodological adjustments, attachment behaviors in autistic children can still be classified using the standard 4-way (ABCD) classification framework.

In contrast, some researchers have developed alternative coding systems that deviate from the standard 4-way attachment classification scheme (Akdemir, 2009; Grzadzinski et al., 2014; Rogers et al., 1991; Siller et al., 2014). While these modified coding systems aim to capture attachment behaviors in autistic children, they lack the extensive validation of the SSP and SSP-M. Moreover, they do not necessarily align with the traditional ABCD attachment classification scheme, which limits their comparability with data from the traditional ABCD attachment coding system in non-autistic children. Given these limitations, the current study focuses exclusively on studies that have used the well-validated SSP and SSP-M and the standard 4-way (ABCD) attachment classification scheme.

Previous reviews on attachment in autistic children

A meta-analysis by Rutgers et al. in 2004 compared attachment behaviors of autistic and non-autistic children with various attachment measures such as the SSP (ABCD classifications), the AQS, and attachment-related observations of children's reactions ($k = 10$). Their results revealed a medium to large effect size ($r = .24$), indicating that autistic children were less securely attached than non-autistic children. Moreover, effect sizes were larger when autistic children presented with lower mental developmental ($r = .37$) and when an autism diagnostic was compared to pervasive developmental disorder not otherwise specified (PPD-NOS) ($r = .38$). In addition, based on a systematic review of four studies using the 4-way ABCD classification scheme with a modified SSP, the authors reported that 53% of autistic children ($n = 72$) had secure attachment with their parents. The authors concluded that, when compared to the proportion of attachment security in normative samples (Van IJzendoorn et al., 1992, 1999), autistic children were less likely to

form a secure attachment. However, this meta-analysis could not estimate the proportions of individual insecure categories due to the lack of studies using the ABCD classifications and statistically compare them with one another, as was the case in previous meta-analyses on infant attachment and preschool children (Deneault et al., 2023; Madigan et al., 2023).

Research suggests that there may be differences in the proportions of insecure categories among autistic children compared to the general population. For example, a study suggested that the insecure-resistant classification may be a precursor to an autism diagnosis (Martin et al., 2020). However, some researchers have disagreed with this claim, particularly because they mentioned that the design from Martin et al. (2020) would not allow such conclusions to be reached (Green et al., 2022). Several studies have suggested that attachment disorganization is more frequent in samples of autistic children compared to the general population (Naber et al., 2007a, Willemsen-Swinkels et al., 2000). According to Mary Main's coding notes of autistic children, one possible explanation is their challenges with physical contact, which may cause them to fear close physical proximity to the parent (Coughlan et al., 2019). However, a recent meta-analysis by Madigan et al. (2023) found no significant differences in the proportions of secure and insecure attachments in children with neurodevelopmental conditions, which included autism, Down syndrome, cerebral palsy, hearing impairment, and intellectual disability (ID). This finding warrants further exploration, given that combining children with various neurodevelopmental conditions into a single category may obscure potential differences between groups. Each neurodevelopmental condition may present unique characteristics that influence attachment differently. For example, if distinct attachment behaviors are more common in different neurodevelopmental conditions, their effects could counterbalance, making it more difficult to detect significant differences across groups. Moreover, the distinct behavioral manifestations associated with these conditions suggest that focusing on a single population, such as autistic children, could provide greater clarity in understanding attachment processes.

Another systematic review was conducted on the attachment of autistic children and included 40 studies on parent-child interactions in the context of autism (Teague et al., 2017). Only half of the reviewed studies ($k = 22$) measured attachment using the SSP (modified and non-modified), and many studies used adapted coding systems that are difficult to compare to one another. The review identified two key predictors of attachment security in autistic children: the severity of autistic characteristics and children's developmental delay. The authors argued that more severe autistic characteristics were associated with lower attachment security. However, the findings reviewed were inconsistent, with some studies supporting this association (Akdemir, 2009; Grzadzinski et al., 2014; Naber et al., 2007a; Rogers & DiLalla, 1990; Van IJzendoorn et al., 2007) and others not (Deslauriers, 2011; Rogers et al., 1991). Similarly, the authors reported that greater developmental delays were linked to lower attachment security. Again, the evidence was mixed, with some studies finding this association (Koren-Karie et al., 2009; Rogers et al., 1991; Rozga et al., 2018) and others not (Akdemir, 2009; Bauminger-Zvieli & Kugelmass, 2013; Capps et al., 1994; Shapiro et al., 1987). The authors also sought to estimate the proportion of children with a secure attachment, retaining seven samples. They found a proportion of 47% of security in autistic children ($n = 186$). The conclusion of this review supported that of

Rutgers et al. (2004) showing that autistic children were less securely attached than children from the general population samples. However, similar to the meta-analysis of Rutgers et al. (2004), Teague and colleagues only focused on the proportion of children with a secure classification, providing little information about the different insecure classifications, and did not compare ABCD proportions with one another in a systematic statistical way.

Potential moderators of attachment of autistic children

In addition to moderators commonly tested in meta-analyses, such as country of study and year of publication, the literature on autism and attachment suggests field-specific moderating variables that may influence the attachment of autistic children.

Child age

While the SSP was developed for children between 12 and 24 months of age, the age at which autistic children are generally diagnosed and assessed in the SSP is generally higher, approximately starting at 30 months and extending up to 6 years (Oppenheim et al., 2022). This discrepancy with the age of children assessed with the original SSP is also because autistic children often function at a developmental level below their chronological age (Capps et al., 1994). Nevertheless, considering that this age range goes beyond that of the age group the original SSP was originally intended for, as children are older and more likely to express their needs, they are more likely to show secure attachment. Indeed, a higher proportion of older children might be associated with a higher proportion of children with secure attachment.

Child sex

The sex ratio of autistic children is estimated to be three boys to one girl (Loomes et al., 2017). One reason why fewer autistic girls are diagnosed is that they generally have better social and interactional skills than autistic boys (Lai et al., 2015). Thus, higher proportions of securely attached children may be found in samples with a greater proportion of girls.

Parent sex

Consistent with broader attachment research, most studies on attachment in autistic children have focused on the child's attachment to the mother. The few studies that have included fathers show that autistic children display fewer prosocial behaviors and have lower rates of secure attachment with their fathers compared to their mothers (Grzadzinski et al., 2014; Oppenheim et al., 2022). Thus, samples with a greater proportion of fathers could thus associated with a lower proportion of securely attached children.

Child developmental level and severity of autism

As suggested by Teague et al. (2017), these two variables appear to be associated with the degree of attachment security in autistic children. Similarly, we could expect that samples with higher proportions of children with lower developmental levels or with more severe autism could be associated with a lower proportion of securely attached children.

The current study

The objective of the current systematic review and meta-analysis was to conduct a synthesis of attachment in autistic children assessed with the 4-way attachment classification scheme during the SSP (with a procedure or a coding system modified or not). A second objective was to examine whether the attachment distribution of autistic children significantly differs from the distribution in normative children, as reported in the recent meta-analyses of Deneault et al. (2023) and Madigan et al. (2023). A third objective was to test for potential moderators to examine whether the attachment distribution's proportions among autistic children vary based on samples and study characteristics.

Methodology

Search strategy & study selection: CASCADE

The current study adhered to the PRISMA guidelines for systematic reviews (Moher et al., 2009). This review relied on the systematic Child Attachment Studies Catalogue And Data Exchange catalogue (CASCADE; Madigan, 2020), a repository of studies that used observational methods to measure child-parent attachment. The catalogue was based on a search for published and unpublished studies in the following databases: PsycINFO, MEDLINE, Embase, Web of Science, and Dissertation Abstracts International. The search covered records from 1967 to 2023. It included database-specific headings and keywords: "strange situation," "q-sort," and "attachment." Concepts were combined with the Boolean "AND" and synonymous words were combined with the Boolean "OR." Truncated symbols were used to identify words with various spellings and endings (e.g. child*). The database search yielded 42,982 non-duplicate records (see Figure 1).

This figure details the selection of eligible studies for systematic review and meta-analysis. The abstract of each record and its full text were screened by two independent coders (inter-rater reliability: 95.5% and 94.1%, respectively). Inclusion criteria for CASCADE were: (a) reporting empirical data, (b) using an observational measure of attachment (e.g. SSP, modified SSP, Attachment Q-Sort), and (c) being published in English, French, or Spanish (the languages spoken by our team). A total of 2,318 studies were included in CASCADE. Further information on the screening process is provided in Madigan et al. (2023). Each record in CASCADE was cataloged according to sample characteristics.

Study selection: current study

For the current study, we selected studies catalogued as having samples of children with neurological impairment, intellectual disability, or developmental delay in CASCADE. These selection criteria were used, given that autism was not specifically coded in the catalogue. A total of 43 studies were identified and screened for eligibility. Studies were eligible if they 1) included diagnosed autistic children; 2) used the SSP (Ainsworth et al., 1978) or a modified version including the core components of the SSP (e.g. at least one separation-reunion between the child and its parent); 3) measured attachment using the 4-way attachment classification scheme (Ainsworth et al., 1978; Main & Solomon, 1990). We also documented

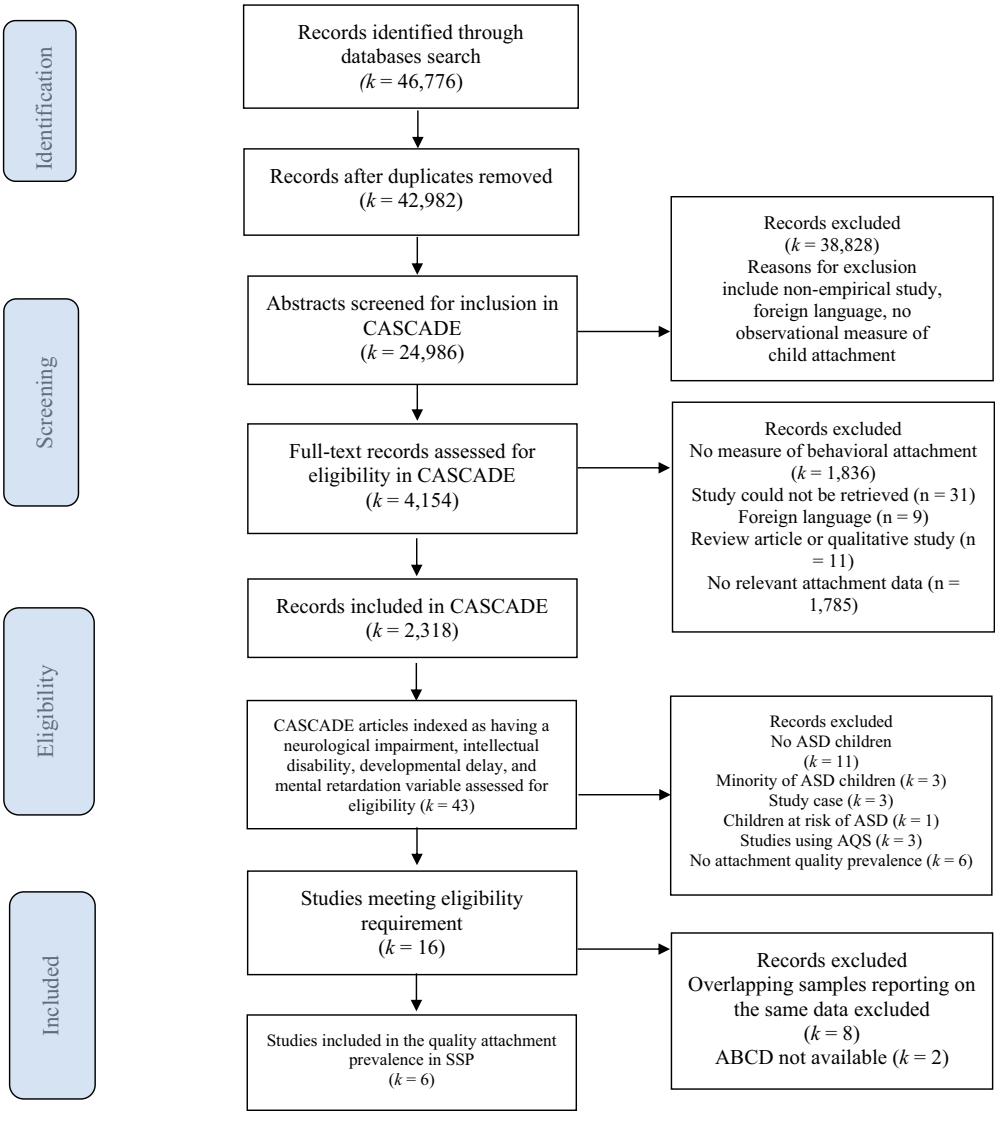

Figure 1. PRISMA flow chart of study Selection.

changes to the procedure (e.g. the number of separations during the procedure) and to the ABCD coding system and were used as categorical moderators in the meta-analysis.

Studies were not included if: 1) children were at high risk of autism or did not have a formal diagnosis; 2) the sample included children with neurodevelopmental conditions other than autism (e.g. intellectual disabilities, attention deficit hyperactivity disorder, etc.); 3) the sample was too heterogeneous (e.g. a range of clinical disorders), with less than 50% of autistic children; 4) attachment was assessed with a continuous versus categorical observational measure (e.g. Attachment Q-Sort), representational measure, or self-reported measure; 5) attachment was not measured using a 4-way attachment

classification scheme (e.g. only 3-way attachment was assessed, social behaviors scales, observational questionnaires, etc.).

Two coders screened each record. The interrater agreement was high for the selection of the articles (κ = .77; 91% agreement). Disagreements were resolved by the first author. A total of 16 eligible studies were identified. Among these studies, 8 studies were excluded due to overlapping samples (e.g. multiple studies reporting on the same sample of children) or because they did not report on the 4-way attachment classification scheme ($k = 2$). In these two studies, the authors either included the ABC classification scheme or only computed proportions for the organized (ABC in one group) and disorganized (D) classifications. We contacted the authors for additional information but did not receive a response. In total, 6 studies published between 1994 and 2022 were included (see Figure 1).

Data extraction

Two independent coders performed the data extraction. The following data were coded: 1) attachment distribution of the sample (i.e. *n* in each of the secure, avoidant, resistant, and disorganized classifications); 2) children's chronological age (in months); 3) children's developmental level (in months; including developmental quotient [DQ] or intellectual quotient [IQ] or mental age as extracted from the selected articles); 4) the severity of autism (i.e. severity level according to average instrument scores); 5) child sex (% of boys); 6) parent sex (% of mothers); 7) publication year; 8) country in which the study was conducted; 9) method to confirm autism diagnosis (e.g. instruments used to confirm the diagnosis, assessment carried out by experts, etc.); 10) modification to the SSP procedure (e.g. number of separations, length of separation); and 11) modifications to the ABCD coding system (e.g. removing stereotypies, guidelines for assessing disorganization in children with neurological conditions, etc.). The interrater agreement was high for the prevalence of ABCD classifications (90% agreement) and for continuous moderators (ICC = .93). Disagreements were resolved by the first author.

Data analysis

We conducted a proportion meta-analysis in Stata version 17.0 with the GLLAMM package. This package estimates generalized linear mixed models with random effects, using the *multinomial logit model with random intercept*. The estimation of proportions for each classification considers the presence of the other three classifications, such that the proportions across the four classifications add up to 100%. Publication bias was not tested, given that this type of analysis is not recommended for proportion meta-analyses (see Barker et al., 2021). For moderator analysis, we only tested for continuous moderators, given the small number of studies included in the meta-analysis. Each moderator was added to the multilevel model. The secure group was used as the reference group for moderator analyses. For more information about the analytical strategy, see the meta-analysis by Madigan et al. (2023).

Lastly, estimated proportions were compared with the prevalence across the general population in Madigan et al. (2023) and Deneault et al. (2023) meta-analyses, which relied on the same analytical methods. Considering that some studies included in our meta-

analysis could also be included in Madigan et al. (2023) meta-analysis, estimated proportions were also compared to those of infants without neurodevelopmental conditions from Madigan et al. (2023). Differences between classifications were considered significant if the confidence intervals (CIs) did not overlap.

Results

Study characteristics

Among selected studies, two studies included an autistic children group and a comparison group (Naber et al., 2007a; Filippello et al., 2015), and four comprised only autistic children (Capps et al., 1994; Koren-Karie et al., 2009; Oppenheim et al., 2022; Rozga et al., 2018). Two studies were conducted in Israel (Koren-Karie et al., 2009; Oppenheim et al., 2022), two in the USA (Capps et al., 1994; Rozga et al., 2018), one in Italy (Filippello et al., 2015), and one in the Netherlands (Naber et al., 2007a). The six studies used the 4-way attachment classification scheme from Ainsworth et al. (1978) and Main and Solomon (1990).

Table 1 presents study characteristics and authors' modifications of the traditional 4-way ABCD attachment classification scheme (Ainsworth et al., 1978; Main & Solomon, 1990) to account for autistic traits. Regarding the quality of the included studies, based on the characteristics of the Critical Appraisal Skills Programme (CASP) checklist for cross-sectional studies (Critical Appraisal Skills Programme, 2024), the studies show similar features. Consequently, this group of studies is consistent in terms of quality.

Meta-analytical results of distribution of ABCD in autistic children

Based on the selected studies, we estimated the 4-way attachment distribution of attachment in autistic children. The overall distribution was 18.7% (95% CI [10.5%, 23.4%]) for avoidant, 45.6% (95% CI [27.8%, 50.9%]) for secure, 8.5% (95% CI [5.4%, 29.7%]) for resistant, and 27.2% (95% CI [15.8%, 43.5%]) for disorganized.

Comparison to the distribution in non-autistic children

The comparison of these estimated proportions and CIs with those obtained from the meta-analyses on the general population of infants (Madigan et al., 2023) and preschoolers (Deneault et al., 2023) is presented in Table 2.

Table 2 presents the estimates of attachment classifications for autistic children calculated in the present meta-analysis as well as attachment classifications for children in the general population derived from other meta-analyses on SSP. Despite some visual differences, the overlap between the CIs in the current study and those of the Deneault et al. (2023) and Madigan et al. (2023) meta-analyses indicates that the attachment distribution for autistic children is similar to that of non-autistic children. Several additional comparisons were conducted to verify the robustness of the results presented (see Supplementary information for more details).

Table 1. Study characteristics.

Study	Changes to 4-way attachment classification scheme	IQ/DQ		Child age		Boys (%)	Mothers (%)	Attachment (%)				
		Instruments	Mean	Range (years)	Mean (months)			n	A	B	C	D
Rozga et al. (2018)	To distinguish the manifestations of autism from disorganized attachment, the coders subdivided the disorganized classification into two subclassifications: D-Autism (subclassification indicates that children display enough autistic features common to the disorganized attachment to assume that this classification can be attributed to the child's neurological condition) and D-Attachment (classification indicates that there are enough markers of disorganization that can be best explained by the parent-child relationship).	MSEL SBIS,	65.0	3–5	47.0	77	97	29	17	45	3	34
Filippello et al. (2015)	The study used the guidelines of Pipp-Siegel et al. (1999) for assessing attachment disorganization in children with neurological conditions. These guidelines highlight all the characteristics of neurological conditions that may overlap with characteristics of disorganized attachment, which therefore includes stereotypies and other characteristics of disorganized attachment (e.g. disoriented facial expression, repeated strange postures).	GMDS-ER	30.2	3–4.5	43.2	100	100	10	20	70	10	0
Koren-Karie et al. (2009)[a]	This study used the guidelines of Pipp-Siegel et al. (1999). The changes account for the challenges of socio-emotional reciprocity that may characterize some autistic children. Under this adaptation, the child receives security points if the presence of their parent calms them or prompts them to return to the behaviors observed before the first separation, even if the child does not greet his parent positively upon his return.	BSID, K-ABC	63.7	3–6	49.4	100	100	45	16	42	20	22
Naber et al. (2007a)[b]	This study makes changes to account for stereotypies. The coders rely on the initial pre-separation episode as a reference point for children's behaviors and stereotypies when their attachment system is not yet activated.	MSEL	61.9	2	30.2	79	100	34	18	38	6	38
Capps et al. (1994)[c]	This study adapts the assessment of disorganization to exclude stereotypies from the disorganization scheme codification.	CSII	47.0	3–6	48.6	84	100	15	7	40	13	40
Oppenheim et al. (2022)[d]	This study used the guidelines of Pipp-Siegel et al. (1999) and the changes from Koren-Karie et al. (2009).	MSEL, WPPSI.	68.0	2.5–6	49.5	100	58	69	28	59	4	9

A = avoidant, B = secure, C = resistant, D = disorganized. MSEL: Mullen Scales of Early Learning. WPPSI: The Wechsler Preschool and Primary Scale of Intelligence. CSII: Cattell Scale of Infant Intelligence. K-ABC: Kaufman Assessment Battery for Children. BSID: Bayley Scales of Infant Development. GMDS-ER: Griffiths Mental Development Scales-Extended Revised. SBIS: Stanford – Binet Intelligence Scale.

[a]Overlapped with Dolev et al. (2014), Levy et al. (2020), Marcu et al. (2009), Oppenheim et al. (2009) and Oppenheim et al. (2012).

[b]Overlapped with Naber et al. (2007b), Naber et al. (2008) and Van IJzendoorn et al. (2007).

[c]The SSP in the Capps et al. (1994) study included only one separation, while all other studies included 2 separations.

[d]The attachment distribution reported for Oppenheim et al. (2022) excludes the ten children categorized as non-applicable (NA).

Table 2. Attachment proportions of autistic children in different 4-way attachment classification distributions.

Attachment Distribution				
Attachment Classifications	Current meta-analysis of Autistic Children $k = 6$; $N = 202$	Infants from the general population[a] $k = 285$; $N = 20{,}720$	Infants without neurodevelopmental conditions[a]	Preschoolers from the general population[b] $k = 97$; $N = 8{,}186$
Secure (B)	45.6% [27.8, 50.9]	51.6% [49.6, 53.5]	52.0% [49.0, 54.0]	53.5% [49.7, 56.8]
Avoidant (A)	18.7% [10.5, 23.4]	14.7% [13.6, 15.8]	15.0% [14.0, 16.0]	14.0% [12.1, 15.9]
Resistant (C)	8.5% [5.4, 29.7]	10.2% [9.3, 11.1]	10.0% [9.0, 11.0]	11.0% [9.8, 12.4]
Disorganized (D)	27.2% [15.8, 43.5]	23.5% [21.6, 25.6]	23.0% [21.0, 25.0]	21.5% [18.3, 25.5]

[95% CI].
[a]Madigan et al. (2023).
[b]Deneault et al. (2023).

Moderator analyses

Child age

The only significant comparison was the contrast between the disorganized and secure classifications ($B = -.041$, $SE = .044$, $p = .035$), such that samples with older children were more likely to include children classified as secure and less likely to be classified as disorganized. Other contrasts were not significant (avoidant relative to secure: $B = -.003$, $SE = .029$, $p = .928$; resistant relative to secure: $B = .017$, $SE = .052$, $p = .743$).

Developmental level

None of the three comparisons were statistically significant (avoidant relative to secure: $B = .019$, $SE = .023$, $p = .408$; resistant relative to secure: $B = -.009$, $SE = .030$, $p = .754$; disorganized relative to secure: $B = -.029$, $SE = .040$, $p = .471$).

Publication year

Significant contrasts were found between the disorganized and the secure classifications and between the resistant and secure classifications. Over time, children were less likely to be classified as disorganized or resistant and more likely to be classified as secure (resistance relative to secure: $B = -.609$, $SE = .298$, $p = .038$; disorganized relative to secure: $B = -.607$, $SE = .267$, $p = .023$). The avoidant and secure classification comparison was not significant ($B = -.129$, $SE = .229$, $p = .574$).

No other moderators could be tested, such as severity of autism, country in which the study was conducted, the method to confirm the diagnosis of autism, the modifications to the SSP procedure, or the modifications to the ABCD classification system, given the limited sample size at each level of the moderator variable. Furthermore, given the lack of variability in child and parent sex, these moderators have not been tested.

Discussion

Our results indicate that 45.6% of autistic children were securely attached to their parents. This distribution is similar, or somewhat (visually) lower, than those found in previous reviews, in which 47% (systematic review by Teague et al., 2017) to 53% (meta-analysis by Rutgers et al., 2004) of children had a secure attachment. However, direct comparison across studies is challenging due to differences in search strategies, inclusion criteria, and methodological approaches. Notably, some studies included in earlier reviews did not use the 4-way attachment classification scheme, limiting comparability. Additionally, while previous reviews calculated attachment security as an absolute proportion, our analysis accounts for the relative distribution of all attachment classifications, allowing for a clearer understanding of how attachment classifications are represented relative to one another within the group of autistic children.

Our findings suggest that a substantial proportion of autistic children are securely attached to their parents and that their likelihood of developing a secure attachment is comparable to that of non-autistic children. This conclusion is based on a comparison of attachment proportions in autistic children, derived herein, with recent meta-analyses that provided the most comprehensive distributions of ABCD attachment to date (Deneault et al., 2023; Madigan et al., 2023). Specifically, the CIs in this study overlapped with those reported in Madigan et al. (2023) and Deneault et al. (2023), suggesting that autistic children are just as likely as non-autistic children to form secure attachment to their parents. Moreover, this finding is in line with Madigan et al. (2023), who found no differences in the distribution of attachment among children with neurodevelopmental conditions (autism, developmental delay, Down syndrome, intellectual disability, cerebral palsy, and hearing impairment).

A key aim of the current study was to estimate the proportions of children classified with different types of insecure attachment. We found a distribution of 18.7% for avoidant attachment, 8.9% for resistant attachment, and 27.2% for disorganized attachment. To our knowledge, our study is the first to provide meta-analytic estimates for the distribution of these three attachment classifications in autistic children. These results contribute to ongoing discussions in the literature on the attachment of autistic children. Notably, Martin et al. (2020) reported that autistic children are more likely to be classified as insecure-resistant than children at risk of autism in a prospective study, leading the authors to argue that this classification could be a precursor of later autism (Martin et al., 2020). However, our results found that the proportion of resistant attachment is similar to that of the general population, in addition to being the smallest of the three insecure attachment classifications in autistic children. These findings run counter to Martin et al. (2020) hypothesis.

The second least represented attachment classification in autistic children was avoidant attachment. This result may be surprising considering that several characteristics of autism are conceptually very similar to those of avoidant attachment (e.g. eyes contact avoidance, difficulties with physical touch; Coughlan et al., 2019). This finding shows that assessing attachment in autistic children goes beyond a simple observation of children's behaviors to consider how the child uses their parent as a secure base and safe haven. This capacity may still be possible even if the child shows limited eye contact or does not actively seek physical proximity.

Our results also indicate that, although the proportion of disorganized attachment in autistic children (27.5%) is similar to that observed in the general population (23.5%), with overlapping CIs, it emerged as the most common type of insecure attachment in the current study. Some authors argue that autism-related characteristics may contribute to attachment disorganization in autistic children, potentially due to sensory hypersensitivity or discomfort with physical proximity to the parent (Coughlan et al., 2019). Further longitudinal research is needed to more fully identify the factors associated with the development of disorganized attachment in autistic children. Future research should also address certain confounding factors that may affect these results. One such factor is the inconsistency in how attachment disorganization is distinguished from the features of autism. Among the six studies included in this meta-analysis, five different approaches were used to adapt the coding procedures for autistic children in the SSP. Specifically, in two studies, the changes consisted only of excluding stereotypies as an indicator of attachment disorganization (Capps et al., 1994; Willemsen-Swinkels et al., 2000). However, some authors argue that the complexity of distinguishing between attachment behaviors and autism characteristics requires more comprehensive adaptations than merely excluding stereotypies (Rozga et al., 2018). For instance, one study assessed stereotypies during the pre-separation baseline to determine whether they were attributable to autism rather than the disorganization of the attachment system (Naber et al., 2007a). Another study adopted guidelines developed by Pipp-Siegel et al. (1999) for children with neurological conditions (Filippello et al., 2015). Two other studies integrated Pipp-Siegel's guidelines with additional modifications to the coding of attachment security, aiming to account for socioemotional reciprocity challenges in autistic children (Koren-Karie et al., 2009; Oppenheim et al., 2022).

These methodological adaptations represent progress in refining the assessment of attachment in autistic children. However, they can also raise concerns about the extent to which these adaptations may impact the distribution of attachment classifications. Due to the limited number of available studies, this meta-analysis was unable to test the impact of coding adaptations on attachment distributions. However, future studies should investigate whether these adaptations affect the attachment distribution in autistic children.

Another key methodological difference that distinguishes the assessment of attachment in autistic children from non-autistic children is the number of separations included in the SSP. While most studies in the present meta-analysis used the SSP with two separations (i.e. Filippello et al., 2015; Koren-Karie et al., 2009; Naber et al., 2007a; Oppenheim et al., 2022; Rozga et al., 2018), others used an alternative version of SSP with a single separation (Capps et al., 1994). Some researchers justify using a single separation by noting that autistic children often experience heightened distress when their routines are disrupted. Unexpected separations, such as those in the SSP, could cause them significant distress, potentially reducing the validity of the procedure. Others argue that leaving children alone during the second separation, as required in both the SSP and SSP-M (Capps et al., 1994; Rutgers et al., 2004), is ethically concerning for autistic children.

Training in attachment assessment using the SSP emphasizes the importance of including two reunions following separations to assign a valid attachment classification to the child. Notably, research suggests that autistic children's responses become more similar to those of non-autistic children when a second reunion is included (Sigman &

Mundy, 1989). This indicates that methodological differences, such as using a single versus two separations, may significantly impact attachment classifications. However, of the included studies in this meta-analysis, only one (Capps et al., 1994) used a single separation, and therefore, we could not test whether the number of separations influenced attachment distributions.

Children's chronological age

The results of our moderator analyses provide some insights to contextualize the findings of this study. Results revealed that studies with older autistic children were significantly more likely to include children with a secure attachment than a disorganized attachment. Recent longitudinal research suggests that, as they get older. autistic children show higher levels of communicative functioning with age (Fountain et al., 2023). Verbal improvements may contribute to the development of a secure attachment relationship with the parent. It may be easier for a parent to respond to their child's needs if expressed verbally. In turn, the parent's sensitivity may contribute to fostering a secure attachment (Cossette-Côté et al., 2021). However, this result should be interpreted with caution, given that all the evaluated children were older than the age range for which the SSP was validated and that the studies used the SSP and not the SSP-M. In normative samples, the SSP is validated for use with infants aged 11 to 24 months. Children in the included studies were aged between 24 months and 6 years old. In their pioneering study, Capps et al. (1994) justified the inclusion of older children (i.e. 3–6 years old) on the basis that children's language and social functioning levels were equivalent to those of 2-year-old children. Most studies generally do not provide such arguments.

Another practical reason why studies may focus on older samples is that very few autistic children are diagnosed between 12 and 24 months. Martin et al. (2020) avoided this issue by using a retrospective design. They assessed child-parent attachment using the SSP in 15-month-old infants at risk of autism and then selected those for their sample based on the ones that had received a formal diagnosis by 36 months. A shortcoming of this method is that it requires assessing a large number of children (their study included 95 children at risk of autism) to identify a small number of children that will meet a formal diagnosis retrospectively (16 autistic children in their study). Another option that has not been yet explored is to use the SSP-M, which has already been adapted for use with older children. Importantly, the SSP-M was developed by a group of 28 experts in the field of attachment, which allows for a more consensus-based approach than adaptations implemented by individual labs. The use of the SSP-M was initially discarded in the meta-analysis by Rutgers et al. (2004) because this version had not yet been validated. Since the SSP-M has been extensively validated across the general population and used in nearly 200 studies to date (Deneault et al., 2023). In terms of using the SSP-M with autistic children, a case study involving two autistic children has been conducted successfully (see Fardoulys & Coyne, 2016), suggesting that the SSP-M could be used with autistic children.

In general, one way to ensure the robustness of the results obtained in autism research is to conduct (quasi)experimental studies, in which a variable is systematically manipulated in one group. This approach allows for more confident inferences about the specific contribution of a given factor to developmental outcomes in autistic children. Only through such controlled designs can we begin to disentangle whether the predictors and outcomes

associated with attachment in autistic children are primarily attributable to characteristics of autism, including neurobiological factors or developmental delays (e.g. chronological vs. mental age) that may compromise attachment development, to environmental influences (e.g. parental sensitivity), or more likely to their interplay. For instance, if age is hypothesized to moderate the association between autism and attachment, experimental, longitudinal studies testing attachment at multiple time points, along with other potential moderators/predictors, such as children's cognitive skills and language abilities and parental behaviors and psychosocial states, are crucial. A recent meta-analysis reported a medium association ($r = .48$; $k = 7$) between parental sensitivity and attachment in autistic children (Cossette-Côté et al., 2021). These results suggest that attachment of autistic children is shaped by environmental processes similar to those influencing non-autistic children. These results are in line with Oppenheim et al. (2012), who also found an association between attachment and parental sensitivity in autistic children. Conversely, Van IJzendoorn et al. (2007) showed that higher maternal sensitivity was associated with child attachment security, but only in dyads of mothers with a non-autistic child, suggesting that attachment in autistic children is constrained by neurobiological factors. All of these studies relied on cross-sectional designs, making it difficult to determine the processes shaping attachment in autistic children. Intervention studies aiming to enhance attachment security by parental sensitivity could be a way to better understand this process.

Publication year

We found a decrease in the percentages of children with a disorganized or resistant attachment over time and an increase in children with a secure attachment in more recently published studies. This shift over the years may help explain why our findings show a similar proportion of secure attachment in autistic children and the general population, whereas earlier reviews reported that autistic children were less securely attached than non-autistic children (Rutgers et al., 2004; Teague et al., 2017). These changes over time could suggest that coders are becoming better at distinguishing autistic behaviors from disorganized or resistant attachment behaviors. A meta-analysis has shown that differences between autistic and non-autistic individuals have decreased over the years, probably because our current understanding of autism is associated with a greater inclusion of autistic individuals with more heterogeneous characteristics than in the past (Rødgaard et al., 2019).

Developmental level and severity of autism

Children's developmental level was not a significant moderator of the attachment distribution. This result must be interpreted in light of the few studies that were included in this study. The studies included in the analysis relied on various instruments to assess the developmental level of autistic children, and the reported scores encompassed not only global scores but also subtest scores of developmental tests. The heterogeneous nature of the extracted data may account for the non-significant findings.

Another important variable that may be associated with attachment classifications in autistic children is the severity of autistic characteristics. This variable was assessed in some of the studies included in our meta-analysis (Filippello et al., 2015; Naber et al., 2007a;

Oppenheim et al., 2022). However, it was not possible to test the severity of autistic characteristics as a moderator because the studies used different measures that did not provide standardized scores. Most studies in the current meta-analysis used the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2001) to confirm the autism diagnosis (Filippello et al., 2015; Koren-Karie et al., 2009; Naber et al., 2007a; Oppenheim et al., 2022; Rozga et al., 2018). One study used the ADOS raw score (Naber et al., 2007a), another used two separate scores (one for the total of social effects and one for the total of restricted/repetitive behaviors (Filippello et al., 2015), and a third used another measure of autism severity based on an algorithm that generates a score from the ADOS diagnosis and the child's age (Oppenheim et al., 2022). While we could have assigned a severity level score for each sample according to the scores obtained on each measure and conducted moderation analyses using categorical moderators, the limited number of studies included in the meta-analyses prevented testing categorical moderators (Higgins et al., 2019).

Clinical implications

Our results can help inform attachment-based clinical work with autistic children and their families. First, our study suggests that autistic children can and do use their parents as a secure base and a safe haven, as shown by the substantial proportion of autistic children with a secure attachment, despite some characteristics that may resemble insecure attachment. From an assessment perspective, distinguishing between signs of attachment insecurity and autism-related characteristics is crucial (Coughlan et al., 2022). While there is no clear consensus yet on the best way to assess attachment in autistic children, adapted methods based on gold-standard assessment, such as those used in the studies of this meta-analysis, support the idea that it is possible to distinguish markers of insecure attachment from features of autism. It should be noted that although the use of the SSP may be of clinical interest, the interpretation of a single child's SSP has its limitations, and the use of the SSP is primarily destined to population-level analyses (Forslund et al., 2022). Moreover, the ability to make use of the SSP (or SSP-M) by clinicians remains limited, as this requires a strong understanding of both attachment theory and autism. There are now no robust attachment instruments available to support clinicians in this task.

From a clinical perspective, it seems rather more important to address parental psychological distress and the quality of the parent-child relationship by supporting parents in better understanding their child's needs and communicative signals. While autistic children can use their parents as a safe haven and security base, it can be emotionally difficult for parents when their child does not exhibit the typical proximity-seeking behaviors observed in neurotypical development (Périard-Larivée et al., 2024). An important clinical task is therefore to raise parents' awareness that attachment behaviors of autistic children may be more challenging to grasp and observe than those of non-autistic children. Autistic children have their own ways of seeking support from their parents to regulate themselves and alleviate stress. Interventions aimed at supporting parents in observing their child's attachment behaviors may be an efficient way to promote the development and consolidation of a secure relationship. For example, attachment-based interventions using video feedback (e.g. AVI: Cyr et al., 2023; PACT: Green et al., 2010; VIPP-AUTI: Poslawsky et al., 2015) can enhance parents' observational skills, allowing them to witness their child's attachment behaviors and the impact of their own caregiving responses. These interventions have yielded positive outcomes for both the child

and the parent, such as improvements in child attachment security, less parental intrusiveness and parental feeling of self-efficacy (Cyr et al., 2023; Poslawsky et al., 2015).

Limitations

The current study has several limitations. First, this meta-analysis is based on a small number of studies ($k = 6$). This small number of studies resulted in large CIs for each of the calculated attachment proportions, which may have made it more difficult to find significant differences in comparisons with general population samples. Therefore, the moderators included were limited to continuous moderators, as two groups of at least four studies each are needed to test categorical moderators (Higgins et al., 2019). Moreover, autistic characteristics, modifications made to the SSP coding system, child sex and parent sex could not be tested as moderators. Lastly, the meta-analysis included several moderators, while the number of studies was low. The moderator analysis likely lacked power, and future studies are needed to robustly examine potential differences based on different factors in the attachment distributions in autistic children.

Conclusion

The current meta-analysis provided the first 4-way meta-analytical estimate of attachment in autistic children. We found that a considerable proportion of them show a secure attachment (46.5%), a percentage comparable to the general population (51.6%). The proportion of children with a disorganized attachment (27.2%) was also similar to that of the general population (23.5%). Moderator analyses suggest that samples with older children were more likely to include children classified as secure instead of disorganized. They also show a decrease in children with disorganized or resistant classifications over the years in favor of an increase in children with a secure classification. The number of studies included in the present meta-analysis is, however, small. Going forward, it is important to come to a consensus regarding adaptations to the assessment of attachment in autistic children to allow for more reliable and robust comparisons.

Note

1. The authors would like to acknowledge the ongoing debate about the appropriate terminology for referring to this population. In the absence of a clear consensus, we have chosen to use an identity-first language (e.g. "autistic children") in line with the preferences expressed by many members of the autistic community and the positive repercussions that can be associated with the use and appropriation of this terminology (Bury et al., 2023).

Acknowledgments

The authors would like to thank Cheri Nickel, MLIS (University of Calgary), for conducting the literature search; Anh Ly (University of Calgary), for coordinating and carrying out the abstract review, data extraction, and data management; as well as Marjorie Brochu and Gabrielle Boucher (University of Quebec at Trois-Rivieres) for their contributions to study selection.

Disclosure statement

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

Funding

This work was supported by doctoral grants awarded to the first author from the Social Sciences and Humanities Research Council of Canada, the Fonds de Recherche du Québec– Société et Culture, the Fonds de recherche Inclusion sociale, the Institut Universitaire DI-TSA, and the Centre interdisciplinaire de recherche en réadaptation et intégration sociale.

Data availability statement

All data analyzed during this meta-analysis are included in this published article

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