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Association between the autistic traits, internalising and externalising traits, dysregulation, and competence in 18-36-months toddlers

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ABSTRACT

Evidence supports the dimensionality of autistic traits, internalising and externalising traits, dysregulation, and competence. The paper presents the preliminary results of the simultaneous application of the Quantitative-CHecklist for Autism in Toddlers and the Infant Toddler Social Emotional Assessment on 361 mothers of 18–36-month-old toddlers. The associations between the study's variables were controlled for toddlers' age and sex. In addition, the associations between the study's variables and the child's age were explored and controlled by socio-demographic features. Sex differences were investigated. The potential relationship between ATs and internalising and externalising traits, dysregulation, and competence was examined and controlled by socio-demographic features. The cross-sectional association between the child's age and the study's variables was supported: The results revealed that older toddlers showed fewer autistic traits and greater competence than younger ones. Autistic traits, externalising traits, and dysregulation were more prevalent in boys, while the competence domain was higher in girls. Findings suggest the importance of evaluating these traits and domains since infancy and toddlerhood in the general population to detect toddlers with an increased likelihood of autism, as well as those with subthreshold scores.

Autistic Traits

Autism diagnosis is characterised by social and nonsocial traits (American Psychoiatric Association, 2022). Social ATs include poor eye contact, reduced responsiveness, and difficulties in peer interactions, while nonsocial ATs involve repetitive behaviours, strong attachment to specific objects, and a preference for sameness (Baron-Cohen et al., 2009; Constantino & Todd, 2003). Because autistic traits may range from mild to extreme, autism is a dimensional condition (Constantino & Charman, 2016). In other words, the social and nonsocial ATs are distributed along a continuum, that is, they vary from absent/poor to high/extreme levels. Following this conceptualisation, ATs are reported not only by the autistic population but also by the general population. Thus, the severity of the ATs has an impact. The high severity, pervasiveness, and maladaptive social and nonsocial ATs lead to an autism diagnosis (Baron-Cohen

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et al., 2001; Constantino and Todd, 2003; Whitehouse & Bishop, 2009). In contrast, an absent or poor level of social or nonsocial ATs is reported in the general population (Constantino et al., 2009; Robinson et al., 2011).

The role served by sociodemographic features is worth considering. To begin, a sex discrepancy has been noted in autism with a high male prevalence (Zeidan et al., 2022). Males generally showed greater autistic social and nonsocial traits than females (Barańczuk et al., 2024; Haraguchi et al., 2019; (Mandy et al., 2018; Torske et al., 2023). The sex discrepancy is a broadly debated issue; thus, considering sex in the current study could expand knowledge on the topic. Regarding the child's age, the stability of ATs in time has been documented in autistic samples, with studies showing high stability from childhood into later years (Constantino et al., 2009; Guthrie et al., 2013). However, evidence also showed the stability of ATs in the general population. For instance, the longitudinal study by Constantino et al. (2009) on 3–18-years-old children with and without autism found that ATs change in function with age and according to their severity assessed at baseline. The longitudinal study by Whitehouse et al. (2011) revealed that social ATs assessed in males during early childhood [mean age 2.14 years (.16)] were positively correlated with ATs assessed in adulthood [mean age 19.51 years (.71)]. Correlations for non-social ATs did not achieve significance. Holmboe et al. (2014) reported a longitudinal (from 8 to 9 years, from 8 to 12 years, and from 9 to 12 years) moderately high stability of ATs over time for both sexes. Haraguchi et al. (2019) found that ATs are stable during the transition period from preschool (i.e., 5 years) and school (i.e., 8 years) age in boys and girls. In addition, the authors (Holmboe et al., 2014) found that both mild and severe ATs are stable over time. In sum, evidence highlighted that ATs are highly stable across childhood or during the transition period from preschool to school age. Albeit cross-sectionally, it is worth exploring the association between toddlers' age and ATs, expanding knowledge on this topic.

A further issue regards the comorbidity of the ATs. High/extreme (or clinical) levels of social and nonsocial ATs, characterising the autism diagnosis, are linked to co-morbid psychiatric disorders. A recent systematic literature review highlighted that there is a substantial heterogeneity in the prevalence of co-morbidities in children and adolescents with autism (Bougeard et al., 2024). Among the psychiatric co-morbidities, the reviewed studies reported a high prevalence of internalising symptoms in terms of anxiety (~82.20 %) or depressive disorders (~74.80 %) and externalising ones in the form of overactivity and impulsivity (~86.00 %). In addition, high levels of dysregulation (~ 69 %) were reported in the autistic population (Vasa et al., 2022).

In sum, evidence supported the presence of ATs in the early developmental stages in the general population. Thus, their early identification may be useful not only to detect children with high levels of ATs who later were diagnosed with autism but also those who reported borderline (or subthreshold) levels. To overcome and/or mitigate AT-related difficulties, intervention programmes could be designed for both groups of children, not only when a clinical condition is diagnosed. In addition, it is worth considering the insights regarding the association between ATs and other clinical conditions. Having a clear understanding of the association and the simultaneous presentation of social and nonsocial ATs and other psychiatric conditions, such as internalising and externalising traits, and dysregulation, is a pivotal public health issue. However, the intervention programmes may also benefit from the children's competence profile, which will guide the learning objectives.

Based on this, the following sections review the evidence on internalising and externalising traits, dysregulation, and competence. Afterwards, a focus on the association between ATs and internalising and externalising traits, dysregulation, and competence will be provided.

Internalising and externalising traits, dysregulation, and competence

Internalising and externalising traits, dysregulation, and competence are integral components of the individuals' Social-Emotional Development (SED) and encompass their ability to understand, regulate, and express emotions appropriately and to form and sustain healthy relationships in various contexts (Carter et al., 2003; Malti, 2011; Cohen et al., 2005; Levante et al., 2021a,b, 2023). SED is an umbrella term that incorporates the internalising and externalising traits, dysregulation, and competence. Internalising traits include anxiety, depression, social withdrawal, separation distress, and fearfulness, whereas externalising traits involve overactivity, poor impulse control, noncompliance, defiance, and aggression (Achenbach, 1966). Dysregulation is the domain consisting of problems in sleeping and eating, problems regulating negative emotional states concerning reactivity and regulation, and unusual sensory sensitivities. In contrast, the competence domain includes compliance, attention regulation, imitation, and pretend-play skills. The internalising, externalising, and dysregulation are problem-based domains, whereas competence is a strengths-based domain. Similar to ATs, they may be conceived dimensionally. This means they are developed on a continuum that varies from absent/poor to high/extreme levels. Following this conceptualisation, exploring the problems- and strengths-based domains is essential in monitoring infants' and toddlers' developmental trajectory and detecting cases which require clinical attention.

The role played by sociodemographic features is worth taking into account. Evidence reported that infants' and toddlers' sex and age significantly influence problems- and strengths-based domains. Nevertheless, inconsistent results have been highlighted. For instance, Briggs-Gowan et al. (2001) on 1–2-years-old toddlers found no sex effect on both internalising and externalising traits (Briggs-Gowan et al., 2001); the longitudinal study by Lahey et al. (Lahey et al., 2000) on 9–17-years-old individuals revealed that there were no sex differences in externalising traits in terms of oppositional behaviours; nevertheless, aggression, property and/or status offences, were more common among boys than girls. The study by Mayes et al. (2020) on 2–17-year-old individuals highlighted that boys showed more hyperactivity, inattention, and aggression than girls, while no sex discrepancy has been found for anxiety, depression, and somatic complaints. The study by Carter et al. (2003) on 12–36-month-old infants and toddlers reported no sex difference in dysregulation, but a higher score in the internalising domain and competence for girls compared to boys; the latter rated higher on the externalising domain than their girl counterparts. Longitudinal studies reveal patterns in the co-occurrence of internalising and externalising traits. For example, the study by Weeks et al. (2016) revealed that 8–9-year-old children reporting high levels of internalising traits (total score) showed fewer externalising traits (total score) at ages 12–13 years. Additionally, they

observed that higher externalising traits at ages 12–13 predicted higher internalising ones at ages 16–17, with a stronger prediction for girls. Perle et al. (2013) highlighted that sex acts as a significant moderator in the development of internalising (i.e., withdrawn/depressed and anxious/depressed) and externalising (i.e., aggression, tantrums, overt violence) traits. Other longitudinal studies show considerable stability of these traits from childhood to preadolescence, and an increase in both internalising and externalising traits can predict adult psychopathology (Fanti and Henrich, 2010; Kim-Cohen et al., 2003). The results of the reviewed studies highlight the need for further investigations. Considering the dimensionality of the problems and strengths-based domains, their severity should be taken into account. Thus, their early detection is critical due to their potential impact on children's later development (Davis et al., 2015; Olson et al., 2017). It is worth detecting not only toddlers with high levels of problems and strengths-based domains who later were diagnosed with a clinical condition but also those who reported borderline (or subthreshold) levels.

Autistic traits, internalising and externalising traits, dysregulation, and competence

Autistic people show a high rate of psychiatric comorbidities, including internalising, externalising, and dysregulation symptoms (Andersen et al., 2017; Bitsika & Sharpley, 2016; Hoffmann et al., 2016; Lugnegård et al., 2011). Nevertheless, a relationship between several ATs and internalising and externalising traits has been detected in typically developing individuals (Hallett et al., 2009). Regarding the relationship between ATs and internalising traits in middle and late childhood, the longitudinal study by Hallett et al. (2010) found an asymmetric bidirectional relationship: The ATs detected at 7–8 years old moderately and directly affected the development of internalising symptoms at 12 years old. The reverse relationship was significant. The longitudinal community-based study by Saito et al. (2017) showed that internalising and externalising traits in 7-year-old children were predicted by higher ATs assessed at age 5.

Regarding the dysregulation domain assessing a wide array of problems, ranging from sleeping and eating routines, reactivity and regulation of emotions, and unusual sensory sensitivities, the association between ATs and dysregulation highlighted a positive direction. For instance, evidence reported that higher levels of autistic traits were associated with shorter weekday sleep duration (Salmela et al., 2019). Similarly, a systematic review found a concurrent association between ATs and problematic eating behaviours in nonclinical samples (Christensen et al., 2019). On reactivity and regulation of emotion, the existing literature showed that autistic traits exacerbate emotion dysregulation (Lu et al., 2025).

Also, the competence domain is negatively associated with the ATs: To be accurate, the higher the latter, the lower the attention regulation, imitation, and pretend play skills (Edwards, 2014; Yoshimura et al., 2020).

Given the high prevalence of internalising, externalising, and dysregulation symptoms in individuals later diagnosed with autism (Andersen et al., 2017; Bitsika & Sharpley, 2016; Hoffmann et al., 2016; Lugnegård et al., 2011) as well as the distribution of these traits in the general population (Hallett et al., 2009) exploring them since toddlerhood may have a significant cascade effect in preventing future mental illness and designing early intervention (Colombi et al., 2023; Denham, 2006). At the time that these problem-based domains are evaluated, the assessment of the infants' and toddlers' strengths-based domain in terms of competence, which reflects their current developmental level, is pivotal for intervention programmes. Comprehensively, clinical or borderline levels of social and nonsocial ATs, as well as internalising and externalising traits and dysregulation, may impact the increased likelihood of onset of severe and comorbid psychiatric disorders (Carpita et al., 2019; Dell'osso et al., 2019, 2021). This multicausal framework (Fried & Cramer, 2017) is likely the only suitable candidate model to make a meaningful simultaneous assessment of these traits. The approach considers that mental illness is predicted by the presence of more than one clinical and/or borderline trait rather than a single one. The autistic traits and the internalising and externalising traits, as well as the dysregulation, are often comorbid in older children. Thus, exploring whether they may be associated and investigating their potential causal power during the early developmental stage (i.e., toddlerhood) is a pivotal primary prevention issue. It would allow healthcare services to train toddlers, changing their atypically developing trajectory.

What the current study adds

The main and novel approach of this paper is to investigate the preliminary results of the association/relationship between ATs and problems- and strengths-based domains in a community sample of toddlers (18–36 months). The existing literature has devoted attention mainly to childhood and beyond. While identifying clinical and borderline (or threshold) ones of ATs, internalising, and externalising traits in the general population since toddlerhood via early screening procedures (Levante et al., 2020) may allow detection not only of children at risk for autism or other clinical condition (i.e., internalising and externalising problems) but also of those reporting a clinical complex condition (e.g., autism with co-morbidities). Compared to the previous study assessing the association between autistic traits, internalising, and externalising ones (Levante et al., 2020), the current one added the assessment of the dysregulation and competence domains, providing a more detailed toddlers' profile. Indeed, it is worth noting that to date, there is a paucity of studies investigating the association and the potential relationship between the ATs, dysregulation, and competence domains in toddlerhood. Dysregulation is conceived as a risk factor for internalising and externalising traits (Carter et al., 2003) and exploring whether this problem-based domain may be associated with ATs in the general population may expand knowledge on the topic. The current study also added the assessment of the toddlers' competence domain. From a primary prevention perspective, the evaluation of the strengths of the toddlers may provide essential additional information that professionals can leverage in changing the atypically developing trajectory.

A further novelty of the current study was administering the association/relationship between the study's variables using valid and

reliable screening tools. The main advantage of using screening questionnaires regards the low administration cost in terms of human and financial resources. Although observational procedures are accurate in assessing toddlers, they require not only trained professionals but also high financial resources. The screening questionnaires are easy to complete and have a user-friendly format. Based on this, two open-source caregiver-report questionnaires have been administered for the current study's purposes: The Quantitative-CHecklist for Autism in Toddlers (Q-CHAT; Allison et al., 2008) assesses the ATs, while the Infant and Toddler Social and Emotional Assessment (ITSEA; Carter et al., 1999) assesses the internalising and externalising traits, dysregulation, and competence domains. The Q-CHAT has been selected because, in contrast to other valid screening measures for assessing autistic traits (e.g., M-CHAT; (Robins & Dumont-Mathieu, 2006), it was developed using a dimensional approach. In other words, the Q-CHAT allows for the assessment of the frequency (from always to never) of social and non-social autistic traits and not the mere absence/presence of them. We opted for the ITSEA because, in contrast to the CBCL (Achenbach & Rescorla, 2014), it is open-source and it provides a comprehensive assessment of socio-emotional development in terms of not only internalising and externalising traits, but also of dysregulation and competence.

In sum, the study's purposes are to (1) investigate the association between toddlers' age and study variables (i.e., ATs, internalising, externalising, dysregulation, and competence) controlling by child's sex and maternal education; (2) explore the relationship between ATs and internalising and externalising traits, dysregulation, and competence controlling by child's sex and maternal education, and child's age.

Method

Procedure

Data were collected in a web-based cross-sectional study (EC approval: 31665/2023). Three inclusion criteria have been predefined to select parents: (1) having $\geq$ 18 years, (2) having typically developing children aged 18–36 months, and (3) being fluent in the Italian language. The e-questionnaire has been imported into LimeSurvey, and the link has been spread through the main social platforms (i.e., WhatsApp and Facebook). Parents signed an e-consent before filling out the e-questionnaire to participate and to publish data anonymously. Informed consent was obtained for participation and the publication of results. The privacy rights of participants have been observed.

Participants

Three hundred sixty-one questionnaires have been filled out by mothers of 18–36-months children [*M*(SD) of the total sample 28.98 (4.65) months]. 178 questionnaires have been completed for females [*M*(SD) = 28.12(4.34) months; males = *M*(SD) = 28.37(4.20) months]. Most of the children were full-term (n = 305). Two hundred and two mothers declared a low educational level (i.e., high school) and one hundred fifty-five declared a high level (i.e., bachelor's or master's degree or post lauream). Most of the mothers are married (n = 315).

Measures

Autistic traits. The Quantitative-CHecklist for Autism in Toddlers (Allison et al., 2008) was administered to assess autistic traits. It is a parent-report questionnaire evaluating autism traits in 18- to 36-month-old toddlers. The measure provides a nuanced view of ATs through a frequency scale that allows detecting behaviour(s) at a reduced frequency. Thus, the measure captures varying degrees of atypical behaviours (from mild to severe) rather than the mere presence or absence of them.

The open-source screener consists of 25 items scored on a 5-point Likert scale ranging from 0 (never) to 4 (always). Three types of ATs were evaluated using the questionnaire: (1) non-social/behavioural ATs, (2) speech and language, and (3) joint attention/non-verbal communication. The non-social-behaviours factor assesses the child's tendency to line the objects or toys, his or her interest in spinning objects (e.g., washing machine or toy car), and his or her tendency to sniff or lick unusual objects. Additionally, this factor evaluates repetitive behaviours (e.g., doing the same thing over and over again, twiddling objects repetitively) and unusual hand movements. The second factor evaluates the child's speech and language ability in the form of response to the name, number, and understandability of the words and echolalia. The last factor of joint attention/non-verbal communication assesses the frequency of imperative and declarative pointing, response to joint attention, and referential gestures (e.g., waving goodbye).

The main measure's psychometric properties have been demonstrated. The questionnaire showed a 3-factor structure (moderate to low reliability: Ω factor 1 =.78; factor 2 =.33; factor 3 =.67; (Lecciso et al., 2019) and moderate internal consistency (α = .67; (Allison et al., 2008); it also showed a good test-retest reliability (~.82; (Levante et al., 2021); (Allison et al., 2008) and measurement invariance across time (Levante et al., 2021) and gender (Lecciso et al., 2019; Stevanović, 2021); criterion validity (Gutiérrez-Ruiz et al., 2019; Levante et al., 2021; Magiati et al., 2015) and diagnostic accuracy as well (Levante, Petrocchi, & Lecciso, 2020; Ruta et al., 2019a,b; Tartarisco et al., 2021) have been reached. The measure has been translated into several languages (e.g., Italian, Persian, Korean), and its demonstrated validity for the Italian population encourages its administration in the present study. In the current study, the Italian translation was administered (Levante et al., 2020).

Internalising and Externalising Traits, Dysregulation, and Competence. The Infant and Toddler Social and Emotional Assessment (ITSEA) is a parent-report measure assessing the socio-emotional domain in infants and toddlers aged 12–36 months. The measure was developed to dimensionalise these traits in infants and toddlers. Indeed, the questionnaire provides a nuanced view of internalising and externalising traits, dysregulation, and competence through a frequency scale that allows detecting behaviour(s) at

an increased frequency.

The questionnaire assesses four domains of behaviours: Three problem-based domains in the form of internalising traits (i.e., depression, social withdrawal, anxiety, separation distress, and extreme inhibition/shyness), externalising ones (i.e., activity, impulsivity, aggression, and defiance) and dysregulation (i.e., problems in sleeping and eating, problems regulating negative emotional states concerning reactivity and regulation, and unusual sensory sensitivities). A strength-based domain in terms of infants' and toddlers' competence (i.e., attention regulation, imitation and pretend play skills, mastery of motivation, empathy, emotional awareness, and prosocial peer behaviours). It is worth noting that problem- and strength-based domains are both related and independent. In other words, a typically developing trajectory emphasises a decrease in the problem-based domain in contrast to competencies that are expected to increase over time. Thus, the questionnaire develops this domain not only as the lack of problem-based domains but also as the presence of age-appropriate skills, which reflect the child's strengths.

The response rate varied on a 3-point Likert scale ranging from 0 (not true/rarely) to 2 (very true/often). A score for each of the four domains is calculated as the mean of the domain-specific items. The higher the score, the higher the severity of the internalising, externalising, and dysregulation traits; the higher the score, the higher the competencies shown by the toddlers.

The main psychometric properties have been demonstrated. The questionnaire showed good criterion validity (Lee et al., 2018), factor structure (Carter et al., 2003; Lee et al., 2018), and strong internal consistency (internalising traits $\alpha = .80$; externalising traits $\alpha = .87$; dysregulation $\alpha = .86$; competence $\alpha = .90$; (Carter et al., 2003). In addition, good test-retest reliability has been reached (Carter et al., 1999; Jianduan et al., 2009; Lee et al., 2018). The measure has been translated into several languages (e.g., Italian, Chinese, Korean), and its validity has been broadly demonstrated. To date, no study has been carried out for the Italian general population. This supports its preliminary application in the present study.

Statistical plan

The power analysis has been calculated via G*Power 3.1.9.6 for Mac OSx 10.7–14 to select the adequate sample size. The a priori power analysis to compute the sample size, given $\alpha = .05$, effect size $= .60$, and $1\text{-}\beta = .95$, required a total sample size of $n = 148$ participants [$t(146) = 1.97$; $\zeta = 3.64$]. To test the normality of the data distribution and the homoscedasticity (or homogeneity of variance) of data, skew and kurtosis parameters and Levene's test have been calculated, respectively. Skew and kurtosis parameters indicated a Gaussian distribution, and the variances among groups (males vs. females) were equal. Because the Gaussianity of data was not violated and the homoscedasticity (i.e., homogeneity of variance) was assumed, parametric analyses were computed. No imputation strategy has been run due to the mandatory responses. Partial correlations using Pearson's *r* coefficients were calculated to investigate the associations between the child's age and study variables controlled by the child's sex and the maternal educational levels. Hierarchical models were run to examine the relationships between the child's sex and maternal educational levels (null model), the child's age, ATs (as predictive variables), and internalising and externalising traits, dysregulation, and competence (as outcome variables). All regression models were controlled by toddlers' gender and age. Statistical analyses were computed using SPSS v.25 (IBM, 2023).

Results

Preliminary descriptive results

Table 1 shows preliminary descriptive results in terms of mean scores, standard deviations, sex comparison t-test, and the theoretical range of ATs, internalising and externalising traits, dysregulation, and competence. Although the mean score of the ATs is high and close to the Italian cut-off of 43 (Lecciso et al., 2019), it is not above the clinical threshold. Regarding the internalising and externalising traits and dysregulation, the mean scores are low, indicating no clinical or borderline threshold. The competence mean score is average.

Furthermore, the independent two-paired sample *t*-test showed that ATs and externalising traits were significantly higher for boys than girls, whereas females showed more competence than their male counterparts.

Table 1
Mean, standard deviations, and theoretical range of the study's variables.

Study's variables	Total sample M (SD)	Boys M (SD)	Girls M (SD)	*t*-test	Theoretical range
ATs	35.34(7.38)	36.39(8.13)	34.30(6.41)	t(347) = −3.100**	0 −100
Internalising traits	.47(.22)	.45(.23)	.49(.21)	t(359) = 1.031	0 −2
Externalising traits	.46(.28)	.48(.30)	.44(.26)	t(349) = −1.961*	0 −2
Dysregulation	.40(.25)	.41(.25)	.40(.24)	t(359) = −.535	0 −2
Competence	1.34(.29)	1.31(.30)	1.37(.29)	t(359) = 2.335*	0 −2

*** $p < .001$; ** $p < .010$; * $p < .050$

Association between the child's age, ATs, internalising and externalising traits, dysregulation, and competence

Partial correlation coefficients controlled by the child's sex and maternal educational levels were tabulated (Table 2). The child's age was associated negatively with the autistic traits and positively with the child's competence. The ATs were positively associated with internalising and externalising traits, and dysregulation. A negative association between ATs and competence was found. Except for the association between internalising traits and competence, each association among the study's variables was significant.

Relationship between ATs, internalising and externalising traits, dysregulation, and competence

As shown in Table 3, controlling for child's sex and maternal educational level (Step 1) and the child's age (Step 2), children's autistic traits are potential factors (Step 3) affecting their internalising and externalising traits, dysregulation, and competence. Indeed, four significant hierarchical regression models were achieved. Three models showed that ATs served as potential risk factors for internalising and externalising traits and dysregulation as well. This means that the higher the ATs, the higher the internalising and externalising, and the dysregulation.

No significance has been found for the socio-demographic features (i.e., child's age and gender, maternal educational levels) in the former three models. The results outlined the negligible role served by the socio-demographic feature on the target outcomes.

Regarding competence, the results reported a negative relationship: This means that the lower the ATs, the higher the competence. In addition, a positive impact of the child's age on competence was found: This means the older the children, the higher the competence.

Discussion

The novelty of the current study regards the investigation of not only the association/relationship between ATs and internalising and externalising, but also the underexplored association/relationship between ATs and dysregulation and competence. A further novelty regards the involvement of the low-explored population of 18-to 36-month-old toddlers. Lastly, to date, this is the first study using two open-source questionnaires, the Quantitative-CHecklist for Autism in Toddlers and the Infant Toddler Socio-Emotional Assessment.

Preliminary descriptive results showed similar mean scores of ATs to those achieved in a study on 18–24-month-old toddlers (Magiati et al., 2015), but they are higher scores compared to other ones on 18–24-month-old toddlers (Allison et al., 2008; Auyeung et al., 2010) for the total sample, and boys and girls separately. On internalising and externalising traits as well as on dysregulation and competence, the mean scores of the current study were lower than those achieved in other studies on 12–36-month-old toddlers (Carter et al., 2003; Lee et al., 2018), considering the total sample. On girls only, Lee et al. (Lee et al., 2018) reported lower mean scores for externalising traits than the mean score achieved in the current study. On sex, Lee et al. (2018) reported a higher mean score for dysregulation in males and a lower one for competence in girls compared to those achieved in the current study. It is worth noting that the mean scores achieved in the current study are not clinical or borderline; thus, this discussion aimed at comparing the mean scores narratively. On children's sex comparisons, our results are in line with the sex ratio for autism and ATs (Loomes et al., 2017). On externalising traits and dysregulation, findings showed that they were higher in boys than girls, as found by others (Carter et al., 2003; Lee et al., 2018). Higher score in competence was also reached by girls compared to their counterparts (Carter et al., 2003).

Regarding the first study purpose, investigating the association between toddlers' age and ATs, internalising and externalising traits controlling by child's sex and maternal education, the results agree with both cross-sectionally studies on 8–30-month-old (Ding et al., 2021) and longitudinally ones on 12–36-month-old (Levante et al., 2020) and 5–7-year-old children (Saito et al., 2017) demonstrating a positive association between ATs and the internalising and externalising traits during toddlerhood. This means that children under 36 months simultaneously presented these traits, emphasising their early onset. The novelty of the present study lies in the investigation of the associations between ATs and dysregulation and competence using the same measure. In sum, the positive association between ATs and dysregulation and the negative one when competence was considered were found. On dysregulation, a body of literature on children and adolescents (Gormley et al., 2022; Morie et al., 2019; Samson et al., 2014) revealed that core features of autism may be the basis for individuals' dysregulation as well as the latter being associated with ATs in terms of repetitive behaviours and social

Table 2
Partial correlations between the child's age and the study's variables were controlled by the child's sex and maternal educational levels.

Study's variables	M (SD)	(1)	(2)	(3)	(4)	(5)
Child's sex	28.24(4.26) months	−.163***	−.031	−.063	−.024	.186***
Autistic Traits (1)	35.34(7.38)		.147*	.217***	.282***	−.477***
Internalising Traits (2)	.47(.22)			.555***	.597***	−.086
Externalising Traits (3)	.46(.28)				.598***	−.172**
Dysregulation (4)	.40(.25)					−.297***
Competence (5)	1.34(.30)					-
Controlled by						
Child's gender	1.50(.50)					
Maternal educational levels	1.36(.48)					

*** $p < .001$; ** $p < .010$; * $p < .050$

Table 3
Regression results of the socio-demographic features and ATs on internalising and externalising, dysregulation, and competence.

Study's variables in regression		Internalising traits	Externalising traits	Dysregulation	Competence
		β	β	β	β
Step 1	Child's sex	−.096	.029	−.035	−.026
	Maternal education	.003	−.049	−.005	.006
Step 2	Child's age	−.007	−.029	.023	**.031***
Step 3	Autistic Traits	**.148***	**.214*****	**.290*****	**−.463*****
Final model		$F(1296) = 6.285$; $p < .001$	$F(1296) = 13.622$; $p < .001$	$F(1296) = 25.612$; $p < .001$	$F(1296) = 79.646$; $p < .001$

difficulties as promoting factors. As reported above, it is worth noting that the dysregulation domain using the ITSEA evaluates a wide array of problems, e.g., sleep disturbances, eating problems, negative emotionality, and sensory sensitivity. Together, our findings agree with studies revealing an association between ATs and each aforementioned scale. For instance, as others have found, the study's results reported that the more ATs, the more sleep disturbance in preschool-aged children (Favole et al., 2023). Similarly, ATs were positively associated with eating problems. A systematic review (Baraskewich et al., 2021) on children, adolescents, and youths highlighted that most of the reviewed studies noted that disordered eating attitudes, such as picky eating and food avoidance or fear of trying new foods, occurred more frequently in individuals with autism than their peers without autism. In the last decade, similar cognitive and behavioural patterns between individuals with autism and those with eating disorders have been revealed (Rhind et al., 2014): For instance, weak central coherence and/or deficits in social cognition (Roberts et al., 2007), including impaired theory of mind (Marchetti et al., 2013). Our results supported that this association may be noticeable since toddlerhood, and this could be valuable additional information in defining the toddlers' profile and in designing specific training. A positive association with negative emotionality, as argued by others (Dell'Osso et al., 2023), is a part of the autistic continuum from childhood to adulthood. Based on a trans-nosographic approach (Sheppes et al., 2015), ATs may represent the phenotypical presentation of potential psychiatric emotional disorders. Nevertheless, many aspects of this relationship remain controversial (Dell'Osso et al., 2023) and should be further investigated. A final consideration regards the positive association between ATs and sensory sensitivity as a component of the dysregulation domain. In line with studies highlighting an association over time from preschool age to adulthood (e.g., (Kern et al., 2007; Leekam et al., 2007; Robertson & Simmons, 2013), the cross-sectional results of the current study revealed that high levels of ATs may be associated with children's sensory reactivity.

Although our results are aligned with existing literature, which administered different measures, they may support the use of the Q-CHAT and ITSEA as tools in the screening procedure to evaluate autistic traits and the socio-emotional development.

A further novelty of the current study regards the investigation of the association between ATs and the strength-based domain of competence. It is worth noting that the developer of the ITSEA (Carter et al., 2003) conceived competence as 12–36-month-old toddler-specific abilities, such as attention regulation, imitation and play, mastery motivation, empathy, and prosocial peer behaviours. Considering the general population recruited for the present paper, it is not surprising the negative association observed by our study and others on 6–24-month-old infants and toddlers (Young et al., 2011): As is well known, the competencies assessed by the ITSEA are the main one in which children with an increased likelihood of autism as well as those with a diagnosis of autism have considerable difficulties in toddlerhood (i.e., 12–36 months; (Kruizinga et al., 2014) as well as in all age (Pontoppidan et al., 2017). Nevertheless, assessing these toddlers' competencies in detail, in terms of each domain's subscale score, would allow for extracting the actual level of each toddler's potential strengths. In sum, the opportunity to detect both children's competence as well as their difficulties using only one questionnaire may be pivotal in early screening and diagnosis procedures and intervention planning as well. For instance, the Early Start Denver Model (Dawson et al., 2010) leverages acquired 12–48-month-old children's competence and/or in-progress ones to overcome their difficulties (Colombi et al., 2023).

The correlational analysis allowed for investigation of the association between toddlers' age and the study's variables, controlled by the child's sex and maternal educational levels. The study's results support previous studies findings that older children reported lower ATs (Allison et al., 2008) and more competence (Carter et al., 2003; Sanner et al., 2016). This finding is not surprising given the unselected population recruited for this study; therefore, this topic should be further investigated in the clinical population using the same open-source measures. In contrast with existing literature (Carter et al., 2003; Levy et al., 2023), no association between internalising and age was found. Although cross-sectionally, it could be hypothesised that the study's result was in line with the "low-stable trajectory" of the internalising traits found in the longitudinal study by Bayer et al. (2012). The authors found that the internalising traits of the majority (86 %) of children aged 46 to 94 months in the general population followed this trajectory, indicating the stability of internalising traits over time. Future studies could explore this lack of association in other normative samples, taking into account potential risk factors such as parental discipline or distress.

The second study's purpose is to explore the relationship between ATs and internalising and externalising traits, dysregulation, and competence during toddlerhood, controlled by the child's sex and age and maternal educational levels. ATs may be a potential risk factor for internalising and externalising traits and dysregulation. In addition, high levels of ATs were related to low levels of competence. Similar to others (Carter et al., 2003), the former model also reported a positive relation with the child's age: The older the child, the higher the competence. Regarding the child's sex and maternal education levels, they did not affect the study's outcome variables. Nevertheless, due to the potential role served by them as found by others from infancy to 5 years of age (e.g., (Bayer et al., 2012; Goh et al., 2018; Kim et al., 2009), further investigations are required.

Overall, despite the cross-sectional and exploratory nature of the study, these results appear promising and support the broader assessment of ATs, internalising and externalising traits, dysregulation, and competence during the early developmental stage in the general population, in line with the multicausal approach for psychopathology (Fried and Cramer, 2017). Additionally, using a fully transdiagnostic dimensional approach (e.g., see (Dalgleish et al., 2020; Fusar-Poli et al., 2019), both toddlers who met diagnostic clinical thresholds or borderline subthreshold may be described in terms of psychological functioning. The early and repeated screening procedure may play a pivotal role in this frame: The broader assessment consisting of social development, communication and language, emotion regulation, etc., may help professionals define the children's developmental profile. Having this comprehensive children's developmental profile may help professionals and carers use strategies tailored to the target profile.

Consequently, a reflection arose. The dimension of ATs may be relevant not only for toddlers at risk but also for those who do not meet the clinical threshold for an autism diagnosis. For example, social communication and interaction difficulties, as well as sensory sensitivity, have been revealed to be highly prevalent in children with hyperactivity/impulsivity (Fabio et al., 2024; Grossman & Avital, 2023; Panagiotidi et al., 2018; Piltz et al., 2024). Thus, the early assessment of ATs in the general population may help to detect toddlers with an increased likelihood of other neurodevelopmental disorders. This broader, early, and repeated screening procedure using accurate screeners (Petrocchi et al., 2020; Thabtah & Peebles, 2019) for children who are later diagnosed with autism may allow them to obtain a more in-depth overview of their functioning. This is important because providing a realistic perspective on possibilities for change and development/promotion of abilities may inform the intervention planning markedly.

Strengths, limitations, & future directions

Our study reported the exploratory application of two open-source tools in evaluating ATs and problem- and strengths-based domains. Following the cross-sectional nature of the study, these promising results may promote the administration of these tools as potential screeners for toddlers with an increased likelihood of autism. Additionally, our research suggests that using two parent-report questionnaires simultaneously might be useful for screening during paediatric checkups. Indeed, they would allow the detection of toddlers who need clinical attention using a low-cost screening protocol. Albeit the ITSEA consists of more than one hundred items, it allows for the exploration of a wide array of behaviours which are pivotal for outlining the children's developmental profile.

However, the study's results should be read in light of limitations. The study conclusions depended solely on caregiver reports, which could introduce rater bias and correlated measurement errors. Future research should include additional informants (paediatricians' observations, kindergarten teachers), behavioural assessments (e.g., observational procedure), and neuroimaging data (e.g., MRI) for a more comprehensive evaluation. The cross-sectional design restricts the generalisability of our findings and does not account for environmental factors such as parental influence and home environment. Future longitudinal multidisciplinary studies could develop a database consisting of children's comprehensive assessment, for instance, including genetic exams, familial environmental information, and behavioural assessments. In this vein, it would be advisable to collect genetic exams (Wei et al., 2021) as a routine check recommended by paediatricians as well as storing data on children's behavioural/emotional development or information about family history. Together, this might provide a comprehensive overview of toddlers' development. The lack of follow-up data on autism and related psychopathology further limits the scope. Future studies could examine the diagnostic accuracy of the measures and their discriminative validity by comparing toddlers with an increased likelihood of autism and typically developing peers. The unbalanced age range of 18–36 months in the sample necessitates testing across different developmental stages and in at-risk or clinical groups.

Longitudinal studies are needed to assess the stability of ATs, internalising and externalising traits, dysregulation, and competence domains over time and control how several factors (e.g., sex, gender, family environment) may serve a pivotal role in children's development. Prior research (Whitehouse et al., 2011) shows that early ATs correlate with social ATs in adulthood, emphasising the need for ongoing monitoring, especially for males. The higher vulnerability of females to internalising traits (Matos et al., 2017) further underscores the importance of monitoring these traits to prevent anxiety and depression.

Understanding how various factors of ATs and internalising and externalising traits, dysregulation, and competence interact could inform intervention programmes. The ecology-based theory of child psychopathology (Bronfenbrenner & Evans, 2000) suggests that environmental interactions influence symptom development. Studies indicate that developmental disorders in children can strain caregivers and affect their perceptions of child behaviour (Bussing et al., 2003; Vaughan et al., 2010; Levante et al., 2021; Levante et al., 2022). Interventions addressing caregiver stress and promoting family relationships (Da Paz et al., 2018; Kim et al., 2018; Lecciso et al., 2013; Hanöz et al., 2024; Singh et al., 2014) can benefit the entire family. Overall, our findings support a comprehensive approach to identifying at-risk children and addressing autism and psychopathology.

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CRediT authorship contribution statement

Chiara Martis: Writing – review & editing, Methodology, Investigation. **Annalisa Levante:** Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Luigia Duma:** Writing – review & editing, Methodology, Investigation. **Flavia Lecciso:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization.

Declaration of Competing Interest

I have nothing to declare.

Data availability

Data will be made available on request.

References

Achenbach, T. M. (1966). The classification of children's psychiatric symptoms: A factor-analytic study. *Psychological Monographs, 80*(7), 1–37. https://doi.org/10.1037/H0093906

Achenbach, T. M., & Rescorla, L. A. (2014). The achenbach system of empirically based assessment (ASEBA) for ages 1.5 to 18 years. *The use of psychological testing for treatment planning and outcomes assessment* (pp. 179–213). Routledge,.

Allison, C., Baron-Cohen, S., Wheelwright, S., Charman, T., Richler, J., Pasco, G., & Brayne, C. (2008). The Q-CHAT (Quantitative CHecklist for Autism in Toddlers): a normally distributed quantitative measure of autistic traits at 18-24 months of age: preliminary report. *Journal of Autism and Developmental Disorders, 38*(8), 1414–1425. https://doi.org/10.1007/S10803-007-0509-7

American Psychiatric Association. (2022). Diagnostic and statistical manual of mental disorders (5th ed., text rev.). American Psychiatric Association Publishing. https://doi.org/10.1176/appi.books.9780890425787.

Andersen, P. N., Hovik, K. T., Skogli, E. W., & Øie, M. G. (2017). Severity of autism symptoms and degree of attentional difficulties predicts emotional and behavioral problems in children with High-Functioning autism: A two-year follow-up study. *Frontiers in Psychology, 8*, 2004. https://doi.org/10.3389/FPSYG.2017.02004

Auyeung, B., Taylor, K., Hackett, G., & Baron-Cohen, S. (2010). Foetal testosterone and autistic traits in 18 to 24-month-old children. *Molecular Autism, 1*, 1–8.

Barańczuk, U., Goncikowska, K., Pisula, E., & Pisula, W. (2024). Sex/gender differences in the level and variability of autistic traits: A meta-analysis of the Autism-Spectrum quotient. *Health Psychology Report, 54*(1), 11–24. https://doi.org/10.5114/HPR/183105

Baraskewich, J., von Ranson, K. M., McCrimmon, A., & McMorris, C. A. (2021). Feeding and eating problems in children and adolescents with autism: A scoping review. *Autism, 25*(6), 1505–1519. https://doi.org/10.1177/1362361321995631

Baron-Cohen, S., Ashwin, E., Ashwin, C., Tavassoli, T., & Chakrabarti, B. (2009). Talent in autism: Hyper-systemizing, hyper-attention to detail and sensory hypersensitivity. *Philosophical Transactions of the Royal Society B Biological Sciences, 364*(1522), 1377–1383. https://doi.org/10.1098/RSTB.2008.0337

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): evidence from asperger Syndrome/High-Functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*(1), 5–17. https://doi.org/10.1023/A:1005653411471/METRICS

Bayer, J. K., Ukoumunne, O. C., Mathers, M., Wake, M., Abdi, N., & Hiscock, H. (2012). Development of children's internalising and externalising problems from infancy to five years of age. *Australian & New Zealand Journal of Psychiatry, 46*(7), 659–668.

Bitsika, V., & Sharpley, C. F. (2016). The association between social responsivity and depression in High-Functioning boys with an autism spectrum disorder. *Journal of Developmental and Physical Disabilities, 28*(2), 317–331. https://doi.org/10.1007/S10882-015-9470-0

Bougeard, C., Picarel-Blanchot, F., Schmid, R., Campbell, R., & Buitelaar, J. (2024). Prevalence of autism spectrum disorder and Co-Morbidities in children and adolescents: A systematic literature review. *FOCUS, 22*(2), 212–228.

Briggs-Gowan, M. J., Carter, A. S., Skuban, E. M., & Horwitz, S. M. C. (2001). Prevalence of social-emotional and behavioral problems in a community sample of 1- and 2-year-old children. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*(7), 811–819. https://doi.org/10.1097/00004583-200107000-00016

Bronfenbrenner, U., & Evans, G. W. (2000). Developmental science in the 21 century: Emerging questions, theoretical models, research designs and empirical findings. *Social Development, 9*(1), 115–125. https://doi.org/10.1111/1467-9507.00114

Bussing, R., Gary, F. A., Mason, D. M., Leon, C. E., Sinha, K., & Garvan, C. W. (2003). Child temperament, ADHD, and caregiver strain: exploring relationships in an epidemiological sample. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*(2), 184–192. https://doi.org/10.1097/00004583-200302000-00012

Carpita, B., Muti, D., Muscarella, A., Dell'Oste, V., Diadema, E., Massimetti, G., Signorelli, M. S., Poli, L. F., Gesi, C., Aguglia, E., Politi, P., Carmassi, C., & Dell'Osso, L. (2019). Sex differences in the relationship between PTSD spectrum symptoms and autistic traits in a sample of university students. *Clinical Practice and Epidemiology in Mental, 15*(1), 110–119. https://doi.org/10.2174/1745017901915010110

Carter, A. S., Briggs-Gowan, M. J., Jones, S. M., & Little, T. D. (2003). The Infant-Toddler social and emotional assessment (ITSEA): Factor structure, reliability, and validity. *Journal of Abnormal Child Psychology, 31*(5), 495–514. https://doi.org/10.1023/A:1025449031360

Carter, A. S., Little, C., Briggs-Gowan, M. J., & Kogan, N. (1999). The infant–toddler social and emotional assessment (ITSEA): Comparing parent ratings to laboratory observations of task mastery, emotion regulation, coping behaviors, and attachment status. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health, 20*(4), 375–392.

Christensen, S. S., Bentz, M., Clemmensen, L., Strandberg-Larsen, K., & Olsen, E. M. (2019). Disordered eating behaviours and autistic traits—are there any associations in nonclinical populations? A systematic review. *European Eating Disorders Review, 27*(1), 8–23.

Cohen, J., Onunaku, N., Clothier, S., & Poppe, J. (2005, September). Helping young children succeed: Strategies to promote early childhood social and emotional development. In Research and Policy Report. Washington, DC: National Conference of State Legislatures.

Colombi, C., Chericoni, N., Bargagna, S., Costanzo, V., Devescovi, R., Lecciso, F., … Contaldo, A. (2023). Case report: Preemptive intervention for an infant with early signs of autism spectrum disorder during the first year of life. *Frontiers in Psychiatry, 14*, Article 1105253.

Constantino, J. N., Abbacchi, A. M., Lavesser, P. D., Reed, H., Givens, L., Chiang, L., Gray, T., Gross, M., Zhang, Y., … Todd, R. D. (2009). Developmental course of autistic social impairment in males. *Development and Psychopathology, 21*(1), 127–138. https://doi.org/10.1017/S095457940900008X

Constantino, J. N., & Charman, T. (2016). Diagnosis of autism spectrum disorder: Reconciling the syndrome, its diverse origins, and variation in expression. *The Lancet Neurology, 15*(3), 279–291. https://doi.org/10.1016/S1474-4422(15)00151-9

Constantino, J. N., & Todd, R. D. (2003). Autistic traits in the general population: A twin study. *Archives of General Psychiatry, 60*(5), 524–530. https://doi.org/10.1001/ARCHPSYC.60.5.524

Da Paz, N. S., Siegel, B., Coccia, M. A., & Epel, E. S. (2018). Acceptance or despair? Maternal adjustment to having a child diagnosed with autism. *Journal of Autism and Developmental Disorders, 48*(6), 1971–1981. https://doi.org/10.1007/S10803-017-3450-4

Dalgleish, T., Black, M., Johnston, D., & Bevan, A. (2020). Transdiagnostic approaches to mental health problems: Current status and future directions. *Journal of Consulting and Clinical Psychology, 88*(3), 179–195. https://doi.org/10.1037/CCP0000482

Davis, S., Votruba-Drzal, E., & Silk, J. S. (2015). Trajectories of internalizing symptoms from early childhood to adolescence: associations with temperament and parenting. *Social Development, 24*(3), 501–520. https://doi.org/10.1111/SODE.12105

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., … Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: the Early Start Denver Model. *Pediatrics, 125*(1), e17–e23.

Dell'Osso, L., Bertelloni, C. A., Di Paolo, M., Avella, M. T., Carpita, B., Gori, F., Pompili, M., & Carmassi, C. (2019). Problematic Internet use in university students attending three superior graduate schools in Italy: is autism spectrum related to suicide risk? *International Journal of Environmental Research and Public Health, 16*(7), 1098. https://doi.org/10.3390/IJERPH16071098

Dell'Osso, L., Cremone, I. M., Amatori, G., Cappelli, A., Cuomo, A., Barlati, S., Massimetti, G., Vita, A., Fagiolini, A., Carmassi, C., & Carpita, B. (2021). Investigating the relationship between autistic traits, ruminative thinking, and suicidality in a clinical sample of subjects with bipolar disorder and borderline personality disorder. *Brain Sciences, 11*(5), 621. https://doi.org/10.3390/BRAINSCI11050621

Dell'Osso, L., Massoni, L., Battaglini, S., De Felice, C., Nardi, B., Amatori, G., Cremone, I. M., & Carpita, B. (2023). Emotional dysregulation as a part of the autism spectrum continuum: A literature review from late childhood to adulthood. *Frontiers in Psychiatry, 14*, Article 1234518. https://doi.org/10.3389/FPSYT.2023.1234518

Denham, S. A. (2006). Social-Emotional competence as support for school readiness: what is it and how do we assess it? *Early Education and Development, 17*(1), 57–89. https://doi.org/10.1207/S15566935EED1701_4

Ding, N., Gao, H., Jiang, J., Zhai, M., Shao, H., Fu, L., Li, C., Ren, Y., Li, Y., Feng, M., Cui, X., Qiu, N., Jin, P., & Ke, X. (2021). The characteristics and factors of the internalizing and externalizing behaviours of children at high risk for autism spectrum disorder. *BMC Psychiatry, 21*(1), 1–10. https://doi.org/10.1186/S12888-021-03479-6

Edwards, L. A. (2014). A meta-analysis of imitation abilities in individuals with autism spectrum disorders. *Autism Research, 7*(3), 363–380.

Fabio, R. A., Orsino, C., Lecciso, F., Levante, A., & Suriano, R. (2024). Atypical sensory processing in adolescents with attention deficit hyperactivity disorder: A comparative study. *Research in Developmental Disabilities, 146*, Article 104674. https://doi.org/10.1016/j.ridd.2024.104674

Fanti, K. A., & Henrich, C. C. (2010). Trajectories of pure and co-occurring internalizing and externalizing problems from age 2 to age 12: findings from The National institute of child health and human development study of early child care. *Developmental Psychology, 46*(5), 1159–1175. https://doi.org/10.1037/A0020659

Favole, I., Davico, C., Marcotulli, D., Sodero, R., Svevi, B., Amianto, F., Ricci, F. S., Arduino, G. M., & Vitiello, B. (2023). Sleep disturbances and emotional dysregulation in young children with autism spectrum, intellectual disability, or global developmental delay. *Sleeping Medicine, 105*, 45–52. https://doi.org/10.1016/J.SLEEP.2023.02.026

Fried, E. I., & Cramer, A. O. J. (2017). Moving forward: challenges and directions for psychopathological network theory and methodology. *Perspectives on Psychological Science, 12*(6), 999–1020. https://doi.org/10.1177/1745691617705892

Fusar-Poli, P., Solmi, M., Brondino, N., Davies, C., Chae, C., Politi, P., Borgwardt, S., Lawrie, S. M., Parnas, J., & McGuire, P. (2019). Transdiagnostic psychiatry: A systematic review. *World Psychiatry, 18*(2), 192–207. https://doi.org/10.1002/WPS.20631

Goh, D. A., Gan, D., Kung, J., Baron-Cohen, S., Allison, C., Chen, H., & Magiati, I. (2018). Child, maternal and demographic factors influencing caregiver-reported autistic trait symptomatology in toddlers. *Journal of Autism and Developmental Disorders, 48*, 1325–1337.

Gormley, E., Ryan, C., & McCusker, C. (2022). Alexithymia is associated with emotion dysregulation in young people with autism spectrum disorder. *Journal of Developmental and Physical Disabilities, 34*(1), 171–186. https://doi.org/10.1007/S10882-021-09795-9

Grossman, A., & Avital, A. (2023). Emotional and sensory dysregulation as a possible missing link in attention deficit hyperactivity disorder: A review. *Frontiers in Behavioral Neuroscience, 17*, Article 1118937. https://doi.org/10.3389/FNBEH.2023.1118937

Guthrie, W., Swineford, L. B., Nottke, C., & Wetherby, A. M. (2013). Early diagnosis of autism spectrum disorder: Stability and change in clinical diagnosis and symptom presentation. *Journal of Child Psychology and Psychiatry, 54*(5), 582–590. https://doi.org/10.1111/JCPP.12008

Gutiérrez-Ruiz, K., Delgado, A. R., & Prieto, G. (2019). Rasch analysis of the Q-CHAT in Colombian toddlers with autism spectrum disorder. *Current Psychology, 38*, 116–120.

Hallett, V., Ronald, A., & Happé, F. (2009). Investigating the association between autistic-like and internalizing traits in a community-based twin sample. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(6), 618–627.

Hallett, V., Ronald, A., Rijsdijk, F., & Happé, F. (2010). Association of autistic-like and internalizing traits during childhood: A longitudinal twin study. *American Journal of Psychiatry, 167*(7), 809–817. https://doi.org/10.1176/APPI.AJP.2009.09070990

Hanöz, L., Özgün, S., Zeytinoğlu Saydam, S., Şen, C. N., & Ayyıldız, E. (2024). Siblings under the shadow: A qualitative study of young adults' parentification experiences with siblings with special needs. *International Journal of Systemic Therapy, 35*(1), 127–144. https://doi.org/10.1080/2692398X.2023.2282954

Haraguchi, H., Stickley, A., Saito, A., Takahashi, H., & Kamio, Y. (2019). Stability of autistic traits from 5 to 8 years of age among children in the general population. *Journal of Autism and Developmental Disorders, 49*(1), 324–334. https://doi.org/10.1007/S10803-018-3770-Z

Hoffmann, W., Weber, L., König, U., Becker, K., & Kamp-Becker, I. (2016). The role of the CBCL in the assessment of autism spectrum disorders: An evaluation of symptom profiles and screening characteristics. *Research in Autism Spectrum Disorders, 27*, 44–53. https://doi.org/10.1016/J.RASD.2016.04.002

Holmboe, K., Rijsdijk, F. V., Hallett, V., Happé, F., Plomin, R., & Ronald, A. (2014). Strong genetic influences on the stability of autistic traits in childhood. *Journal of the American Academy of Child & Adolescent Psychiatry, 53*(2), 221–230. https://doi.org/10.1016/J.JAAC.2013.11.001

IBM Corp. Released 2023. IBM SPSS Statistics for Windows, Version 29.0.2.0 Armonk, IBM Corp.

Jianduan, Z., Huishan, W., Shuhua, S., Xiaonan, H., Guoyan, L., Guangli, L., & Junxin, S. (2009). Reliability and validity of standardized Chinese version of urban infant–toddler social and emotional assessment. *Early Human Development, 85*(5), 331–336.

Kern, J. K., Trivedi, M. H., Grannemann, B. D., Garver, C. R., Johnson, D. G., Andrews, A. A., Savla, S. J., Mehta, J. A., & Schroeder, J. L. (2007). Sensory correlations in autism. *Autism, 11*(2), 123–134. https://doi.org/10.1177/1362361307075702

Kim, H. K., Capaldi, D. M., Pears, K. C., Kerr, D. C., & Owen, L. D. (2009). Intergenerational transmission of internalising and externalising behaviours across three generations: Gender-specific pathways. *Criminal Behaviour and Mental Health, 19*(2), 125–141.

Kim, E., Hwang, J., & Park, S. (2018). Acceptance of disability and Hwa-Byung among Korean mothers of children with developmental disabilities. *International Journal of Disability Development and Education, 65*(1), 76–89. https://doi.org/10.1080/1034912X.2017.1319914

Kim-Cohen, J., Caspi, A., Moffitt, T. E., Harrington, H. L., Milne, B. J., & Poulton, R. (2003). Prior juvenile diagnoses in adults with mental disorder: Developmental follow-back of a prospective-longitudinal cohort. *Archives of General Psychiatry, 60*(7), 709–717. https://doi.org/10.1001/ARCHPSYC.60.7.709

Kruizinga, I., Visser, J. C., Van Batenburg-Eddes, T., Carter, A. S., Jansen, W., & Raat, H. (2014). Screening for autism spectrum disorders with the brief Infant-Toddler social and emotional assessment. *PLOS One, 9*(5), Article e97630. https://doi.org/10.1371/JOURNAL.PONE.0097630

Lahey, B. B., Schwab-Stone, M., Goodman, S. H., Waldman, I. D., Canino, G., Rathouz, P. J., Miller, T. L., Dennis, K. D., Bird, H., & Jensen, P. S. (2000). Age and gender differences in oppositional behavior and conduct problems: A cross-sectional household study of middle childhood and adolescence. *Journal of Abnormal Psychology, 109*(3), 488–503. https://doi.org/10.1037/0021-843X.109.3.488

Lecciso, F., Levante, A., Signore, F., & Petrocchi, S. (2019). Preliminary evidence of the structural validity and measurement invariance of the Quantitative-CHecklist for autism in toddler (Q-CHAT) on Italian unselected children. *Electronic Journal of Applied Statistical Analysis, 12*(2), 320–340.

Lecciso, F., Petrocchi, S., Savazzi, F., Marchetti, A., Nobile, M., & Molteni, M. (2013). The association between maternal resolution of the diagnosis of autism, maternal mental representations of the relationship with the child, and children's attachment. *Life Span Disabil, 16*(1), 21–38.

Lee, K. S., Park, J., Bahn, G. H., Cho, Y., Il, & Shin, Y. J. (2018). Reliability and validity of the Korean version of the Infant-Toddler social and emotional assessment. *Psychiatry Investigation, 15*(5), 460–469. https://doi.org/10.30773/PI.2018.02.25

Leekam, S. R., Nieto, C., Libby, S. J., Wing, L., & Gould, J. (2007). Describing the sensory abnormalities of children and adults with autism. *Journal of Autism and Developmental Disorders, 37*(5), 894–910. https://doi.org/10.1007/S10803-006-0218-7

Levante, A., Martis, C., Bianco, F., Castelli, I., Petrocchi, S., & Lecciso, F. (2023). Internalizing and externalizing symptoms in children during the COVID-19 pandemic: a systematic mixed studies review. *Frontiers in Psychology, 14*. https://doi.org/10.3389/fpsyg.2023.1182309

Levante, A., Petrocchi, S., & Lecciso, F. (2020). The criterion validity of the first year inventory and the quantitative-checklist for autism in toddler: A longitudinal study. *Brain Sciences, 10*(10), 729. https://doi.org/10.3390/brainsci10100729

Levante, A., Petrocchi, S., & Lecciso, F. (2021b). Test-retest reliability and measurement invariance across time of the Quantitative-CHecklist for autism in toddler. *Electronic Journal of Applied Statistical Analysis, 14*(1), 146–166.

Levante, A., Petrocchi, S., Bianco, F., Castelli, I., Colombi, C., Keller, R., Narzisi, A., Masi, G., & Lecciso, F. (2021a). Psychological impact of COVID19 outbreak on families of children with autism spectrum disorder and typically developing peers: an online survey. *Brain Science, 11*(6), 808. https://doi.org/10.3390/brainsci11060808

Levante, A., Petrocchi, S., Colombi, C., Keller, R., Narzisi, A., & Lecciso, F. (2022). The effect of Sleep-Wake routines on negative emotional states and aggressive behaviors in adults with autism spectrum disorder (ASD) during the COVID-19 outbreak. *International Journal of Environmental Research and Public Health, 19*(9), 4957. https://doi.org/10.3390/ijerph19094957

Levy, R. S., Fipp-Rosenfield, H. L., Lee, J. P., Grauzer, J. M., & Roberts, M. Y. (2023). Understanding internalizing and externalizing behaviors in autistic toddlers. *American Journal of SpeechLanguage Pathology, 32*(6), 2908–2921. https://doi.org/10.1044/2023_AJSLP-23-00088

Loomes, R., Hull, L., & Mandy, W. P. L. (2017). What is the Male-to-Female ratio in autism spectrum disorder? A systematic review and Meta-Analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(6), 466–474. https://doi.org/10.1016/J.JAAC.2017.03.013

Lu, H. H., Nandy, A., & Ni, H. C. (2025). Autistic traits and emotion dysregulation in 5–11-Year-Old intellectually able children with autism spectrum condition: Mediating role of emotion regulation strategies. *Autism Research, 18*, 1050–1061.

Lugnegård, T., Hallerbäck, M. U., & Gillberg, C. (2011). Psychiatric comorbidity in young adults with a clinical diagnosis of asperger syndrome. *Research in Developmental Disabilities, 32*(5), 1910–1917. https://doi.org/10.1016/J.RIDD.2011.03.025

Magiati, I., Goh, D. A., Lim, S. J., Gan, D. Z. Q., Leong, J. C. L., Allison, C., Baron-Cohen, S., Rifkin-Graboi, A., Broekman, B. F. P., Saw, S. M., Chong, Y. S., Kwek, K., Gluckman, P. D., Lim, S. B., & Meaney, M. J. (2015). The psychometric properties of the quantitative-checklist for autism in toddlers (Q-CHAT) as a measure of autistic traits in a community sample of Singaporean infants and toddlers. *Molecular Autism, 6*(1), 1–14. https://doi.org/10.1186/S13229-015-0032-1

Malti, T. (2011). Developing life skills in youth. In In. T. Malti, & C. Hanbury (Eds.), *The Jacobs Foundation guideline on monitoring and evaluating life skills for youth development: Volume 1: The guidelines* (pp. 8–23). Jacobs Foundation.

Mandy, W., Pellicano, L., St Pourcain, B., Skuse, D., & Heron, J. (2018). The development of autistic social traits across childhood and adolescence in males and females. *Journal of Child Psychology and Psychiatry, 59*(11), 1143–1151.

Marchetti, A., Castelli, I., Cavalli, G., Di Terlizzi, E., Lecciso, F., Lucchini, B., & Valle, A. (2013). Theory of mind in typical and atypical developmental settings: Some considerations from a contextual perspective. *Reflective thinking in educational settings: A cultural framework* (pp. 102–136). Cambridge University Press,.

Matos, A. P., Salvador, M. D., Costa, J. J., Pinheiro, M. D., Arnarson, E.Ö., & Craighead, W. E. (2017). The relationship between internalizing and externalizing problems in adolescence: does gender make a difference? *Canadian International Journal of Social Science and Education, 8*, 45–63.

Mayes, S. D., Castagna, P. J., & Waschbusch, D. A. (2020). Sex differences in externalizing and internalizing symptoms in ADHD, autism, and general population samples. *Journal of Psychopathology and Behavioral Assessment, 42*(3), 519–526. https://doi.org/10.1007/S10862-020-09798-4

Morie, K. P., Jackson, S., Zhai, Z. W., Potenza, M. N., & Dritschel, B. (2019). Mood disorders in high-functioning autism: The importance of alexithymia and emotional regulation. *Journal of Autism and Developmental Disorders, 49*(7), 2935–2945. https://doi.org/10.1007/S10803-019-04020-1

Olson, S. L., Choe, D. E., & Sameroff, A. J. (2017). Trajectories of child externalizing problems between ages 3 and 10 years: Contributions of children's early effortful control, theory of mind, and parenting experiences. *Development and Psychopathology, 29*(4), 1333–1351. https://doi.org/10.1017/S095457941700030X

Panagiotidi, M., Overton, P. G., & Stafford, T. (2018). The relationship between ADHD traits and sensory sensitivity in the general population. *Comprehensive Psychiatry, 80*, 179–185. https://doi.org/10.1016/J.COMPPSYCH.2017.10.008

Perle, J. G., Levine, A. B., Odland, A. P., Ketterer, J. L., Cannon, M. A., & Marker, C. D. (2013). The association between internalizing symptomology and risky behaviors. *Journal of Child & Adolescent Substance Abuse, 22*(1), 1–24. https://doi.org/10.1080/1067828X.2012.724289

Petrocchi, S., Levante, A., & Lecciso, F. (2020). Systematic review of level 1 and level 2 screening tools for autism spectrum disorders in toddlers. *Brain Sciences, 10*(3), 180. https://doi.org/10.3390/brainsci10030180

Piltz, V. J., Halldner, L., Markus, J. F., Fridell, A., Bölte, S., & Choque Olsson, N. (2024). Symptom similarities and differences in social interaction between autistic children and adolescents with and without ADHD. *Current Psychology, 43*(4), 3503–3513. https://doi.org/10.1007/S12144-023-04499-Z

Pontoppidan, M., Nissa, N. K., Pejtersena, J. H., Julianc, M. M., & Væverd, M. S. (2017). Parent report measures of infant and toddler social-emotional development: A systematic review. *Family Practice, 34*(2), 127–137. https://doi.org/10.1093/FAMPRA/CMX003

Rhind, C., Bonfioli, E., Hibbs, R., Goddard, E., Macdonald, P., Gowers, S., & Treasure, J. (2014). An examination of autism spectrum traits in adolescents with anorexia nervosa and their parents. *Molecular Autism, 5*, 1–9.

Roberts, M. E., Tchanturia, K., Stahl, D., Southgate, L., & Treasure, J. (2007). A systematic review and meta-analysis of set-shifting ability in eating disorders. *Psychological Medicine, 37*(8), 1075–1084.

Robertson, A. E., & Simmons, D. R. (2013). The relationship between sensory sensitivity and autistic traits in the general population. *Journal of Autism and Developmental Disorders, 43*(4), 775–784. https://doi.org/10.1007/S10803-012-1608-7

Robins, D. L., & Dumont-Mathieu, T. M. (2006). Early screening for autism spectrum disorders: update on the modified checklist for autism in toddlers and other measures. *Journal of Developmental & Behavioral Pediatrics, 27*(2), S111–S119.

Robinson, E. B., Munir, K., Munaf, M. R., Hughes, M., McCormick, M. C., & Koenen, K. C. (2011). Stability of autistic traits in the general population: Further evidence for a continuum of impairment. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*(4), 376–384. https://doi.org/10.1016/J.JAAC.2011.01.005

Ruta, L., Arduino, G. M., Gagliano, A., Apicella, F., Leonardi, E., Famà, F. I., & Muratori, F. (2019a). Psychometric properties, factor structure and cross-cultural validity of the quantitative checklist for autism in toddlers (Q-CHAT) in an Italian community setting. *Research in Autism Spectrum Disorders, 64*, 39–48.

Ruta, L., Chiarotti, F., Arduino, G. M., Apicella, F., Leonardi, E., Maggio, R., … Muratori, F. (2019b). Validation of the quantitative CHecklist for autism in toddlers (Q-CHAT) in an Italian clinical sample of young children with autism and other developmental disorders. *Frontiers in Psychiatry, 10*, 488. https://doi.org/10.3389/FPSYT.2019.00488

Saito, A., Stickley, A., Haraguchi, H., Takahashi, H., Ishitobi, M., & Kamio, Y. (2017). Association between autistic traits in preschool children and later Emotional/Behavioral outcomes. *Journal of Autism and Developmental Disorders, 47*(11), 3333–3346. https://doi.org/10.1007/S10803-017-3245-7

Salmela, L., Kuula, L., Merikanto, I., Räikkönen, K., & Pesonen, A. K. (2019). Autistic traits and sleep in typically developing adolescents. *Sleeping Medicine, 54*, 164–171.

Samson, A. C., Phillips, J. M., Parker, K. J., Shah, S., Gross, J. J., & Hardan, A. Y. (2014). Emotion dysregulation and the core features of autism spectrum disorder. *Journal of Autism and Developmental Disorders, 44*(7), 1766–1772. https://doi.org/10.1007/S10803-013-2022-5

Sanner, N., Smith, L., Wenzel-Larsen, T., & Moe, V. (2016). Early identification of social–emotional problems: applicability of the Infant-Toddler social emotional assessment (ITSEA) at its lower age limit. *Infant Behavior and Development, 42*, 69–85. https://doi.org/10.1016/J.INFBEH.2015.11.001

Sheppes, G., Suri, G., & Gross, J. J. (2015). Emotion regulation and psychopathology. *Annual Review of Clinical Psychology, 11*, 379–405. https://doi.org/10.1146/ANNUREV-CLINPSY-032814-112739

Singh, N. N., Lancioni, G. E., Winton, A. S. W., Karazsia, B. T., Myers, R. E., Latham, L. L., & Singh, J. (2014). Mindfulness-Based positive behavior support (MBPBS) for mothers of adolescents with autism spectrum disorder: effects on adolescents' behavior and parental stress. *Mindfulness, 5*(6), 646–657. https://doi.org/10.1007/S12671-014-0321-3/TABLES/2

Stevanović, D. (2021). Quantitative checklist for autism in toddlers (Q-CHAT): a psychometric study with serbian toddlers. *Research in Autism Spectrum Disorders, 83*, Article 101760.

Tartarisco, G., Cicceri, G., Di Pietro, D., Leonardi, E., Aiello, S., Marino, F., & Ruta, L. (2021). Use of machine learning to investigate the quantitative checklist for autism in toddlers (Q-CHAT) towards early autism screening. *Diagnostics, 11*(3), 574.

Thabtah, F., & Peebles, D. (2019). Early autism screening: a comprehensive review. *International Journal of Environmental Research and Public Health, 16*(18), 3502.

Torske, T., Nærland, T., Quintana, D. S., Hypher, R. E., Kaale, A., Høyland, A. L., Hope, S., Johannessen, J., Øie, M. G., & Andreassen, O. A. (2023). Sex as a moderator between parent ratings of executive dysfunction and social difficulties in children and adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 53*(10), 3847–3859. https://doi.org/10.1007/S10803-022-05629-5

Vasa, R. A., Singh, V., McDonald, R. G., Mazefsky, C., Hong, J. S., & Keefer, A. (2022). Dysregulation in children and adolescents presenting to a multidisciplinary autism clinic. *Journal of Autism and Developmental Disorders, 52*(4), 1762–1770.

Vaughan, C. A., Foshee, V. A., & Ennett, S. T. (2010). Protective effects of maternal and peer support on depressive symptoms during adolescence. *Journal of Abnormal Child Psychology, 38*(2), 261–272. https://doi.org/10.1007/S10802-009-9362-9

Weeks, M., Ploubidis, G. B., Cairney, J., Wild, T. C., Naicker, K., & Colman, I. (2016). Developmental pathways linking childhood and adolescent internalizing, externalizing, academic competence, and adolescent depression. *Journal of Adolescence, 51*, 30–40. https://doi.org/10.1016/J.ADOLESCENCE.2016.05.009

Wei, H., Zhu, Y., Wang, T., Zhang, X., Zhang, K., & Zhang, Z. (2021). Genetic risk factors for autism-spectrum disorders: A systematic review based on systematic reviews and meta-analysis. *Journal of Neural Transmission, 128*, 717–734.

Whitehouse, A.J. O., Bishop, D.V. M. (2009). Communication Checklist - Adult (CC- A). Pearson.

Whitehouse, A. J. O., Hickey, M., & Ronald, A. (2011). Are autistic traits in the general population stable across development? *Plos One, 6*(8), Article e23029. https://doi.org/10.1371/JOURNAL.PONE.0023029

Yoshimura, S., Kobayashi, K., Ueno, T., Miyagi, T., Oishi, N., Murai, T., & Fujiwara, H. (2020). Autistic traits are associated with the functional connectivity of between—but not within—attention systems in the general population. *BMC Neuroscience, 21*, 1–8.

Young, G. S., Rogers, S. J., Hutman, T., Rozga, A., Sigman, M., & Ozonoff, S. (2011). Imitation from 12 to 24 months in autism and typical development: a longitudinal rasch analysis. *Developmental Psychology, 47*(6), 1565–1578. https://doi.org/10.1037/A0025418

Zeidan, J., Fombonne, E., Scorah, J., Ibrahim, A., Durkin, M. S., Saxena, S., Yusuf, A., Shih, A., & Elsabbagh, M. (2022). Global prevalence of autism: A Systematic review update. *Autism Research, 15*(5), 778–790. https://doi.org/10.1002/AUR.2696