Cognitive, behavioural and communication correlates of dysregulation in Australian autistic preschoolers

Weng Tong Wu
School of Clinical Medicine, University of New South Wales, Sydney, New South Wales, Australia
James Rufus John
Academic Unit of Infant, Child, and Adolescent Psychiatry Services, South Western Sydney Local Health District, Liverpool, New South Wales, Australia https://orcid.org/0000-0002-8720-8300
Antonio Mendoza Diaz
Tasmanian Centre for Mental Health Service Innovation, Tasmanian Health Service, Hobart, Tasmania, Australia
Cheryl Dissanayake
Olga Tennison Autism Research Centre, La Trobe University, Victoria, Australia
Valsamma Eapen
v.eapen@unsw.edu.au

School of Clinical Medicine, University of New South Wales, Sydney, New South Wales, Australia

Research Article

Keywords:

Posted Date: October 15th, 2025

DOI: https://doi.org/10.21203/rs.3.rs-7852299/v1

Additional Declarations: The authors declare no competing interests.

Abstract

Purpose: This study investigated whether cognitive, behavioural, and communication differences are associated with emotional dysregulation among preschool-aged autistic children in Australia.

Methods: Secondary data analysis was undertaken in a sample of autistic preschool children as part of the Autism Subtyping Project, receiving early intensive intervention in six Autism Specific Early Learning and Care Centres (ASELCCs) across the six states in Australia. Multilevel multivariable logistic regression analyses were used to determine associations between sociodemographic factors, autistic traits (adjusted for sociodemographic covariates), and their dysregulation profile. Further, multivariable linear regression analyses were conducted to determine whether dysregulation profile was a significant predictor of changes in autistic traits following intervention.

Results: Among the sample of 415 children, 43 % (n=180) of the sample were classified as having a dysregulation profile (DP). Findings from regression analyses showed that children with higher social communication (AOR 1.11, 95% CI: 1.05, 1.17) and repetitive behaviour (AOR 1.09, 95% CI: 1.06, 1.12) differences at baseline were associated with higher odds of having a DP.Key sociodemographic covariates including older age was associated with higher odds of having a DP whereas being from a culturally and linguistically diverse background and having a higher annual family income had protective effect on DP. Further, DP scores at baseline were not predictive of changes in social communication, repetitive behaviours, or cognitive functioning following receipt of EII.

Conclusion: The study findings suggest screening for DP among autistic preschool children may lead to early identification and intervention of a discrete pattern of behavioural difficulties.

Introduction

Autism spectrum disorder (hereafter autism) is characterised by difficulties in social communication and presence of restricted repetitive behaviours (RRBs) (American Psychiatric Association, 2013). Studies report that autistic children may have unique differences in processing and/or interpreting social stimuli (Johnson & Myers, 2007), presenting with differences in gaze, emotional expressions, and social initiative (Falck-Ytter & von Hofsten, 2011), thereby impacting reciprocal social interaction. Many autistic children may also present with other co-occurring mental health issues ranging from internalising behaviours like anxiety and depression (Kim et al., 2012) to externalising behaviours like aggression, hyperactivity, and impulsivity (Ding et al., 2021). These concerns can equate or exceed the impact of core autism traits on learning, social relationships, and other dimensions of functioning (Fulton et al., 2014).

Difficulties with self-regulation (dysregulation) is estimated to affect between 1-5% of the general population, and are highly prevalent across neurodevelopmental conditions (Uljarević et al., 2018). A co-occurring pattern of attention problems, aggressive behaviours, and an anxious-depressed presentations – known as dysregulation profile (DP) is linked to paediatric bipolar disorders and co-occurring psychiatric disorders in early adult life and beyond (Aitken et al., 2019; Ayer et al., 2009; Biederman et al.,

1995). DP is associated with greater autistic traits and persistent internalising and externalising behaviours that continue with age despite improvements in adaptive functioning, socialisation, and language skills (Berkovits et al., 2017a; Cibralic et al., 2019). Further, dysregulated profile (DP) have been linked to limited social and educational opportunities (Dawson, 2008; Eapen, 2011), greater likelihood of cognitive impairments in younger children (Kim et al., 2012), and pronounced difficulties in receptive and expressive language abilities (Cibralic et al., 2023).

As individual differences in self-regulation emerge early in development, early identification of dysregulation is important in tailoring intervention to lead to better long-term outcomes (Althoff et al., 2010; Uljarević et al., 2018). This has been observed in autistic children (Berkovits et al., 2017a), particularly in early (Dawson et al., 2010) and middle (Kuppens & Onghena, 2012) childhood when children are in a period of marked brain plasticity that enables a flexible establishment of neuronal networks through environmental modifications (Dawson, 2008; Zhou et al., 2012). Therefore, interventions for autistic children with DP should begin as soon as early signs manifest to accelerate their cognitive, social-emotional, and language development (Eapen et al., 2013).

Despite impaired self-regulation being linked to adverse outcomes, most studies have focused on older children, adolescents, or adults (Bruggink et al., 2016; Mazefsky et al., 2013). Further, the literature is inconsistent with regard to the relationship between self-regulation and cognitive development in the early years (Cibralic et al., 2023; Uljarević et al., 2018). There is also limited research examining the association between intervention outcomes and dysregulated behaviours in autistic preschoolers. To address this knowledge gap, this study aimed to determine whether severity of autism and cognitive, behavioural, and communication differences are linked to DP among autistic preschoolers in the context of an early intervention program. The findings from this study will provide insights on potential areas to target when tailoring intervention and support plans, which will impact autistic children's growth and development.

Methods

Study setting and design

The study utilised secondary data from the Autism Subtyping project, a longitudinal study of 760 autistic children attending early intervention programs across six Autism Specific Early Learning and Care Centres (ASELCCs) in Australia (Masi et al., 2021). While the six programs of supports differed across the six centres, the core structure, strategies, and processes were largely similar. All children had a diagnosis of Autism Spectrum Disorder as per the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (American Psychiatric Association, 2013). No other specific inclusion or exclusion criteria and no pre-screening measures were applied for this cohort of children (Masi et al., 2021). Ethics approval was granted from the University of New South Wales Institutional Human Research Ethics Committee (reference number: HC14267).

Early intervention

Dyadic engagement with functional behaviour assessment, antecedent-based intervention, and joint activity routines were the common intervention components in the programs across the six ASELCCs (Masi et al., 2021). The Early Start Denver Model (ESDM; Rogers & Dawson, 2010) and the Social Communication, Emotional Regulation, and Transactional Support (SCERTS) Model (Prizant et al., 2006) were the two most common approaches used in the centres. Whilst ESDM focuses on integrating a relationship-based, developmental, and naturalistic approach that uses play as a learning tool (Rogers & Dawson, 2010), the SCERTS model is a flexible and functional model that aims to support children's development by enhancing their abilities in the social context of daily activities and experiences (Prizant et al., 2006).

Study measures

The Research Electronic Data Capture (REDCap) tools (Harris et al., 2019) were used for data collection and auditing. Parent-reported Child Behavioural Checklist (CBCL) was used to construct a DP profile (outcome variable). Autism traits were measured using the clinician administered Autism Diagnostic Observation Schedule-second edition (ADOS-2) and two parent-reported measures: the Social Communication Questionnaire (SCQ) and Repetitive Behaviour Scale-Revised (RBS-R). Children's developmental status was measured using the Mullen Scales of Early Learning (MSEL). All assessments were conducted at baseline and following approximately 10 months of early intervention, consistent with an academic year.

Child Behavioural Checklist-Dysregulation Profile (CBCL-DP)

The Child Behavioural Checklist-Dysregulation Profile (CBCL-DP) is a useful measure of dysregulated behaviour (Jucksch et al., 2011). A dysregulation profile score (CBCL-DP) was calculated from the summed T score of three CBCL subscales – anxiety/depression, aggressive behaviour, and attention problems (Althoff et al., 2010). The literature suggests a clinical cut-off of either a T score ≥70 on each subscale (Peyre et al., 2015), or a summed T-score ≥180 (Hofheimer et al., 2023), or ≥210 from the three subscales (Kim et al., 2012). A summed T-score of 180 was utilised here, which has been clinically validated in preschool aged samples (Hofheimer et al., 2023). The CBCL-DP score was then dichotomised based on the cut-off as DP = 0 (no) and DP = 1 (yes). The current study had excellent (Cronbach's alpha= 0.920) internal consistency between the subitems within the three subscales. For the purpose of this study, only those with a valid CBCL-DP score at baseline from the overall sample was included for analysis.

Autism Diagnostic Observation Schedule- second edition (ADOS-2)

The ADOS-2 is a standardised diagnostic observational assessment for autism (Lord et al., 2012) comprising specific developmental- and language-level dependent modules that measure autism traits in domains of RRB and social affect. Scores from the two domains and the total score were converted into calibrated severity scores which allows comparability across modules with higher scores indicating more autism traits.

Social Communication Questionnaire (SCQ)

The SCQ is a parent -reported 40-item questionnaire measuring 1) reciprocal social interaction, 2) language and communication, and 3) repetitive and stereotyped patterns of behaviour (Rutter et al., 2003) using a dichotomous 'yes/no' response. The current study had good (Cronbach's alpha= 0.887) internal consistency.

Repetitive Behaviour Scale-Revised (RBS-R)

The RBS-R is a 43-item parent-completed questionnaire that measures RRBs (Lam & Aman, 2007) with six subscales: stereotyped, self-injurious, compulsive, ritualistic, sameness, and restricted behaviour. A 3-point scale is used with "0" indicating not present and "3" indicating a severe problem. The internal consistency was excellent (Cronbach's alpha= 0.935) in the current study.

Mullen Scales of Early Learning (MSEL)

The MSEL assesses children's development across key domains (Mullen, 1995). Four subscales were used here (visual reception, fine motor, receptive, and expressive language) including a standardized and age-equivalent overall early learning composite score. A standardized developmental quotient (DQ; DQ = age-equivalent score/chronological age x100) was calculated for both non-verbal (mean age-equivalent score of fine motor and visual reception) and verbal (mean age-equivalent score of receptive and expressive language) domains (Messinger et al., 2013).

Sociodemographic covariates

Sociodemographic data collected at baseline and used here included children's age (in years), gender (male, female), culturally and linguistically diverse (CALD) background status (no, yes), other medical conditions (no, yes), mother's age (in years), father's age (in years), primary and secondary carer's education level (primary/ secondary, postgraduate/ tertiary), primary and secondary carer's occupation (professional/ paraprofessional, other labour), and annual family income (in four ranges).

Data analysis

The baseline characteristics of the sample were descriptively analysed and presented as mean and standard deviations for continuous measures and as frequency counts with percentages for categorical measures. Bivariate analyses including independent samples T tests and chi-square tests were used to determine significant differences in DP for the continuous variables and between two or more levels of each categorical variable, respectively. Pearson's correlation analysis was conducted to determine any significant correlation between the variables before entering them into the multivariable regression models. A multilevel multivariable binary logistic regression analyses were conducted to determine whether the sociodemographic, severity of autism and cognitive, behavioural, and communication differences were associated with DP. Additionally, multivariable linear regression models were used to determine whether DP at baseline was a significant predictor of changes in social communication, repetitive behaviours, and cognitive functioning post-intervention while adjusting for sociodemographic covariates. The change scores for social communication, repetitive behaviours, and cognitive functioning were created by using post intervention (T1) scores – baseline scores (T0).

The findings from the logistic regression model were reported as adjusted odds ratio (AOR), confidence interval (CI) and p-value (*p*); findings from the linear regression model were reported similarly, except using non-standardised coefficients (β) instead of AOR. All statistical analyses were conducted using Statistical Package for Social Sciences (SPSS) v.28 (SPSS Inc., Chicago, IL, USA) and the R language Version 2023.12.1+402 (2023.12.1+402) within the RStudio IDE.

Results

Descriptive findings

The descriptive characteristics of the sample are presented in **Table 1**. Out of the 760 participants in the original sample, only 415 participants had a valid CBCL-DP score and were included. There were no significant differences between participants who completed the CBCL assessments and those who did not, indicating the CBCL-DP sample was representative of the total sample. However, significant differences in child's age, primary carer's occupation, and annual family income were noted between the DP and non-DP groups.

(Insert Table 1)

Association between cognitive, communication, and repetitive behaviours with DP

The results from the multivariable logistic regression model are shown in **Table 2** indicating that children with higher social communication differences had 11% (AOR 1.11, 95% CI: 1.05, 1.17) higher risk of having a DP. Similarly, children with higher repetitive behaviours (AOR 1.09, 95% CI: 1.06, 1.12) scores also had higher risk of having a DP.

Key sociodemographic covariates such as older age was associated with 49% higher odds of having a DP (AOR 1.49, 95% CI: 1.12, 2.01) whereas those from culturally and linguistically diverse backgrounds (AOR 0.53, 95% CI: 0.29, 0.91) and higher annual family income (AOR 0.42, 95% CI: 0.18, 0.95) were associated with lower odds of having a DP.

(Insert Table 2)

DP as a predictor of changes in social communication, repetitive behaviours, and cognitive functioning

Findings of the multilevel linear regression analyses showing baseline DP as a predictor of changes in children's autism traits and cognition, with sociodemographic variables controlled for, are shown in **Table 3**. We found that DP score at baseline was not a significant predictor of changes in social communication, repetitive behaviours, or cognitive functioning following early intervention.

(Insert Table 3)

Discussion

This study examined the relationship between dysregulation profile (DP) and autism severity, cognitive, behavioural, and communication characteristics, as well as sociodemographic factors, in autistic preschoolers. It was found that DP was significantly associated with social communication differences and restricted and repetitive behaviours, but not with cognitive functioning. Importantly, DP did not predict changes in autistic traits or cognition following early intervention, suggesting that while dysregulation reflects concurrent behavioural difficulties, it may not influence short-term developmental trajectories in these domains.

It was found that greater severity of RRB were significantly associated with higher odds of having a DP in autistic children. This is in keeping with previous studies (Cibralic et al., 2019; Greenlee et al., 2021) which also reported that although dysregulation declined over time, autistic children with greater severity of RRBs still had higher CBCL-DP scores three years later compared to autistic peers with low RRBs. This may indicate a potential underlying neurobiological mechanism that is common to both RRBs and self-regulation in autism (Greenlee et al., 2021), or RRB might be a behavioural manifestation or coping mechanism associated with dysregulated emotional states (Samson et al., 2014). Further research is needed to examine the nature and mediators of this relationship by examining long-term temporal trajectories.

We also found that greater severity of social communication differences was associated with higher risk of DP at baseline, consistent with previous studies (Jahromi et al., 2013; Masi et al., 2015). As emotional regulation is a core factor in social and behavioural functioning in younger autistic children (Berkovits et al., 2017a), dysregulation may undermine or mask the facilitating effect of social motivation on social skills (Neuhaus et al., 2019). Therefore, autistic children with a DP may have exacerbated social difficulties and subsequently higher rates of social rejection or even social neglect (Berkovits et al.,

2017a). This may be due to the fact that children with relatively strong interest in others (high social motivation) will normally approach peers for interactions and may succeed and hence experience less social difficulties (Neuhaus et al., 2019). On the other hand, if they have dysregulated behaviours and struggle with outbursts or aggression when disagreements raise, they are more likely to have negative peer interactions and decreased receptiveness from peers (poor social success), likely leading to fewer opportunities to practice social skills and form positive relationships (Neuhaus et al., 2019).

Findings of this study showed that DP was not a significant predictor of changes in autistic traits or cognition. Although there are few early intervention studies focused on dysregulation and its impact on outcomes, the literature suggests that autistic children with poorer emotional regulation exhibit declines in social skills when covariates are adjusted (Berkovits et al., 2017b) and that a greater impairment in social motivation was associated with greater improvement in emotional regulation post intervention (Tajik-Parvinchi et al., 2020). Whilst our findings were different from those of Berkvotis et al (2017b) and Tajik-Parvinchi et al (2020), the difference in the ages of participants (4–7 years and 8–12 years in each study, respectively) may explain the differences. However, as dysregulation is a target of intervention for social skill improvements (Neuhaus et al., 2019), future studies should prioritise implementing targeted initiatives to address dysregulation and examine the impact on a wide range of outcomes including social skills, motivation and communication to further verify these findings.

Our study found several sociodemographic risk factors associated with DP. Older children were more likely to exhibit dysregulated behaviours. Consistent with this, Greenlee et al. (2021) exploring a DP in children aged from 5–12 years found that dysregulation in autistic children declined over a period of three years, irrespective of age. While this may seem to suggest that behavioural regulation difficulties are more pronounced in the preschool years, Greenlee et al highlighted the marked between-person variability in changes in dysregulation, cautioning that group-level averages may not reflect the true experiences of all autistic children. Given the limited literature on the relationship between CBCL-DP and age, future longitudinal studies are needed to further delineate the diverse trajectories of self-regulation in young autistic children. Identifying children whose dysregulation is more likely to persist would allow for targeted intervention and supports beginning in early preschool years.

We also found that higher annual income was protective of dysregulation. This finding is consistent with a previous study (Lee et al., 2019) that household income is a core factor in family stability. Higher-income families may have greater access to early intervention services, educational supports, and enrichment activities that promote self-regulation skills (Engle et al., 2011). These findings underscore the importance of considering socioeconomic context when assessing behavioural regulation in autistic children, and suggest that interventions targeting dysregulation may need to be tailored to address the additional challenges faced by families with limited financial resources.

Our study also found that those from a CALD background were protective against having a DP. Whilst this finding may be contradictory to existing literature (Priest et al., 2012), one possible explanation is that many CALD families emphasise structured routines, close family cohesion, and culturally specific

socialisation practices, which may support the development of behavioural regulation in children (Eapen et al., 2023). Additionally, strong family and community networks often found in CALD communities may provide social support and buffering against stressors that can contribute to dysregulated behaviours. This finding underscores the importance of considering cultural context in understanding the development of self-regulation and tailoring interventions to the needs of diverse populations.

Limitations, implications and directions for future research

This is the first study to examine the association between DP and early intervention outcomes in autistic preschoolers based on a large, diverse, and well-characterised sample across Australia. However, this study also has several limitations. Participant recruitment from the ASELCCs, which are specialised intervention centres for autistic children, may limit the generalisability of the findings. Furthermore, the use of parent-reported measures including CBCL to examine DP and the SCQ and RBS-R may have resulted in method invariance, affecting the results, thus some caution is needed in interpreting the current findings which need independent replication.

Despite these limitations, the findings have important clinical implications. These suggest that autistic children with a DP may benefit from appropriate screening and, when a DP is present, offer appropriate interventions and supports in order to maximise therapeutic impact. Future longitudinal studies may also ascertain the cost-benefit of identifying and intervening directly on dysregulation issues early in life, as available evidence indicates that the cost incurred in supporting children will be offset via reduction in subsequent use of other services (Cidav et al., 2017). Future research will also need to examine the association between DP and age of intervention on long-term outcomes, which will be an enabler for the design of personalised interventions.

Conclusion

The current findings add to the limited evidence regarding the relationship between dysregulation, as indexed by the CBCL-DP, and autistic traits in preschool children. While significant associations between DP and core autism traits (SCQ and RBS-R) were found at baseline, there was no relationship with cognition. Further, DP was not predicative of changes in autism traits or cognitive functioning after early intervention. These findings highlight that autistic pre-schoolers with self-regulation challenges might benefit from appropriate tailored supports with a cultural lens, but more research is still needed to determine the factors including nature of intervention that may predict DP profile change or improvement after intervention. If such factors were to be identified, that could form the basis of targeted intervention in turn may maximise the outcomes and life-long trajectories for autistic children with DP and their families.

References

1. Aitken, M., Battaglia, M., Marino, C., Mahendran, N., & Andrade, B. F. (2019). Clinical utility of the CBCL Dysregulation Profile in children with disruptive behavior. *Journal of Affective Disorders, 253*, 87-95.
2. Althoff, R. R., Ayer, L. A., Rettew, D. C., & Hudziak, J. J. (2010). Assessment of dysregulated children using the Child Behavior Checklist: a receiver operating characteristic curve analysis. *Psychological assessment, 22*(3), 609-617.
3. American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders*. https://doi.org/https://doi.org/10.1176/appi.books.9780890425596
4. Ayer, L., Althoff, R., Ivanova, M., Rettew, D., Waxler, E., Sulman, J., & Hudziak, J. (2009). Child Behavior Checklist Juvenile Bipolar Disorder (CBCL-JBD) and CBCL Posttraumatic Stress Problems (CBCL-PTSP) scales are measures of a single dysregulatory syndrome. *Journal of Child Psychology and Psychiatry, 50*(10), 1291-1300.
5. Berkovits, L., Eisenhower, A., & Blacher, J. (2017a). Emotion regulation in young children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 47*, 68-79.
6. Berkovits, L., Eisenhower, A., & Blacher, J. (2017b). Emotion Regulation in Young Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 47*(1), 68-79. https://doi.org/10.1007/s10803-016-2922-2
7. Biederman, J., Wozniak, J., Kiely, K., Ablon, S., Faraone, S., Mick, E., Mundy, E., & Kraus, I. (1995). CBCL clinical scales discriminate prepubertal children with structured interview—derived diagnosis of mania from those with ADHD. *Journal of the American Academy of Child & Adolescent Psychiatry, 34*(4), 464-471.
8. Bruggink, A., Huisman, S., Vuijk, R., Kraaij, V., & Garnefski, N. (2016). Cognitive emotion regulation, anxiety and depression in adults with autism spectrum disorder. *Research in Autism Spectrum Disorders, 22*, 34-44.
9. Cibralic, S., Kohlhoff, J., Wallace, N., McMahon, C., & Eapen, V. (2019, 2019/12/01/). A systematic review of emotion regulation in children with Autism Spectrum Disorder. *Research in Autism Spectrum Disorders, 68*, 101422. https://doi.org/https://doi.org/10.1016/j.rasd.2019.101422
10. Cibralic, S., Kohlhoff, J., Wallace, N., McMahon, C., & Eapen, V. (2023). Emotional Regulation and Language in Young Children With and Without Autism Traits. *Journal of Early Intervention*, 10538151231176188.
11. Cidav, Z., Munson, J., Estes, A., Dawson, G., Rogers, S., & Mandell, D. (2017). Cost offset associated with Early Start Denver Model for children with autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(9), 777-783.
12. Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and psychopathology, 20*(3), 775-803.
13. Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., Donaldson, A., & Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: the Early Start Denver Model. *Pediatrics, 125*(1), e17-e23.

14. Ding, N., Gao, H., Jiang, J., Zhai, M., Shao, H., Fu, L., Li, C., Ren, Y., Li, Y., & Feng, M. (2021). The characteristics and factors of the internalizing and externalizing behaviours of children at high risk for autism spectrum disorder. *BMC Psychiatry, 21*, 1-10.
15. Eapen, V. (2011). Genetic basis of autism: is there a way forward? *Current Opinion in Psychiatry, 24*(3), 226-236.
16. Eapen, V., Črnčec, R., & Walter, A. (2013). Clinical outcomes of an early intervention program for preschool children with autism spectrum disorder in a community group setting. *BMC Pediatrics, 13*(1), 1-9.
17. Eapen, V., Karlov, L., John, J. R., Beneytez, C., Grimes, P. Z., Kang, Y. Q., Mardare, I., Minca, D. G., Voicu, L., & Malek, K. A. (2023). Quality of life in parents of autistic children: A transcultural perspective. *Frontiers in psychology, 14*, 1022094.
18. Engle, P. L., Fernald, L. C., Alderman, H., Behrman, J., O'Gara, C., Yousafzai, A., De Mello, M. C., Hidrobo, M., Ulkuer, N., & Ertem, I. (2011). Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *The lancet, 378*(9799), 1339-1353.
19. Falck-Ytter, T., & von Hofsten, C. (2011). How special is social looking in ASD: A review. *Progress in brain research, 189*, 209-222.
20. Greenlee, J. L., Stelter, C. R., Piro-Gambetti, B., & Hartley, S. L. (2021). Trajectories of dysregulation in children with autism spectrum disorder. *Journal of Clinical Child & Adolescent Psychology, 50*(6), 858-873.
21. Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., & Kirby, J. (2019). The REDCap consortium: building an international community of software platform partners. *Journal of biomedical informatics, 95*, 103208.
22. Hofheimer, J. A., McGrath, M., Musci, R., Wu, G., Polk, S., Blackwell, C. K., Stroustrup, A., Annett, R. D., Aschner, J., & Carter, B. S. (2023). Assessment of Psychosocial and Neonatal Risk Factors for Trajectories of Behavioral Dysregulation Among Young Children From 18 to 72 Months of Age. *JAMA network open, 6*(4), e2310059-e2310059.
23. Jahromi, L. B., Bryce, C. I., & Swanson, J. (2013). The importance of self-regulation for the school and peer engagement of children with high-functioning autism. *Research in Autism Spectrum Disorders, 7*(2), 235-246.
24. Johnson, C. P., & Myers, S. M. (2007). Identification and evaluation of children with autism spectrum disorders. *Pediatrics, 120*(5), 1183-1215.
25. Jucksch, V., Salbach-Andrae, H., Lenz, K., Goth, K., Döpfner, M., Poustka, F., Freitag, C. M., Lehmkuhl, G., Lehmkuhl, U., & Holtmann, M. (2011). Severe affective and behavioural dysregulation is associated with significant psychosocial adversity and impairment. *Journal of child psychology and psychiatry, 52*(6), 686-695.
26. Kim, J., Carlson, G. A., Meyer, S. E., Bufferd, S. J., Dougherty, L. R., Dyson, M. W., Laptook, R. S., Olino, T. M., & Klein, D. N. (2012). Correlates of the CBCL-dysregulation profile in preschool-aged children.

Journal of child psychology and psychiatry, 53(9), 918-926.

27. Kuppens, S., & Onghena, P. (2012). Sequential meta-analysis to determine the sufficiency of cumulative knowledge: The case of early intensive behavioral intervention for children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 6*(1), 168-176.
28. Lam, K. S., & Aman, M. G. (2007). The Repetitive Behavior Scale-Revised: independent validation in individuals with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 37*, 855-866.
29. Lee, D. W., Shin, J., Choi, D.-W., Kim, K., & Park, E.-C. (2019). Effects of household income change on children's problem behavior: findings from a longitudinal study. *Journal of Adolescent Health, 65*(4), 527-535.
30. Lord, C., Rutter, M., DiLavore, P., Risi, S., Gotham, K., & Bishop, S. (2012). *Manual for the autism diagnostic observation schedule: ADOS-2*.
31. Masi, A., Dissanayake, C., Alach, T., Cameron, K., Fordyce, K., Frost, G., Grove, R., Heussler, H., Silove, N., Sulek, R., Tucker, M., Williams, K., & Eapen, V. (2021). Clinical outcomes and associated predictors of early intervention in autism spectrum disorder: A study protocol. *BMJ open, 11*(8), e047290.
32. Masi, G., Muratori, P., Manfredi, A., Pisano, S., & Milone, A. (2015, 2015/01/30/). Child behaviour checklist emotional dysregulation profiles in youth with disruptive behaviour disorders: Clinical correlates and treatment implications. *Psychiatry Research, 225*(1), 191-196. https://doi.org/https://doi.org/10.1016/j.psychres.2014.11.019
33. Mazefsky, C. A., Herrington, J., Siegel, M., Scarpa, A., Maddox, B. B., Scahill, L., & White, S. W. (2013). The role of emotion regulation in autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*(7), 679-688.
34. Messinger, D., Young, G. S., Ozonoff, S., Dobkins, K., Carter, A., Zwaigenbaum, L., Landa, R. J., Charman, T., Stone, W. L., & Constantino, J. N. (2013). Beyond autism: a baby siblings research consortium study of high-risk children at three years of age. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*(3), 300-308.
35. Mullen, E. M. (1995). *Mullen scales of early learning* (AGS edn. ed.). American Guidance Service Inc. .
36. Neuhaus, E., Webb, S. J., & Bernier, R. A. (2019). Linking social motivation with social skill: The role of emotion dysregulation in autism spectrum disorder. *Development and Psychopathology, 31*(3), 931-943.
37. Peyre, H., Speranza, M., Cortese, S., Wohl, M., & Purper-Ouakil, D. (2015). Do ADHD children with and without child behavior checklist–dysregulation profile have different clinical characteristics, cognitive features, and treatment outcomes? *Journal of attention disorders, 19*(1), 63-71.
38. Priest, N., Baxter, J., & Hayes, L. (2012). Social and emotional outcomes of Australian children from Indigenous and culturally and linguistically diverse backgrounds. *Australian and New Zealand Journal of Public Health, 36*(2), 183-190.

39. Prizant, B. M., Wetherby, A. M., Rubin, E., Laurent, A. C., & Rydell, P. J. (2006). *The SCERTS model: A comprehensive educational approach for children with autism spectrum disorders, Vol. 1*. Paul H. Brookes Publishing Co.
40. Rogers, S. J., & Dawson, G. (2010). *Early Start Denver Model for young children with autism: Promoting language, learning, and engagement*. Guilford Publications.
41. Rutter, M., Bailey, A., & Lord, C. (2003). *The social communication questionnaire: Manual*. Western Psychological Services.
42. 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*, 1766-1772.
43. Tajik-Parvinchi, D. J., Farmus, L., Cribbie, R., Albaum, C., & Weiss, J. A. (2020). Clinical and parental predictors of emotion regulation following cognitive behaviour therapy in children with autism. *Autism, 24*(4), 851-866.
44. Uljarević, M., Hedley, D., Nevill, R., Evans, D. W., Cai, R. Y., Butter, E., & Mulick, J. A. (2018). Brief report: Poor self-regulation as a predictor of individual differences in adaptive functioning in young children with autism spectrum disorder. *Autism Research, 11*(8), 1157-1165.
45. Zhou, Q., Chen, S. H., & Main, A. (2012). Commonalities and differences in the research on children's effortful control and executive function: A call for an integrated model of self-regulation. *Child development perspectives, 6*(2), 112-121.

Tables

Table 1. Child and family characteristics by DP status

Total	**DP**	**Non-DP**	**p-value**
(N=415)	(n=180, 43.4%)	(n=235, 56.6%)	
Child characteristics			
Age, mean (SD)	4.78 (0.95)	4.29 (1.05)	**<0.001**
Gender, n (%)			
Male	136 (75.6%)	195 (83.0%)	0.06
Female	44 (24.4%)	40 (17.0%)	
CALD background status, n (%)			
Non-CALD	102 (56.7%)	118 (50.2%)	0.06
CALD	65 (36.1%)	111 (47.2%)	
Missing	13 (7.2%)	6 (2.6%)	
Other medical conditions, n (%)			
No	142 (78.9%)	186 (79.1%)	0.94
Yes	38 (21.1%)	49 (20.9%)	
Missing	0 (0.0%)	0 (0.0%)	
Family characteristics			
Mother's age, mean (SD)	34.46 (5.51)	35.63 (7.90)	0.12
father's age, mean (SD)	37.26 (6.49)	38.53 (8.34)	0.14
Primary carer's education level, n (%)			
Primary/ secondary	46 (25.6%)	49 (20.9%)	0.16
Postgraduate/ tertiary	122 (67.8%)	181 (77.0%)	
Missing	12 (6.7%)	5 (2.1%)	
Secondary carer's education level, n (%)			
Primary/ secondary	52 (28.9%)	54 (23.0%)	0.08
Postgraduate/ tertiary	98 (54.4%)	154 (65.5%)	
Missing	30 (16.7%)	27 (11.5%)	
Primary carer's occupation, n (%)			
Professional/ paraprofessional	35 (19.4%)	87 (37.0%)	**<0.001**
Other labour	129 (71.7%)	128 (54.5%)	

Missing	16 (8.9%)	20 (8.5%)	
Secondary carer's occupation, n (%)			
Professional/ paraprofessional	74 (41.1%)	115 (48.9%)	0.06
Other labour	79 (43.9%)	81 (34.5%)	
Missing	27 (15.0%)	39 (16.6%)	
Annual family income, n (%)			
<$40,000	41 (22.8%)	34 (14.5%)	**0.025**
$40,001 - $85,000	36 (20.0%)	45 (19.1%)	
$85,001 - $115,000	19 (10.6%)	46 (19.6%)	
>$115,000	27 (15.0%)	47 (20.0%)	
Missing	57 (31.7%)	63 (26.8%)	

Abbreviations: DP: dysregulation profile; SD: standard deviation; p: p-value; CALD: culturally and linguistically diverse

Table 2. Multivariable binary logistic regression analysis showing association between a dysregulation profile (baseline) and baseline autism traits and cognition

	Unadjusted OR (95% CI)	Model 1 AOR (95% CI)	Model 2 AOR (95% CI
Sociodemographic factors			
Child's age	1.63 (1.32, 2.05)*	1.49 (1.12, 2.01)*	Not reported
Child's gender			
Female	Reference	Reference	Not reported
Male	1.58 (0.98, 2.56)	2.00 (0.97, 4.19)	
Child's CALD status			
Non-CALD	Reference	Reference	Not reported
CALD	0.68 (0.45, 0.99)*	0.53 (0.29, 0.91)*	
Other medical conditions			
No	Reference	Reference	Not reported
Yes	1.02 (0.63, 1.63)	1.22 (0.61, 2.43)	
Primary carer's education level			
Primary/ secondary	Reference	Reference	Not reported
Postgraduate/ tertiary	0.72 (0.45, 1.14)	0.77 (0.41, 1.46)	
Annual family income, n (%)			
<$40,000	Reference	Reference	Not reported
$40,001 - $85,000	0.66 (0.35, 1.24)	0.69 (0.34, 1.44)	
$85,001 - $115,000	0.34 (0.17, 0.68)*	0.39 (0.18, 0.87)*	
>$115,000	0.48 (0.25, 0.91)*	0.42 (0.18, 0.95)*	
Child measures			
ADOS-2 CSS	0.92 (0.83, 1.03)	-	0.96 (0.81, 1.12)
SCQ total	1.12 (1.07, 1.16)**	-	1.11 (1.05, 1.17)**
RBS-R total	1.07 (1.05, 1.09)**	-	1.09 (1.06, 1.12)**
MSEL non-verbal DQ	1.00 (0.99, 1.01)	-	1.02 (0.99, 1.03)
MSEL verbal DQ	1.00 (0.99, 1.01)	-	1.01 (0.99, 1.02)

Abbreviations: AOR: adjusted odds ratio; CI: confidence interval; CALD: culturally and linguistically diverse; ADOS-2: Autism Diagnostic Observation Schedule- Second edition; CSS: calibrated severity

score; SCQ: Social Communication Questionnaire; RBS-R: Repetitive Behaviour Scale- Revised; MSEL: Mullen Scale of Early Learning; DQ: developmental quotient; Model 1 – sociodemographic factors only; Model 2 – Child's autistic tratis and adjusted for sociodemographic covariates; Given each of the child's autistic traits were adjusted for sociodemographic covariates, their estimates were not reported in model 2; *p-value<0.05., **p-value<0.01.

Table 3. Multilevel linear regression analysis showing dysregulation profile (baseline) as a predictor of changes in children's autism traits and cognition adjusted for sociodemographic covariates.

Variable	Changes in social communication	Changes in repetitive behaviours	Changes in non-verbal developmental quotient	Changes in verbal developmental quotient
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Baseline Dysregulation profile (CBCL-DP)	-0.59 (-2.26, 1.07)	-3.29 (-9.35, 2.77)	-1.39 (-5.95, 3.16)	1.03 (-3.13, 5.19)

Adjusted for sociodemographic covariates