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Community-guided, autism-adapted group cognitive behavioral therapy for depression in autistic youth (CBT-DAY): Preliminary feasibility, acceptability, and efficacy

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Abstract

This study examined the preliminary feasibility, acceptability, and efficacy of an autism-adapted cognitive behavioral therapy for depression in autistic youth, CBT-DAY. Twenty-four autistic youth (11–17 years old) participated in the pilot non-randomized trial including 5 cisgender females, 14 cisgender males, and 5 non-binary youth. Youth participated in 12 weeks of, CBT-DAY and youth depressive symptoms (i.e., primary clinical outcome) and emotional reactivity and self-esteem (i.e., intervention mechanisms) were assessed through self-report and caregiver report at four timepoints: baseline (week 0), midpoint (week 6), post-treatment (week 12), and follow-up (week 24). Results suggested that CBT-DAY may be feasible (16.67% attrition) in an outpatient setting and acceptable to adolescents and their caregivers. Bayesian linear mixed-effects models showed that CBT-DAY may be efficacious in targeting emotional reactivity [$\beta_{T1\text{-}T3} = -2.53$, $CrI_{95\%}$ (−4.62, −0.58), $P_d = 0.995$, $d = -0.35$] and self-esteem [$\beta_{T1\text{-}T3} = -3.57$, $CrI_{95\%}$ (−5.17, −2.00), $P_d > 0.999$, $d = -0.47$], as well as youth depressive symptom severity [$\beta = -2.72$, $CrI_{95\%}$ (−3.85, −1.63), $P_d > 0.999$]. Treatment gains were maintained at follow-up. A cognitive behavioral group therapy designed for and with autistic people demonstrates promise in targeting emotional reactivity and self-esteem to improve depressive symptom severity in youth. Findings can be leveraged to implement larger, more controlled trials of CBT-DAY. The trial was registered at Clinicaltrials.gov (Identifier: NCT05430022; https://beta.clinicaltrials.gov/study/NCT05430022).

Lay Abstract

Depression in youth is a significant public health problem worldwide, particularly for autistic youth who are over twice as likely to experience depression than their non-autistic peers. Although pathways to depression are complex, emotional reactivity and negative self-esteem are two risk factors for depression in autistic and non-autistic youth. Although autistic youth are more likely to experience depression than their non-autistic peers, psychotherapy options for autistic youth are very limited; community guidance in the development and testing of psychotherapy programs is a promising approach in autism. Therefore, in this study, we designed an autism-adapted CBT-DAY, in collaboration with autistic community members. Specifically, CBT-DAY combined neurodiversity-affirming and cognitive behavioral approaches to target emotional reactivity and self-esteem in youth to improve depressive symptom severity in a group setting across 12 weeks. We examined the preliminary feasibility, acceptability, and efficacy of CBT-DAY in a pilot non-randomized trial. In addition, we implemented a rigorous protocol for assessing, monitoring, and addressing potential harms in this intervention. Results from 24 autistic youth (11–17 years old) suggest that CBT-DAY may be feasible to use in an outpatient clinical setting and generally acceptable to youth and their caregivers. Participation

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in CBT-DAY may be associated with significant improvements in youth emotional reactivity and self-esteem, as well as depressive symptom severity per self-report only. Exploratory analyses showed that participation in CBT-DAY may also be associated with significant improvements in internalizing symptoms. Findings demonstrate the potential promise of neurodiversity-affirming and cognitive behavioral approaches to treating depressive symptoms in some autistic youth.

Keywords
autism, cognitive behavioral therapy, community-guided intervention, depression, harms monitoring, youth

Adolescent depression is a prevalent public health problem in the United States (Avenevoli et al., 2015), particularly among autistic youth who experience depression at rates nearly twice that of their non-autistic peers (Hudson et al., 2019; Schwartzman & Corbett, 2020). Interventions targeting depression in autistic youth are limited, which is concerning as untreated depression is associated with adverse outcomes (e.g., poor physical health, suicidal thoughts and behaviors (STBs), and caregiver stress; Cadman et al., 2021; Hawton et al., 2013) and diminished quality of life (Clayborne et al., 2019; Lawson et al., 2020). Autism-adapted interventions outperform standard approaches for anxiety (Johnson et al., 2023; White et al.,2013, 2009; Wood et al., 2020, 2021) and obsessive-compulsive disorder (Kose et al., 2018; Vause et al., 2017) in youth, which suggests that autism-adapted interventions may be efficacious for depression in this population.

Cognitive behavioral therapy for depression in youth

Intervention efforts for depression in autistic youth may be guided by a larger body of research on non-autistic youth: Cognitive behavioral therapy (CBT; Beck, 1991) is a leading intervention that is supported by a robust evidence base. A recent systematic review and meta-analysis of 31 randomized controlled trials indicates that CBT is effective for the treatment of depression and prevention of relapse in non-autistic children and adolescents (Oud et al., 2019). Evidence also supports the use of group-based formats to deliver CBT as a treatment for depression in non-autistic youth (Keles & Idsoe, 2018). As groups allow multiple individuals to participate in a course of treatment simultaneously, they also increase access to treatment. For clinics, group models may be more cost-effective than individual formats.

Although CBT is a leading treatment for depression in non-autistic youth, its evidence base in autism is limited. In a review of depression treatments for autistic people, only 20 psychosocial treatments met the inclusion criteria for the review, with just 12 studies targeting depressive symptoms (Linden et al., 2023; Menezes et al., 2020). Of those studies, only two studies tested the efficacy of group CBT in treating depressive symptoms in autistic youth and adults (McGillivray & Evert, 2014; Santomauro et al., 2016). In the first non-randomized trial, 26 autistic youth and adults (15–25 years old; mean age = 20) participated in 9 weeks of group CBT and results indicated no significant effect for the Group × Time interaction (McGillivray & Evert, 2014). However, participants with more significant depressive symptoms at baseline experienced greater symptom reduction over time (McGillivray & Evert, 2014). Autism adaptations to CBT included discussions of the social difficulties experienced by autistic people and how these experiences contribute to negative views of self and others (McGillivray & Evert, 2014). In the second trial, 20 autistic youth (13–18 years old; mean age = 16) were randomly assigned to 10 weeks of standard group CBT or a waitlist control and results indicated no treatment effects on depressive symptom severity (Santomauro et al., 2016).

Despite this emerging evidence base, both trials were underpowered to assess the effects of interest; this may be explained, in part, by recruitment difficulties in one trial (Santomauro et al., 2016) and limited information on intervention acceptability and floor effects from participants without current depressive symptoms in the other trial (McGillivray & Evert, 2014). To our knowledge, autistic people and community members were not involved in designing these interventions and are important for designing neurodivergence-informed therapy (Chapman & Botha, 2023). Furthermore, there are opportunities to collect more comprehensive data on intervention feasibility, acceptability, potential harms, and mechanisms to inform findings and future trials.

Intervention targets: Emotion dysregulation and negative self-esteem

Although pathways to depression in youth are complex, emotion dysregulation and negative self-esteem are important risk factors for both autistic (Conner et al., 2022) and non-autistic youth (Dale et al., 2019). Emotion dysregulation, defined as difficulties in altering one's emotions in a goal-directed manner (Aldao et al., 2010), is a transdiagnostic risk factor for depression in autistic and non-autistic people (Cai et al., 2018). Interventions targeting emotion dysregulation in autistic people have reported success in

improving emotion regulation (ER) and depressive symptoms severity (Conner et al., 2019), which points to the potential of ER-focused interventions in alleviating depressive symptoms in autism. Negative self-esteem, a broad construct that includes pessimistic beliefs and attitudes of self and self-concept (Cast & Burke, 2002), is another transdiagnostic risk factor for depression and adverse mental health outcomes in autistic and non-autistic people (McCauley et al., 2019; van der Cruijsen & Boyer, 2021). Autistic people experience marginalization and dehumanization across societal levels (e.g., family, school, and community; Botha & Frost, 2020; Cooper et al., 2017; Han et al., 2022; Turnock et al., 2022), which can be internalized about one's autistic identity. Relatedly, autistic youth are more likely to endorse depressive symptoms related to interpersonal problems than their non-autistic peers (Schwartzman et al., 2022). Taken together, this evidence suggests that self-esteem and autistic identity are interconnected and may be influenced by social experiences that can lead to depression and other adverse mental health outcomes.

Present study

The goal of this study was to examine the preliminary feasibility, acceptability, and efficacy of a community-guided, autism-adapted group CBT intervention, *Cognitive Behavioral Therapy for Depression in Autistic Youth (CBT-DAY)*, in targeting emotion dysregulation and negative self-esteem using neurodiversity-affirming approaches to improve depressive symptom severity in youth. We hypothesized that CBT-DAY would be: (1) feasible, as measured by attrition (at/below 28%; De Haan et al., 2013) and session attendance (attendance at least two-thirds of sessions; Haan et al., 2013), (2) acceptable to families, as assessed by satisfaction ratings following the intervention, (3) potentially efficacious in improving youth depressive symptom severity (primary clinical outcome), as assessed by self-report and caregiver report measures over time, and (4) potentially efficacious in targeting intervention mechanisms (i.e., emotion dysregulation, self-esteem), as measured by self-report and caregiver report measures. Exploratory outcomes included potential changes in the severity of youth internalizing symptoms over participation in CBT-DAY.

Methods

Study design

A pilot non-randomized trial was conducted to investigate the feasibility, acceptability, and preliminary efficacy of CBT-DAY and pre-registered (Identifier: NCT05430022; https://beta.clinicaltrials.gov/study/NCT05430022). Study participants included autistic youth (11–17 years old) with elevated depressive symptoms who were recruited from an ongoing clinical service. All study procedures were approved by the Vanderbilt University Institutional Review Board in accordance with the 1964 Helsinki Declaration and its later amendments. Informed consent and assent were collected from caregivers and youth in writing, respectively, prior to inclusion in the study.

Recruitment

Study participants were recruited from the Psychiatry Autism Research Team (PART) outpatient clinic at Vanderbilt University Medical Center (VUMC). The PART Clinic is comprised of a multidisciplinary team of psychiatrists, psychologists, and nurse practitioners with experience in serving neurodivergent people. Referrals are sent from providers in the VUMC healthcare system and other healthcare networks throughout Tennessee, including urban and rural areas, for patients with commercial and/or state-based insurance. Given a high volume of therapy referrals, particularly amid the COVID-19 pandemic, a group therapy service line for autistic youth with depression was started to increase access to therapy. Youth between 11 and 17 years old were included a priori as youth were in middle and high school (i.e., similar social landscapes).

During informed consent and assent, families were told that participation in the research was voluntary and separate from their participation in the group therapy; their decision to participate in the study would not affect their relationship with the PART Clinic or VUMC more broadly.

Participants

Study participants included youth (age 11–17 years) in middle and high school who met the following criteria: (1) diagnosed with autism spectrum disorder (ASD) by a qualified clinician through review of medical records, and confirmed by clinical judgment and total T-score $\geqslant 60$ on the Social Responsiveness Scale (SRS-2; (Constantino & Gruber, 2012), (2) had elevated depressive symptoms, as evidenced by a T-score $\geqslant 60$ on the depression subscale of the Revised Children's Anxiety and Depression Scale (RCADS; (Chorpita et al., 2005), (3) were comfortable participating in English-based therapy, and (4) were interested in participating in CBT-DAY.

Participants were excluded if they: (1) had an intellectual disability, per caregiver report, (2) exhibited physical aggression toward others (e.g., hitting, punching, slapping, or other acts of physical violence toward other people in any setting) in the past six months, per caregiver report, in order to preserve group safety, and/or (3) endorsed severe suicidal thoughts and behaviors (STBs) and/or non-suicidal self-injury (NSSI) that warranted higher-level care (e.g., hospitalization, intensive

outpatient treatment, etc.), as assessed by the Columbia Suicide Severity Rating Scale (C-SSRS; (Posner et al., 2011). No changes in inclusion or exclusion criteria were applied during the study.

Procedures

Interested caregivers completed a telephone screening with study staff and were subsequently scheduled for an intake visit to review consent/assent documents. During the intake visit, study staff provided families with an overview of the intervention (e.g., time commitment, schedule, skills taught), completed a semi-structured interview with families, and administered caregiver report and youth self-report questionnaires on REDCap (Harris et al., 2009). The semi-structured interview included questions about youth mental health and treatment history, psychiatric medications, and reasons for wanting to participate in the group intervention. The C-SSRS (Posner et al., 2011) was administered to all youth to screen for current and lifetime STBs and NSSI. The caregiver report and self-report questionnaires assessed aspects of youth mental health (e.g., depressive symptoms, self-esteem) from the perspective of both raters. Families who were interested in participating in CBT-DAY and eligible for this group therapy were added to the roster for the next group. Participants and their caregivers completed study measures at four timepoints: pre-intervention (Time 1; T1), at intervention midpoint (Time 2; T2), at intervention conclusion (Time 3; T3), and at 12 weeks following the intervention conclusion (Time 4; T4). A total of three groups ($n = 8$ youth per group) were conducted during the study, with each group comprised of youth of both sexes and diverse gender identities.

Community involvement

Three autistic adults (authors A.V.P, A.X.J., and Z.J.W.) participated in the study in various ways including the design of CBT-DAY, co-facilitation of group sessions, ongoing clinical consultation, interpretation of findings, and writeup of the present manuscript. Specifically, autistic adults were engaged in the project as part of the TREND Lab Neurodivergent Advisory Team at VUMC (PI: Schwartzman) given their interests in participatory research and clinical service, as well as personal and/or family experiences of psychiatric disorders and psychotherapy. All members of the TREND Lab Neurodivergent Advisory Team received financial compensation for their expertise, participated in the writing and review of the present manuscript, and are included as co-authors. In addition, the first author collected additional insights on CBT-DAY treatment content from three additional autistic adults who elected not to participate in the writing of the manuscript.

Intervention: CBT-DAY

CBT-DAY is a 12-week group intervention developed by the first author in collaboration with neurodivergent adults and caregivers. Detailed information on CBT-DAY (e.g., session content, structure, etc.) is available in Supplemental Document 1. The intervention content may also be accessed by emailing the first author. The intervention uses cognitive behavioral and neurodiversity-affirming approaches to target key mechanisms (i.e., emotion dysregulation, self-esteem) to improve youth depressive symptom severity. A brief description of session content is included in Figure 1. Intervention content was adapted from "Modular CBT for Children and Adolescents with Depression" by Drs. Katherine Nguyen Williams and Brent R. Crandal, which is an evidence-based CBT program for non-autistic youth with depression (Williams & Crandal, 2015).

The 90-min group sessions occurred weekly for 12 consecutive weeks with seven to eight youths per group within the PART Clinic (outpatinet). Groups were facilitated by a licensed clinical psychologist and clinical trainees (e.g., clinical psychology intern, psychology practicum student, medical student). The weekly session structure included: (a) 10 min of relaxation exercises, (b) 20 min of exercise review (i.e., homework review), (c) 45 min of didactic instruction, (d) 10–15 min of break (provided mid-session), and (e) 5 min to discuss the next week's exercise. Relaxation exercises (e.g., deep breathing, gratitude) were consistent each week and first taught by group leaders; eventually, group members elected to lead the relaxation exercises. Exercise review included discussion of the weekly exercise, identification of barriers to attempting exercises, and problem-solving to increase engagement with the exercises in the following week. Didactic instruction included multiple modalities (e.g., visual, audio, written) and approaches (e.g., large-group discussions, small-group activities, etc.) to increase access to the material for all group members of diverse communication and learning styles (see Supplemental Document 1). Examples of weekly exercises included thought records, identifying cognitive distortions ("thinking traps"), practice using the Shoe Swap strategy (i.e., cognitive reappraisal), and engaging ER skills in social situations. The exercises were designed to be brief and feasible (3–5 min) for youth to practice and incorporate into everyday situations (e.g., school, community events). A worksheet describing the weekly skill and exercise was emailed to caregivers each week to not only share the weekly treatment content, but also to guide caregivers in reinforcing youth practice with the exercises. Specifically, caregivers were instructed to encourage their adolescents to attempt the weekly exercise at least three times throughout the week. For additional information on session format, an outline of one session is included below.

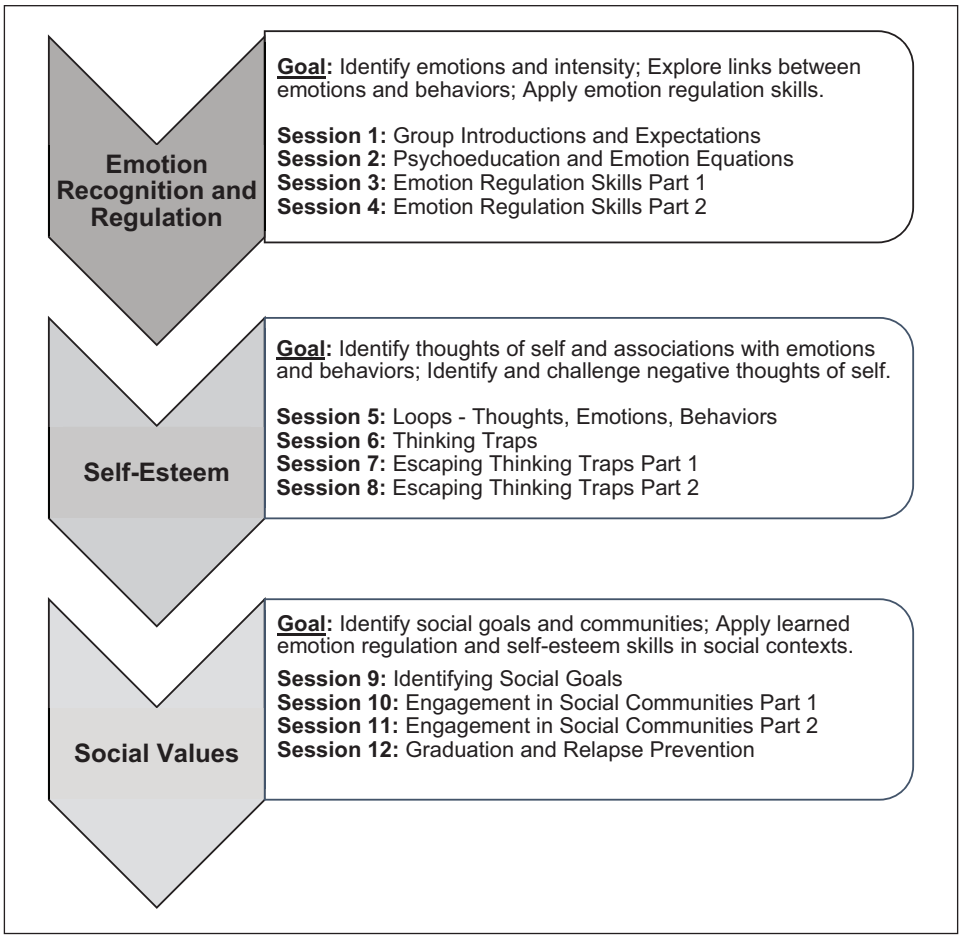

Figure 1. Treatment content of CBT-DAY.

As an example, one session in the Emotion Recognition & Regulation module (see Figure 1) opened with guided deep breathing and gratitude exercises. For this session, the previous week's exercise was to notice and record three body signals (e.g., sweating, increased body temperature, etc.) and behaviors (e.g., biting nails, pacing back and forth, etc.) at least three times in the week (e.g., at school, home, out in the community, etc.) on a provided worksheet, and then use this information to identify the emotion they were feeling in that situation from a list of previously-reviewed options (e.g., sadness, anger, anxiety, relaxed, etc.). Of note, to facilitate skill acquisition and homework compliance, each week's exercise was practiced in-session with group members and then assigned for homework during the week. Didactic instruction comprised the majority of the session and focused first on reinforcing the skill of identifying body signals and behaviors and using this information to identify emotions, and then how to advance this skill by learning to rate the intensity of emotions on a scale from 1 to 10 by creating personalized rating scales in a small-group activity. At the midpoint of each group session, participants had a 10–15 min break during which snacks were provided and participants took turns sharing YouTube videos of their interests (e.g., video games, favorite music, etc.) with the group. The session closed with a discussion of the exercise assigned for the upcoming week, which was to practice noticing and identifying an emotion using clues from body signals and behaviors on a worksheet, then rating its intensity (using a personalized 1–10 scale) at least three times.

The final session of CBT-DAY was unique as it included a review and reinforcement of learned CBT skills and relapse prevention strategies, followed by a graduation pizza party.

Measures

Eligibility and screening measures. The Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012) is a caregiver-rated questionnaire that assesses multiple domains of autistic traits (e.g., comfort in social interactions, preference for routines). The SRS-2 was administered to caregivers in the initial visit to confirm autism diagnostic status (i.e., Total T-score ≥ 60), in combination with clinical judgment. The Revised Children's Anxiety and Depression Scale, Parent [Caregiver] and

Child versions (RCADS-P and RCADS-C, respectively; Chorpita et al., 2005) is a caregiver- and self-report questionnaire that assesses the severity of youth internalizing symptoms (e.g., low mood, loss of interest in activities, worries, nervousness in social situations, etc.). The RCADS-P/C has been validated for use with autistic youth (Kaat & Lecavalier, 2015; Khalfe et al., 2023). Youth with elevated depressive symptoms per caregiver report and/or self-report on the RCADS-P/C (i.e., either T-score $\geqslant 60$), confirmed by clinical judgment (i.e., youth understood the questionnaire items, presence of elevated depressive symptoms), met inclusion criteria. The C-SSRS (Posner et al., 2011) was administered to all youth during the initial visit to assess for the presence and severity of current and lifetime STBs and NSSI. As suicidal ideation is common in the context of depression (Hawton et al., 2013), youth with low-grade STBs were not excluded. However, to monitor adolescent safety, the C-SSRS was routinely administered throughout the program.

Feasibility. Program attrition, session attendance, and success of outcome data collection were used to assess the feasibility of CBT-DAY.

Acceptability. The acceptability of CBT-DAY was assessed by caregiver and adolescent ratings at Time 3 (i.e., post-intervention) using the clinic-created CBT-DAY Satisfaction Questionnaire. The CBT-DAY Satisfaction Questionnaire is a mixed method questionnaire that is based on the Client Satisfaction Questionnaire (CSQ; Attkisson & Greenfield, 1999) and measures program satisfaction, skill helpfulness (e.g., *How helpful was each skill?*), skill utilization (e.g., *How likely are you to use the skills you learned in the future?*), and program recommendation (e.g., *How likely would you be to recommend this program to others?*) through a series of Likert-type scale items. At the end of the questionnaire, youth and caregivers also answered open-ended questions about the most/least helpful components of CBT-DAY and were given an opportunity to provide suggestions to improve the program. The CBT-DAY Satisfaction Questionnaire was completed by youth and caregivers anonymously to potentially increase the validity of ratings.

Potential harms. Multiple methods were used to assess, address, record, and report harms experienced by participants during the study and aligned with established recommendations (Klatte et al., 2023). Detailed information on the methods used to assess, address, record, and report harms experienced by participants during the study is available in Supplemental Document 2. For *harm assessment*, youth, caregivers, and clinicians routinely measured the severity of adolescent depressive symptoms and STBs/NSSI throughout the 12-week program using scores from the RCADS-C/P and C-SSRS. Multimethod assessment approaches may be important for autistic youth as some youth may be more likely to endorse suicidal thoughts on a self-report questionnaire than to a clinician (Schwartzman et al., 2023). To *address harm* in this study, written safety protocols for harm assessment and intervention were provided to all study staff and reviewed before the start of each cohort. In terms of *recording and reporting harm*, serious adverse events (SAEs) would be reported immediately to the Institutional Review Board at Vanderbilt. Adverse events reported by families and/or observed by the study team would be evaluated for relatedness to the intervention (i.e., characterizing adverse events) and degree of burden to the family (i.e., classifying adverse events). Reporting information during CBT-DAY is included in the Results section of this manuscript.

Primary clinical outcome. The primary clinical outcome of CBT-DAY was improvement in adolescent depressive symptom severity over the 12 weeks, as measured by significant reductions in T-scores on the depression subscale of the RCADS-P and RCADS-C.

Intervention mechanisms. Two measures were administered at all timepoints to assess changes in the intervention mechanisms of emotional reactivity and self-esteem: the Emotion Dysregulation Inventory-Reactivity Short Form (EDI Reactivity; Mazefsky et al., 2018) and the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965). The EDI Reactivity is a caregiver report questionnaire that assesses the severity of adolescent emotional reactivity (e.g., frequency of outbursts, difficulties in calming down). Higher scores on the EDI indicate higher reactivity and emotion dysregulation, while lower scores indicate lower reactivity and emotion dysregulation. The RSES is a 10-item self-report questionnaire that assesses beliefs of self and self-esteem (e.g., person of worth, comparable to others). Lower scores on the RSES suggest higher self-esteem, while higher scores suggest lower self-esteem.

Exploratory clinical outcome. T-Scores of total internalizing symptoms from the RCADS-P/C were examined at all timepoints to explore additional changes that may be associated with participation in CBT-DAY.

Statistical analysis

The feasibility of the CBT-DAY was assessed by attrition (i.e., proportion of youth enrolled who completed the program), session attendance (i.e., proportion of sessions attended by each participant), and success of outcome data collection (i.e., proportion of families who completed study measures at study timepoints). The means and standard deviations of adolescent and caregiver ratings on the CBT-DAY Satisfaction Questionnaire at Time 3 were calculated to assess intervention acceptability.

All statistical analyses were performed in R version 4.2.0 (R Core Team, 2022). To assess the effects of CBT-DAY on the primary outcome (RCADS depression T-scores), we fit a Bayesian linear mixed-effects model to RCADS-P and RCADS-C scores simultaneously, with a student-*t* likelihood (to provide additional robustness to outliers), fixed effects of timepoint (T1, T2, T3, T4), rater (self, caregiver), and their interaction, as well as random effects by an individual for intercept, timepoint, rater, and timepoint × rater interaction terms. An identical model was fit to the RCADS-P/C Internalizing T-scores, which were examined as an exploratory secondary outcome. Timepoint was modeled as an *ordinal* predictor (Bürkner & Charpentier, 2020) in all models. Models were fit using Markov chain Monte Carlo (MCMC) estimation, as implemented in the *brms* R package (Bürkner, 2017a, 2017b). Notably, Bayesian estimation was required for these models, as the random effect structures would have produced empirically underidentified models in a standard maximum-likelihood framework. Additional details of the models and priors can be found in Supplemental Table S1.

Omnibus tests of each main effect and interaction were carried out based on the posterior distributions of the respective regression slopes (i.e., beta parameters). Notably, the beta values for the "timepoint" and "timepoint × rater" omnibus effects represent the mean contrast between adjacent timepoints (i.e., the mean of T1-T2, T2-T3, and T3-T4). Parameter summaries from model posterior distributions were operationalized as the median and the 95% highest-density credible interval (CrI). In addition, the probability of direction (P_d, i.e., the posterior probability that the true parameter value has the same sign as its point estimate; Makowski et al., 2019) was computed for all parameters, with values of $P_d > 0.975$ indicating "statistical significance" at a level comparable to traditional frequentist tests. Effect sizes for the intervention mechanisms and primary and exploratory clinical outcomes were estimated by calculating the individual contrast of interest in raw scale units (the unstandardized mean difference) and dividing it by pre-intervention (T1) standard deviation of the full sample (Ben-Shachar et al., 2020). Based on current research findings in the applied literature (Sawilowsky, 2009), the following effect sizes were defined as: (a) $d = 0.01$ very small, (b) $d = 0.2$ small, (c) $d = 0.5$ medium, (d) $d = 0.8$ large, (e) $d = 1.2$ very large, and (f) $d = 2.0$ huge.

In the case that the timepoint × rater interaction was not significant, we examined the marginal treatment effect of CBT-DAY on RCADS-C/P scores (pooled across participants and raters) using the *emmeans* R package (Lenth, 2022). The primary contrast of interest for all models was comparing baseline scores to those at the end of the CBT-DAY intervention (i.e., the T1-T3 contrast). However, we also performed secondary (i.e., exploratory) contrasts to examine changes in outcomes of interest over the baseline to midpoint (T1-T2), midpoint to endpoint (T2-T3), endpoint to follow-up (T3-T4), and baseline to follow-up (T1-T4) time periods. In addition, even when timepoint × rater interactions were *not* statistically significant, we performed exploratory post-hoc contrasts that examined the RCADS-C and RCADS-P individually to provide additional information about rater-specific outcomes.

To further examine individual-level change in depressive symptoms over the course of the intervention, we calculated the Reliable Change Index (RCI; Jacobson & Truax, 1991) for each individual at T2, T3, and T4. RCI values were calculated using the pre-test standard deviation of the RCADS-C and RCADS-P, published coefficient alpha values from a prior study validating the RCADS-C/P in autistic youth receiving psychotherapy (RCADS-C: $\alpha = 0.82$; RCADS-P: $\alpha = 0.67$; Khalfe et al., 2023), and model-based difference scores based on individual-level expected values of the posterior predictive distribution at each timepoint. RCI values of −1.645 or lower were defined as indicating significant improvement for an individual (based on a one-tailed frequentist *p*-value of 0.05). If observed, we also classified RCI values of 1.645 or higher as indicating significant (i.e., greater-than-chance) deterioration in depressive symptoms.

To examine the hypothesized mechanisms of the intervention (i.e., changes in emotion dysregulation and self-esteem), we fit linear mixed-effect models with a fixed effect of timepoint and random intercept by participant ID and outcomes of EDI-7 scores and RSES scores. These models were exclusively tested using *emmeans* contrasts, with the T1-T3 contrast as the primary outcome and the T1-T2, T2-T3, T3-T4, and T1-T4 contrasts considered exploratory. Missing data were accommodated using 10-fold multiple imputations based on random forests from the *missForest* R package (Stekhoven & Stekhoven, 2013; Stekhoven & Bühlmann, 2012).

Results

Study population

Thirty-two autistic youth participated in an intake appointment and eight did not enroll in CBT-DAY due to lack of interest ($n = 4$), transportation difficulties ($n = 1$), and severe suicidal thoughts/behaviors that warranted higher-level care ($n = 3$). Twenty-four autistic youth participated in the study (age range 11–17 years; $M = 13.79$, $SD = 1.96$; see Table 1). The sample included 5 cisgender females, 14 cisgender males, and 5 non-binary youth (four assigned female sex at birth and one assigned male sex at birth). The majority of youth identified as not Hispanic/Latinx (83.33%) and White (83.33%), and a small proportion (16.67%) identified as Black. The sample was neither ethnically nor racially diverse, which limits the findings.

Table 1. Sample demographics at Time 1.

Demographic	Frequencies
Age	*M* = 13.79, *SD* = 1.96
Sex	15 male/9 female
Gender	14 cisgender male/5 cisgender female / 5 gender non-binary
Ethnicity	20 Not Hispanic/Latinx/4 Hispanic/Latinx
Race	20 White/4 Black
Annual household income	2 participants $25,000–$50,000 8 participants $50,000–$75,000 2 participant $75,000–$100,000 2 participant $100,000–$125,000 9 participants $125,000+ 1 participant Prefer Not to Say
Psychiatric diagnoses	3 PDD, mild; ADHD inattentive presentation 3 PDD, mild; SAD; ADHD inattentive presentation 1 PDD, mild; Tourette syndrome; ADHD combined presentation 1 PDD, mild; Gender Dysphoria 1 PDD, mild; GAD; Gender Dysphoria; ADHD inattentive presentation 2 PDD, moderate; GAD; Gender Dysphoria 3 PDD, moderate; GAD; ADHD inattentive presentation 1 PDD, moderate; OCD; Gender Dysphoria; ADHD inattentive presentation 2 MDD, single episode, mild[a]; ADHD combined presentation 2 MDD, single episode, mild[a]; OCD 2 MDD, single episode, mild[a]; GAD; ADHD combined presentation 1 MDD, single episode, mild[a]; SAD; ADHD inattentive presentation 1 MDD, single episode, moderate[a]; ADHD inattentive type; Specific phobia 1 MDD, single episode, moderate[a]; GAD
Psychotropic medication status	10 participants not taking medications 14 participants taking medications 11 Selective serotonin reuptake inhibitors (sertraline ×6, citalopram ×3, paroxetine, fluoxetine) 7 Psychostimulants (methylphenidate ×4, mixed amphetamine salts ×3) 3 Second-generation antipsychotics (aripiprazole ×2, quetiapine) 2 Bupropion 2 Alpha-2 agonists (clonidine, guanfacine) 2 Anticonvulsant mood stabilizers (oxcarbazepine, lamotrigine) 1 Tricyclic antidepressants (amitriptyline) 1 Other (memantine)
Psychiatric hospitalization	9 participants hospitalized for suicidal thoughts and behaviors 15 participants never hospitalized
C-SSRS	Suicidal Ideation: 9 past month, 14 lifetime, 1 never Suicidal Attempt: 0 past three months, 9 lifetime, 15 never NSSI: 3 past three months, 10 lifetime, 11 never
Previous psychotherapy	4 no previous psychotherapy 20 previous psychotherapy
RCADS-C T-scores	
Depression	62.58 (11.1); Range: 39-80 T-score
Total internalizing symptoms	56.71 (11.9); Range: 37–80 T-score
RCADS-P T-scores	
Depression	63.25 (12.1); Range: 38–80 T-score
Total internalizing symptoms	63.83 (13.9); Range: 38–80 T-score
SRS-2 total T-score	75.64 (9.1); Range: 61–90+ T-score

PDD: Persistent depressive disorder; ADHD: Attention-deficit/hyperactivity disorder; SAD: Social anxiety disorder; GAD: Generalized anxiety disorder; OCD: Obsessive compulsive disorder; MDD: Major depressive disorder; C-SSRS: Columbia Suicide Severity Rating Scale; NSSI: Non-suicidal self-injury; RCADS-C: Revised Children's Anxiety and Depression Scale, Child Version; RCADS-P: Revised Children's Anxiety and Depression Scale, Parent/Caregiver Version; SRS-2: Social Responsiveness Scale, Second Edition.
[a]New diagnosis was established at intake appointment.

Annual family incomes ranged from $25,000–$50,000 to $125,000+.

All youth were previously diagnosed with at least one psychiatric disorder (see Table 1). All youth met the criteria for a depressive disorder at the time of intake, with nine youths receiving a depression diagnosis for the first time at intake. The majority of youth were taking psychotropic medications (58.33%; 14/24) and many (83.33%; 20/24) reported previous engagement in psychotherapy. Of the total sample, nine youths (37.5%) had previously been hospitalized for STBs.

Feasibility

Of the 24 participants originally enrolled in the trial, 20 completed CBT-DAY (16.67% attrition). All four participants who did not complete the trial terminated prematurely after the first or second group session. Reasons provided for early termination included transportation difficulties ($n=1$), changes in STBs and family decision to pursue intensive outpatient care ($n=1$), and lack of interest in continued participation ($n=2$). Session attendance of the 20 youths who completed CBT-DAY included: 6 youths attended 12 sessions (30.00%), 4 youths attended 11 sessions (20.00%), 7 youths attended 10 sessions (35.00%), and 3 youths attended 9 sessions (15.00%). With regards to data collection, 100% of families (24/24) completed measures at Time 1, 95% (19/20) of those still enrolled completed measures at Time 2, 95% (19/20) of those still enrolled completed measures at Time 3, and 75% (15/20) of those who graduated completed measures at Time 4.

Acceptability

A summary of adolescent and caregiver ratings of CBT-DAY is provided in Table 2. On average, youth and caregivers were satisfied with CBT-DAY. Caregivers' perceptions of adolescent satisfaction with the program were also high. In terms of skill helpfulness, youth provided the highest ratings for the skills of "Emotion Scores" and "Emotion Regulation in Social Settings." Caregivers provided the highest ratings for the skills of "Emotion Equations," "Emotion Scores," "Naming Thinking Traps," "Social Values and Goals," and "Emotion Regulation in Social Settings." For skill utilization, youth and caregivers reported a high likelihood of using learned skills in the future. Mixed ratings between youth emerged on their recommendation of CBT-DAY to others, while caregivers were more likely to recommend the program.

Across both adolescent and caregiver responses, the most helpful aspects of CBT-DAY were: (1) in-session discussions and affirmations of autistic identity, and (2) opportunities to engage with other autistic youth. For example, one adolescent wrote, "It was nice to have autism talked about as a good thing. You don't really hear that a lot." Similarly, one caregiver wrote, "[CBT-DAY] Helped my child understand that being autistic is not this bad thing and that there are kids out there like her. Peer interactions in group helped her self-esteem so much." In terms of least helpful aspects of CBT-DAY, several youth reported: (a) difficulties in understanding the Shoe Swap (i.e., cognitive reappraisal) exercise (e.g., "Sometimes it's hard to know what someone else would think if they had my thought"), and (b) group sessions after school made the day feel long (e.g., "It's hard to pay attention sometimes after going to school all day"). Several caregivers reported that some exercises had open-ended response options, which were difficult for some teens.

Suggestions from youth to improve CBT-DAY included: (1) additional sessions on ER skills in social settings, (2) more small-group exercises, and (3) discussion of ER skills in dating relationships. The most common suggestion from caregivers was to include concurrent, but separate, caregiver sessions. Additional caregiver suggestions included: (1) more sessions, (2) offer booster/refresher sessions, and (3) weekend session times.

Harms monitoring, addressing, and reporting

No SAEs occurred during the study. Prior to the second group session, one participant withdrew from CBT-DAY as they were offered a spot on a waiting list for an intensive outpatient program. At the time, the participant reported an increase in the frequency of passive suicidal thoughts (i.e., occurring once a week rather than once every 10–12 days) to their caregiver. The family notified the group leader and an individual meeting was held with the family to conduct a crisis assessment and develop a safety plan as the teen transitioned to the new program. The event was deemed unrelated to the CBT-DAY intervention and the group leader followed up with the family by phone to check in on enrollment in the new program. The family expressed interest in returning to the CBT-DAY program at a later date.

At the T2 and T3 timepoints, scores from Item 37 of the RCADS-C/P (i.e., suicidal ideation) and C-SSRS remained stable and/or improved for participants; there were no increases in adolescent STBs reported. In addition, no harms or adverse events were reported by families on the CBT-DAY Satisfaction Questionnaire at T3.

In terms of treatment response, the majority of youth (84.21%; 16/19) who completed measures at the T1 and T3 timepoints reported improvements in depressive symptom severity (i.e., treatment responders). Three youths (15.79%; 3/19) did not respond to CBT-DAY, as evidenced by increases in self-reported depressive symptom severity. As per caregiver report, four youths (21.05%; 4/19) did not

Table 2. Adolescent and caregiver acceptability ratings of CBT-DAY at Time 3.

Acceptability domain	Adolescent	Caregiver
	M (SD)	*M (SD)*
Program satisfaction[a]		
Please rate your overall satisfaction with CBT-DAY	4.18 (0.6)	4.80 (0.4)
Please rate your teen's overall satisfaction with CBT-DAY	–	4.27 (0.9)
Skill helpfulness: How helpful was each skill?[b]		
Emotion equations	3.55 (0.9)	4.00 (0.8)
Emotion scores	4.00 (0.9)	4.20 (0.9)
Emotion strategies	3.45 (1.4)	3.80 (1.1)
Naming thinking traps	3.82 (1.3)	4.40 (0.9)
Escaping thinking traps: shoe swap	3.45 (1.3)	3.87 (0.8)
Escaping thinking traps: evidence for/against	3.45 (1.4)	3.64 (0.9)
Social values and goals	3.91 (0.9)	4.07 (1.1)
Emotion regulation in social settings	4.50 (0.5)	4.14 (1.1)
Skill utilization[c]		
How likely are you to use the skills you learned in the future?	4.09 (0.8)	–
How likely is your teen to use the skills they learned in the future?	–	4.33 (0.7)
Program recommendation[c]		
How likely would you be to recommend this program to others?	3.73 (0.9)	4.73 (0.5)

CBT-DAY: cognitive behavioral therapy for depression in autistic youth.
[a]Item response options: 5—very satisfied, 4—satisfied, 3—neutral, 2—dissatisfied, 1—very dissatisfied.
[b]Item response options: 5—very helpful, 4—helpful, 3—neutral, 2—a little helpful, 1—not helpful.
[c]Item response options: 5—highly likely, 4—likely, 3—neutral, 2—not likely, 1—never.

respond to CBT-DAY as evidenced by increases in depressive symptom severity over the T1 and T3 timepoints. A portion of caregivers (21.05%; 4/19) who completed measures about their adolescent at the T1 and T3 timepoints reported stable severity of adolescent depressive symptoms. The remaining caregivers (57.89%; 11/19) reported improvements in adolescent depressive symptom severity.

Primary clinical outcome

When examining the effects of CBT-DAY on RCADS depressive symptoms (T-scores), the model demonstrated both a significant overall main effect of time [$\beta = -2.72$, $CrI_{95\%}$ (−3.85, −1.63), $P_d > 0.999$] and a significant timepoint × rater interaction [$\beta = 1.58$, $CrI_{95\%}$ (0.17, 2.96), $P_d = 0.987$]. However, the main effect of rater failed to reach the threshold for statistical significance [$\beta = 1.48$, $CrI_{95\%}$ (−2.14, 5.09), $P_d = 0.791$]. Table 3 presents all estimated marginal means and post hoc contrasts for this model. Self-rated depressive symptoms significantly improved by a moderate amount over the full CBT-DAY intervention [$\beta_{T1\text{-}T3} = -7.36$, $CrI_{95\%}$ (−10.57, −4.26), $P_d > 0.999$, $d = -0.64$, $CrI_{95\%}$ (−0.92, −0.37)]. In contrast, parent-rated depressive symptoms improved a small and statistically non-significant amount between T1 and T3, though there was over a 96% posterior probability of this effect being in the hypothesized direction [$\beta_{T1\text{-}T3} = -3.36$, $CrI_{95\%}$ (−7.11, 0.36), $P_d = 0.961$, $d = -0.29$, $CrI_{95\%}$ (−0.62, 0.03)].

Individual-level analyses of RCADS-C and RCADS-P scores were also conducted based on the (model-based) RCI. Standard errors of measurement (SEM) were 5.24 and 6.49 T-score points for the RCADS-C and RCADS-P, respectively. At T2 (midpoint), the mean (*SD*) value of RCADS-C RCI was −1.07 (0.44) SEM units [range (−2.00, −0.29)], and the mean value of RCADS-P RCI was −0.37 (0.59) SEM units [range (−1.65, 0.56)], with three individuals demonstrating significant improvement per the RCADS-C and one individual demonstrating significant improvement per the RCADS-P. At T3 (post-intervention), the mean (*SD*) value of RCADS-C RCI was −1.41 (0.56) SEM units [range (−2.61, −0.39)], and the mean value of RCADS-P RCI was −0.52 (0.75) SEM units [range (−2.12, 0.69)], with seven individuals demonstrating significant improvement per the RCADS-C and two individuals demonstrating significant improvement per the RCADS-P. At T4 (follow-up), the mean (*SD*) value of RCADS-C RCI was −1.56 (0.62) SEM units [range (−2.88, −0.44)], and the mean value of RCADS-P RCI was −0.53 (0.83) SEM units [range (−2.30, 0.81)], with nine individuals demonstrating significant improvement per the RCADS-C and three individuals demonstrating significant improvement per the RCADS-P. Notably, all autistic youth who demonstrated significant improvement per the RCADS-P RCI also demonstrated significant improvement based on the contemporaneous RCADS-C RCI. No significant worsening in depressive symptoms (> 1.645 SEM) was noted across the study cohort at any timepoint.

Table 3. Bayesian linear mixed-effect model of target mechanisms and primary and exploratory clinical outcomes over CBT-DAY.

Measure	*M (SE)*	Contrast	β [95% CrI]	P_d	*d* [95% CrI]
RCADS-C $^+$ Depression	**T1:** 62.00 (2.32)	**T1–T3**	**−7.36 [−10.57, −4.26]**	**>0.999**	**−0.64 [−0.92, −0.37]**
	T2: 56.39 (2.14)	**T1–T2**	**−5.57 [−8.60, −2.75]**	**>0.999**	**−0.48 [−0.75, −0.24]**
	T3: 54.60 (2.12)	**T2–T3**	**−1.71 [−3.44, −0.06]**	**>0.999**	**−0.15 [−0.30, −0.01]**
	T4: 53.82 (2.15)	**T3–T4**	**−0.62 [−2.08, 0.00]**	**>0.999**	**−0.05 [−0.18, 0.00]**
		T1–T4	**−8.14 [−11.56, −4.88]**	>0.999	**−0.71 [−1.01, −0.43]**
RCADS-P $^+$ Depression	**T1:** 63.47 (2.36)	T1–T3	−3.36 [−7.11, 0.36]	0.961	−0.29 [−0.62, 0.03]
	T2: 61.09 (2.14)	T1–T2	−2.39 [−5.81, 1.03]	0.914	−0.21 [−0.51, 0.09]
	T3: 60.11 (2.18)	T2–T3	−0.97 [−2.93, 0.92]	0.856	−0.09 [−0.26, 0.08]
	T4: 60.05 (2.24)	T3–T4	−0.08 [−1.77, 1.65]	0.555	−0.01 [−0.15, 0.14]
		T1–T4	−3.42 [−7.46, 0.58]	0.954	−0.30 [−0.65, 0.05]
RCADS-P/C $^+$ Internalizing	**T1:** 60.14 (2.38)	**T1–T3**	**−5.42 [−8.44, −2.50]**	**>0.999**	**−0.47 [−0.73, −0.22]**
	T2: 55.81 (2.31)	**T1–T2**	**−4.28 [−7.05, −1.64]**	**0.999**	**−0.37 [−0.61, −0.14]**
	T3: 54.69 (2.35)	**T2–T3**	**−1.03 [−2.51, 0.03]**	**0.986**	**−0.09 [−0.22, 0.00]**
	T4: 54.23 (2.38)	**T3–T4**	−0.35 [−1.64, 0.33]	0.902	−0.03 [−0.14, 0.03]
		T1–T4	**−5.90 [−9.14, −2.82]**	**>0.999**	**−0.51 [−0.80, −0.25]**
RCADS-C $^+$ Internalizing	**T1:** 56.72 (2.55)	**T1–T3**	**−5.62 [−8.80, −2.42]**	**>0.999**	**−0.49 [−0.77, −0.21]**
	T2: 52.23 (2.48)	**T1–T2**	**−4.44 [−7.29, −1.73]**	**>0.999**	**−0.39 [−0.63, −0.15]**
	T3: 51.08 (2.50)	**T2–T3**	**−1.05 [−2.52, 0.00]**	**>0.999**	**−0.09 [−0.22, 0.00]**
	T4: 50.55 (2.54)	**T3–T4**	**−0.37 [−1.62, 0.00]**	**>0.999**	**−0.03 [−0.14, 0.00]**
		T1–T4	**−6.16 [−9.61, −2.72]**	>0.999	**−0.54 [−0.84, −0.24]**
RCADS-P $^+$ Internalizing	**T1:** 63.55 (2.74)	**T1–T3**	**−5.23 [−9.02, −1.51]**	**0.997**	**−0.46 [−0.79, −0.13]**
	T2: 59.39 (2.45)	**T1–T2**	**−4.14 [−7.66, −0.74]**	**0.991**	**−0.36 [−0.67, −0.06]**
	T3: 58.30 (2.51)	T2–T3	−1.02 [−2.64, 0.15]	0.963	−0.12 [−0.30, 0.03]
	T4: 57.91 (2.56)	T3–T4	−0.32 [−1.78, 0.85]	0.820	−0.03 [−0.15, 0.07]
		T1–T4	**−5.63 [−9.76, −1.48]**	**0.996**	**−0.49 [−0.85, −0.13]**
EDI-7	**T1:** 10.17 (1.32)	**T1–T3**	**−2.53 [−4.62, −0.58]**	**0.995**	**−0.35 [−0.65, −0.08]**
	T2: 9.16 (1.07)	**T1–T2**	**−0.91 [−2.31, 0.00]**	**0.995**	**−0.13 [−0.32, 0.00]**
	T3: 7.62 (0.87)	**T2–T3**	**−1.50 [−2.94, −0.24]**	**0.995**	**−0.21 [−0.41, −0.03]**
	T4: 7.10 (0.89)	**T3–T4**	**−0.44 [−1.31, 0.00]**	**0.995**	**−0.06 [−0.18, 0.00]**
		T1–T4	**−3.06 [−5.46, −0.72]**	0.995	**−0.43 [−0.77, −0.10]**
RSES[a]	**T1:** 20.02 (1.53)	**T1–T3**	**−3.57 [−5.17, −2.00]**	**>0.999**	**−0.47 [−0.67, −0.26]**
	T2: 17.84 (1.38)	**T1–T2**	**−2.14 [−3.42, −0.98]**	**>0.999**	**−0.28 [−0.45, −0.13]**
	T3: 16.43 (1.34)	**T2–T3**	**−1.39 [−2.41, −0.44]**	**>0.999**	**−0.18 [−0.31, −0.06]**
	T4: 15.86 (1.36)	**T3–T4**	**−0.47 [−1.47, 0.00]**	**>0.999**	**−0.06 [−0.19, 0.00]**
		T1–T4	**−4.13 [−6.02, −2.40]**	>0.999	**−0.54 [−0.78, −0.31]**

CBT-DAY: cognitive behavioral therapy for depression in autistic youth; CrI: highest-density credible interval; *d*: Standardized mean difference effect size based on baseline standard deviation; RCADS-C: Revised Children's Anxiety and Depression Scale, Child Version; RCADS-P: Revised Children's Anxiety and Depression Scale, Parent/Caregiver Version (T-scores); RCADS-P/C: Revised Children's Anxiety and Depression Scale, pooled across reporters (T-scores); EDI-7: Emotion Dysregulation Inventory-7; RSES: Rosenberg Self-Esteem Scale.

Means and standard errors represent estimated marginal means and the standard deviations of their posterior distributions. For RCADS-P/C, standard deviation calculations treat parent/child observations from the same individual as independent; Significant contrasts ($P_d > 0.975$) highlighted in bold.

[a]Lower scores indicate higher self-esteem; $^+$ T-scores ($M = 50$, $SD = 10$ in normative sample).

Exploratory clinical outcome

When examining the effects of CBT-DAY on RCADS internalizing symptoms (see Table 3), the model demonstrated significant overall main effects of time [$\beta = -2.05$, $CrI_{95\%}$ (−3.20, −0.91), $P_d > 0.999$] and rater [parents demonstrating higher ratings; $\beta = 6.87$, $CrI_{95\%}$ (2.35, 11.40), $P_d > 0.999$]. In contrast to the depressive symptom model, the timepoint × rater interaction was not statistically significant [$\beta = 0.16$, $CrI_{95\%}$ (−1.22, 1.62), $P_d = 0.589$]. Collapsing across raters (due to the non-significant interaction), RCADS internalizing symptoms improved by a moderate amount over the full CBT-DAY intervention [$\beta_{T1\text{-}T3} = -5.42$, $CrI_{95\%}$ (−8.44, −2.50), $P_d > 0.999$, $d = -0.47$, $CrI_{95\%}$ (−0.73, −0.22)].

Intervention mechanisms

Table 3 presents results for the intervention mechanisms (i.e., emotional reactivity, self-concept) at all four timepoints. Over the full duration of CBT-DAY (T1-T3), youth

significantly improved in both their emotional reactivity [EDI-7; $\beta_{T1\text{-}T3} = -2.53$, $CrI_{95\%}$ (−4.62, −0.58), $P_d = 0.995$, $d = -0.35$, $CrI_{95\%}$ (−0.65, −0.08)] and self-esteem [RSES; $\beta_{T1\text{-}T3} = -3.57$, $CrI_{95\%}$ (−5.17, −2.00), $P_d > 0.999$, $d = -0.47$, $CrI_{95\%}$ (−0.67, −0.26)].

Discussion

Findings from this single-arm pilot trial support the feasibility, acceptability, and preliminary efficacy of CBT-DAY in improving depressive symptom severity in autistic youth. Additional findings suggest that CBT-DAY may potentially be efficacious in targeting the hypothesized mechanisms of emotional reactivity and self-esteem using cognitive-behavioral and neurodiversity-affirming approaches; although, the current study was neither designed nor powered to test whether these outcomes mediated the intervention's effects on depressive symptomatology. Further, collateral improvements in adolescent total internalizing symptoms were associated with participation in CBT-DAY. These results suggest that community-guided, group-based CBT may be a potentially efficacious treatment model for autistic youth experiencing depressive symptoms and that treatment gains may be maintained over time. However, as this study was not randomized and lacked a comparison arm, further more rigorous clinical trials are clearly needed to assess the efficacy of CBT-DAY or other group CBT interventions for depression in autistic youth relative to suitable controls (e.g., group psychoeducation, social skills training).

The moderately low attrition, consistent session attendance, and high completion of measures in this study may suggest that CBT-DAY is a feasible intervention for autistic youth and their families when delivered in outpatient settings. Similarly, these indices show that autistic youth can be engaged in group-based interventions for depression in an outpatient setting. Attrition in this study (16.67%) was similar to attrition rates in previous trials of standard CBT for depression [13.04% reported by Santomauro and colleagues (2016)] and individual autism-adapted CBT for anxiety [12.99% reported for the BIACA intervention by Wood and colleagues (2020)]. From a systems perspective, the group-based model increased access to treatment for more autistic youth ($N = 24$) than could be accommodated in the psychologist's individual service line ($N = 9$–10 clients total per year). As youth continue to encounter barriers to accessing therapy in the United States (U.S. Surgeon General, 2021), particularly autistic youth (Maddox et al., 2020), group therapy may be an important service line to increase access.

On average, overall program satisfaction, helpfulness of learned skills, and the likelihood of future skill use in this study suggest that CBT-DAY may be an acceptable intervention for autistic youth and their caregivers. The ER skills, particularly as applied in social contexts and interactions, were rated as the most helpful by autistic youth and highlight the importance of ER skills in improving well-being. Variability in adolescent ratings of program recommendation suggests that CBT-DAY may be perceived as more acceptable by some autistic youth than others; a consideration of *which* autistic youth may perceive CBT-DAY to be acceptable, and *why*, are important future directions. Similarly, it would be important to understand specific factors that contribute to lower acceptability and then consider adaptations to CBT-DAY accordingly. In addition, variability in ratings of skill helpfulness may suggest that other skills (e.g., Thinking Traps, Escaping Thinking Traps) may be more potent for certain youth, which points to the need for continued research on active CBT ingredients with this population. Overall, youth reported that they were likely to use learned skills in the future; however, ratings were global and thus, not specific to *which skills* that youth may be more or less likely to use. Future studies could consider skill-specific ratings to detect the most relevant CBT ingredients for this population and to administer ratings at the midpoint timepoint as well.

Spontaneous feedback from families about the importance of a neurodiversity-affirming approach in CBT-DAY reiterates the importance of promoting autistic identity (Botha & Frost, 2020; Cage & Troxell-Whitman, 2020; Chapman & Botha, 2023). Although changes in attitudes toward autistic identity were not measured over time in this trial, feedback from families suggests that this may be an active mechanism of CBT-DAY. It is possible that youth attitudes toward autistic identity may have changed over time and contributed to the improvements in self-esteem observed; however, without explicit assessment of youth attitudes toward autistic identity, conclusions are limited. Importantly, caregivers expressed interest in concurrent caregiver sessions to complement CBT-DAY and this may serve as a meaningful platform to explore and promote adolescent autistic identity with caregivers using neurodiversity-affirming approaches. As caregiver–child relationships affect both adolescent (Laursen & Collins, 2009) and caregiver (Ferenc et al., 2023) mental health outcomes, opportunities to explore autistic identity with caregivers may be an important next step in this line of research for youth and caregivers alike.

Multiple initiatives to assess, address, record, and report harms experienced by participants during the study were implemented and aligned with established recommendations for non-autistic youth (Klatte et al., 2023). No serious adverse events occurred during the study, and are important to monitor in future therapy trials for autistic youth. As noted, one participant withdrew from CBT-DAY after the first session to pursue a more intensive treatment program. Routine assessment for STBs, weekly opportunities to discuss any concerns with the group leaders, and weekly email communications with caregivers were

important strategies to effectively monitor for potential harms. As efforts to improve harm detection in autism intervention research continue (Bottema-Beutel et al., 2021; Dawson & Fletcher-Watson, 2022), we suggest that the harms protocols used in this study (detailed in Supplemental Document 2) be modified to guide future studies in similarly rigorous assessment of this often-overlooked outcome domain in autism.

Youth depressive symptom severity improved overall during CBT-DAY. However, rater-specific analyses revealed that while both youth self-reports and caregiver reports of depressive symptom severity likely improved over CBT-DAY (with posterior probabilities greater than 96% in both cases), only self-reported depressive symptoms met our a priori threshold for statistical significance. Moreover, self-reported symptoms continued to significantly decrease during the follow-up period (albeit to a clinically negligible degree), whereas caregiver-reported depressive symptoms stayed approximately equal over that follow-up period. Several points can be considered in interpreting these findings. First, this study included a small sample that was certainly underpowered to detect the more subtle changes in caregiver ratings over time; however, these initial findings demonstrate promise for future large-scale trials. Second, it is also likely that significant improvements only emerged at the self-report level as depression is a subjective phenomenon that is more apparent to the individual. Finally, maladaptive attitudes that are directly targeted in CBT (e.g., negative automatic thoughts) may affect youth responses to RCADS items that would be detected in self-report, but not caregiver report. Collectively, findings emphasize the need for more research that analyzes these effects with multiple raters simultaneously in order to tease apart rater effects and/or pool across multiple data sources.

Significant improvements in emotional reactivity and self-esteem (i.e., putative mechanisms) were observed over CBT-DAY and suggest that this intervention may be potentially efficacious in targeting these mechanisms. However, the effect sizes on youth depressive symptom severity observed in this study were larger than the effect sizes of these putative mechanisms and may indicate that changes in depressive symptom severity are not fully explained by changes in these mechanisms. Given the limited sample size of this pilot investigation, mediation analyses were not conducted; however, a consideration of mediating variables (e.g., perception of autistic identity, group belongingness, etc.) in future controlled, larger trials is an important area of investigation. Feedback from autistic adolescents at the end of CBT-DAY suggests that ER skills applied in social situations/interactions may be most interesting for this population. Based on this feedback, an important future direction of this research is to investigate the potential added benefits of ER skills to socially-based interventions for autistic youth.

Interventions targeting self-esteem in autistic people are limited, particularly for autistic youth, and our findings add to this sparse literature. Without measures of autistic identity in this study, it is difficult to determine the extent to which neurodiversity-affirming discussions of autistic identity in a group environment in CBT-DAY potentially contributed to improvements in adolescent self-esteem; this constitutes a critical future direction.

Limitations

There are several limitations to this study that warrant a discussion. First, findings are limited by a small sample and lack of randomization with a control group to robustly investigate the feasibility, acceptability, and efficacy of CBT-DAY compared to treatment as usual or other interventions. The lack of randomization in particular stopped us from being able to determine the degree to which reductions in depressive symptoms from this study were due to the CBT-DAY intervention as opposed to non-specific factors such as regression to the mean, expectancy effects, and spontaneous remission of depression over time (see also Curie et al., 2023). In addition, as with many pilot non-randomized psychotherapy trials, participants, families, and group leaders were not blind to study conditions. Future studies that randomize individuals to multiple interventions may consider utilizing centralized clinician raters who are blind to group allocation as a way of minimizing the influence of "unblinded" participants on the primary outcome. Second, the sample included predominantly White, financially-resourced autistic youth without intellectual disability, and thus, findings cannot be generalized to all autistic youth. In particular, CBT-DAY was not intended for autistic youth with intellectual disabilities, and the intervention protocol likely requires further modification before it can be successfully leveraged with much of that population. A third limitation is that adolescent attitudes toward autistic identity were not measured in this study, thereby limiting our ability to draw conclusions about relationships between autistic identity, self-esteem, and depressive symptoms. Fourth, caregiver-report and self-report measures were used to assess target mechanisms and clinical outcomes and may be subject to bias (Mazefsky et al., 2018). Future studies could employ multimethod approaches (e.g., clinical interviews, neurophysiological measures) to enhance the measurement of intervention mechanisms and outcomes. In particular, the use of a clinician-administered primary outcome, such as the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS; Kaufman et al., 1997) Depression Rating Scale, which can be completed separately with parents and children to ascertain rater-specific changes in depression symptoms over time, represents a very promising future direction for this and other psychotherapeutic trials. Fifth, given the pilot nature of the study, we did not examine the potential effects of previous therapy and/or co-occurring psychiatric conditions on the feasibility and efficacy of CBT-DAY; these are important considerations for future, large-scale trials. Sixth, though autistic adults and caregivers were

actively involved in the design of CBT-DAY and throughout the study, autistic youth were not involved; this is a clear area for adaptation in future trials of CBT-DAY. Seventh, we did not record the number of families who expressed interest in the CBT-DAY groups, which would provide important information on patient interest, access, and other indicators of feasibility. As a final limitation, treatment fidelity and weekly homework completion were not systematically monitored in this pilot trial, and these remain important aspects to add to future large-scale studies.

Conclusion

With depression on the rise among autistic youth, research into risk factors and intervention approaches is critical. Although pathways to depression in adolescence are complex, emotional reactivity and negative self-esteem are salient risk factors and potential intervention targets as autistic youth are more likely to experience depression and to endorse higher rates of emotional reactivity and negative self-esteem than their non-autistic peers. The current study of a community-guided, autism-adapted group CBT program for autistic youth (CBT-DAY) found the intervention to be feasible, generally acceptable to youth and families, and potentially efficacious in improving both target mechanisms (i.e., emotional reactivity, self-esteem) and clinical outcomes (i.e., depressive symptom severity, internalizing). No significant adverse events were observed despite a rigorous adverse event monitoring protocol. Neurodiversity-affirming approaches in sessions and a group format demonstrate promise as active ingredients of this intervention, and there remain many opportunities for future investigation of these and other aspects of CBT in larger and more rigorously designed clinical trials.

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Supplemental material

Supplemental material for this article is available online.

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