ORIGINAL PAPER

Behavioral Parent Training via Telehealth for Autistic Children: Further Exploration of Feasibility During the COVID-19 Pandemic

Ryan J. Martin[1,2] · Jaime Crowley-Zalaket[1,3] · Kaitlin Gould[1,4] · Sarah Weddle[1] · Cynthia M. Anderson[1]

Abstract

Objectives Many autistic children exhibit challenging and disruptive behaviors that can present challenges for both children and their families by interfering with acquisition of adaptive skills and affecting family and peer relationships. Behavioral parent training (BPT) is an evidence-based approach to reducing autistic children's disruptive behavior, but many families face a number of barriers to accessing BPT, such as availability of BPT in their community, and transportation and scheduling challenges. Therefore, we sought to explore the feasibility and promise of effectiveness of adapting an established BPT program to a telehealth format during the COVID-19 pandemic.

Methods A feasibility trial of BPT via telehealth was conducted with fourteen parents of autistic children.

Results Parents and clinicians were able to implement BPT via telehealth with a high degree of fidelity, and parents rated both BPT and the telehealth format favorably. The program also showed promise of effectiveness in reducing autistic children's disruptive behavior, improving their adaptive skills, as well as reducing parents' stress, and improving parents' sense of parenting competence.

Conclusions The findings replicate and extend findings from previous studies, further demonstrating the promise of telehealth as a viable alternative format for delivering BPT. We also explore implications for future research, including the opportunity for more thorough evaluation of the effectiveness of BPT via telehealth.

Keywords Autism · ASD · Caregivers · Behavioral parent training · Telehealth

Beyond the core features of autism spectrum disorder (ASD), such as differences in social communication and interaction and restricted and repetitive patterns of behavior (American Psychological Association, 2013), many autistic children also exhibit challenging and disruptive behaviors such as aggression, non-compliance, and tantrums (Chandler et al., 2016; Lecavalier et al., 2006), and approximately one in four autistic children meet the diagnostic criteria for a disruptive behavior disorder (Kaat & Lecavalier, 2013). Disruptive behavior can present challenges for both children and their families by interfering with children's acquisition

of adaptive skills and affecting the development of peer relationships (Davis & Rispoli, 2018). Disruptive behavior may also increase parental stress and can deteriorate parent–child relationships (Rivard et al., 2014).

Behavioral parent training (BPT) programs are parent-mediated interventions that are designed to teach parents specific skills to prevent and reduce disruptive behavior and teach and encourage adaptive skills. Commonly taught skills include environmental rearrangement and other antecedent strategies, prompting skills, and contingency management. BPT programs have a robust evidence base documenting significant and durable changes for children who exhibit disruptive behavior (see Eyberg et al., 2008 for a review). Furthermore, there is a growing evidence base supporting BPT for parents of children diagnosed with ASD (e.g., Agazzi et al., 2013; Aman et al., 2009; Scahill et al., 2016).

Of note, the Research Units in Behavioral Intervention (RUBI) Autism Network parent training program was developed specifically for parents of autistic children (Aman et al., 2009; Bearss et al., 2013; Johnson et al., 2007). Like other

✉ Ryan J. Martin
  rmartin@mosaictherapy.com

1   May Institute, Randolph, MA, USA

2   Mosaic Pediatric Therapy, 2810 Coliseum Centre Dr,
    Charlotte, NC, USA

3   Children's Specialized Hospital, New Brunswick, NJ, USA

4   The College of Saint Rose, Albany, NY, USA

BPT programs, RUBI-PT trains parents in skills to reduce problem behavior and increase pro-social skills. However, RUBI is unique in that it includes components specific for autistic children including modules focused on common adaptive behavior deficits such as mealtime problems, sleep difficulties, and toileting. RUBI-PT is the first BPT program specifically for parents of children with ASD to be evaluated in a rigorous, randomized-controlled study. Bearss et al. (2015) examined the effectiveness of RUBI-PT in a multicenter trial of 180 children with ASD and challenging behavior. Results of the trial demonstrated that RUBI was superior to psychoeducation in reducing parent-reported challenging behaviors. Further analysis by Scahill et al. (2016) found that RUBI-PT also led to significantly greater improvements in children's adaptive functioning. RUBI-PT has also resulted in significant improvements in mealtime behavior and sleep routines (Johnson et al., 2013, 2015) and specific modifications available to supplement RUBI have been found to be effective in reducing self-injurious behaviors (Fodstad et al., 2018). Iadarola and colleagues (2018) found that parents who received RUBI reported a greater sense of parental competence and less stress than parents who received only psychoeducation.

Despite the promise of BPT for families of autistic children, BPT continues to be inaccessible for many families (Weisenmuller et al., 2021). A considerable barrier is the insufficient number of qualified providers to meet the growing needs of families (Mello et al., 2016). Second, regularly traveling to receive services can be infeasible for many families, especially if families must travel great distances to see a provider, or if they have busy schedules from parent employment or other competing appointments with other providers; many autistic children and their families are seen frequently by numerous professionals such as pediatricians, speech pathologists and occupational therapists, behavior analysts, and other specialists (Tsiplova et al., 2022). These barriers are likely exacerbated in under-resourced rural communities (Dahiya et al., 2021) and among low socioeconomic status families, as these families are not only more likely to experience structural barriers to accessing care, but also less knowledgeable of available services (Pickard & Ingersoll, 2015).

One way to address these barriers and expand access to BPT is by delivering it remotely via telehealth. Telehealth generally refers to the use of various technologies to provide medical or behavioral healthcare services, including email, telephone calls, and videoconferencing (Ellison et al., 2021). Thus, telehealth allows clinicians to provide intervention in real time over great distances (Dudding, 2009). As documented by Dorsey and Topol (2016), telehealth is expanding rapidly in medicine and behavioral health. Within autism intervention, telehealth has been used to teach parents to increase children's social communication and reduce

challenging behavior (e.g., Ingersoll & Berger, 2015; Lindgren et al., 2020; Vismara et al., 2013; Wacker et al., 2013). Research generally supports the effectiveness of telehealth as a delivery model and suggests it is acceptable to parents (e.g., Lindgren et al., 2020), and this technology was crucial for continuing services for children and families during the COVID-19 pandemic when services were significantly disrupted (Ellison et al., 2021).

Although research supports the effectiveness of both BPT and telehealth as a treatment modality, relatively little research has explored using telehealth to deliver more complex, manualized BPT programs such as RUBI. Bearss et al. (2018a) conducted a feasibility study of delivering RUBI via telehealth with 14 families of children with ASD. They evaluated a clinic-to-clinic "hub-and-spoke" model wherein therapists at one clinic used telehealth to work with parents who were present at another clinic. Indicators of feasibility included whether clinicians could deliver RUBI with fidelity, and whether parents attended sessions, participated in sessions, and completed homework. A preliminary evaluation of effectiveness for reducing parent-reported disruptive behavior was also included. Bearss et al. (2018a) found that RUBI delivered via telehealth was acceptable to parents, that clinicians could implement it with fidelity, and that parents were engaged in the process. Furthermore, parent report of disruptive behavior suggested significant improvements.

Although Bearss et al. (2018a) provided initial evidence that RUBI could be implemented remotely without sacrificing the integrity or effectiveness of the intervention, caregivers were still required to drive to a clinic and to attend regularly scheduled sessions. Therefore, this model did not address many of the barriers to accessing behavioral services. A clinic-to-home model for providing BPT has the potential to reduce the burden on families and expand access to BPT by allowing for the intervention to occur at greater convenience to parents and in a more natural setting. Thus, the purpose of the current study was to replicate and extend the Bearss et al. (2018a) feasibility study by delivering RUBI via telehealth (henceforth RUBI-T) directly to families in their homes. Specifically, the present study sought to evaluate the fidelity of implementation of RUBI-T, its potential effectiveness across both child and parent outcomes, as well as parents' perceptions of its social validity.

Method

Participants

Participants in the study included fourteen individuals with autism and their parents living in the greater metro area of a major city in the northeast USA. In the present study, parent refers to a child's primary caregiver, which could be a

child's parent (biological or adoptive), foster parent, or a relative who is responsible for the child's day-to-day care and safety. This term is not inclusive of teachers, daycare providers, etc. Families were recruited to participate through posting recruitment flyers within two local clinics providing early intensive behavioral intervention (EIBI) for children diagnosed with ASD. Clinical directors were also informed of the study and asked to refer parent–child dyads that may be eligible and interested. Additionally, digital advertisements were posted to the website of a local organization that provided resources to families of children with disabilities, and targeted advertisements were posted on social media platforms.

The following inclusion criteria were used to determine eligibility for children to participate: (1) children were between 3 and 10 years old at baseline, (2) carried a formal community diagnosis of ASD, and (3) engaged in challenging or disruptive behavior in the home environment. Exclusion criteria were as follows: (1) concurrent receipt of other forms of BPT at baseline (e.g., Parent Child Interaction Therapy [PCIT], Family Check-Up) and (2) unstable dosage

of psychotropic medication at baseline (children were permitted to participate at a later point once dosage was stable for at least 6 weeks). These exclusion criteria were used to reduce possible threats to internal validity from concomitant treatments. There were no inclusion or exclusion criteria for caregivers outside of providing consent, though it was necessary for caregivers to have access to high-speed internet to effectively participate in the intervention. Parents were given the option to borrow a webcam-enabled laptop from the researchers if needed to participate in intervention sessions, or parents could elect to use their own devices. Parents were eligible to receive up to two $100 Amazon gift cards for their time completing measures at baseline and post-intervention assessments.

Table 1 provides demographic and characterization data across each participant, as well as key target problems that parents reported were most concerning to them upon enrollment. The majority of the children identified as White, though some children identified as Black/African American, Hispanic/Latino, other race, or more than one race. Most children were from two-parent households (69%), and most

Table 1 Summary of RUBI sessions

RUBI session	Session span	Session description/objectives
Core		
Behavioral Principles	1	Introduce the fundamental principles of behavior and how they apply to autistic children
Prevention Strategies	1	Teach techniques to prevent challenging behavior by modifying the environment and creating predictability
Daily Schedules	1	Help parents create structured daily routines to promote predictability and consistency for their child
Reinforcement	2	Train parents to use positive reinforcement to increase desired behaviors and strengthen the parent–child relationship
Planned Ignoring	1	Teach parents to ignore minor misbehavior to reduce the frequency of such behavior
Compliance Training	1	Help parents develop strategies for increasing their child's compliance with requests and instructions
Functional Communication Training	1	Assist parents in teaching their child alternative, appropriate ways to communicate their needs and desires
Teaching New Skills	2	Provide parents with strategies for teaching their child new skills such as play and independence
Generalization amd Maintenance	1	Support parents in promoting consistent application of learned skills over time and across contexts
Supplemental		
Toilet Training	2	Guide parents through various toilet training challenges common among autistic children
Mealtime/Feeding	1	Help parents develop structured mealtime routines and promote a more varied diet
Sleep/Bedtime Routines	2	Guide parents through various toilet training challenges common among autistic children
Imitation Skills	1	Instruct parents on how to teach their child to imitate others
Token Economy Systems	1	Train parents to use token economies to reinforce desired behaviors
Timeout	1	Teach parents how to effectively use timeout from reinforcement as a strategy for reducing challenging behavior
Crisis Planning	1	Prepare parents to manage challenging behaviors in emergency situations and develop a crisis plan
Booster	3	Provide additional support and reinforcement for parents to ensure the ongoing success of strategies learned throughout the program

had at least one sibling (38%). Caregivers ranged in age from 34 to 59 years old (mean 45 years). Most parents held an advanced graduate degree, and the majority of families had an annual household income of $100,000 or more.

Interventionists were two doctoral-level clinicians (second and third authors). One had a degree in Applied Behavior Analysis and the other had a degree in School Psychology. Both had extensive experience working with individuals with ASD and their families, as well as experience delivering evidence-based interventions. Both interventionists identified as White and female. Interventionists were trained on RUBI-T procedures and attended an 8-h virtual training provided by a developer of the RUBI program. Interventionists also received weekly supervision by senior clinicians to ensure competency with intervention delivery.

Ratings of autism characteristics and severity were conducted by an independent evaluator who was not otherwise involved with study design or implementation (fourth author). The evaluator was a doctoral-level school psychologist and behavior analyst with significant experience working with individuals diagnosed with ASD.

Procedure

Prior to implementation of study procedures, approval of the study procedures was granted by the Institutional Review Board. The present study occurred over the course of 2 years. Once parents provided consent for participation, baseline data collection was initiated. For three of the participating families, baseline included meeting in person to orient them to RUBI-T materials, planning for the logistics of telehealth, set goals for the child relative to the home environment, and completing standardized measures. Due to the COVID-19 pandemic, the remaining ten families did not meet interventionists in person and therefore completed all baseline activities remotely using the telehealth technology described below.

Following baseline, interventionists guided parents through the sessions as outlined in the RUBI manual (Bearrs et al., 2015), a manualized BPT intervention specially designed for parents of children diagnosed with autism and who exhibit disruptive behavior at home. RUBI is composed of 11 core sessions spanning six themes: Understanding Behavior, Prevention Strategies, Reinforcement, Consequences, Teaching Skills, and Generalization and Maintenance. It also includes seven supplemental sessions on a variety of topics relevant to challenges autistic children and their parents encounter. See Table 1 for a summary of RUBI sessions, or, for a more complete overview of the RUBI manual, please refer to Bearss et al. (2018b). RUBI-T included all 11 core sessions, and parents could choose up to two supplemental sessions, and up to three additional booster sessions to assess and promote maintenance. Session activities

included direct instruction as well as other practice activities (vignettes, worksheets) to teach behavior management strategies to caregivers, as directed by the manual. Additionally, caregivers were given homework assignments to complete between sessions, which involved applying the strategies introduced during previous sessions. Optional booster sessions occurred at 15, 17, and 19 weeks to assess and promote maintenance of the intervention. Sessions lasted between 60 and 90 min and were held via encrypted videoconferencing software. Some sessions, such as Teaching New Skills and Bathroom/Toilet Training spanned multiple weeks. The only deviation from the standard RUBI protocol was the omission of some role-play activities and mid- and post-intervention home visits, consistent with previous studies that used telehealth (Bearss et al., 2018a). Sessions were scheduled at times that were convenient for families, and thus specific session times varied from week to week.

Post-intervention assessment was conducted once dyads had completed the core RUBI sessions and any supplemental and booster sessions. Post-intervention measures were collected in the same manner as baseline. Given that the time to complete the full RUBI-T program differed across dyads (described in the results section), the latency between baseline and post-intervention data collection was also variable across dyads.

Setting

All sessions for data collection and RUBI-T implementation were conducted remotely through Zoom® teleconferencing software. Parents participated in interviews and RUBI-T sessions from their homes. Clinicians attended sessions from a private office or room in their homes.

Measures

Participant Characterization

Family and child demographics were assessed with a brief demographic survey collected at baseline. See Table 2 for a summary of demographic information across dyads. Due to the COVID-19 pandemic, the autism diagnosis of participating children could not be confirmed directly through assessment. Global autism characteristics were assessed at baseline by the independent evaluator using the Severity subscale of the Ohio Autism Clinical Impressions Scale (OACIS; Butter & Mulick, 2006). It is important to note that although the term *severity* may be appropriate for describing disruptive behaviors (i.e., with the "Aberrant/Abnormal Behavior" item), such terms are not always preferred within the autism community for describing characteristics of autism (Bottema-Beutel et al., 2021). Therefore, the "Overall level of Autism" item of the severity and improvement subscales

Table 2 Child and parent demographics at baseline

Child demographics	
Child age (years), mean ± SD	6.6 ± 2
Gender: male, N (%)	10 (77%)
Race, N (%)	
White	11 (84.6%)
Black/African American	2 (15.4%)
Asian	0 (0%)
Hispanic/Latino	1 (7.7%)
Native American	0 (0%)
More than one race	1 (7.7%)
Other	1 (7.7%)
ABC-2-Irritability, mean ± SD	19.5 ± 6.4
OACIS Aberrant/Abnormal Behavior, % rated moderate or greater	93%
VABS-3, mean ± SD	77.1 ± 7.2
OACIS Autism Severity, % rated moderate or greater	85%
Parent demographics	
Parent age, mean ± SD	45 ± 6.4
Gender: female, N (%)	10 (77%)
Mean number of parents living in home, N (mode)	1.8 (2)
Mean number of children living in home, N (mode)	2.1 (2)
Annual household income, N (%)	
Less than $20,000	0 (0%)
$20,000–40,000	2 (15.4%)
$40,000–60,000	1 (7.7%)
$60,000–80,000	1 (7.7%)
$80,000–100,000	1 (7.7%)
More than 100,000	8 (61.5%)
Parent education, N (%)	
High school graduate or GED	1 (7.7%)
Some college or 2-year degree	1 (7.7%)
College graduate	4 (30.8%)
Advanced graduate or professional degree	7 (53.8%)

may be more appropriately interpreted as "global level of impairment" (i.e., the degree to which characteristics or behaviors associated with autism are manifested in ways that negatively influence individual and family functioning). The OACIS is an autism-specific adaptation of the Clinical Global Impression scale (CGI; Guy, 1976), designed to provide a clinician's global clinical impression of an individual's ASD symptom severity and improvement. The clinical impression is based on a brief observation of the child as well as any other existing clinical data (e.g., review of ABC and VABS-3 scores, caregiver reports). Scores on the severity subscale range from 1 to 7, lower numbers indicating lower severity and higher numbers indicating greater severity. Also due to the COVID-19 pandemic, OACIS ratings were derived primarily from clinical data and brief interviews with caregivers, though brief observations of children were conducted via telehealth when possible.

Procedural Fidelity

Implementation of RUBI-T was assessed by measuring caregiver adherence to intervention procedures (i.e., participation during sessions, completion of homework assignments) and implementation fidelity of the RUBI manual by clinicians. We used the same measures employed in previous studies to evaluate parent and clinician adherence to RUBI procedures (Bearss et al., 2015, 2018a). Adherence to RUBI-T was measured with the Parent Treatment Adherence Scale (PTAS), which was completed by the interventionist at the end of each RUBI-T session. The PTAS requires the interventionist to rate caregiver engagement and understanding of materials and assignments within sessions across 3–6 items (depending on the session) on a scale of 0–2 (0 = Goal not achieved, 1 = Goal partially achieved, 2 = Goal fully achieved, or Not Applicable), with higher scores indicating greater adherence. To assess fidelity of implementation by interventionists, a Treatment Fidelity Checklist (TFC) was also completed after each session. The TFC is a self-report form wherein interventionists rate themselves across treatment goals for each session. As with the PTAS, treatment goals are rated on a scale of 0–2 (0 = Goal not achieved, 1 = Goal partially achieved, 2 = Goal fully achieved, or Not Applicable), with 6–13 goals present per session. Scores for the PTAS and TFC were derived by calculating the sum of ratings for each session, dividing by the total possible score, then multiplying by 100 to obtain a percentage. Inter-rater agreement (IRA) for the PTAS and TFC was calculated for a random selection of at least two core or supplemental sessions per dyad, which was equivalent to 23% of all sessions. IRA was calculated by comparing the clinician's score to that of the secondary rater, dividing the lower scores by the larger score, then multiplying by 100 to obtain a percentage. Mean IRA for the PTAS was 97% (SD = 0.07, range = 67–100%), and mean IRA for the TFC was 98% (SD = 0.04, range = 83–100%).

We also report the attrition rate for the study (i.e., the proportion of participating parent–child dyads that withdrew from the study before completing the full RUBI program), as well as percentage of RUBI-T sessions attended by parents and their utilization of optional supplemental and booster sessions.

Effectiveness

Indicators of potential effectiveness were assessed pre- and post-intervention across both child and parent outcomes. Children's disruptive behavior was assessed using the Aberrant Behavior Checklist, 2nd Edition (ABC-2; Aman & Singh, 2017) Irritability subscale. The ABC is a 58-item caregiver-report measure that assesses children's behavior across five domains: Irritability, Social Withdrawal, Stereotypies, Hyperactivity, and Inappropriate Speech. Items are

scored on a Likert scale ranging from 0 to 3, with higher scores indicating more severe behavior. The Irritability subscale is composed of 15 items relating to tantrums, aggression, and self-injurious behaviors; past randomized-controlled trials have demonstrated the subscale is sensitive to change during treatment and it has been used as a primary outcome variable in past studies of RUBI (Bearss et al., 2015, 2018a). Children's adaptive behavior was also assessed by parent report with the adaptive behavior composite of the Vineland Adaptive Behavior Scales, 3rd Edition (VABS-3; Sparrow et al., 2016). The VABS-3 is a commonly used standardized assessment of children's adaptive behavior across the domains of socialization, communication, and daily living skills, and includes an optional domain of maladaptive behavior. Caregivers provide scores of 2 (Usually), 1 (Sometimes), or 0 (Never) based on what developmentally appropriate skills children demonstrate throughout daily life. Additionally, an independent evaluator used the Improvement subscale of the OACIS to provide a global rating of child improvement across the domains of aberrant/abnormal behavior and core and associated features of autism. Scores on the Improvement subscale range from 1 to 7. Ratings of 1–3 indicate improvement, 4 indicates no change, and values greater than 4 indicate a worsening of symptoms. Typically, ratings of 1 or 2 are considered the benchmark for a "positive response" to treatment, as with CGI-I (Swiezy et al., 2021). As with severity ratings, due to the COVID-19 pandemic, ratings were derived primarily from clinical data and brief interviews with caregivers; brief observations of children were conducted via telehealth when possible.

Parents' sense of competence was assessed via parent self-report using the Parenting Sense of Competence (PSOC; Gibaud-Wallston & Wandersman, 1978) scale. The PSOC is a self-report measure comprised of 17 items across two factors: self-effectiveness, knowledge, and skills; and satisfaction, comfort, and worthiness. Items fall on a Likert-type scale, ranging from 1 (Completely Disagree) to 6 (Completely Agree). Although originally developed for use with mothers of neonates, the PSOC has been shown to be reliable with parents of autistic children (Arellano et al., 2019). Parents' stress levels were also assessed by parent self-report using the Autism Parenting Stress Index (APSI; Silva & Schalock, 2011). The APSI is a validated self-report measure that assesses parenting stress specifically related to children's core and associated features of autism. It consists of 13 Likert-type items where parents provide a rating ranging from 0 (Not stressful) to 5 (So stressful sometimes we feel we can't cope).

Social Validity

Indicators of acceptability were assessed across multiple social validity measures collected post-intervention.

Caregivers completed a modified version of the Intervention Rating Profile (IRP-15; Martens et al., 1985) at the end of treatment to assess general acceptability of the intervention procedures. The standard IRP-15 is a 20-item, 6-point Likert scale (1 = Strongly Disagree; 6 = Strongly Agree). The IRP-15 is a reliable and valid measure of intervention acceptability that is often applied to implementation of school-based interventions with educators (Elliot et al., 2017), with higher total scores representing a greater level of acceptability. For the present study, items were adapted such that wording reflected the point of view of caregivers of autistic children and five items specific to school-based interventions were omitted (maximum score = 90). Additionally, parents also completed the Parent Satisfaction Questionnaire (PSQ), which is a 20-item questionnaire where parents rate the quality of the training, usefulness of the teaching tools, value of the program elements, and their confidence in managing future behavioral concerns on a three-point Likert-type scale (Very Helpful, Somewhat Helpful, Not Helpful). Parents also completed the Telehealth Caregiver Satisfaction Survey (TCSS), which is a 14-item questionnaire focused on the telehealth delivery of RUBI-T. Items on the TCSS are rated on a 5-point Likert-type scale ranging from Strongly Agree to Strongly Disagree, with a sixth option to indicate Not Applicable. Both the PSQ and TCSS were developed by the RUPP Autism Network (2007) and have been used in previous research evaluating RUBI and telehealth (Bearss et al., 2018a).

Data Analyses

A pre-test/post-test pre-experimental design was employed in the present study. Descriptive statistics are reported for procedural fidelity and social validity outcomes, as well as global ratings of effectiveness. Inferential statistical analyses were conducted across child and parent effectiveness measures. The Shapiro–Wilk test was used to assess for normality of data distributions (Royston, 1992). Based on the non-normality of the data, the Wilcoxon paired signed rank test (MacFarland & Yates, 2016) was used as a nonparametric significance test of change between pre- and post-intervention scores. For significant outcomes, we calculated Hedges' g (Hedges & Olkin, 1985) to determine effect size and account for the relatively small sample. Additionally, the percentage of children who demonstrated a positive response to intervention relative to baseline levels is reported, as indicated by scores of one (very much improved) or two (much improved) on the OACIS post-intervention.

Results

Procedural Fidelity

Of the 14 parent–child dyads enrolled in the present study, 13 (93%) completed the full RUBI-T program. One dyad was lost-to-follow up after completing baseline measures. Thus, 100% of the dyads that started RUBI-T completed it. Of those dyads, 11 (79%) elected to receive at least one supplemental session, and all dyads (100%) also elected to participate in at least one optional booster session. The length of time in which RUBI-T was completed varied across families. Mean treatment length across families was 8 months (SD = 2.4, range = 4–11 months). Rescheduling sessions with parents occurred frequently (M = 6, SD = 3.3, range = 1–13) due to events such as illnesses within the family, busy parent work schedules, and family vacations. Four dyads (29%) failed to attend a session without providing the clinician advance notice, though this occurred only five times across the duration of the study.

Parent engagement during RUBI-T sessions was high. As measured by the PTAS for each session, mean parent fidelity was 96.8% (SD = 8, range = 50–100%). Similarly, clinicians also implemented RUBI-T procedures with a high degree of fidelity. As measured by the TFS, mean clinician fidelity was 98.6% (SD = 3.9, range = 75–100).

Effectiveness

Figure 1 and Table 3 present the results across parent-reported child and parent outcome measures. Children exhibited significantly reduced levels of disruptive behavior between baseline and post-intervention assessments, as measured by the ABC-2 (Mdn difference = − 5; $p = 0.01$), representing a large effect ($g = -1.13$; 95% CI [− 0.32, − 1.94]). Children also demonstrated significant improvements in adaptive functioning as measured by the VABS-3 (Mdn difference = 3.5; $p = 0.02$), though the effect was modest ($g = 0.44$; 95% CI [0.15, 0.73]). Global ratings by the independent evaluator were more mixed. In the Aberrant/Abnormal Behavior domain, five children (45%) were rated as having a positive response to the intervention, though nine children (82%) were rated as at least Minimally Improved. In the Overall Autism Severity domain,
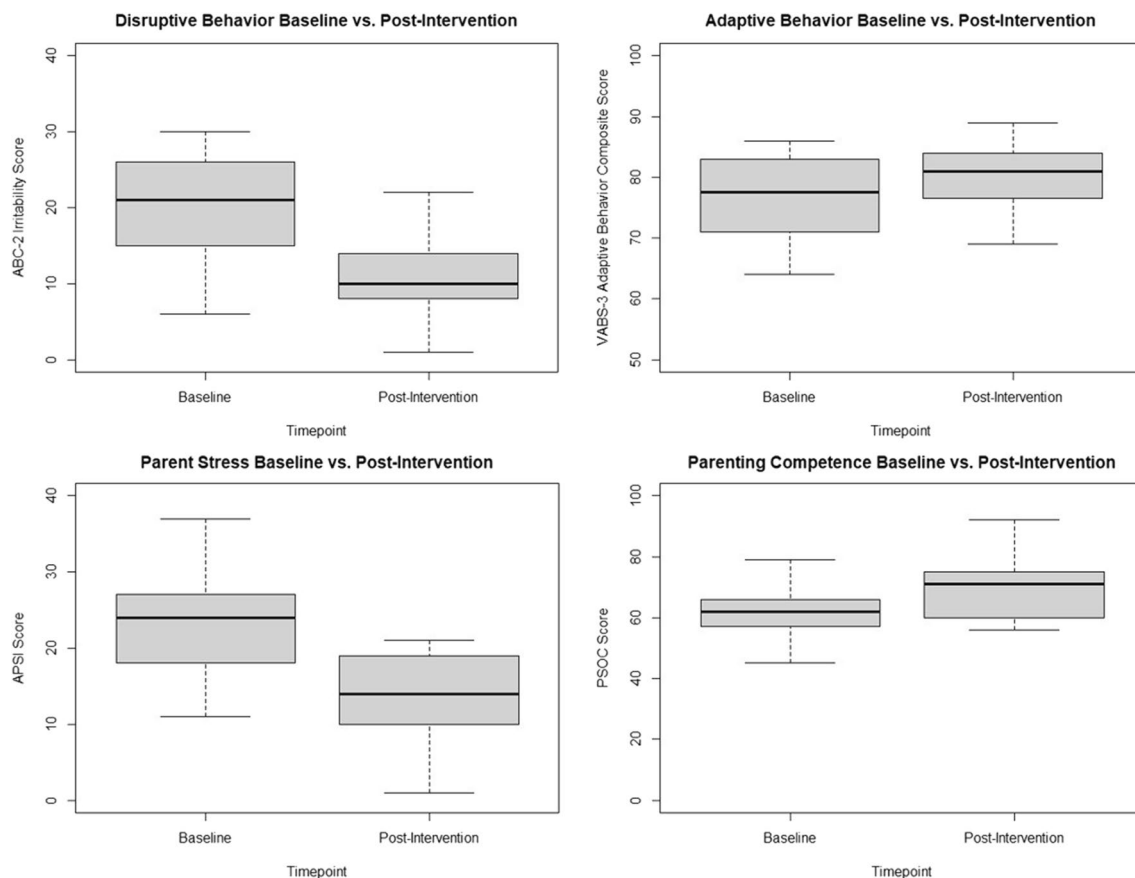

Fig. 1 Change in child and parent outcomes across baseline and post-intervention timepoints

Table 3 Indicators of potential effectiveness across child and parent outcomes

Measure	Pre-intervention median (IQR)	Post-intervention median (IQR)	Median difference	p value	Effect size (g)
Child outcomes					
ABC-2-I†	21 (11)	10 (6)	− 5	.01	− 1.13
VABS-3 ABC	77.5 (10.5)	81 (6.25)	3.5	.02	0.44
Parent outcomes					
APSI†	24 (9)	14 (9)	− 9	.01	− 1.31
PSOC	62 (9)	71 (15)	8	.01	0.71

IQR, inter-quartile range; *ABC-2-I*, Aberrant Behavior Checklist, 2nd edition, Irritability subscale; *VABS-3 ABC*, Vineland Adaptive Behavior Scales, 3rd edition, Adaptive Behavior Composite; *APSI*, Autism Parenting Stress Index; *PSOC*, Parenting Sense of Competence Scale

†Declining scores represent improvement

two children (18%) were rated as having a positive response, whereas 10 (91%) were rated as at least Minimally Improved.

Parents also demonstrated improvements across both effectiveness outcomes from baseline to post-intervention. As measured by the APSI, parents exhibited significant reductions in their reported stress levels (Mdn difference = − 9; p = 0.01), representing a large effect (g = − 1.31; 95% CI [− 1.88, − 0.73]). Parents also demonstrated significant improvements in parenting sense of competence as measured by the PSOC (difference of Mdn difference = 8; p = 0.01), representing a medium effect (g = 0.71; 95% CI [0.27, 1.15]).

Social Validity

Table 4 presents the results across social validity measures. Ratings on measures of social validity were consistently positive. One parent did not submit the IRP-15 after completing RUBI-T. As measured by the modified IRP-15, parents' high total scores indicated a high degree of acceptability for RUBI-T (M = 79, SD = 5). The only item on the IRP-15 that received lower scores from parents (four parents; 33%) was "This intervention is consistent with those I have used previously for my child."

All parents returned the PSQ and PTSS post-intervention. On the PSQ, parents rated all components of RUBI-T as either Somewhat Helpful or Very Helpful, and each component was rated as Very Helpful by most parents. One deviation from this pattern was the video examples component, which was rated as only Somewhat Helpful by 46% of parents. Additionally, 100% of parents indicated that they were more confident since beginning the program, and confident that they would be able to address new behaviors in the future. Ninety-two percent of parents indicated that they would recommend RUBI-T to other parents; only one parent indicated "Maybe; some reservations." All parents responded to an open-ended question about aspects of RUBI-T they especially liked or found valuable. Four parents noted that having support with problem-solving was helpful, and two

mentioned having a coach guide them through the process was a positive aspect. Five parents named specific concepts or components that were helpful; having the parent workbook as a reference, developing the behavior support plan, planned ignoring and "catching them being good," developing a token economy, and toilet training were mentioned specifically. Finally, three parents mentioned ways in which RUBI-T changed their perspectives. One parent stated, "Being able to get perspective on the expectations we set for him and how to recognize that there is simply something else going on inside his brain that is getting in the way of good behavior." One stated, "I liked how it empowered me to observe behavior and identify appropriate interventions." Another said, "…you can get a better understanding with ur (sic) child on that spectrum and it works if you use (RUBI) the proper way."

Parent ratings were similar on the TCSS. All parents provided positive ratings (i.e., Agree and Strongly Agree) when asked about clinician behaviors (e.g., making eye contact, facing the camera) during sessions, their trust in the clinician, and feeling prepared for sessions. Eleven parents (85%) indicated Strongly Disagree when asked if the telehealth technology was unnecessarily complicated, whereas two parents (15%) indicated Strongly Agree. Twelve parents (92%) indicated Disagree (N = 1) or Strongly Disagree (N = 11) when asked if it was easier to attend session in a clinic, while one parent selected Not Applicable. Similarly, eleven parents (85%) indicated Agree (N = 1) or Strongly Agree (N = 10) when asked if seeing a clinician via telehealth was just as good as seeing one in person; two parents (15%) indicated Unsure. Twelve parents (92%) indicated that they would choose telehealth over in-person services, whereas one indicated they were Unsure. Finally, all parents (100%) noted that they would recommend telehealth services to others. Seven parents left comments at the end of the TCSS survey. Six of the comments elaborated on parents' preference for telehealth and its convenience. For example, one parent stated, "This was absolutely, 1000%, easier than going in person. Loved this method!" Other parents noted specific ways in which

Table 4 Parent ratings across measures of social validity

Measure			
IRP-15			Mean Total Score* (SD)
			79 (5)
PSQ			
	Item		% rated "Very Helpful"
	Number of sessions		85
	Length of sessions		92
	Materials presented by clinician		92
	Video examples		54
	Handouts		77
	Session: Behavioral Principles		85
	Session: Prevention Approaches/Visual Strategies		100
	Sessions: How to reward/When to pay attention		92
	Session: Use of ignoring		77
	Session: Teaching child to listen or comply		69
	Sessions: How to teach child		85
	Sessions: Maintain and generalize child behavior		92
	Behaviors targeted for change		92
% rated "More Confident"			
	Present level of confidence		100
	Confidence for new problems/managing future behaviors		92
% rated "Yes"			
	Currently using behavior management principles?		100
	Would you recommend the program to other parents?		92
TCSS			
	Item		% rated "Strongly Agree"
	Given clear instructions before appointment		92
	Clinician faced the camera		100
	Clinician made eye contact		100
	Could hear the clinician sufficiently		100
	Clinician was friendly		92
	Technology was unnecessarily complicated to use**		85
	It is easier to go to the clinic than use telehealth technology**		85
	Comfortable seeing the clinician with telehealth technology		92
	Had a lot of trust in the clinician		92
	Likely in future to choose telehealth over in-person care		92
	Likely to recommend telehealth services to others		100
			% rated "Strongly Disagree"
	Technology was unnecessarily complicated to use		92
	It is easier to go to the clinic than use telehealth technology		85

IRP, Intervention Rating Profile; *PSQ*, Parent Satisfaction Questionnaire; *TCSS*, Telehealth Caregiver Satisfaction Survey. Highest possible rating on the modified IRP-15 = 90

telehealth was more convenient, such as "As a mom with two kids with ASD, telemedicine is SO MUCH easier for me than trying to bring both my kids or somehow get childcare coverage" and "…telehealth resembled a clinical setting and was more convenient because it eliminated commute times and was more accessible." One parent noted that telehealth was critical for participation: "I do not think this would have worked for me if I had to drive 30 + minutes to a session each week." Finally, one parent cautioned that telehealth was convenient for parent training but may be less preferable for direct services with children: "I answered this section as ME being the person receiving the telehealth visits. For me, they worked great because it gave me the flexibility to integrate them during

my work day. If it required (child name) to participate, I would prefer in-person."

Discussion

The present study sought to expand upon previous research exploring the feasibility of adapting the RUBI parent training program to a telehealth format (RUBI-T). The results provide further support for the feasibility and acceptability of RUBI-T when delivered to parents directly within their homes, and additional preliminary evidence of effectiveness. Parent engagement during RUBI-T sessions was high, and the attrition rate for the present study was low; every parent that began the program participated in core sessions as well as supplemental and optional booster sessions. These data were consistent with parents' ratings and comments on measures of social validity. Parents consistently indicated that both the RUBI program and the telehealth format were acceptable and feasible to implement. In fact, many parents appeared to prefer the telehealth format over in-person formats. Similarly, clinicians were also able to implement RUBI-T with a high level of fidelity. Although the present study was non-experimental, changes from pre- to post-intervention across child and parent outcomes highlight the potential effectiveness of RUBI-T. Children exhibited significant reductions in disruptive behavior and modest improvements in adaptive skills. This pattern suggests that RUBI-T not only allowed parents to manage challenging behavior more effectively, but the reduction of challenging behavior combined with parents' use of teaching strategies facilitated development of pro-social behaviors. However, global ratings of improvement by an independent evaluator were more mixed. Parent outcomes were also positive. Parents exhibited significant reductions in stress and significant improvements in their sense of competence as parents.

These findings echo and extend prior research examining the feasibility of RUBI via telehealth. While Bearss et al. (2018a) first demonstrated the feasibility and promise of effectiveness of a hub-and-spoke, clinic-to-clinic telehealth format, the results of the study suggest that a clinic-home telehealth format is comparably feasible and desirable, and no less effective. The present study coincidentally enrolled the same number of parent–child dyads and had an identical attrition rate. Parent attendance was higher in the present study, though this may be due to greater flexibility afforded to parents in terms of rescheduling weekly sessions and allowing parents to complete the program over a longer period of time. Parent and clinician adherence to the RUBI-T program was also consistently high. Regarding potential effectiveness, the present study found similar evidence for reduced disruptive behavior among children, and improvements in adaptive skills. Notably, the present

study showed statistically significant improvements in the VABS-3 composite score. The results diverged from Bearss et al. (2018a) regarding independent global ratings of child improvement. Whereas most children (78%) were rated as positive responders to treatment (Much Improved or Very Much Improved) in Bearss and colleagues' study, only a minority of the sample in the present study (18%) was rated as such. However, most of the children in the present study did improve to some degree relative to baseline. It is unclear whether this difference may be related to the use of a different measure (CGI vs. OACIS) or the omission of some child observations as part of the OACIS assessment protocol due to the COVID-19 pandemic.

The results of the present study also build upon recent research demonstrating the promise of the clinic-home RUBI-T format. Shanok et al. (2021) recently explored the feasibility of RUBI-T among a community sample of 29 parent–child dyads. Shanok and colleagues found that parent attendance and attrition were somewhat worse than the original Bearss et al. (2018a) feasibility study, though they found additional evidence for the potential effectiveness of RUBI-T for reducing children's disruptive behaviors, as well as improving parent knowledge of behavioral principles. Recent research has also demonstrated similar results for RUBI-T in novel contexts. Graucher et al. (2022) conducted an open trial of RUBI in person vs. RUBI-T, but presented in a group format, for Jewish and Arab families living in Israel. Gaucher and colleagues found evidence that the group format is feasible via telehealth, consistent with previous research on clinic-based group delivery of RUBI (Burrell et al., 2020). Additionally, Gaucher and colleagues found that RUBI-T led to significant reductions in children's disruptive behavior.

In addition to confirming and extending findings from previous research, the present study also expands upon the current literature. First, in addition to positive changes in child outcomes, the present study also demonstrated similar positive changes in parent outcomes. While Graucher et al. (2022) show that RUBI-T can improve parents' knowledge of behavioral principles, results indicated RUBI-T also reduces parents' stress levels and improves their sense of parenting competence, consistent with previous research of clinic-based implementation of RUBI (Iadarola et al., 2018). These findings are notable given that parents of autistic children consistently report high levels of stress and strain, which has been exacerbated since the arrival of the COVID-19 pandemic (Corbett et al., 2021; Rivard et al., 2014).

The present study also provides a more in-depth analysis of social validity outcomes compared to prior research. Across multiple measures, parents consistently indicated that they viewed both the content and components of the RUBI program and the telehealth modality favorably. This is consistent with a growing body of research illustrating

the use of telehealth technology to train and support parents of autistic children (Ellison et al., 2021) and that telehealth interventions are acceptable to parents (de Nocker & Toolan, 2021). Item-level analysis in combination with open-ended responses from parents provided additional nuance. Notably, parents rated all components of RUBI-T favorably, but video vignettes received comparatively less favorable ratings. Parents also stated that RUBI-T was inconsistent with previous intervention approaches they had been using, which highlights possible gaps in available services that many families experience (Raulston et al., 2019). Finally, multiple parents emphasized that the telehealth format worked well because parents were the recipients rather than the children; they noted that in-person formats were preferred for direct services with children. In response to the COVID-19 pandemic, many providers temporarily provided direct services (e.g., discrete trial instruction) via telehealth while shelter-in-place orders were in effect. Although limited research has shown that children can make comparable progress in this format (Ferguson et al., 2020; Pollard et al., 2021), additional research is needed to determine contextual factors and child and family characteristics that may influence effectiveness, and data on the social validity of such approaches is notably absent (Pollard et al., 2021).

Limitations and Future Research

While the present study replicates and extends previous research, there were also several limitations. Foremost, the study was non-experimental, therefore effectiveness data from the present study must be considered preliminary and interpreted with caution. A true test of the effectiveness of RUBI-T will require a more robust experimental design with an appropriate control condition. Similarly, since the present study was primarily focused on evaluating feasibility, more flexibility was allowed in implementing RUBI-T (e.g., frequency and schedule of sessions, total length of treatment) than previous studies or possibly what may be expected in clinical practice due to constraints related to staff schedules, billing insurance, among others. It is unclear whether or how this flexibility may have impacted child outcomes (e.g., maturity), parent outcomes (e.g., reduced stress from fewer schedule constraints), or implementation fidelity (e.g., fewer withdrawals, higher attendance). Additionally, the results were based on self-reports from parents and must also be interpreted with caution. Although an independent evaluator was utilized to assess global improvements in child functioning, these ratings were also largely derived from parent reports. Thus, it is unclear whether RUBI-T led to actual changes in child or parent behavior. Finally, the present study relied on a small convenience sample from a large metro area of the northeast region of the USA, and the majority of participants were white, educated, and of high socioeconomic status (SES). Therefore, the results may not generalize to families of other backgrounds or in other regions. While research has shown that parents tend to respond favorably to BPT regardless of their SES, disadvantaged families may prematurely discontinue services or struggle to maintain positive changes over time (Leijten et al., 2013; Parent et al., 2022). Additionally, the telehealth format may be less feasible for families lacking high-speed internet connections and equipment like webcam-enabled computers and smartphones, or those less experienced with such technology (Brunner et al., 2023), and in rural or mountainous areas where internet connections are less reliable (Dahiya et al., 2021). Additional research that explores ways to improve access to BPT for under-resourced families—via telehealth or otherwise—is warranted.

Despite the limitations of the present study, the findings, combined with past research, indicate that RUBI-T is feasible across multiple contexts and shows promise of effectiveness. RUBI-T is well-positioned for evaluation through more robust research designs, such as randomized-controlled trials (RCTs), which could be employed to determine the effectiveness of RUBI-T or its relative effectiveness compared to clinic-based, in-person delivery. Research at larger scales could also help determine for whom RUBI-T is appropriate, and in what contexts, and help explore additional variables related to feasibility, such as cost-effectiveness. Additional research may also explore ways in which RUBI-T may be modified to improve its feasibility and effectiveness. For example, Andrews et al. (2021) recently found that combining RUBI-T with elements of acceptance and commitment training (ACT) can also reduce parent stress, and parents consider the combined approach acceptable. Bearss and colleagues (2022) recently used user-center design and implementation science strategies to adapt RUBI to school settings. A similar approach may be valuable for determining how to modify RUBI or, given recent calls to include participatory practices in autism intervention research (Pukki et al., 2022), this approach may be employed to explore the acceptability of RUBI among autistic individuals and possibly further modify the program.

Declarations

Ethics Approval The present study was approved by the May Institute institutional review board. All participating parents provided informed consent prior to participation. Adverse events were monitored over the course of the study, and none was reported by participants.

Conflict of Interest The first, second, fourth, and fifth authors are employed by organizations that deliver services based on the science of applied behavior analysis for individuals with disabilities, and the third author maintains a faculty position within a graduate program for applied behavior analysis. There are no other potential conflicts of interest to report.

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