Providing Telehealth Support for Parents of Autistic Children Using a Mobile App

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Abstract

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that presents many challenges for parents and providers while impacting a child's developmental trajectory across several domains, including disruptive behaviors. Unfortunately, due to limited access and affordability of care, especially during the pandemic or other situations that require people to stay at home, in-person services are not always feasible. Rural or underserved communities may face additional barriers, such as geographic isolation and lack of ASD resources. Accessibility of ASD treatment may be expanded through telehealth supports, such as mobile applications. When implementing these supports for autistic children, decreasing child problem behaviors while improving parent stress, knowledge, and competence is crucial. The current study investigated the feasibility and preliminary efficacy of a behavior consultation mobile application, *Treks*, to improve telehealth support for 26 parents (n_{male} = 2) of autistic children (3-13 years). Participants were randomly assigned to a one-session telehealth consultation with 1) the enhancement of the *Treks* app over the course of one month (TH) or 2) with access to mobile resources comparable to *Treks* for one month (CC). They were then administered measures at baseline, pre-*Treks*, and post-*Treks* to assess changes in parenting stress, knowledge, competence, and child behaviors as well as feasibility metrics. Results indicated that the mobile app was received positively across groups, showing significant improvement in participants enrolled in the TH group from pre- to post-*Treks* on parenting and child outcomes, in addition to moderate to high satisfaction. Future directions should examine the use of mobile supports to supplement parent training consultations for caregivers of autistic children who present with a range of behavioral difficulties.

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General Audience Abstract

Autism spectrum disorder (ASD) presents with many challenges for parents and providers. Unfortunately, due to limited access and affordability of care, especially during the pandemic or other situations that require people to stay at home, in-person services are not always feasible. Rural or underserved communities may face additional barriers, such as geographic isolation and lack of ASD resources. Accessibility of ASD treatment can include telehealth (e.g., mobile applications), and should focus on decreasing child problem behaviors while improving parent stress, knowledge, and competence. The current study investigated the feasibility and preliminary efficacy of a behavior consultation mobile application, known as Treks, to improve telehealth support for 26 parents of autistic children (3-13 years). Participants were randomly assigned to a one-session telehealth consultation with access to 1) Treks for one month (TH) or 2) mobile resources comparable to Treks for one month (CC). They were then administered measures at baseline, pre-Treks, and post-Treks to assess changes in parenting stress, knowledge, competence, and child behaviors as well as feasibility. Results indicated that the mobile app was received positively across groups, showing significant improvement in participants enrolled in the TH group from pre- to post-Treks on parenting and child outcomes, in addition to moderate to high satisfaction. Future research should examine the use of mobile apps to supplement parent training for caregivers of autistic children who present with a range of behavioral difficulties.

Dedication

I would like to dedicate this dissertation to my wonderful husband, Rayman Singh, who has been by side throughout this entire experience. Thank you for moving across the country with me so that I could pursue my career and for supporting me every step of the way. You have provided incredible amounts of unconditional love and support, from reviewing documents to listening to me practice presentations to bringing me coffee and making sure I eat during those late nights of working. I love you and am so grateful to have you as my partner in life. We have had quite an adventure living in Virginia these past five years, and I would not have had it any other way.

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Angela Verma Dahiya, M.S.

Introduction

Autism spectrum disorder affects 1 in 44 children (Maenner et al., 2021), and is the fastest growing neurodevelopmental disorder. It is associated with lifelong impairment, including significant impairment in academics, social, and adaptive functioning and includes deficits in social communication and restricted, repetitive interests and behaviors (RRBs) domains (American Psychological Association, 2013). Early interventions can improve outcomes in terms of behavioral, social, and academic functioning related to ASD. Children in rural settings or who are at or below the poverty line receive diagnoses at a much lower rate or with substantial time delays, although actual prevalence of the condition is thought to be the same (Antezana et al., 2017; National Survey of Children's Health, 2007). Several reasons for this delay have been proposed, including geographic distance, limited specialty providers, and cultural factors (Scarpa et al., 2020). Given these findings, it is crucial to bridge the barriers to intervention by offering telehealth support for parents of autistic children in rural communities, thus providing geographically easier-to-access treatments that meet the needs of the community. Additionally, it is important to understand the developing literature on efficient methods to deliver services, including technology (Ashburner et al., 2016). Recent innovations, such as telehealth, can help bridge these gaps (Dahiya et al., 2020; 2021).

Considering the COVID-19 pandemic, it is becoming more apparent that alternative methods to delivering treatment need to be further examined, and this gap can be addressed using technology. Developing and implementing advanced information and communication technology can provide unique alternatives to the standard in-person delivery of evidence-based practices

(Baggett et al., 2010), which can thus expand services to individuals in remote or rural areas. Several options have emerged over the past few years, such as live videoconferencing, online/mobile platforms, or telehealth kits delivered to an individual's home (Dahiya et al., 2021).

Behavioral Problems in ASD

Autistic children commonly experience behavioral difficulties, such as aggression, frustration (e.g., screaming, yelling), self-injurious behavior, tantrums, meltdowns, destruction of property, and emotion dysregulation (Clauser et al., 2021). These behaviors can occur very early on in life and often persist throughout development, which can become more interfering and challenging if not addressed effectively and as early as possible (Aman et al., 2009; Lowe et al., 2007; McClintock et al., 2003). These interfering behaviors have also been associated with parental stress and depression (Clauser et al., 2021; Hastings et al., 2005; Herring et al., 2006; Olson et al., 2022).

Parent Training for ASD

In a systematic review and meta-analysis on parent training (PT) for disruptive behaviors in autistic children (Postorino et al., 2017), it was found that there are a number of essential elements needed for PT in ASD. All the PT programs, for example, included didactic material about behavioral problems in autistic children in addition to general information on ASD and general behavior management training (Reitzel et al., 2013; Sofronoff et al., 2004). Some of the key elements of PT that are pulled from behavior management training include evidence-based principles (EBPs) based on Applied Behavior Analysis (ABA; Cooper et al., 2007). ABA is one of the most well-known approaches to ASD treatment, as it includes EBP's of functional behavioral assessment and training (Wong et al., 2014). It includes the key foundational EBPs

required for behavior management and positive skill development in children, which includes techniques used for successful PT interventions. For example, the Antecedent-Behavior-Consequence (ABC) model is taught to conduct a functional behavioral analysis to understand the triggers and situations that precede a specific behavioral problem, as well as prevention and reinforcement strategies. Additionally, behavior management also includes opportunities for creating structure at home while using specific techniques to address other non-compliance behaviors (Johnson et al., 2019).

One specific treatment manual, known as the Parent Training Manual for Disruptive Behaviors: The RUBI Autism Network (Bearss et al., 2018) has been developed for children from 3 to 7 years of age and includes 11 sessions of treatment with optional sessions and telephone booster calls to assist with other interfering behaviors that may be present (e.g., toileting, feeding, sleep). The primary sessions covered the following skills for parents: behavioral principles, prevention strategies, daily schedules, reinforcement, planned ignoring, functional communication, teaching skills, and generalization/maintenance of skills. Results from randomized control trials (RCT) on RUBI's program noted improvements in adaptive behaviors, parent knowledge of the PT behavioral management techniques, and overall reduction in disruptive behaviors (Bearss et al., 2015; Scahill et al., 2016). Several other PT programs have included EBPs for autistic children (Wong et al., 2014, 2015), especially focusing on the Autism Focused Intervention Resources and Modules (AFIRM), which disseminate information into online learning modules and identified appropriate EBPs that can be delivered easily to practitioners (Sam et al., 2020).

Telehealth in ASD

Based on the results from the RUBI program's initial RCT (Bearss et al., 2015), Bearss et al. (2018) set out to examine a telehealth version of this intervention with parents and families from rural communities. In this study, the PT sessions were delivered through telemedicine sites in settings to ensure adequate Internet connection and HIPPA compliant video conferencing features. Results supported the feasibility and reliability of using RUBI via telehealth with high parent engagement and satisfaction. Additionally, outcomes were comparable to the original RCT (Bearss et al., 2015), but challenges were still faced in terms of applying this modality of treatment to a diverse sample of families in underserved populations.

Another PT program for autistic children that focuses on behavioral management principles and has utilized telehealth is the COMPASS for Hope intervention (C-HOPE; Kuravackel et al., 2018). C-HOPE is an 8-week treatment program that targeted child problem behaviors as well as parenting outcomes, to improve overall parental stress and competence. The program targeted children between ages 3 to 12 years and incorporated a combination of group and individual sessions, which provided the opportunity for each family to refine an individualized behavior plan to track problem behaviors and progress. The sessions covered the following evidence-based information: behavioral principles, proactive and reactive strategies to behaviors, replacement behaviors, teaching strategies, and parent self-care and relaxation techniques. When C-HOPE was administered both face-to-face and via telehealth, outcomes were positive, as there were significant improvements from pre- to post- treatment in both conditions. Parents also reported high levels of satisfaction and fidelity of the treatment across both modalities, suggesting that this intervention can be implemented in both settings.

Other behavioral-focused treatments that included ABA in PT have also been delivered via telehealth. One specific review paper focused on ABA (Ferguson et al., 2019) noted positive outcomes across all 28 identified studies, suggesting telehealth as a feasible platform for behavioral treatment. Although the types of technology utilized in these studies were limited in the amount of information provided by the research, video conferencing platforms (e.g., Skype, Zoom) and online training via websites reportedly met parent satisfaction in terms of use and capabilities, but were not aimed at replacing face-to-face delivery (Vismara et al., 2016). Telehealth has also been used for assessment purposes in autistic individuals, including video and mobile applications, but there are few studies that examine this methodology (refer to Boisvert et al., 2010; Dahiya et al., 2021 for reviews), suggesting a need for more research focused on assessing the feasibility of using technology as a supplement to services as usual.

Although several studies have examined these methods of telehealth as a way of training parents on behavior management techniques for their children with disruptive behaviors, in ASD, much of this research involves live weekly sessions where parents are able to receive in-vivo feedback on the implementation of their behavioral techniques (Dudding, 2009). Specifically, distance-learning resources can be a valuable approach to encourage interaction with the treatment materials, which can increase overall knowledge of the behavioral principles being taught from pre- to post- training. These resources can include technology that embeds video streaming, narrated presentations, and assigned exercises to practice the skills (Hamad et al., 2010; Vismara et al., 2009). Vismara et al. (2013) examined the use of a self-guided website in addition to live videoconferencing to conduct PT (based on the Early Start Denver Model, which is an ABA treatment) remotely for families with young autistic children. Although they did have live video sessions, the feature of this study was the use of an interactive website that included a

message board (to interact with their therapist or anonymously ask questions to other families in the study), media sharing capabilities, a resource page, video/text-based modules on each topic of the treatment curriculum, a tracker for parent progress, and check-in questions. Parents reported high satisfaction of the website, reporting it as easy to navigate and highly relevant to their training goals. They also reported high levels of confidence and generally felt supported, despite not having in-person contact with a therapist. These results suggests that an interactive telehealth platform that is readily available to families may be able to effectively serve as an alternative to traditional face-to-face services, especially in PT programs for autistic children.

The Current Study

The current study aimed to adapt a technology-based behavior change consultation platform, to support parents of autistic children and co-occurring behavioral challenges. The mobile application included brief daily lessons completed over the course of a month; these lessons were based on the aforementioned EBP's necessary for effective PT programs for autistic children (i.e., conducting functional behavior assessments, implementing prevention strategies, using reinforcements). The goal for this project was to provide the field with an objective, cost-effective consultation platform that could be used to complement treatments in community clinics, remotely, and in rural settings to improve challenging behaviors associated with ASD. This study was also a feasibility study that investigated how well parents of autistic children could use this telehealth-based platform as a supplement to consultation service to aid in managing their child's behaviors. Due to the events that have occurred over the past two years during the COVID-19 pandemic, including the closing of clinics, implementation of stay-at-home orders, and difficulties dealing with illness, it has been even more imperative to shift to a telehealth platform, as it not always feasible to rely on in-person services. This situation

underscored the dire necessity for finding effective options to reach populations when they cannot come to a clinic.

Thrust Interactive is a company that applies a game science philosophy towards outcome-based approaches to treatment. *Treks* is the company's behavior change support platform that supports users in gaining clarity on their struggles and supports them through a game that helps them create small habits that grow into lifestyle changes. The game incorporates technological supports, such as instructional videos, strategies to attempt, options of activities to commit to and engage in, and reinforcement for effort. For the current study, *Treks* was used as a foundation to develop the consultation enhancement that will aid parents in learning and consistently using behavioral strategies aimed at reducing their child's challenging behaviors and increasing parental confidence.

The primary objective of this project was to conduct a pilot study of the *Treks* telehealth behavior consultation mobile application for parents of autistic children. The specific aims were to investigate the following: (1) The feasibility of the mobile application by examining attrition, compliance, ease of use, and appropriateness of the *Treks* app, and (2) The preliminary benefits on parent and child outcomes following use of the app over the course of 4 weeks as an enhancement to a telehealth consultation versus a telehealth consultation control condition with access to an online resources version of the *Treks* app over the course of 4 weeks.

For aim 1 of the study, it was hypothesized that the *Treks*-supplemented consultation model would be feasible, evidenced by high compliance, and high parental ratings of satisfaction, appropriateness, acceptability, and feasibility. For aim 2, it was hypothesized that the telehealth (TH) group would reveal greater improvements in parent knowledge, competence, and stress compared to the consultation control (CC) group.

Method

Participants

The current study examined the feasibility and preliminary benefits of the *Treks*-application with supplemental consultation in a piloted RCT. Participants included 26 parents and their autistic children (M_{age} = 6.81, SD_{age} = 2.91). Eligible families included parents who spoke English, had private access to internet and videoconferencing (i.e., smartphone, tablet, computer), and reported concerns related to at least one of the following categories of behavior difficulties in their child: tantrums, noncompliance, difficulties with transitions, and/or aggression. Eligible children were between 3-13 years of age, presented with an ASD diagnosis given by a doctor, counselor, or other qualified treatment provider, displayed behavioral difficulties, and presented with receptive language skills equivalent to or greater than 18 months. Participants were allowed to be enrolled in treatment with stable medication or no medication prior to entry and were not asked to stop services while enrolled in the study. Because of the nature of the treatment and its focus on targeted disruptive behaviors present outside of a clinical setting, the study excluded children with severe suicidal or homicidal behaviors or severe medical conditions (i.e., seizures). Eligible families were screened over the phone and via HIPAA compliant Zoom to confirm their child's ASD diagnosis using specific measures. The child was required to score above the clinical cutoff on either the Social Responsiveness Scale, 2nd Edition (SRS-2; Constantino & Gruber, 2012) or on the Social Communication Questionnaire, Lifetime (SCQ; Rutter et al., 2003), meet criteria for ASD on the Childhood Autism Rating Scale-2nd Edition, Observation (CARS-2^{Obs}; Sanchez & Constantino, 2020), and present with receptive language abilities of at least an 18-month age equivalency on the Peabody Picture Vocabulary Test, 5th Edition (PPVT-5; Dunn, 2019) to be eligible for this study (refer to

next section for measure details). Eligible participants were then randomized into the consultation with telehealth support condition (TH) or the consultation-only condition (CC).

Participants were recruited via email listserv through the Virginia Tech Autism Clinic & Center for Autism (VTAC/CAR) newsletter as well as other Virginia Tech affiliated social media platforms and websites. Most participants were from the Southwest Virginia area, but due to the nature of this study taking place via telehealth, participants from out of state were also recruited.

Thirty-eight families expressed interest in the study. Of these families, 30 met eligibility based on the initial phone screen and intake assessment. These 30 participants were then randomized to either the TH or CC condition. Two of these participants (both in CC condition) did not download the *Treks* app following the consultation session, and two participants (both in TH condition) did not complete measures following completion of the *Treks* app. Thus, the current study included a total of 26 participants whose data were used in the final analyses (refer to Figure 1 for *CONSORT* diagram). These individuals consisted of 14 participants in the TH condition and 12 participants in the CC condition. The final sample of children consisted of 69% males (N_{males} = 18). Refer to Table 2 for detailed demographic information.

Measures (Refer to Appendices for details)

The following measures were completed at Intake Screening (Time 1), Consultation (Time 2), and one-month post-consultation/post-completion of the *Treks* app (Time 3). Refer to Table 1 for the timeline of measures administered.

Screening Measures (assessed at Time 1 to determine eligibility)

SRS-2 (Constantino & Gruber, 2012; Appendix A). The SRS-2 is a 65-item scale that assesses social deficits associated with ASD and is rated on a 4-point Likert scale (ranging from

Not True to *Almost Always True*). The measure includes subscales of Social Awareness, Social Cognition, Social Communication, Social Motivation, and Restructured, Repetitive Behaviors. The SRS-2 also provides a severity rating based on the overall *T*-score (*Within Normal Limits, Mild*, *Moderate*, or *Severe)*, suggesting the degree of interference in everyday situations that are often associated with ASD. This measure was administered as a Time 1 screener to support the presence of an ASD diagnosis. Cronbach's alpha for both the Preschool Version (.98) and the School-Age Version (.90) indicate excellent internal consistency.

SCQ (Rutter et al., 2003; Appendix B). The SCQ is a 40-item scale of Yes/No questions that assesses communication skills and social functioning in children. It will be administered to parents as a Time 1 screener to confirm if their child meets the clinical cut-off for ASD (cut-off score = 15). The internal consistency of the SCQ ranges from .84 to .93 and is able to differentiate ASD from non-ASD samples (sensitivity = .71; specificity = .71) (Corsello et al. 2007). To be eligible for the study, the participant needed to obtain a cut-off score of at least 15 or to meet in the *Mild* category or above on the SRS-2 (illustrated above).

Problem Behavior Inventory (Appendix C): A problem behavior inventory was administered at the Time 1 screening and was referred to during the consultation session (Time 2) to help parent identify a target problem behavior to apply the EBP behavior management strategies throughout the study. Because the *Treks* app aims to focus on specific behavioral techniques, the categories are narrowed down from the original eleven categories mentioned above to four options: tantrums, aggression, non-compliance, and resistance to change. The child was required to exhibit one of these problem behaviors to be included in this study.

Demographic and Child History Form (Appendix D). This questionnaire includes general demographic information to collect information on the child (e.g., sex, age, ethnicity,

developmental history), parents (e.g., age, education, income, family living arrangement), as well as general family medical history. This form also inquired about treatments that the child is enrolled in and any medications that they are taking and confirms the setting in which the child received their ASD diagnosis.

PPVT-5 (Dunn, 2019; Appendix E). The PPVT-5 measures receptive language skills in a format that is conducive to measuring language skills in autistic children. The examiner orally presents a word with a set of four pictures, and the participant is prompted to choose the picture that best depicts that word. The PPVT-5 score is calculated by subtracting the number of errors the child makes from a total ceiling score, which is then converted to a standard score. The standard score (M = 100, SD = 15) determines age equivalence amongst same-aged peers, and this age equivalence was be used to determine the child's language ability for inclusion in the study (greater than or equal to 18 months). The PPVT demonstrates good psychometric validation (Williams & Wang, 1997).

CARS-2^{Obs} (Sanchez & Constantino, 2020; Appendix F). The CARS-2^{Obs} is a 15-minute parent-facilitated observation used to confirm an ASD diagnosis and consists of 8 items. This measure shows high correlations with the *Autism Diagnostic Observation Schedule, 2nd Edition* (ADOS-2; Lord et al., 2012) and moderate correlations with the SRS-2, supporting this observation as a tool to differentiate children with and without ASD. The cut-off score of 16 provides a specificity of 93.2% and a sensitivity of 65.9%. The CARS-2 ST (Standard) was administered to children ages 6 years or younger and the CARS-2-HF (High Functioning) was used for children above 6 years. To be eligible for the study, the child needed to obtain a cut-off score of at least 16. If the child met eligibility based on the above requirements, then the

outcome measures described below were sent to the parents to complete following the intake screening appointment.

Outcome Measures (assessed at Time 1, Time 2, and Time 3)

Parenting Stress Index, 4th Edition, Short Form (PSI-4-SF; Abidin, 2012; Appendix G). The PSI-4 is a 36-item scale measures the amount of stress parents experience in their parenting role within the domains of child characteristics, parent characteristics, and the parent-child relationship. The items are rated on a 5-point Likert scale (ranging from *Strongly Disagree* to *Strongly Agree*). The PSI demonstrates strong internal consistency (alpha .96 or greater for each domain and test-retest reliability ranging from .65 to .96 for the Total Stress score; Abidin, 2012). The PSI-4-SF was administered at Time 1 (after eligibility was confirmed), as well Time 2 and Time 3 to measure change in parenting stress study. The Cronbach's alpha indicates excellent internal consistency of the PSI-4-SF (.91).

Parenting Sense of Competence Scale (PSOC; Johnston & Mash, 1989; Appendix H. The PSOC is a 16-item scale that assesses parental confidence in regard to how they feel they can handle their child's problem behaviors. The items are rated on a 6-point Likert scale (ranging from *Strongly Disagree* to *Strongly Agree*) from The PSOC was administered at Time 1 (after eligibility was confirmed), Time 2 and Time 3 to measure change in parenting-self efficacy as related to child problem behaviors over the course of the study. The Cronbach's alpha indicates good internal consistency of the PSOC for the total score (.79), the satisfaction domain (.75), and the efficacy domain (.76).

Eyberg Child Behavior Inventory (ECBI; Eyberg & Pincus 1999; Appendix I). The ECBI is a 36-item scale of problem behavior in children between the ages of 2 and 16 years and includes a subscale of Intensity, which rates the frequency of each behavior. Items are rated on a

7-point scale (ranging from *Never* to *Always*) with positive scores indicating higher frequency of problem behaviors. The ECBI's test-retest reliability (>0.75) and internal consistency are at high levels (>0.90) (Funderburk, Eyberg, Rich, & Behar; 2003). This was administered at Time 1 (after eligibility was confirmed), as well as Time 2 and Time 3 to measure change in child problem behaviors study. The Cronbach's alpha indicates excellent internal consistency of the ECBI (.93).

Parent Training Knowledge Questionnaire (PTKQ; Appendix J). A questionnaire was adapted for based on the *Parent Knowledge Questionnaire* developed by Kuravackel et al. (2018) for the aforementioned C-HOPE parent training study to measure parent knowledge of parent training and supportive strategies. This 18-item questionnaire assessed the knowledge of parent training and behavioral management strategies, based on the EBPs reviewed during the consultation session and in the *Treks* application. The PTKQ was administered at Time 1 (after eligibility was confirmed), as well as Time 2 and Time 3 to measure change in parent knowledge.

Outcome Measures (assessed daily between Time 2 and Time 3)

Daily Check-In Questions. The *Treks* app included four daily check-in questions prior to completing each daily task, rated on a 5-point scale (ranging from *Not At All* to *Extremely*). The questions are the following: (1) "How confident are you in your ability to manage your child's behaviors today?" (2) "How prepared are you to use the skills you've learned to manage your child's behaviors today?" (3) "How stressed have you felt in relation to your child's behaviors in the last 24 hours?" (4) "How severe have your child's behaviors been in the last 24 hours?"

Feasibility Measures (assessed at Time 3)

***Treks* Telehealth Satisfaction Survey (TTSS; Appendix K).** A questionnaire was developed for this study as a modification of the *Telehealth Satisfaction Scale* (Morgan et al., 2014) to obtain parental feedback following completion of the *Treks* app. The 10-item survey assessed the satisfaction of the application, ease of use, and appropriateness of the mobile app model for addressing the target behavior, and comfort with the application. Eight items are rated on a 4-point scale (ranging from *Poor* to *Excellent*), 1 item is rated on a 5-point scale (ranging from *Very Dissatisfied* to *Very Satisfied*), and 1 item asked participants to provide additional feedback or comments. This measure was modified for those in the CC group to ask questions about the satisfaction, ease of use, and appropriateness of the resource page (the phrase "*Treks* mobile app" was replaced with "*Treks* mobile resources").

Acceptability, Appropriateness, and Feasibility of Implementation (Appendix L). Acceptability, appropriateness, and feasibility was measured using the *Acceptability of Intervention Measure* (AIM), *Intervention Appropriateness Measure* (IAM), and *Feasibility of Intervention Measure* (FIM; Appendix B; Weiner et al., 2017). These measures include 4 items each and have been shown to be indicators of implementation success (Weiner et al, 2017). Items are rated on a 5-point scale (ranging from *Completely Disagree* to *Completely Agree*). These scales demonstrate strong psychometric properties in terms of content validity, discriminant content validity, reliability, structural validity, structural invariance, known-groups validity, and responsiveness to change. Predictive validity of the measure is currently being researched.

Fidelity of Consultation Session (Appendix M). The consultation session was rated by an observer (a trained undergraduate or graduate research assistant) to assess the consultant's fidelity of implementation. Fidelity was assessed on completion of session goals (e.g., How

many of the four evidence-based principle's categories did the consultant review?; Did the consultant preview the session agenda at start of the session?), presentation of the *Treks* app and resources to participants, and level of engagement between the consultant and participants (How would you describe the engagement between the parent(s) and the consultant during the session?). Level of engagement was rated on a 4-point scale (ranging from *Very Poor* to *Good*).

Compliance Metrics. Data were also collected on compliance rates as well as reasons and rates of drop out. These were measured by: (1) When participants were screened and declined to participate or dropped out of the study, they were asked if they could provide a reason for why are declining and (2) The percentage of participants who sign the consent form for the study and complete the study protocol in its entirety was calculated as well as those who consented but did not complete the study protocol.

Procedure

The study procedure consisted of (1) an initial screening (Time 1), consisting of a) phone call with the parent to determine eligibility and to identify target behavioral problems that are of the parent's primary concern (e.g., aggression, tantrums, repetitive behaviors) and b) telehealth (via HIPAA compliant Zoom video conferencing) session with the parent and child to confirm the child's ASD diagnosis and verbal ability using the PPVT-5 and the CARS-2^{Obs}, (2) one 1.5 to 2 hour telehealth consultation session at Time 2, in which parents were taught the basics of evidence-based behavioral strategies (also via HIPAA compliant Zoom), and (3) either 4 weeks of telehealth support with the *Treks* mobile application, using established EBPs (TH group) or 4 weeks of access to the app with a link to the *Treks* resource page (CC group), which includes resources to assist parents through the implementation of the EBPs that are included in *Treks* application. Both the consultation session and mobile application utilized EBPs from established

interventions to target behaviors of concern. The principles used in the *Treks* application include the following: the ABCs of behavior, prevention strategies, visual schedules, reinforcement, planned ignoring, replacement behaviors, compliance training, teaching techniques, and generalization and maintenance of behaviors.

Participants were then randomly assigned to receive enhanced behavioral support via the *Treks* mobile application (TH group) or behavioral support via the *Treks* mobile application resource page (CC group). As noted above, the telehealth screening (Time 1) included questionnaires and a brief observation to confirm the child's ASD diagnosis and verbal ability. Additionally, questionnaires were administered to parents in both groups to track progress (e.g., parent knowledge, parent competence, parent stress, child problem behaviors), at the time of consultation (Time 2) and again one month after consultation for both groups and after completing 4 weeks of behavioral support (Time 3). Brief ratings on severity of child behaviors parent confidence, preparedness, and stress were also collected daily throughout the month. Data were stored on Research Electronic Data Capture (REDCap; Harris et al., 2009).

Data Analytic Plan

Feasibility (Aim 1). To address aim 1 of the feasibility of the *Treks* platform, primary analyses included tracking compliance with the study protocol, as well as ease of use and appropriateness of the *Treks* tool. To do this, several feasibility and compliance metrics were recorded, including reasons for ineligibility, reasons for declining participation (e.g., parents are without internet access or a mobile device), parent completion of the full protocol, and reason for dropout (refer to the Compliance Metrics above). Percentages were calculated for participants who completed the screening process but were not eligible, were eligible but decline to enroll, declined due to lack of internet access or a mobile device, and completed the consultation session

but did not finish the *Treks* app. A CONSORT (Consolidated Standards of Reporting Trials; Schulz et al., 2010) diagram is included to demonstrate the flow from recruitment to participation and completion of the study (refer to Figure 1).

To test the hypothesis of acceptability, appropriateness, and feasibility of the app, scores from the AIM, IAM, and FIM were calculated to determine an overall mean score, which demonstrates the extent to which the *Treks* app is judged as suitable for parents of autistic children with behavioral problems. An average score of 3 or above on each item indicates adequate acceptability, appropriateness, and feasibility. An average mean score was also calculated for the TTSS to measure satisfaction level with the telehealth model.

Preliminary Efficacy (Aim 2). Data analysis for aim 2 examined whether *Treks* improves parent and child outcomes, compared to a single telehealth consultation without the ongoing *Treks* application support. Specifically, the study assessed the preliminary efficacy of the program compared to the one-session telehealth consultation with the *Treks* app resource page, in terms of improvements in parent competence, stress, knowledge, and child problem behaviors. Eligible participants who enrolled in the study and completed at least 80% or more of the entire *Treks* app were analyzed for efficacy and specific parent and child outcomes were analyzed for those who complete the measures at all three time points.

As a preferred alternative to a power analysis, Hedeker et al. (1999) noted the following sample size estimations as applicable for longitudinal designs with two groups while accounting for attrition: To detect a large effect, the sample size required at Time 1 ranges from 12 to 15 for attrition rates of 0.00 to 0.10, a sample size of 31 to 38 is required to detect a medium effect, and a sample size of 192 to 237 is required to detect a small effect. Thus, the current sample size (n = 26) for the current study falls in the minimum range to detect a large effect between groups.

Because the sample size is only meant to collect pilot data, effect sizes have been examined in addition to significance levels.

Further, because the sample size reached the minimum requirement for a large effect, an independent samples *t*-test was used to determine group differences in treatment outcomes parent stress (PSI-4-SF), knowledge (PTKQ), competence (PSOCS), and child problem behaviors (ECBI) as well as demographic information at baseline. Paired samples *t*-tests were used to examine parent stress (PSI-4-SF), knowledge (PTKQ), competence (PSOCS), and child problem behaviors (ECBI) from pre-*Treks* (T2) to post-*Treks* (T3). Then, the trajectories of the check-in ratings over the course of the month for both the TH and CC groups were examined.

Individual level change in parent stress, knowledge, competence, and child problem behaviors was also examined using calculations of reliable change index (RCI; Jacobson & Truax, 1991). This evaluates change over time of an individual measurement score to determine meaningful change from pre-*Treks* (T2) to post-*Treks* (T3). This is calculated as a ratio of the observed difference score to standard error of measurement of the difference. RCI values +/- 1.96 are recommended to infer statistically significant and meaningful change.

Correlational analyses were also conducted to examine if child age and scores on the PPVT-5, correlated with overall change in parent and child outcomes.

Results

Aim 1

The *Treks* Telehealth Satisfaction Survey. Scores from the TTSS questionnaire were calculated to determine an overall mean score. A score of 37 was the highest possible score on this measure. Results on the TTSS demonstrated moderate to high satisfaction for participants in both the TH (n = 14) and CC conditions (n = 12). For the TH condition, parent's mean rating of

satisfaction for the *Treks* app was 31.79 (*SD* = 5.28; *Range* = 20-37). For the CC condition, the mean rating of satisfaction for the *Treks* mobile resources was 33.83 (*SD* = 2.95*; Range* = 27-37). These scores did not demonstrate a significant difference in telehealth satisfaction between groups. For each of the items, a score of 3 or above was considered a positive rating. Twenty of the 26 participants (77%) rated each item as at least 3 or above, with 6 participants rating some items at a 2 (*Fair*), indicating moderate satisfaction (TH = 4; CC = 2). Specifically, items that were given a score of 2 included "The quality of using the *Treks* mobile app or mobile resources" and "Your personal comfort in using the *Treks* mobile app or mobile resources". None of the participants rated items on the TTSS as 1 (*Poor*). Further, participants provided qualitative data on this measure indicating satisfaction with the program. However, three participants did face technical difficulties with the *Treks* app (TH = 2; CC = 1), in which they were signed off the app after completing a week of the program and were required to restart, as their data were not saved. Further, one final item on the TTSS allowed for participants to provide comments (Appendix K, item 10: "Please provide any additional comments or feedback below"). Most participants provided comments on this item, including appreciation of the resources offered but also some frustration with the technical issues faced. This feedback is organized in Table 3.

Acceptability, Appropriateness, and Feasibility of Implementation. Scores from the Acceptability, Appropriateness, and Feasibility (AIM, IAM, and FIM) questionnaires were calculated to determine an overall mean score and item-level mean score for participants in the TH condition. All three questionnaires demonstrated that the *Treks* app was acceptable, appropriate, and feasible to participants who completed the *Treks* app (*n* = 14). A score of 20 was the highest possible score on each measure. For each of the items, a score of 3 or above was

considered a positive rating. Thirteen of the 14 participants rated each item as at least 3 or above for all of the questionnaires, with one participant providing a score of 2 (*Disagree*) on four items ("The *Treks* app is appealing to me", "I like the *Treks* app", "The *Treks* app seems fitting", and "The *Treks* app seems applicable". Refer to Table 4 for a break-down of each item on the measure. In terms of the overall scores, the AIM's mean rating was 16.21 (*SD* = 3.41; *Range* = 11-20). On the IAM, the mean rating was a 15.86 (*SD* = 2.91, *Range* = 10-20). On the FIM, the mean rating was 16.14 (*SD*= 2.80, *Range*= 12-20).

Fidelity of Consultation Session. Each consultation session (*n* = 30) was conducted by a trained graduate clinician enrolled in a clinical psychology Ph.D. program. Each session was rated by a fellow graduate clinician or a trained undergraduate research assistant to assess the consultant's fidelity of implementation. Consultants achieved 100% fidelity on previewing the session agenda with participants, discussing all four categories of evidence-based principles, and reviewing the *Treks* app (TH) or the *Treks* app resources (CC) with participants. Level of engagement was rated as either a 4 (*Good*; *n* = 26) or 3 (*Average*; *n* = 4).

Compliance Metrics. As illustrated in Figure 1, several participants out of the 38 families recruited did not participate or were ineligible for the study. For participants who were screened over the phone and did not participate (*n* = 8), two participants did not report a specific problem behavior in their child that they were concerned about and thus were not eligible (5.26%), and six participants did not respond to follow-up contact after the phone screen (15.79%).

Of the 30 families who were eligible and randomized, two participants (both in CC condition) did not begin the *Treks* program following the consultation session (6.67%). Two other participants did not complete the entire *Treks* app protocol and did not complete the post-

treatment measures (6.67%). No reason for dropout was given. A total of 86.67% of randomized participants consented to the study and completed the entire study protocol, whereas 13.33% of randomized participants signed the consent form but did not complete the study in its entirety. No participants declined or dropped out due to lack of internet access or a mobile device.

Aim 2

Baseline Comparisons. Independent samples tests were conducted for the measures collected at baseline (T1/pre-consultation) and can be found in Table 5. It was found that across the TH and CC groups, no significant differences were noted amongst scores on the screening measures or parent and child outcome measures at baseline, apart from the PSI-4-SF total score, $t_{(20.62)} = -.853$; $p = .032$. The mean of the PSI-4-SF total score in the TH group was significantly lower than the mean in the CC group, and the standard deviation in the TH group was nearly twice as much as that of the CC group.

Outcome Variables. Outcome results from pre-*Treks* (T2) to post-*Treks* (T3) can be found in Table 6. Paired samples *t*-tests were conducted to examine changes on the parent outcome variables (PSI-4-SF, PTKQ, PSOC) and the child behaviors (ECBI) using the pre- and post- means of each measure to examine the presence of significant change in each group. Results revealed a significant decrease from pre- to post-*Treks* in the TH group on the PSI-4-SF total score and subscale scores as well as the ECBI. This indicates significant improvements in parenting stress and child behavior problems following use of the *Treks* app. There were also significant increases in parent training knowledge in the TH group both in the domain of (a) knowledge of parent training strategies as it relates to the given child's behavior difficulties and (b) increase in parenting training knowledge as a result of participating in the study. Lastly, the parent sense of competency also significantly improved in the TH group, as parents felt more

competent in implementing appropriate management strategies for their child's behavior difficulties following use of the *Treks* app.

When examining the outcome for the CC group from pre-*Treks* (T2) to post-*Treks* (T3), results indicated a significant increase in parent training knowledge following completion of the study, t (11) = -3.429, $p < .05$; d = -.990. However, the remaining outcome variables produced non-significant results that still trended towards a decrease in parenting stress total scores and subscale scores and decrease child behavior problems. Further, minimal change in means were observed on the parent competency scale in this group. Refer to Table 6 for details.

Reliable Change Index. The RCI was examined for all outcome variable scores (PSI-4-SF Total Score, PTKQ, PSOC, ECBI) from pre-*Treks* (T2) to post-*Treks* (T3). Values +/- 1.96 are recommended to infer meaningful change. On the PSI-4-SF measure, three participants in the TH group (21.4%) showed reliable decreases in total parenting stress (*RCI* = -2.141; *RCI* = -2.498; *RCI* = -2.855). One participant in the CC group (8.3%; *RCI* = -2.141) showed reliable decreases in total parenting stress. On the PTKQ measure, four participants in the TH group (28.6%) showed reliable increases in parent training knowledge (*RCI* = 4.104; *RCI* = 6.780; *RCI* = 5.710; *RCI* = 3.390). Five participants in the CC group (41.7%) showed reliable increases in parent training knowledge (*RCI* = 1.963; *RCI* = 2.676; *RCI* = 2.320; *RCI* = 2.676; *RCI* = 2.498). On the PSOC measure, two participants in the TH group (14.3%) showed reliable increases in parent competency (*RCI* = 3.212; *RCI* = 3.925). One participant in the CC group (8.3%; *RCI* = 2.855) showed reliable increases in parent competency. On the ECBI measure, seven participants in the TH group (50%) showed reliable decreases in child behavior problems (*RCI* = -8.921; *RCI* = -7.851; *RCI* = -4.818; *RCI* = -5.353; *RCI* = -2.498; *RCI* = -2.498; *RCI* = -3.747), while one participant (7.1%; *RCI* = 2.676) showed a reliable increase in child behavior problems. In the CC

group, five participants (41.7%) showed reliable decreases in child behavior problems (*RCI* = -5.710; *RCI* = -5.888; *RCI* = -11.776; *RCI* = -6.067; *RCI* = -2.141), while two participants showed reliable increases in child behavior problems (*RCI* = 2.320; *RCI* = 5.531).

Daily Check-In Questions. Both the TH and CC groups were administered daily check-in questions on the *Treks* app, which asked (1) "How confident are you in your ability to manage your child's behaviors today?" (2) "How prepared are you to use the skills you've learned to manage your child's behaviors today?" (3) "How stressed have you felt in relation to your child's behaviors in the last 24 hours?" and (4) "How severe have your child's behaviors been in the last 24 hours?". This data was exported from the *Treks* app, and unfortunately there was inconsistency in the number of times these questions were completed, regardless of the condition. Out of the 14 participants in the TH group, only eight participants completed all daily check-in questions. Items were rated on a 5-point scale (ranging from *Not At All* to *Extremely*). On the question of confidence, many participants indicated that they were *Not Very* (scored as a 2) or *Somewhat* (scored as a 3) confident during the first week and a half of using the app, and then increased their responses to *Somewhat, Very* (scored as a 4) or *Extremely* (scored as a 5) during the remainder of the program. On the question of preparedness, most participants indicated that they were either *Somewhat* or *Very* prepared each day. For the questions asking about daily stress and severity of their child's behaviors, scores varied widely from day to day and ranged from *Not Very* to *Very* high levels of stress and severity. Of note, one participant consistently indicated that they were *Very* confident and prepared, their child's behaviors were *Somewhat* severe, and they felt *Somewhat* stressed most of the time. This data suggests that there was not a consistent trajectory or pattern of participants daily perception of confidence, preparedness, stress, and severity as it relates to their ability to manage their child's behaviors.

Relationships to Change in Outcomes. Lastly, bivariate correlations were conducted for change in overall outcomes. A change score was calculated, subtracting the pre-scores from the post-scores on each measure. When examining change in parent and child outcomes, significant positive correlations emerged between change in parent training knowledge and parenting stress domains, excluding the difficult child domain. This same pattern emerged between the change in parent competence and all parenting stress domains. Further change in child behaviors were positively correlated with all parenting stress domains and negatively correlated with parenting training knowledge gained. No correlations were noted between these outcomes and child age and receptive language skills. These correlations can be found in Table 7.

Discussion

The current study examined a technology-supplemented consultation model for behavior change to support parents of autistic children and co-occurring behavioral difficulties, using the *Treks* mobile application. The specific aims were to investigate (1) The feasibility of the *Treks* app by examining attrition, compliance, acceptability, ease of use, and appropriateness of the app, and (2) The preliminary benefits on parent outcomes (parenting stress, knowledge, and competence) and child behavior problems following use of the *Treks* app for four weeks as an enhancement to a telehealth consultation versus a telehealth consultation control condition with access to an online resource version of the *Treks* app for 4 weeks.

Aim 1

It was hypothesized that the *Treks*-supplemented consultation model would be feasible, evidenced by high compliance and low attrition, in addition to average parental satisfaction ratings on the TTSS measure, and moderate to high ratings of acceptability, appropriateness, and feasibility of the app on the AIM, IAM, and FIM scales. A total of 86.67% randomized

participants completed the entire study protocol. Findings indicated that participants in both the TH (n = 14) and CC (n = 12) groups rated the *Treks* app and *Treks* mobile resources with moderate to high satisfaction. Specifically, participants rated the app as enjoyable with some concerns related to technical issues with the application, as reported by three participants. Second, scores on the Acceptability, Appropriateness, and Feasibility (AIM, IAM, and FIM) questionnaires revealed moderate to high ratings of acceptability, appropriateness, and feasibility of the *Treks* app, as rated by 13 of the 14 participants who completed the program.

In terms of qualitative feedback on satisfaction, many participants in both groups provided positive feedback on the structure and content of the application, with some participants expressing concerns related to technical issues faced (e.g., getting signed out of the app and having to start over with the program). Individuals in the CC group appeared to have a more positive experience from the consultation session, which is understandable since they did not have the guided activities embedded in the *Treks* app itself, given the condition in which they were randomized. Some of this feedback is also supported by the results of Vismara et al. (2013), in which live videoconferencing was provided as a supplement to a self-guided PT website, a platform that has a similar purpose to the *Treks* app.

Aim 2

It was also hypothesized that the preliminary efficacy of *Treks* app would be supported (compared to a one-session telehealth consultation without the support of the *Treks* app) as evidenced by greater improvements in the TH group on parent stress, knowledge, and competence compared to the CC group, as well as a greater decrease in child behavioral problems in the TH versus CC group. At baseline (T1), very little significant differences were noted in parent and child variables across groups, apart from the parenting stress total score. It is

possible that the parents enrolled in the study all experienced a similar level of stress due the pandemic, as this study was conducted throughout 2021. Further, the loss of structure and routine for autistic children likely impacted child problem behaviors, which in turn, impacts parental stress and difficulties with emotion regulation overall (White et al., 2021).

Findings revealed that parents enrolled in the TH group reported significant mean decreases in child behavior problems and parenting stress (across all domains on the PSI-4-SF) and significant mean increases in parent training knowledge and parent competency from T2 (pre-*Treks*) to T3 (post-*Treks*). Results from participants in the CC group showed a nonsignificant trend towards improvement across outcome measures, with a significant increase only in parent knowledge from T2 (pre-*Treks* mobile resource app) to T3 (post-*Treks* mobile resource app). Given that both groups were exposed to the evidence-based principles found in PT treatment through the telehealth consultation session and then through the resources found in the app (TH) and on the mobile resource page (CC), it is possible that the significant increase in parent knowledge from T2 to T3 is because all participants were exposed to the same resources and videos presented across both platforms. Further, it is important to consider the parent participant's perception of their autistic children throughout the study. It is possible that their perception of their child's improvement can change their interactions with their child and thus lead to improvement in both parent and child outcomes.

Further, paired samples t-tests revealed that participants in the CC group showed very little to no change in parent competence compared to the significant improvement noted in the TH group. Another difference between the *Treks* app versus mobile resource page is that the app incorporates activities for the participant to engage in with the addition of a reward system and words of encouragement to provide positive reinforcement throughout the program. Given the

lack of face-to-face contact between participants and clinicians, it's likely that this impacted parental feelings of competence and confidence. Other PT programs have shown to decrease parenting stress (e.g., RUBI, C-HOPE) and improve competences because of the face-to-face contact involved, either in person or via telehealth (Bearss et al., 2015; Kuravackel et al., 2018; Dahiya et al., 2021), so it may be necessary to incorporate more engagement between providers and clients as a supplement to a mobile or telehealth platform. These findings also support the results of Vismara et al. (2016), in which parents reported satisfaction of online trainings, as they were able to engage in some face-to-face contact with providers via telehealth.

The RCI scores also provided support for meaningful changes in outcome variables on an individual level. Participants from both groups illustrated reliable change in parenting stress, knowledge, competence, and child behavior problems, but more TH participant scores (n = 17) demonstrated reliable improvements on at least one of these variables versus the CC participant scores (n = 10). The RCI values were also somewhat higher for TH participants versus CC participants on the PSI-4-SF, PTKQ, and PSOC, while RCI values on the ECBI appeared to be in a similar range for participants in both groups. Specifically, the TH condition showed a 50% reduction rate of behavior problems, while the CC condition showed a 41% reduction rate of behavior problems. It is possible that some of the individuals in the CC group engaged more with the mobile resources than others and thus were able to demonstrate gains in this area. Further, since the TH condition did not show a huge number of participants making gains on these measures (apart from the ECBI), it might not be feasible to expect significant gains for a service that is considered a consultation with brief telehealth supports, especially since this was delivered in a limited dose of a one-session telehealth consultation and one-month of mobile supports. For future research, these supports require further development and in its current state,

may be better suited as a supplement to treatment or as a waitlist condition rather than delivered on its own (Vismara et al., 2013).

Lastly, the daily check-in questions embedded into the *Treks* app were inconsistently completed among participants, which is likely due to glitches in the application itself that allowed participants to move forward in the program without completing the questions. After reviewing the items completed by the eight participants who did complete these questions, a noticeable pattern of responses was not detected, which is likely due to the nuances of the participants day to day life and the variability of their child's behaviors. It is important to note that some of these participants completed the study during the summer months, while others completed the study during the academic year, which can also present differently due to the consistent routines and schedules associated with the school year versus holiday breaks. Future research should consider the differences in family routines and schedules and possibly allow more flexibility in how often each caregiver is required to check-into the app, such as every two to three days instead of daily.

Limitations and Future Directions

Although the outcome of this project presents with some strengths, there are still important limitations to be addressed. As mentioned above, an eligibility criterion for this app-based study required that all participants had access to reliable technology by means of a stable internet connection and an Apple (n = 15) or Android (n = 11) cell phone device. In many remote or rural areas, this is not always feasible. Thus, future directions should examine alternate ways to access telehealth resources or apps using alternative devices if possible (i.e., tablets, laptops).

Secondly, most of the participants in the study were of White race/ethnicity. Further, another eligibility criterion was fluency in English. Thus, future examination of mobile platforms

should investigate how to adapt these resources to various cultures and language levels to better disseminate crucial PT strategies and information for parents and families of diverse backgrounds who may benefit from this information as it applies to their culture. It is important to think about the future implications of using these platforms to broaden access to care for underserved populations. Further, the sample size was also not as large to run more complex analyses for preliminary efficacy, so collecting a larger and more diverse sample can further examine any variance in parent and child outcomes. It is likely that there are considerable differences in types of problem behaviors present in each child, which can impact levels of parenting stress for individuals with autistic children (Olson et al., 2022).

Third, when developing a technology-based tool, glitches with the system come up often, unfortunately. Although only three participants faced some technical difficulties (e.g., having to restart the *Treks* app after already completing a portion of the program; 2 TH, 1 CC) with the application, it is important to troubleshoot thoroughly when testing a new platform of any kind. Additionally, participants did not have any contact with the researchers between T2 (after the telehealth consultation/pre-*Treks*) and T3 (post-*Treks*) but were encouraged to email if they had issues with the application. Based on qualitative feedback (listed in Table 3) provided from participants post-*Treks*, some participants expressed an interest in scheduling a weekly brief check-in with a clinician either via phone call, text message, or video-call to ask questions about the implementation of the PT strategies reviewed in the application or to bring up any technical questions. Further, towards the end of the study, one participant reported that some videos in the app did not run (likely because there were YouTube links that expired), so future iterations of this application or other mobile platforms would benefit from PT training videos developed in-house to avoid this issue. Others also indicated an interest in allowed multiple caregivers to use

the app so other family members in the home were on the same page in terms of implementing specific behavior management strategies. Future research that examines technology similar to this application should take this into consideration, as some additional communication with clinicians as well as within caregivers in the home may be necessary to improve the effectiveness of the program, especially in the earlier stages following receiving an ASD diagnosis.

Fourth, although the *Treks* app was able to include detailed content related to the standard PT evidence-based behavior principles for parents of autistic children, the program itself was not tailored to each individual child and parent participant's needs. Further development of an application that can customize different *Treks* journeys based on the target behavior problem may also improve efficacy for a wide range of behavioral difficulties, beyond the four primary behaviors (tantrums, aggression, non-compliance, and resistance to change) addressed in this study.

Finally, the daily check-in questions also presented as a limitation for this study. Future iterations of this application or other mobile platforms should require participants to complete questions before moving forward in the program. Alternatively, it may be more feasible to require participants to complete these questions at a smaller frequency. For example, the items related to confidence and preparedness can be administered once per week, whereas the items on severity and stress can be administered multiple times per week (but not necessarily every day). In the current study, the completion of these questions were difficult to monitor due to the researchers not having access to the back end of the application as the study was underway, and all output was received following the participant's completion of the program. It is also possible that these daily check-in questions are not a feasible method of collecting data and other types of measures can be utilized, such as ecological momentary assessments (Shiffman et al., 2008)

which can provide more intensive measurements of in-the-moment emotions, behaviors, and observations (e.g., stress, confidence, mood). This may be able to provide more accurate measurement while also examining how self-reported emotions or behaviors correlate to the content or aspect of the application in which they are engaged.

Conclusions

The objective of the current study was to investigate the feasibility and preliminary efficacy of a mobile application-based consultation model to support parents of autistic children and co-occurring behavioral difficulties. Findings revealed feasible outcomes and brief support of this telehealth application, and thus provides preliminary support for this model. The implementation of this mobile application should continue to be examined, as it has the potential to improve parent and child outcomes more so when delivered as a consultation or support to supplement full treatment, compared to a single telehealth consultation parent training session without access to a month-long telehealth application. Families in this population experience varying levels of stress that are impacted by their autistic child's behavior difficulties, and the addition of mobile telehealth services can provide necessary and accessible supplemental support.

Additionally, the *Treks* app can allow families to access support from any location and has the potential to broaden services for underserved and rural communities that include autistic individuals and their families, as these populations often lack specialized care. Offering different options for service delivery, whether it be a mobile application, or a specialized resource page used to supplement brief treatment, can provide more implementable supplementary services for remote or underserved communities that are not only facing barriers due to the pandemic, but also face barriers related to location and lack of specialized ASD care. Providing easy to follow

telehealth platforms can increase accessibility for caregivers and families who are unable to meet with a provider regularly (either in-person or via telehealth video sessions) but still require some support with navigating their autistic child's needs.

This project increased the delivery of services to the families of autistic children in rural and remote settings during the height of the COVID-19 pandemic, and these findings can lead to further dissemination and implementation of projects that can apply telehealth-based supports and/or treatment to other under-resourced populations across America.

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Figure 1: CONSORT Diagram

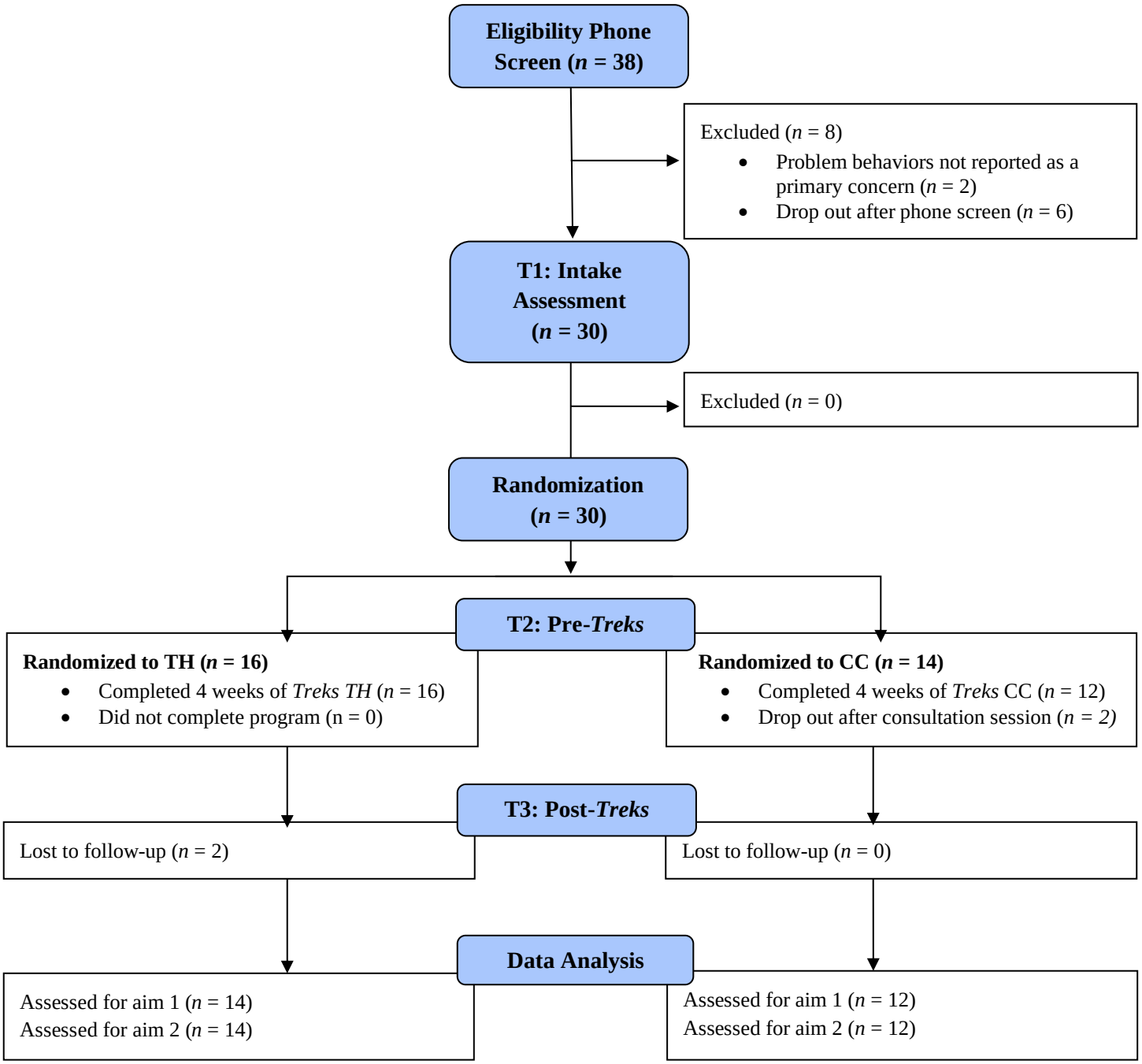

Table 1: Timeline of Measures

	Intake (T1)	**Pre-Tx (T2)**	**Post-Tx (T3)**
Screening Measures			
SRS-2	X		
SCQ-Lifetime	X		
Problem Behavior Inventory	X		
Intake Measures			
Demographic & Child History Form	X		
PPVT-5	X		
CARS-2^{Obs}	X		
Parent Outcomes			
PSI-4-SF	X	X	X
PTKQ	X	X	X
PSOC	X	X	X
Child Outcomes			
ECBI	X	X	X
Feasibility Measures			
TTSS			X
AIM, IAM, & FIM			X
Fidelity of Consultation Session			X

Note. AIM, IAM, & FIM = Acceptability of Intervention Measure, Intervention Appropriateness Measure, & Feasibility of Intervention Measure; CARS-2^{Obs} = Childhood Autism Rating Scale, 2nd Edition, Observation; ECBI = Eyberg Child Behavior Inventory; PPVT-5 = Peabody Picture Vocabulary Test, 5th Edition; PSI-4-SF = Parenting Stress Index, 4th Edition, Short Form; PSOC = Parenting Sense of Competence Scale; PTKQ = Parent Training Knowledge Questionnaire; SCQ = Social Communication Questionnaire; SRS-2 = Social Responsiveness Scale, 2nd Edition; TTSS = *Treks* Telehealth Satisfaction Survey

Table 2: Demographic Information

Group	**TH (*n* = 14)**	**CC (*n* = 12)**
	M (SD)	***M (SD)***
Child Age	6.50 (2.85)	7.17 (3.07)
Parent Age	40.64 (6.20)	37.42 (5.52)
	N (%)	***N (%)***
Family Income		
$25k to $50k	1 (7)	3 (25)
$50k to $75k	4 (29)	2 (17)
$75k to $100k	3 (21)	3 (25)
$100k to $200k	2 (14)	1 (8)
Above $200k	4 (29)	3 (25)
Child Gender		
Male	9 (64.3)	9 (75)
Female	5 (35.7)	3 (25)
Parent Gender		
Male	1 (7)	1 (8)
Female	13 (93)	11 (92)
Race/Ethnicity		
White	8 (57)	8 (66)
Black	2 (14)	0
Asian	4 (29)	2 (17)
Latinx	0	2 (17)
Target Behavior		
Tantrums	1 (7)	4 (33)
Aggression	2(14)	2 (17)
Non-compliance	7 (50)	3 (25)
Resistance to change	4 (29)	3 (25)
Participant Location		
Virginia	7 (50)	9 (75)
California	4 (29)	2 (17)
Other states	3 (21)	1 (8)
Parent Education		
High School	0	1 (8)
Trade School	4 (29)	0
Assoc. Degree	0	2 (17)
College Graduate	4 (29)	1 (8)
Graduate School	6 (42)	8 (67)
	N	***N***
Child Additional Diagnoses		
Anxiety Disorders	3	4
Depression	1	1
ADHD	4	5

Speech/Communication Disorders	6	7
ODD	3	1
PTSD	1	0
Medication		
For ADHD	4	3
For other difficulties	4	5

Note. ADHD = attention-deficit/hyperactivity disorder; ODD = oppositional defiant disorder; PTSD = posttraumatic stress disorder

Table 3: Satisfaction Survey Feedback

Themes	**Quotes**
	TH Group
App Structure & Content	"I really enjoyed this app. The only thing I would change is being able to share the videos (with other caregivers) and to be able to go back and re watch the videos. Also, allowing other caregivers to complete the treks as well so everyone is on the same page. I also think a weekly check-in with a clinician could be beneficial." "I liked the concept of using an app to help guide parents in assessing their child's behavior. I think it would be helpful if more parents had that, especially in the early stages of being diagnosed." "Very good! I liked the reminders and videos plus personalized tips and advice." "The app is a bit too simplistic, and many examples were not applicable to our case."
Activities & Implementation	"I enjoyed that everything was broken down in manageable assignments/tasks which made it feel less overwhelming when learning and implementing strategies." "Useful and manageable program that was a huge help." "I love this study. It helped a lot with my son's hitting. Thank you so much!" "Overall, I learned and implemented lots of new strategies."
Technical Issues	"I found the app to be great except for being knocked and having to start at the beginning, that was a bit frustrating when I had to start over." "I enjoyed using the mobile app. However, it did not work properly for me. It took me back to the beginning and I wasn't able to move forward from the point I was at." "The embedded videos failed during our run, but content was well done and helpful!"
	CC Group
App Structure & Mobile Resources	"I was genuinely surprised how much I came to enjoy the app. Very well done. The clinicians are amazing. We feel enormously blessed to live in a community with this resource." "Identifying the function and motivation to be consistent with consequences were the most valuable pieces of this study for me." "I wish the app instructed me to "do" and activity every day, such as read an article or try XYZ intervention. Some days I'm just so overwhelmed with what's going on with my kiddo, having the prompt to try an intervention or activity may be just what I need to push through the day without feeling completely defeated."

Consultation Session	"Everyone was very nice and informative. They answered all my questions, and I knew what I was going into." "I appreciated the resources and thorough overview during the zoom session." "The app that I had didn't really seem to go much with what they discussed in the consultation sessions on zoom. I got way more out of their presentation on the ABCs of behavior than the app."

Table 4: Acceptability, Appropriateness, & Feasibility of the Treks App

AIM, IAM, & FIM Items	***M (SD)***
Acceptability of Intervention Measure (AIM)	
1. The Treks app meets my approval	4.14 (.770)
2. The Treks app is appealing to me	3.93 (.829)
3. I like the Treks app	4.00 (.877)
4. I welcome the Treks app	4.07 (.997)
Intervention Appropriateness Measure (IAM)	
1. The Treks app seems fitting	4.07 (.616)
2. The Treks app seems suitable	3.93 (.829)
3. The Treks app seems applicable	3.93 (.616)
4. The Treks app seems like a good match	4.00 (.877)
Feasibility of Intervention Measure (FIM)	
1. The Treks app seems implementable	4.00 (.679)
2. Using the Treks app seems possible	4.00 (.784)
3. Using the Treks app seems doable	4.07 (.730)
4. The Treks app seems easy to use	4.14 (.864)

Table 5: Baseline Comparisons (Independent Samples Test)

Group	**TH (*n* = 14)**	**CC (*n* = 12)**	**Group Comparison**
	M (SD)	***M (SD)***	***t*** $_{(df)}$ **= *t*, *p* =**
Screening Measures			
SRS-2 Total T-Score	79.71 (7.24)	77.67 (10.37)	$t_{(24)}$ = .591; p = .443
SCQ Total Score	17.08 (5.0)	15.17 (5.41)	$t_{(24)}$ = 1.121; p = .806
PPVT-5 Standard Score	93.00 (32.66)	95.25 (25.11)	$t_{(24)}$ = -1.064; p = .200
Parent Outcomes			
*PSI-4-SF (Tot)******	59.00 (10.08)	61.67 (5.48)	$t_{(20.62)}$ = -.853; p = .032*****
PSI-4-SF (PD)	55.50 (8.32)	60.08 (5.88)	$t_{(24)}$ = -1.595; p = .324
PSI-4-SF (P-CDI)	58.07 (11.40)	58.33 (9.22)	$t_{(24)}$ = -.064; p = .242
PSI-4-SF (DC)	61.57 (10.97)	63.33 (9.59)	$t_{(24)}$ = -.432; p = .241
PTKQ	42.79 (10.08)	51.58 (12.04)	$t_{(24)}$ = -2.029; p = .834
PSOC	63.21 (11.44)	63.42 (10.54)	$t_{(24)}$ = -.047; p = .771
Child Outcomes			
ECBI	141.64 (28.46)	130.33 (25.07)	$t_{(24)}$ = 1.066; p = .509

Note. ECBI = Eyberg Child Behavior Inventory; PPVT-5 = Peabody Picture Vocabulary Test, 5th Edition; PSI-4-SF = Parenting Stress Index, 4th Edition, Short Form; PSI-4-SF (Tot) = Total; PSI-4-SF (PD) = Parental Distress; PSI-4-SF (P-CDI) = Parent-Child Dysfunctional Interaction; PSI-4-SF (DC) = Difficult Child; PSOC = Parenting Sense of Competence Scale; PTKQ = Parent Training Knowledge Questionnaire; SCQ = Social Communication Questionnaire; SRS-2 = Social Responsiveness Scale, 2nd Edition.

Table 6: Outcome Variables (Paired Samples t-test)

Outcome Measure	**TH Pre** ***M (SD)***	**TH Post** ***M (SD)***	***t***	**Effect Size (Cohen's *d*)**	**Significance (*p*-value)**
PSI-4-SF (Tot)	60.29 (8.99)	54.86 (8.45)	3.387	.905	.005
PSI-4-SF (PD)	56.64 (6.32)	50.64 (5.12)	4.266	1.140	<.001
PSI-4-SF (P-CDI)	59.14 (11.32)	54.93 (8.87)	2.364	.632	.034
PSI-4-SF (DC)	62.86 (10.17)	58.29 (11.56)	2.413	.645	.031
PTKQ (a)	45.29 (12.21)	57.71 (9.29)	-4.072	-1.088	.001
PTKQ (b)	49.07 (11.65)	61.71 (10.56)	-4.707	-1.258	<.001
PSOC	61.71 (9.51)	66.14 (9.21)	-3.500	-.935	.004
ECBI	140.29 (32.05)	127.86 (36.62)	2.322	.621	.037

Outcome Measure	**CC Pre** ***M (SD)***	**CC Post** ***M (SD)***	***t***	**Effect Size (Cohen's *d*)**	**Significance (*p*-value)**
PSI-4-SF (Tot)	62.08 (6.22)	59.50 (7.59)	1.417	.409	.184
PSI-4-SF (PD)	59.25 (4.69)	56.17 (5.92)	1.752	.506	.108
PSI-4-SF (P-CDI)	59.33 (8.78)	57.08 (8.78)	1.108	.320	.291
PSI-4-SF (DC)	64.67 (9.24)	62.58 (8.95)	1.012	.292	.333
*PTKQ (a)**	51.92 (6.93)	58.83 (8.59)	-3.429	-.990	.006*
PTKQ (b)	52.75 (12.04)	55.92 (12.23)	-.673	-.194	.515
PSOC	63.17 (8.86)	67.67 (7.77)	-1.942	-.561	.078
ECBI	127.92 (30.19)	115.17 (25.79)	1.729	.499	.112

Note. ECBI = Eyberg Child Behavior Inventory; PSI-4-SF = Parenting Stress Index, 4th Edition, Short Form; PSI-4-SF (Tot) = Total; PSI-4-SF (PD) = Parental Distress; PSI-4-SF (P-CDI) = Parent-Child Dysfunctional Interaction; PSI-4-SF (DC) = Difficult Child; PSOC = Parenting Sense of Competence Scale; PTKQ = Parent Training Knowledge Questionnaire; PTKQ (a) = Current knowledge; PTKQ (b) = Knowledge gained.

Table 7: Relationships to Change in Outcome (Bivariate Correlation)

		1.	2.	3.	4.	5.	6.	7.	8.
Outcomes	*1. PSI-4-SF (Tot)*	1							
	2. PSI-4-SF (PD)	.823*	1						
	3. PSI-4-SF (P-CDI)	.856*	.637*	1					
	4. PSI-4-SF (DC)	.818*	.489*	.520*	1				
	5. PTKQ (a)	-.578*	-.412*	-.680*	-.378	1			
	6. PTKQ (b)	-.136	.011	-.183	-.179	.547*	1		
	7. PSOC	.647*	.729*	.473*	.538*	-.356	-.103	1	
	8. ECBI	.730*	.549*	.573*	.699*	-.479 *	-.086	.582*	1
Demographics	*9. Child Age*	.158	.377	.052	.004	.880	.017	.305	.077
	10. PPVT-5	-.135	-.004	-.122	-.211	.618	-.039	-.040	-.105

Note. ECBI = Eyberg Child Behavior Inventory; PPVT-5 = Peabody Picture Vocabulary Test, 5th Edition; PSI-4-SF = Parenting Stress Index, 4th Edition, Short Form; PSI-4-SF (Tot) = Total; PSI-4-SF (PD) = Parental Distress; PSI-4-SF (P-CDI) = Parent-Child Dysfunctional Interaction; PSI-4-SF (DC) = Difficult Child; PSOC = Parenting Sense of Competence Scale; PTKQ = Parent Training Knowledge Questionnaire; PTKQ (a) = Current knowledge; PTKQ (b) = Knowledge gained.

Appendix A: Social Responsiveness Scale, 2nd Edition

WPS Test with Confidence

John N. Constantino, MD

Assessment ID _____

SRS-2 AutoScore™ Form **Preschool** ○MALE ○FEMALE

INSTRUCTIONS

For each question, please darken the circle that best describes this child's behavior **over the past 6 months.**

Child's name _____ Child's age _____ years _____ months

Rater's name _____ Date of rating _____

Relationship to rated individual ☐ Mother ☐ Father ☐ Other custodial adult ☐ Teacher ☐ Other specialist

School or clinic _____

PLEASE PRESS HARD WHEN MARKING YOUR RESPONSES.

1 = NOT TRUE 2 = SOMETIMES TRUE 3 = OFTEN TRUE 4 = ALMOST ALWAYS TRUE

1. Seems much more fidgety in social situations than when alone. ① ② ③ ④
2. Expressions on his or her face don't match what he or she is saying. ① ② ③ ④
3. Seems self-confident when interacting with others. ① ② ③ ④
4. When under stress, child seems to go on "autopilot" (for example, shows rigid or inflexible patterns of behavior that seem odd). ① ② ③ ④
5. Doesn't recognize when others are trying to take advantage of him or her. ① ② ③ ④
6. Would rather be alone than with others. ① ② ③ ④
7. Is aware of what others are thinking or feeling. ① ② ③ ④
8. Behaves in ways that seem strange or bizarre. ① ② ③ ④
9. Clings to adults, seems too dependent on them. ① ② ③ ④
10. Unable to pick up on any of the meaning of conversations of older children or adults. ① ② ③ ④
11. Has good self-confidence. ① ② ③ ④
12. Is able to communicate his or her feelings to others in words or gestures. ① ② ③ ④
13. Is slow or awkward in turn-taking interactions with peers. ① ② ③ ④
14. Is not well coordinated in physical activities. ① ② ③ ④
15. Is able to understand the meaning of other people's tone of voice and facial expressions. ① ② ③ ④
16. Avoids eye contact or has unusual eye contact. ① ② ③ ④
17. Recognizes when something is unfair. ① ② ③ ④
18. When on the playground or in a group with other young children, child does not attempt to interact with other children. ① ② ③ ④
19. Gets frustrated trying to get ideas across in conversations. ① ② ③ ④
20. Has a strange way of playing with a toy. ① ② ③ ④
21. Is able to imitate others' actions. ① ② ③ ④
22. Plays appropriately with children his or her age. ① ② ③ ④
23. Does not join group activities unless told to do so. ① ② ③ ④
24. Has more difficulty than other children with changes in his or her routine. ① ② ③ ④
25. Doesn't seem to mind being out of step with or "not on the same wavelength" as others. ① ② ③ ④
26. Offers comfort to others when they are sad. ① ② ③ ④
27. Avoids starting social interactions with peers or adults. ① ② ③ ④
28. Thinks or talks about the same thing over and over. ① ② ③ ④
29. Is regarded by other children as odd or weird. ① ② ③ ④
30. Becomes upset in a situation with lots of things going on. ① ② ③ ④
31. Can't get his or her mind off something once he or she starts thinking about it. ① ② ③ ④
32. Wants to be changed when diaper or underwear is soiled or wet. ① ② ③ ④

Continue on back page

W-608B

PLEASE PRESS HARD WHEN MARKING YOUR RESPONSES.

1 = NOT TRUE 2 = SOMETIMES TRUE 3 = OFTEN TRUE 4 = ALMOST ALWAYS TRUE

33.	Is socially awkward, even when he or she is trying to be polite.	①②③④
34.	Avoids people who want to be emotionally close to him or her.	①②③④
35.	Has trouble keeping up with the flow of normal interaction with other children.	①②③④
36.	Has difficulty relating to adults.	①②③④
37.	Has difficulty relating to peers.	①②③④
38.	Responds appropriately to mood changes in others (for example, when a friend's or playmate's mood changes from happy to sad).	①②③④
39.	Has a restricted (or unusually narrow) range of interests.	①②③④
40.	Is imaginative, good at pretending (without losing touch with reality).	①②③④
41.	Wanders aimlessly from one activity to another.	①②③④
42.	Seems overly sensitive to sounds, textures, or smells.	①②③④
43.	Separates easily from caregivers.	①②③④
44.	Doesn't understand how events are related to one another the way other children his or her age do.	①②③④
45.	Focuses his or her attention to where others are looking or listening.	①②③④
46.	Has overly serious facial expressions.	①②③④
47.	Is too silly or laughs inappropriately.	①②③④
48.	Has a sense of humor, understands jokes.	①②③④
49.	Does extremely well at a few tasks, but does not do as well at most other tasks.	①②③④
50.	Has repetitive, odd behaviors such as hand flapping or rocking.	①②③④
51.	Responds to clear, direct questions in ways that don't seem to make any sense.	①②③④
52.	Knows when he or she is talking too loud or making too much noise.	①②③④
53.	Talks to people with an unusual tone of voice (for example, talks like a robot or like he or she is giving a lecture).	①②③④
54.	Seems to react to people as if they are objects.	①②③④
55.	Knows when he or she is too close to someone or is invading someone's space.	①②③④
56.	Walks in between two people who are talking.	①②③④
57.	Other children do not like to play with him or her.	①②③④
58.	Concentrates too much on parts of things rather than seeing the whole picture. For example, spins the wheels of a toy car but doesn't play with it as a car, or plays with doll's hair but not with the whole doll.	①②③④
59.	Is overly suspicious.	①②③④
60.	Is emotionally distant, doesn't show his or her feelings.	①②③④
61.	Is inflexible, has a hard time changing his or her mind.	①②③④
62.	Gives unusual or illogical reasons for doing things.	①②③④
63.	Touches others in an unusual way (for example, he or she may touch someone just to make contact and then walk away without saying anything).	①②③④
64.	Is too tense in social settings.	①②③④
65.	Stares or gazes off into space.	①②③④

Appendix B: Social Communication Questionnaire, Lifetime

Social Communication Questionnaire (SCQ) **Lifetime**
PC Answer Sheet

Michael Rutter, M.D., F.R.S., Anthony Bailey, M.D., Sibel Kazak Berument, Ph.D.,
Catherine Lord, Ph.D., and Andrew Pickles, Ph.D.

Name of Subject: _____ D.O.B.___/___/___ Interview Date ___/___/___ Age _____

Gender: ____ F ____ M Name of Respondent: _____ Relation to Subject: _____

Directions: Thank you for taking the time to complete this questionnaire. Please answer each question by circling *yes* or *no*. A few questions ask about several related types of behavior; please circle *yes* if *any* of these behaviors have ever been present. Although you may be uncertain about whether some behaviors were ever present or not, please answer *yes* or *no* to every question on the basis of what you think.

1.	Is she/he now able to talk using short phrases or sentences? If *no,* skip to question 8.	**yes**	**no**
2.	Can you have a to and fro "conversation" with her/him that involves taking turns or building on what you have said?	**yes**	**no**
3.	Has she/he ever used odd phrases or said the same thing over and over in almost exactly the same way (either phrases that she/he has heard other people use or ones that she/he has made up)?	**yes**	**no**
4.	Has she/he ever used socially inappropriate questions or statements? For example, has she/he ever regularly asked personal questions or made personal comments at awkward times?	**yes**	**no**
5.	Has she/he ever gotten her/his pronouns mixed up (e.g., saying *you* or *she/he* for *I*)?	**yes**	**no**
6.	Has she/he ever used words that she/he seemed to have invented or made up her/himself; put things in odd, indirect ways; or used metaphorical ways of saying things (e.g., saying *hot rain* for *steam*)?	**yes**	**no**
7.	Has she/he ever said the same thing over and over in exactly the same way or insisted that you say the same thing over and over again?	**yes**	**no**
8.	Has she/he ever had things that she/he seemed to have to do in a very particular way or order or rituals that she/he insisted that you go through?	**yes**	**no**
9.	Has her/his facial expression usually seemed appropriate to the particular situation, as far as you could tell?	**yes**	**no**
10.	Has she/he ever used your hand like a tool or as if it were part of her/his own body (e.g., pointing with your finger, putting your hand on a doorknob to get you to open the door)?	**yes**	**no**
11.	Has she/he ever had any interests that preoccupy her/him and might seem odd to other people (e.g., traffic lights, drainpipes, or timetables)?	**yes**	**no**
12.	Has she/he ever seemed to be more interested in parts of a toy or an object (e.g., spinning the wheels of a car), rather than using the object as it was intended?	**yes**	**no**
13.	Has she/he ever had any special interests that were *unusual* in their intensity but otherwise appropriate for her/his age and peer group (e.g., trains, dinosaurs)?	**yes**	**no**
14.	Has she/he ever seemed to be *unusually* interested in the sight, feel, sound, taste, or smell of things or people?	**yes**	**no**
15.	Has she/he ever had any mannerisms or odd ways of moving her/his hands or fingers, such as flapping or moving her/his fingers in front of her/his eyes?	**yes**	**no**
16.	Has she/he ever had any complicated movements of her/his whole body, such as spinning or repeatedly bouncing up and down?	**yes**	**no**
17.	Has she/he ever injured her/himself deliberately, such as by biting her/his arm or banging her/his head?	**yes**	**no**
18.	Has she/he ever had any objects (*other* than a soft toy or comfort blanket) that she/he *had* to carry around?	**yes**	**no**
19.	Does she/he have any particular friends or a best friend?	**yes**	**no**

Additional copies of this form (W-381E) may be purchased from WPS.
Please contact us at 800-648-8857, Fax, 310-478-7838, or www.wpspublish.com.

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W-381E

For the following behaviors, please focus on the time period between the child's fourth and fifth birthdays. You may find it easier to remember how things were at that time by focusing on key events, such as starting school, moving house, Christmastime, or other specific events that are particularly memorable for you as a family. If your child is not yet 4 years old, please consider her or his behavior in the past 12 months.

20. When she/he was 4 to 5, did she/he ever talk with you just to be friendly (rather than to get something)?	**yes**	**no**
21. When she/he was 4 to 5, did she/he ever *spontaneously* copy you (or other people) or what you were doing (such as vacuuming, gardening, or mending things)?	**yes**	**no**
22. When she/he was 4 to 5, did she/he ever spontaneously point at things around her/him just to show you things (not because she/he wanted them)?	**yes**	**no**
23. When she/he was 4 to 5, did she/he ever use gestures, other than pointing or pulling your hand, to let you know what she/he wanted?	**yes**	**no**
24. When she/he was 4 to 5, did she/he nod her/his head to mean *yes*?	**yes**	**no**
25. When she/he was 4 to 5, did she/he shake her/his head to mean *no*?	**yes**	**no**
26. When she/he was 4 to 5, did she/he usually look at you directly in the face when doing things with you or talking with you?	**yes**	**no**
27. When she/he was 4 to 5, did she/he smile back if someone smiled at her/him?	**yes**	**no**
28. When she/he was 4 to 5, did she/he ever show you things that interested her/him to engage your attention?	**yes**	**no**
29. When she/he was 4 to 5, did she/he ever offer to share things other than food with you?	**yes**	**no**
30. When she/he was 4 to 5, did she/he ever seem to want you to join in her/his enjoyment of something?	**yes**	**no**
31. When she/he was 4 to 5, did she/he ever try to comfort you if you were sad or hurt?	**yes**	**no**
32. When she/he was 4 to 5, when she/he wanted something or wanted help, did she/he look at you and use gestures with sounds or words to get your attention?	**yes**	**no**
33. When she/he was 4 to 5, did she/he show a normal range of facial expressions?	**yes**	**no**
34. When she/he was 4 to 5, did she/he ever spontaneously join in and try to copy the actions in social games, such as *The Mulberry Bush* or *London Bridge Is Falling Down*?	**yes**	**no**
35. When she/he was 4 to 5, did she/he play any pretend or make-believe games?	**yes**	**no**
36. When she/he was 4 to 5, did she/he seem interested in other children of approximately the same age whom she/he did not know?	**yes**	**no**
37. When she/he was 4 to 5, did she/he respond positively when another child approached her/him?	**yes**	**no**
38. When she/he was 4 to 5, if you came into a room and started talking to her/him without calling her/his name, did she/he usually look up and pay attention to you?	**yes**	**no**
39. When she/he was 4 to 5, did she/he ever play imaginative games with another child in such a way that you could tell that they each understood what the other was pretending?	**yes**	**no**
40. When she/he was 4 to 5, did she/he play cooperatively in games that required joining in with a group of other children, such as hide-and-seek or ball games?	**yes**	**no**

Appendix C: Problem Behavior Inventory

Listed below are four categories of potential problem behaviors. Please select those that represent your child's difficulties and rank order them from "1" being the most problematic through whatever number of categories you select. I will then ask you more information about the top area that you identify.

	1. Tantrums: destroys, screams, cries, throws self on floor, flails, destroys property.
	2. Aggression: injuries self/other, hits, pushes, kicks, bites, throws object at another, head butting, spitting
	3. Non-compliance: resisting help in a task, failure to follow through on directives or instructions.
	4. Resistance to change: difficulties in flexibility to change, insistence on routines and sameness.

Appendix D: Demographic and Child History Form

Child's Name: _____ Today's Date: _____

Date of Birth: _____ Gender: M_____ F_____

Race: Asian: _____ Black: _____ Hispanic: _____ White: _____ Other: _____

Form completed by: _____ Relationship to child: _____

BACKGROUND INFORMATION

Please list all individuals who live in the home and their relationship to your child (indicate if there are any siblings/relatives who have moved out of the home):

Name: Relationship: Age: Gender

If both biological parents are not living in the home, please explain:

If child is adopted, please provide any information regarding the biological parents:

Date of Adoption: _____ Age of Adoption: _____

MOTHER'S NAME: _____

Biological mother: ___ Stepmother:____ Adoptive Mother:____ Foster Mother:____
Other:____

Education: ___ Completed 8th grade or less
___ Completed some high school
___ Graduated from high school
___ Graduated from trade school, business school or specialized training
___ Completed some college

___ Completed an Associate degree
___ Graduated from college
___ Completed graduate school

Employment: Is mother/caregiver employed outside the home? Yes _____ No _____

Work schedule (circle one): Full-time Part-time

FATHER'S NAME: _____

Biological father: ____ Stepfather:____ Adoptive Father:____ Foster Father:____
Other:_____

Education: ___ Completed 8th grade or less
___ Completed some high school
___ Graduated from high school
___ Graduated from trade school, business school or specialized training
___ Completed some college
___ Completed an Associate degree
___ Graduated from college
___ Completed graduate school

Employment: Is father/caregiver employed outside the home? Yes _____ No _____

Work schedule (circle one): Full-time Part-time

Income: What is your estimated gross family income?
_____

EDUCATIONAL HISTORY
Is your child currently attending day care, school or an educational program? Yes _____No ____

School Name (In-Person, Virtual, Both): _____
Current grade: _____

CHILD DEVELOPMENTAL HISTORY
Note: If your child is adopted or in your foster care, please complete the following section to the best of your knowledge and leave unknown information blank.

Pregnancy and Prenatal Development:

Did the mother experience any illnesses or complications during pregnancy (e.g., rash, high blood pressure, headaches, bleeding, abdominal pain)?

If yes, specify: _____

Any accidents or problems during pregnancy?: Yes ___ No ___

Please circle the trimester(s) during which the mother smoked during this pregnancy:

Do not know Did Not First Second Third

Please circle the trimester(s) during which the mother drank alcohol during this pregnancy:

Do not know Did Not First Second Third

Please circle the trimester(s) during which the mother drank coffee during this pregnancy:

Do not know Did Not First Second Third

Please circle the trimester(s) during which the mother was exposed to x-ray during this pregnancy:

Do not know Did Not First Second Third

Please indicate below any medications the mother took during pregnancy:
Name of Drug (and what it was taken for) Dates taken during pregnancy (& trimester (s))

_____

_____

If the mother had severe emotional distress prior, during, or after, to this pregnancy, please explain:

_____

_____

Child's Birth Weight: _____ pounds _____ ounces

Length of baby's stay in hospital after birth:_____

Please specify the type of delivery:
_____ Vaginal _____ Normal _____ Induced _____ Forceps
_____Caesarian

If labor or delivery was abnormal in any way, please explain:

_____

_____

If known, please specify any problems the infant during delivery or special treatment received after delivery:

_____

_____

Please describe any difficulties that may have occurred during the baby's first months at home (e.g., excessive crying, sleeping problems, dislike of normal handling):

_____

_____

CHILD'S MEDICAL HISTORY

Has your child experienced any medical difficulties or diagnoses (e.g., Heart disease, Seizure, Cancer, Asthma, Hydrocephalus, Diabetes, Arthritis, Chicken pox)
Yes___ No___ If yes, Please list all medical difficulties and/or diagnoses.

_____

Medications: If your child is currently taking any medications, please specify the name of the medication and the following: dosage, time of day the medicine is taken, and who prescribed the medication.

Current ADHD medications?

_____

Current Anti-Depressant medications?

_____

Current Anti-Anxiety medications?

_____

Other medications

_____

Family Medical History:

Do any members of the family have a medical or psychological problem? Yes _____ No ____

If yes to any of the above, list this person's name/relationship & describe briefly:

PSYCHIATRIC/EMOTIONAL: Has your child previously been diagnosed (by anyone) with any of the following?

Autism Spectrum Disorder (i.e., Asperger Syndrome, Pervasive Developmental Disorder, Autistic Disorder) ……...Yes No
Any form of intellectual disability (i.e., MR or ID) ……Yes No

Specific Learning Disability (i.e., SLD in Math, Reading, and/or Writing)
……..……Yes No
Communication Disorder (i.e., Language Disorder, Speech Sound Disorder, Childhood Fluency Disorder…… Yes No
Social (Pragmatic) Communication Disorder…….....Yes No
Any Anxiety disorders (please specify)……..…..Yes No
Obsessive compulsive disorder…….....Yes No
Selective mutism …….…….....Yes No
Panic disorder…….……...Yes No
Posttraumatic stress disorder…….……Yes No
Oppositional defiant disorder…….……...Yes No
Conduct disorder……Yes No
Attention deficit hyperactivity disorder…….Yes No
Depression/Dysthymia…….....Yes No
Disruptive mood dysregulation disorder……....Yes No

Does child have any other psychiatric, neurodevelopmental, or medical diagnosis?
Yes____ No___
If yes, please specify diagnosis:
_____

For all diagnoses indicated above, please indicate the following: 1) Age at time of diagnosis or date of diagnosis 2) Provider/Clinic providing the diagnosis 3) Outcome/diagnosis

Risk Assessment
Has your child ever expressed suicidal tendencies or behaviors to harm self?

Does your child find it difficult to control his/her emotions (e.g., anger)?

If yes, please explain:
_____

Has your child ever shown aggressive violent behavior?

If yes, please explain:
_____

List any sensory sensitivity that your child might have with sights, sounds, smells, touch, or tastes (e.g., becomes very upset if __, very preoccupied with __)

List any repetitive behaviors or intense preoccupations your child may have

_____

Assessment and Treatment History

Has your child ever been evaluated psychoeducationally by a school or private consultant (include any diagnosis given)?

Please check any special programs in which your child is currently enrolled in school (check all that apply):

A. None
B. Counseling
C. Learning disabled (LD) or resource areas
D. Seriously emotionally disturbed (SED)
E. Reading/Math Assistance
F. Other Health Impaired (OHI)
G. Developmentally Delayed

Services

Please complete the following for any therapies your child has received.

A. **Speech/Language Therapy:** Yes No
For what reasons/problems_____
Of hrs per week_____ Date it started: _____ Date it ended _____
Group_____ and/or Individual_____ Private_____ and/or School system _____

B. **Occupational Therapy:** Yes No
For what reasons/problems_____
Of hrs per week_____ Date it started: _____ Date it ended _____
Group_____ and/or Individual_____ Private_____ and/or School system _____

C. **Applied Behavioral Analysis:** Yes No
For what reasons/problems_____
Of hrs per week_____ Date it started: _____ Date it ended _____
Group_____ and/or Individual_____ Private_____ and/or School system _____
Provider: _____

D. **Play Therapy:** Yes No
For what reasons/problems_____
Of hrs per week_____ Date it started: _____ Date it ended _____
Group_____ and/or Individual_____ Private_____ and/or School system _____

E. **Music Therapy:** Yes No
For what reasons/problems_____
Of hrs per week_____ Date it started: _____ Date it ended _____

Group_____ and/or Individual_____ Private_____ and/or School system _____

F. **Social Skills Therapy:** Yes No

For what reasons/problems_____

Of hrs per week_____ Date it started: _____ Date it ended _____

Group_____ and/or Individual_____ Private_____ and/or School system _____

G. **Individual Therapy:** Yes No

For what reasons/problems_____

Of hrs per week_____ Date it started: _____ Date it ended _____

Private_____ and/or School system _____

H. Other services:

Appendix E: Peabody Picture Vocabulary Test, 5th Edition

PPVT5™

Peabody Picture Vocabulary Test, Fifth Edition

Douglas M. Dunn, PhD

Form A

Record Form

Name: _____ Sex: ☐F ☐M ID #: _____

Address: _____ Current Grade: _____ or Level of Education Completed: _____

City: _____

State: _____ ZIP: _____ School/Agency: _____

Phone: _____ Teacher/Counselor: _____

Language Spoken Most Often: _____ Examiner: _____

Language(s) Spoken at Home: _____ Reason for Testing: _____

	Year	Month	Day
Test Date			
Birth Date			
Age*			

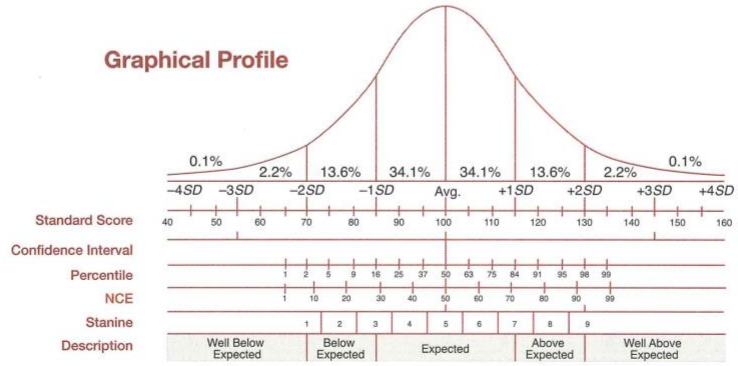
*Do not round up.

Calculating the Raw Score	
Ceiling Item	
Total Errors	–
Raw Score	

Score Summary

Standard Score (Table A.1)	Confidence Interval ☐90% ☐95% (Table A.1)	Percentile Rank (Table A.1)	Normal Curve Equivalent (NCE) (Table A.1)	Stanine (Table A.1)	Test-Age Equivalent (Table B.1)	Growth Scale Value (GSV) (Table B.1)
	___ – ___					

Graphical Profile



Pearson

1 2 3 4 5 6 7 8 9 10 11 12 A B C D E

Product Number 0158013344

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
Training Items A	
A1. boy	+ −
1 2 **3** 4	NR
A2. chair	+ −
1 **2** 3 4	NR
Training Items B	
B1. laughing	+ −
1 **2** 3 4	NR
B2. sleeping	+ −
1 2 **3** 4	NR
START Ages 2:6–3:11	
1. ball	1 0
1 2 **3** 4	NR
2. dog	1 0
1 2 3 4	NR
3. banana	1 0
1 2 3 **4**	NR
4. spoon	1 0
1 2 3 4	NR
5. animal	1 0
1 **2** 3 4	NR
6. foot	1 0
1 2 **3** 4	NR
7. duck	1 0
1 2 **3** 4	NR
8. bus	1 0
1 2 3 **4**	NR
9. shoe	1 0
1 **2** 3 4	NR
10. drinking	1 0
1 2 **3** 4	NR
11. cup	1 0
1 2 3 **4**	NR
START Ages 4:0–4:11	
12. eating	1 0
1 **2** 3 4	NR
13. pencil	1 0
1 **2** 3 4	NR
14. mouth	1 0
1 2 3 4	NR
15. flower	1 0
1 2 3 **4**	NR
16. cookie	1 0
1 2 3 **4**	NR
17. sitting	1 0
1 2 3 4	NR
18. carrot	1 0
1 2 3 4	NR
19. reading	1 0
1 2 3 4	NR
20. swimming	1 0
1 **2** 3 4	NR
21. drum	1 0
1 **2** 3 4	NR
22. toe	1 0
1 2 3 **4**	NR
23. jumping	1 0
1 2 **3** 4	NR
24. turtle	1 0
1 2 3 4	NR
25. square	1 0
1 2 3 **4**	NR

PPVT-5 • Form A 3

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
START Ages 5:0–5:11	
26. fire **1** 2 3 4	1 0 NR
27. belt 1 2 **3** 4	1 0 NR
28. gate 1 2 **3** 4	1 0 NR
29. painting 1 2 **3** 4	1 0 NR
30. penguin **1** 2 3 4	1 0 NR
31. fly 1 2 3 **4**	1 0 NR
32. kicking **1** 2 3 4	1 0 NR
33. whistle **1** 2 3 4	1 0 NR
34. throwing 1 2 3 **4**	1 0 NR
35. lamp 1 2 3 **4**	1 0 NR
36. happy 1 2 **3** 4	1 0 NR
37. empty 1 **2** 3 4	1 0 NR
38. fence 1 2 **3** 4	1 0 NR
39. whale 1 **2** 3 4	1 0 NR
40. dancing 1 2 **3** 4	1 0 NR
41. farm 1 2 **3** 4	1 0 NR
42. gift 1 2 3 **4**	1 0 NR
43. panda **1** 2 3 4	1 0 NR
44. castle 1 **2** 3 4	1 0 NR
45. horn **1** 2 3 4	1 0 NR
46. squirrel 1 2 **3** 4	1 0 NR
47. feather **1** 2 3 4	1 0 NR
48. net 1 **2** 3 4	1 0 NR
49. shoulder 1 2 **3** 4	1 0 NR
50. juggling 1 2 3 **4**	1 0 NR
51. pouring 1 **2** 3 4	1 0 NR
52. cobweb 1 **2** 3 4	1 0 NR
START Ages 6:0–6:11	
53. elbow 1 2 3 **4**	1 0 NR
54. fountain 1 2 **3** 4	1 0 NR
55. roof **1** 2 3 4	1 0 NR

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item		Score
56. peeking	1 2 **3** 4	1 0 NR
57. full	**1** 2 3 4	1 0 NR
58. buckle	**1** 2 3 4	1 0 NR
59. envelope	**1** 2 3 4	1 0 NR
60. diamond	**1** 2 3 4	1 0 NR
61. dressing	**1** 2 3 4	1 0 NR
62. tunnel	**1** 2 3 4	1 0 NR
63. branch	1 2 3 **4**	1 0 NR
64. sawing	1 2 3 **4**	1 0 NR
65. claw	**1** 2 3 4	1 0 NR
START Ages 7:0–7:11		
66. ruler	**1** 2 3 4	1 0 NR
67. calendar	1 2 3 **4**	1 0 NR
68. measuring	1 2 3 **4**	1 0 NR
69. vest	1 2 **3** 4	1 0 NR
70. arrow	1 **2** 3 4	1 0 NR
71. cactus	1 2 **3** 4	1 0 NR
72. target	1 **2** 3 4	1 0 NR
73. furry	1 2 3 **4**	1 0 NR
74. picking	1 2 **3** 4	1 0 NR
75. dentist	1 2 **3** 4	1 0 NR
76. squash	1 2 3 **4**	1 0 NR
START Ages 8:0–10:11		
77. delivering	**1** 2 3 4	1 0 NR
78. raccoon	1 2 3 **4**	1 0 NR
79. group	1 2 **3** 4	1 0 NR
80. knight	**1** 2 3 4	1 0 NR
81. gigantic	1 **2** 3 4	1 0 NR
82. floating	1 **2** 3 4	1 0 NR
83. ax	1 2 3 **4**	1 0 NR
84. uniform	1 2 3 **4**	1 0 NR
85. chimney	1 **2** 3 4	1 0 NR

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
86. dripping 1 2 3 **4**	1 0 NR
87. violin **1** 2 3 4	1 0 NR
88. tablet **1** 2 3 4	1 0 NR
89. river 1 2 **3** 4	1 0 NR
90. waist 1 **2** 3 4	1 0 NR
91. chef **1** 2 3 4	1 0 NR
92. vehicle 1 2 3 **4**	1 0 NR
93. flamingo 1 **2** 3 4	1 0 NR
94. globe 1 **2** 3 4	1 0 NR
START Ages 11:0–12:11	
95. catching 1 2 3 **4**	1 0 NR
96. sharing 1 **2** 3 4	1 0 NR
97. hyena 1 2 3 **4**	1 0 NR
98. vegetable 1 2 **3** 4	1 0 NR
99. plumber 1 2 **3** 4	1 0 NR
100. bloom **1** 2 3 4	1 0 NR

Item	Score
101. swamp 1 **2** 3 4	1 0 NR
102. vase 1 2 3 **4**	1 0 NR
103. trunk 1 **2** 3 4	1 0 NR
104. sorting **1** 2 3 4	1 0 NR
START Ages 13:0–13:11	
105. pigeon **1** 2 3 4	1 0 NR
106. timer **1** 2 3 4	1 0 NR
107. pyramid 1 2 **3** 4	1 0 NR
108. horrified 1 2 **3** 4	1 0 NR
109. flaming 1 2 3 **4**	1 0 NR
110. harp **1** 2 3 4	1 0 NR
111. ankle 1 **2** 3 4	1 0 NR
112. safe 1 2 3 **4**	1 0 NR
113. aquarium **1** 2 3 4	1 0 NR
114. wrench 1 2 **3** 4	1 0 NR
115. heart 1 2 **3** 4	1 0 NR

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
116. refueling	1 0
1 2 3 4	NR
117. luggage	1 0
1 2 3 4	NR
118. athlete	1 0
1 2 3 4	NR
119. canoe	1 0
1 2 3 4	NR
120. surprised	1 0
1 2 3 4	NR
121. vine	1 0
1 2 3 4	NR
START Ages 14:0–16:11	
122. towing	1 0
1 2 3 4	NR
123. directing	1 0
1 2 3 4	NR
124. reptile	1 0
1 2 3 4	NR
125. kiwi	1 0
1 2 3 4	NR
126. digital	1 0
1 2 3 4	NR
127. predatory	1 0
1 2 3 4	NR
128. drone	1 0
1 2 3 4	NR
129. solo	1 0
1 2 3 4	NR
130. palm	1 0
1 2 3 4	NR

Item	Score
131. hydrant	1 0
1 2 3 4	NR
START Ages 17:0–18:11	
132. valley	1 0
1 2 3 4	NR
133. dissecting	1 0
1 2 3 4	NR
134. funnel	1 0
1 2 3 4	NR
135. interviewing	1 0
1 2 3 4	NR
136. pastry	1 0
1 2 3 4	NR
137. clarinet	1 0
1 2 3 4	NR
138. harvesting	1 0
1 2 3 4	NR
139. inflated	1 0
1 2 3 4	NR
START Ages 19:0–90:11+	
140. tusk	1 0
1 2 3 4	NR
141. snarling	1 0
1 2 3 4	NR
142. assisting	1 0
1 2 3 4	NR
143. inhaling	1 0
1 2 3 4	NR
144. coast	1 0
1 2 3 4	NR

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
145. beverage **1** 2 3 4	1 0 NR
146. puzzled **1** 2 3 4	1 0 NR
147. rodent 1 2 **3** 4	1 0 NR
148. amphibian 1 2 **3** 4	1 0 NR
149. injecting **1** 2 3 4	1 0 NR
150. polluting 1 2 **3** 4	1 0 NR
151. demolishing 1 2 **3** 4	1 0 NR
152. mammal 1 **2** 3 4	1 0 NR
153. interior **1** 2 3 4	1 0 NR
154. clamp 1 **2** 3 4	1 0 NR
155. duet **1** 2 3 4	1 0 NR
156. links 1 **2** 3 4	1 0 NR
157. fern **1** 2 3 4	1 0 NR
158. aquatic 1 2 3 **4**	1 0 NR
159. consuming 1 2 3 **4**	1 0 NR

Item	Score
160. feline 1 **2** 3 4	1 0 NR
161. pillar 1 **2** 3 4	1 0 NR
162. florist 1 2 **3** 4	1 0 NR
163. carpenter 1 **2** 3 4	1 0 NR
164. trumpet 1 **2** 3 4	1 0 NR
165. currency 1 2 **3** 4	1 0 NR
166. isolation 1 2 3 **4**	1 0 NR
167. pedestrian 1 2 **3** 4	1 0 NR
168. departing 1 2 **3** 4	1 0 NR
169. garment 1 2 3 **4**	1 0 NR
170. citrus 1 **2** 3 4	1 0 NR
171. reprimanding **1** 2 3 4	1 0 NR
172. hovering **1** 2 3 4	1 0 NR
173. valve 1 2 **3** 4	1 0 NR
174. glider 1 2 **3** 4	1 0 NR

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
175. hedge 1 2 3 4	1 0 NR
176. irregular 1 2 3 4	1 0 NR
177. transparent 1 2 3 4	1 0 NR
178. hatchet 1 2 3 4	1 0 NR
179. primate 1 2 3 4	1 0 NR
180. parallelogram 1 2 3 4	1 0 NR
181. hazardous 1 2 3 4	1 0 NR
182. submerging 1 2 3 4	1 0 NR
183. pentagon 1 2 3 4	1 0 NR
184. syringe 1 2 3 4	1 0 NR
185. talon 1 2 3 4	1 0 NR
186. dejected 1 2 3 4	1 0 NR
187. apparel 1 2 3 4	1 0 NR
188. poultry 1 2 3 4	1 0 NR
189. peninsula 1 2 3 4	1 0 NR

Item	Score
190. appliance 1 2 3 4	1 0 NR
191. detonation 1 2 3 4	1 0 NR
192. cornea 1 2 3 4	1 0 NR
193. porcelain 1 2 3 4	1 0 NR
194. sedan 1 2 3 4	1 0 NR
195. cerebral 1 2 3 4	1 0 NR
196. cascade 1 2 3 4	1 0 NR
197. incarcerating 1 2 3 4	1 0 NR
198. confiding 1 2 3 4	1 0 NR
199. replenishing 1 2 3 4	1 0 NR
200. wedge [WEJ] 1 2 3 4	1 0 NR
201. lever [LE vuhr] 1 2 3 4	1 0 NR
202. perpendicular [puhr pen DI kyoo luhr] 1 2 3 4	1 0 NR
203. depleted [di PLEET ed] 1 2 3 4	1 0 NR

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
204. **pestle** [PE suhl] 1 2 3 **4**	1 0 NR
205. **enumerating** [i NOO muh rayt ing] 1 2 3 **4**	1 0 NR
206. **quintet** [kwin TET] 1 2 **3** 4	1 0 NR
207. **cultivating** [KUHL tuh vayt ing] **1** 2 3 4	1 0 NR
208. **ascending** [uh SEND ing] 1 **2** 3 4	1 0 NR
209. **perusing** [puh ROOZ ing] 1 **2** 3 4	1 0 NR
210. **incandescent** [in kuhn DES uhnt] 1 2 3 **4**	1 0 NR
211. **sternum** [STUHR nuhm] 1 2 **3** 4	1 0 NR
212. **filtration** [fil TRAY shuhn] 1 **2** 3 4	1 0 NR
213. **maritime** [MAR uh tiym] **1** 2 3 4	1 0 NR
214. **mercantile** [MUR kuhn teel] 1 2 **3** 4	1 0 NR
215. **converging** [kuhn VUHRJ ing] **1** 2 3 4	1 0 NR

Item	Score
216. **pilfering** [PIL fuhr ing] 1 **2** 3 4	1 0 NR
217. **coniferous** [koh NIF uh ruhs] 1 2 **3** 4	1 0 NR
218. **honing** [HOHN ing] 1 2 3 **4**	1 0 NR
219. **encumbered** [in KUHM buhrd] 1 2 **3** 4	1 0 NR
220. **wildebeest** [WIL duh beest] **1** 2 3 4	1 0 NR
221. **timpani** [TIM puh nee] 1 2 **3** 4	1 0 NR
222. **caster** [KAS tuhr] 1 2 **3** 4	1 0 NR
223. **embossed** [im BAWST] 1 2 3 **4**	1 0 NR
224. **terpsichorean** [tuhrp sik uh REE uhn] 1 2 **3** 4	1 0 NR
225. **legume** [LE gyoom] **1** 2 3 4	1 0 NR
226. **cupola** [KYOO puh luh] 1 **2** 3 4	1 0 NR
227. **convex** [kon VEKS] **1** 2 3 4	1 0 NR

• **Basal:** 3 consecutive correct responses. • **Ceiling:** 6 consecutive incorrect responses. • **Timing:** about 10 seconds. • **Repetition:** allow 1 per item.

Item	Score
228. **torrent** [TOHR uhnt] 1 2 **3** 4	1 0 NR
229. **derrick** [DER ik] 1 2 3 **4**	1 0 NR
230. **reposing** [ri POHZ ing] 1 2 3 **4**	1 0 NR
231. **arable** [AYR uh buhl] 1 2 **3** 4	1 0 NR
232. **dromedary** [DROM uh dayr ee] 1 **2** 3 4	1 0 NR
233. **calyx** [KAY liks] 1 **2** 3 4	1 0 NR
234. **lugubrious** [luu GOO bree uhs] 1 **2** 3 4	1 0 NR
235. **cenotaph** [SEN uh taf] **1** 2 3 4	1 0 NR
236. **supine** [suu PIYN] 1 2 3 **4**	1 0 NR
237. **cairn** [KAYRN] 1 2 3 **4**	1 0 NR
238. **vitreous** [VI tree uhs] 1 2 **3** 4	1 0 NR
239. **tonsorial** [ton SOHR ee uhl] 1 2 3 **4**	1 0 NR
240. **osculating** [OS kyuh layt ing] 1 **2** 3 4	1 0 NR

Appendix F: Childhood Autism Rating Scale, 2nd Edition, Observation

CARS™2-ST

Childhood Autism Rating Scale, Second Edition

Eric Schopler, Ph.D., Robert J. Reichler, M.D., and Barbara Rochen Renner, Ph.D.

wps

Standard Version
Rating Booklet

Name: _____ Case ID Number: _____ Test date: _____

Gender: _____ Ethnic background: _____ Rater's name: _____ Date of birth: _____

Based on information from: _____ Age: _____ years _____ months

DIRECTIONS: After rating the 15 items, transfer the ratings from the inside pages to the corresponding spaces below. Sum the ratings to obtain the Total raw score, and indicate the corresponding Severity Group. Circle the Total raw score value in the table in the column labeled *All ages* and in the column that corresponds to the age of the person who has been rated. The number printed to the left of each value you have circled is the *T*-score.

SUMMARY

CATEGORY RATINGS

1. Relating to People _____
   median = 2.5 *(3.0, 2.5)*
2. Imitation _____
   median = 2.5 *(2.5, 2.0)*
3. Emotional Response _____
   median = 3.0 *(3.0, 3.0)*
4. Body Use _____
   median = 2.5 *(2.5, 2.5)*
5. Object Use _____
   median = 2.5 *(2.5, 2.0)*
6. Adaptation to Change _____
   median = 2.5 *(2.5, 2.5)*
7. Visual Response _____
   median = 2.5 *(2.5, 2.0)*
8. Listening Response _____
   median = 2.5 *(2.5, 2.0)*
9. Taste, Smell, and Touch Response and Use _____
   median = 2.0 *(2.0, 2.0)*
10. Fear or Nervousness _____
    median = 2.5 *(2.5, 2.5)*
11. Verbal Communication _____
    median = 3.0 *(3.0, 3.0)*
12. Nonverbal Communication _____
    median = 2.5 *(2.5, 2.0)*
13. Activity Level _____
    median = 2.5 *(2.5, 2.0)*
14. Level and Consistency of Intellectual Response _____
    median = 2.5 *(2.5, 2.5)*
15. General Impressions _____
    median = 3.0 *(3.0, 3.0)*

Note. The numbers in parentheses are medians for individuals aged 2–12 or 13+, respectively.

Total raw score = ☐ *Note. SEM* = 0.68.

SEVERITY GROUP

☐ **Minimal-to-No Symptoms of Autism Spectrum Disorder** (15–29.5; *15–27.5 for ages 13+*)

☐ **Mild-to-Moderate Symptoms of Autism Spectrum Disorder** (30–36.5; *28–34.5 for ages 13+*)

☐ **Severe Symptoms of Autism Spectrum Disorder** (37 and higher; *35 and higher for ages 13+*)

Symptom Level Compared to Individuals With Autism Spectrum Diagnoses

		Raw score		
Percentile	*T*-score	All ages	Ages 2–12	Ages 13 and older
	>70	>54	>54	>54
>97	70	54	54	54
97	69	53.5	53.5	52–53.5
	68	52–53	52.5–53	49.5–51.5
96	67	51–51.5	51.5–52	
95	66	50–50.5	51	
93	65	49.5	50–50.5	49
92	64	49	49.5	47.5–48.5
90	63	48–48.5	48.5–49	46–47
88	62	47–47.5	47.5–48	45–45.5
86	61	46.5	46.5–47	44–44.5
84	60	45.5–46	46	
82	59	44.5–45	45–45.5	43.5
79	58	44	44.5	43
76	57	43.5	44	42.5
72	56	42.5–43	43–43.5	42
69	55	42	42–42.5	41–41.5
65	54	41–41.5	41.5	40–40.5
62	53	40–40.5	40.5–41	39.5
58	52	39–39.5	39.5–40	38.5–39
54	51	38.5	39	37.5–38
50	50	37.5–38	38–38.5	36.5–37
46	49	37	37.5	35–36
42	48	36–36.5	36.5–37	34–34.5
38	47	35–35.5	35.5–36	33.5
35	46	34–34.5	35	33
31	45	33.5	34–34.5	32.5
28	44	33	33.5	31–32
24	43	32–32.5	32.5–33	30–30.5
21	42	31.5	32	29–29.5
19	41	30.5–31	31.5	27.5–28.5
16	40	30	30.5–31	26.5–27
14	39	28.5–29.5	30	26
12	38	27.5–28	29–29.5	25–25.5
10	37	26–27	28–28.5	23.5–24.5
8	36	25.5	26–27.5	23
7	35	24.5–25	25.5	21–22.5
6	34	24	24.5–25	20.5
5	33	23–23.5	24	
4	32	22.5	23.5	
3	31	21.5–22	23	
2	30	21	22–22.5	20
	29	20.5		
1	28		21.5	
<1	27	20	21	
	26		20.5	
	25		20	19.5
	24	19.5		
	23		19.5	
	22			
	21			
	20	19	19	
	<20	<19	<19	<19.5

Note. SEM = 2.77.

Additional copies of this form (W-472A) may be purchased from WPS. Please contact us at **800.648.8857** or **www.wpspublish.com**.

W-472A

DIRECTIONS

For each category, use the space provided in the *Observations* section for taking notes concerning the behaviors relevant to that item. After you have finished observing the child, rate the behaviors relevant to each item by circling the number that corresponds to the statement that best describes the child. You may indicate that the child's behavior falls between two descriptions by circling ratings of 1.5, 2.5, or 3.5. Abbreviated rating criteria are presented for each item. See chapter 2 of the Manual for detailed rating criteria.

1. Relating to People

1 **No evidence of difficulty or abnormality in relating to people.** The child's behavior is appropriate for his or her age. Some shyness, fussiness, or annoyance at being told what to do may be observed, but not to an atypical degree.

1.5

2 **Mildly abnormal relationships.** The child may avoid looking the adult in the eye, avoid the adult or become fussy if interaction is forced, be excessively shy, not be as responsive to the adult as is typical, or cling to parents somewhat more than most children of the same age.

2.5

3 **Moderately abnormal relationships.** The child shows aloofness (seems unaware of adult) at times. Persistent and forceful attempts are necessary to get the child's attention at times. Minimal contact is initiated by the child.

3.5

4 **Severely abnormal relationships.** The child is consistently aloof or unaware of what the adult is doing. He or she almost never responds to or initiates contact with the adult. Only the most persistent attempts to get the child's attention have any effect.

2. Imitation

1 **Appropriate imitation.** The child can imitate sounds, words, and movements that are appropriate for his or her skill level.

1.5

2 **Mildly abnormal imitation.** The child imitates simple behaviors such as clapping or single verbal sounds most of the time; occasionally, imitates only after prodding or after a delay.

2.5

3 **Moderately abnormal imitation.** The child imitates only part of the time and requires a great deal of persistence and help from the adult; frequently imitates only after a delay.

3.5

4 **Severely abnormal imitation.** The child rarely or never imitates sounds, words, or movements even with prodding and assistance from the adult.

3. Emotional Response

1 **Age-appropriate and situation-appropriate emotional response.** The child shows the appropriate type and degree of emotional response, as indicated by a change in facial expression, posture, and manner.

1.5

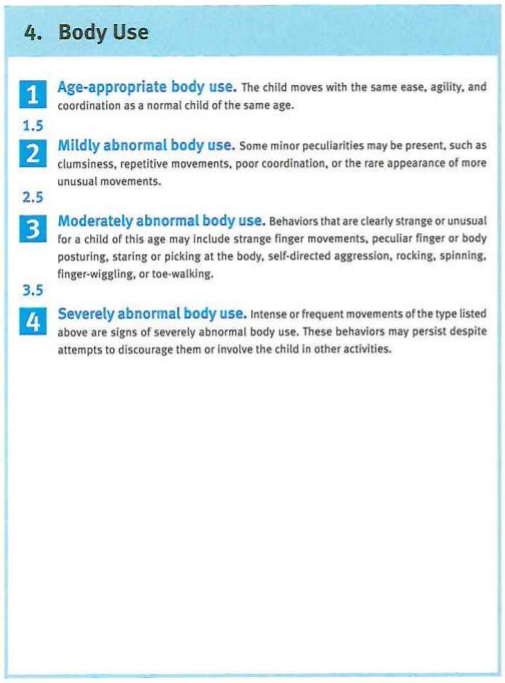
2 **Mildly abnormal emotional response.** The child occasionally displays a somewhat inappropriate type or degree of emotional reaction. Reactions are sometimes unrelated to the objects or events surrounding him or her.

2.5

3 **Moderately abnormal emotional response.** The child shows definite signs of inappropriate type and/or degree of emotional response. Reactions may be quite inhibited or excessive and unrelated to the situation; child may grimace, laugh, or become rigid even though no apparent emotion-producing objects or events are present.

3.5

4 **Severely abnormal emotional response.** Responses are seldom appropriate to the situation; once the child gets in a certain mood, it is very difficult to change the mood. Conversely, the child may show wildly different emotions when nothing has changed.



4. Body Use

1 **Age-appropriate body use.** The child moves with the same ease, agility, and coordination as a normal child of the same age.

1.5

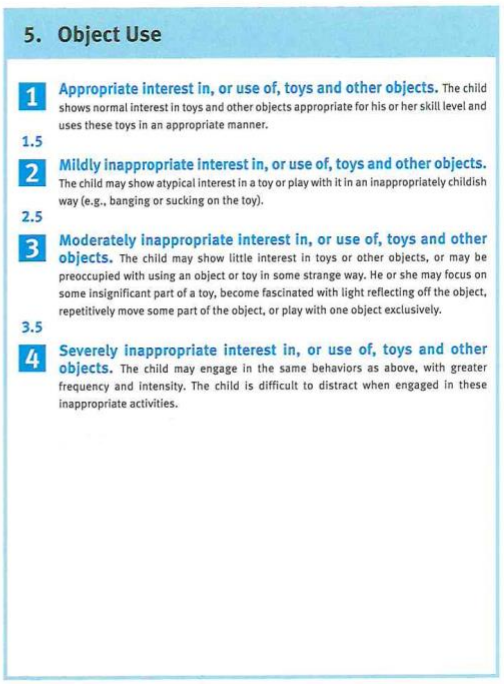
2 **Mildly abnormal body use.** Some minor peculiarities may be present, such as clumsiness, repetitive movements, poor coordination, or the rare appearance of more unusual movements.

2.5

3 **Moderately abnormal body use.** Behaviors that are clearly strange or unusual for a child of this age may include strange finger movements, peculiar finger or body posturing, staring or picking at the body, self-directed aggression, rocking, spinning, finger-wiggling, or toe-walking.

3.5

4 **Severely abnormal body use.** Intense or frequent movements of the type listed above are signs of severely abnormal body use. These behaviors may persist despite attempts to discourage them or involve the child in other activities.



5. Object Use

1 **Appropriate interest in, or use of, toys and other objects.** The child shows normal interest in toys and other objects appropriate for his or her skill level and uses these toys in an appropriate manner.

1.5

2 **Mildly inappropriate interest in, or use of, toys and other objects.** The child may show atypical interest in a toy or play with it in an inappropriately childish way (e.g., banging or sucking on the toy).

2.5

3 **Moderately inappropriate interest in, or use of, toys and other objects.** The child may show little interest in toys or other objects, or may be preoccupied with using an object or toy in some strange way. He or she may focus on some insignificant part of a toy, become fascinated with light reflecting off the object, repetitively move some part of the object, or play with one object exclusively.

3.5

4 **Severely inappropriate interest in, or use of, toys and other objects.** The child may engage in the same behaviors as above, with greater frequency and intensity. The child is difficult to distract when engaged in these inappropriate activities.

6. Adaptation to Change

1 **Age-appropriate adaptation to change.** While the child may notice or comment on changes in routine, he or she accepts these changes without undue distress.

1.5

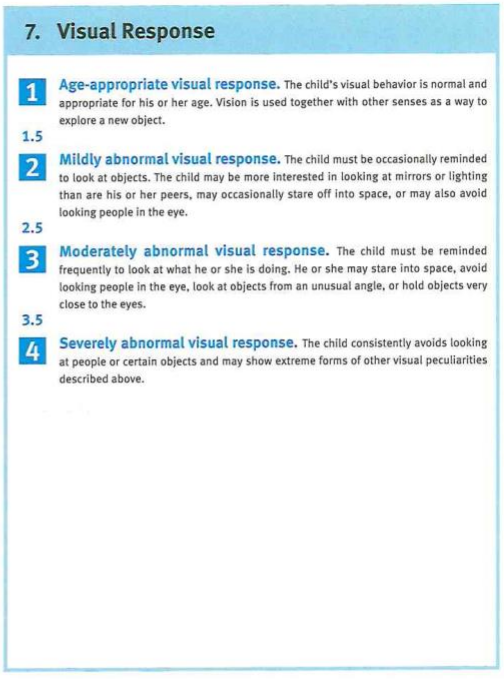
2 **Mildly abnormal adaptation to change.** When an adult tries to change tasks, the child may continue the same activity or use the same materials.

2.5

3 **Moderately abnormal adaptation to change.** The child actively resists changes in routine, tries to continue the old activity, and is difficult to distract. He or she may become angry and unhappy when an established routine is altered.

3.5

4 **Severely abnormal adaptation to change.** The child shows severe reactions to change. If a change is forced, he or she may become extremely angry or uncooperative and respond with tantrums.



7. Visual Response

1 **Age-appropriate visual response.** The child's visual behavior is normal and appropriate for his or her age. Vision is used together with other senses as a way to explore a new object.

1.5

2 **Mildly abnormal visual response.** The child must be occasionally reminded to look at objects. The child may be more interested in looking at mirrors or lighting than are his or her peers, may occasionally stare off into space, or may also avoid looking people in the eye.

2.5

3 **Moderately abnormal visual response.** The child must be reminded frequently to look at what he or she is doing. He or she may stare into space, avoid looking people in the eye, look at objects from an unusual angle, or hold objects very close to the eyes.

3.5

4 **Severely abnormal visual response.** The child consistently avoids looking at people or certain objects and may show extreme forms of other visual peculiarities described above.

3

8. Listening Response

1 **Age-appropriate listening response.** The child's listening behavior is normal and appropriate for his or her age. Listening is used together with other senses.

1.5

2 **Mildly abnormal listening response.** There may be some lack of response or mild overreaction to certain sounds. Responses to sounds may be delayed, and sounds may need repetition to catch the child's attention. The child may be distracted by extraneous sounds.

2.5

3 **Moderately abnormal listening response.** The child's responses to sounds vary; often ignores a sound the first few times it is made; may be startled or cover ears when hearing some everyday sounds.

3.5

4 **Severely abnormal listening response.** The child overreacts and/or underreacts to sounds to an extremely marked degree, regardless of the type of sound.

9. Taste, Smell, and Touch Response and Use

1 **Normal use of, and response to, taste, smell, and touch.** The child explores new objects in an age-appropriate manner, generally by feeling and looking. Taste or smell may be used when appropriate. When reacting to minor everyday pain, the child expresses discomfort but does not overreact.

1.5

2 **Mildly abnormal use of, and response to, taste, smell, and touch.** The child may persist in putting objects in his or her mouth; may smell or taste inedible objects; may ignore or overreact to mild pain that a normal child would express as discomfort.

2.5

3 **Moderately abnormal use of, and response to, taste, smell, and touch.** The child may be moderately preoccupied with touching, smelling, or tasting objects or people. The child may either react too much or too little.

3.5

4 **Severely abnormal use of, and response to, taste, smell, and touch.** The child is preoccupied with smelling, tasting, or feeling objects more for the sensation than for normal exploration or use of the objects. The child may completely ignore pain or react very strongly to slight discomfort.

10. Fear or Nervousness

1 **Normal fear or nervousness.** The child's behavior is appropriate both to the situation and for his or her age.

1.5

2 **Mildly abnormal fear or nervousness.** The child occasionally shows too much or too little fear or nervousness compared to the reaction of a normal child of the same age in a similar situation.

2.5

3 **Moderately abnormal fear or nervousness.** The child shows either quite a bit more or quite a bit less fear than is typical even for a younger child in a similar situation.

3.5

4 **Severely abnormal fear or nervousness.** Fear persists even after repeated experience with harmless events or objects. It is extremely difficult to calm or comfort the child. The child may, conversely, fail to show appropriate regard for hazards that other children of the same age avoid.

11. Verbal Communication

1 **Normal verbal communication, age and situation appropriate.**

1.5

2 **Mildly abnormal verbal communication.** Speech shows overall retardation. Most speech is meaningful; however, some echolalia or pronoun reversal may occur. Some peculiar words or jargon may be used occasionally.

2.5

3 **Moderately abnormal verbal communication.** Speech may be absent. When present, verbal communication may be a mixture of some meaningful speech and some peculiar speech such as jargon, echolalia, or pronoun reversal. Peculiarities in meaningful speech include excessive questioning or preoccupation with particular topics.

3.5

4 **Severely abnormal verbal communication.** Meaningful speech is not used. The child may make infantile squeals, weird or animal-like sounds, or complex noises approximating speech, or may show persistent, bizarre use of some recognizable words or phrases.

CARS™2-HF

Childhood Autism Rating Scale, Second Edition

Eric Schopler, Ph.D., Mary E. Van Bourgondien, Ph.D., G. Janette Wellman, Ph.D., and Steven R. Love, Ph.D.

wps.

High-Functioning Version
Rating Booklet

Name: _____ Case ID Number: _____ Test date: _____

Gender: _____ Ethnic background: _____ Rater's name: _____ Date of birth: _____

Based on information from: _____ Age: _____ years _____ months

DIRECTIONS: After rating the 15 items, transfer the ratings from the inside pages to the corresponding spaces below. Sum the ratings to obtain the Total raw score, and indicate the corresponding Severity Group. Circle the Total raw score value in the table. The number printed to the left of the value you have circled is the *T*-score.

SUMMARY

CATEGORY RATINGS

1. Social-Emotional Understanding _____
   median = 2.5
2. Emotional Expression and Regulation of Emotions _____
   median = 2.5
3. Relating to People _____
   median = 2.5
4. Body Use _____
   median = 2.0
5. Object Use in Play _____
   median = 2.0
6. Adaptation to Change/Restricted Interests _____
   median = 2.5
7. Visual Response _____
   median = 2.0
8. Listening Response _____
   median = 2.0
9. Taste, Smell, and Touch Response and Use _____
   median = 2.0
10. Fear or Anxiety _____
    median = 2.0
11. Verbal Communication _____
    median = 2.5
12. Nonverbal Communication _____
    median = 2.0
13. Thinking/Cognitive Integration Skills _____
    median = 2.0
14. Level and Consistency of Intellectual Response _____
    median = 2.0
15. General Impressions _____
    median = 2.5

Total raw score = ☐ *Note. SEM* = 0.73.

SEVERITY GROUP

☐ **Minimal-to-No Symptoms of Autism Spectrum Disorder** (15–27.5)

☐ **Mild-to-Moderate Symptoms of Autism Spectrum Disorder** (28–33.5)

☐ **Severe Symptoms of Autism Spectrum Disorder** (34 and higher)

Symptom Level Compared to Individuals With Autism Spectrum Diagnoses

Percentile	*T*-score	Raw score
	>70	>47
>97	70	47
97	69	46.5
	68	46
96	67	45.5
95	66	45
93	65	44–44.5
92	64	43.5
90	63	42.5–43
88	62	41.5–42
86	61	41
84	60	40.5
82	59	39.5–40
79	58	38.5–39
76	57	38
72	56	37.5
69	55	37
65	54	36–36.5
62	53	35.5
58	52	35
54	51	34–34.5
50	50	33–33.5
46	49	32.5
42	48	32
38	47	31.5
35	46	30.5–31
31	45	30
28	44	29.5
24	43	28.5–29
21	42	28
19	41	27.5
16	40	27
14	39	26.5
12	38	26
10	37	25–25.5
8	36	24.5
7	35	24
6	34	23.5
5	33	23
4	32	22–22.5
3	31	21.5
2	30	21
	29	20.5
1	28	20
<1	27	19.5
	26	19
	25	
	24	18.5
	23	
	22	
	21	
	20	18
	<20	<18

Note. SEM = 2.87.

Additional copies of this form (W-472B) may be purchased from WPS. Please contact us at **800.648.8857** or **www.wpspublish.com**.

W-472B

DIRECTIONS

For each category, use the space provided in the *Observations* section for taking notes concerning the behaviors relevant to that item. After you finish the direct observation and have gathered infomation from an intreview of a parent or someone else who can give information about the person's early development and current functioning across settings, rate the behaviors by circling the statement that best describes the person's condition. You may indicate that the individual's behavior falls between two descriptions by using ratings of 1.5, 2.5, or 3.5. Abbreviated rating criteria are presented for each item. See chapter 3 of the Manual for detailed rating criteria.

1. Social-Emotional Understanding

Social-emotional understanding addresses a person's *cognitive* understanding of others' communication, behaviors, and differing perspectives. The dimensions of social understanding that are included in this item are the ability to read the nonverbal cues of others and the ability to take another person's perspective. This item does not reflect whether someone has friends or is in a relationship. Rather, it deals with a person's ability to perceive and articulate how another person may feel or what his or her perspective may be on a given situation.

1 **Age-appropriate social-emotional understanding.** Clearly understands facial expressions, gestures, tone of voice, and body language of others. Able to understand that others may have a different perspective and what that perspective may be.

1.5

2 **Mildly impaired social-emotional understanding.** Responsive to most facial expressions and expressions of emotion in others' gestures and body language, but these cues may need to be slightly exaggerated. More subtle expressions such as mild sarcasm, doubt, or ambiguity are sometimes not understood. The ability to take another's perspective is inconsistent.

2.5

3 **Moderately impaired social-emotional understanding.** Shows an understanding of facial expressions, tone of voice, and body language only when these cues are exaggerated. Is likely to ignore or misunderstand expression or perspective of others.

3.5

4 **Severely impaired social-emotional understanding.** Demonstrates virtually no ability to understand appropriate facial expressions, gestures, tone of voice, or body language. Unable to recognize that the perspective, understanding, or expression of others might differ.

2. Emotional Expression and Regulation of Emotions

This item refers to the capacity to express feelings and regulate one's emotions. This item is based on both direct observation and the reports of others who have witnessed this person's behavior in other settings.

1 **Age-appropriate and situation-appropriate emotional response.** Shows appropriate type and degree of emotional response, both by word and behavior, including emotional variation such as happy, sad, proud, angry, scared, anxious, and related internal states.

1.5

2 **Mildly abnormal emotional response.** Emotional expressions are relatively flat, distorted, or slightly exaggerated. Nonverbal expression of emotions does not always match verbal content. Able to describe several emotions in self but limited compared to developmental level. May have intermittent emotional regulation problems.

2.5

3 **Moderately abnormal emotional response.** Expression of emotions is flat, excessive, or frequently inconsistent with situation or content of verbalized topic. May display greater emotion than expected about special interest or idiosyncratic concerns. Ability to describe or understand emotional states in self is limited. Serious problems with emotional regulation that occur frequently in at least one setting.

3.5

4 **Severely abnormal emotional response.** Extreme problems with emotional regulation that occur in more than one setting. Responses are extreme or seldom appropriate to situation or content of discussion. Shows extreme mood shifts that are difficult to change. Expresses only a few emotions in their exaggerated form, or perseverates on a particular emotion without understanding.

2

3. Relating to People

This item is related to the first two items, which also rate aspects of social relationships. This item differs in that it is confined to dimensions related to direct interpersonal interactions and the person's expression and reaction to another person. The two dimensions that are rated in this item are the person's initiation of interactions and the reciprocal nature of the interactions.

1 **No evidence of difficulty or abnormality in relating to people.** Age-appropriate *initiation of interactions* to get help, to have needs met, and for purely *social purposes*. Interactions with others are fluid and show a *reciprocal*, back-and-forth pattern.

1.5

2 **Mildly abnormal relationships.** Initiates interactions only to get obvious needs met or around special interests. Some give-and-take noted in interactions, but lacks consistency or fluidity or appropriateness. Aware of other people of same age and interested in interactions, but may have difficulty initiating or managing interactions. Minimal initiation for purely social purposes that does not involve special interests.

2.5

3 **Moderately abnormal relationships.** Initiates interactions almost totally around his or her special interests, with little attempt to engage others in these interests. Responds to overtures from others, but lacks social give-and-take or responds in ways that are unusual and not always related to original overtures. Unable to maintain an interaction beyond initial overtures.

3.5

4 **Severely abnormal relationships.** Does not initiate any directed interactions and shows minimal response to overtures from others. Only the most persistent attempts to get the person to engage have any effect.

4. Body Use

This item represents grossly deviant body movements and also subtler forms of fine motor and coordination problems. Any obvious current deviant behaviors—including posturing, spinning, rocking, toe-walking, and self-directed aggression—automatically merit a rating of 3 or higher, depending on the persistence of the behavior. Difficulties with handwriting and tying shoes are rated on this item, with higher ratings given for problems that are so severe that the person actively resists these tasks. While this item can be scored using another's report, it is best to base your rating on current behavior. Directly observed behaviors should be given more weight than those from another's report.

1 **Age-appropriate body use.** Moves with the same ease, agility, and coordination as a typical person of the same age.

1.5

2 **Mildly abnormal body use.** Some minor peculiarities may be present, such as clumsiness, repetitive movements, poor coordination, or poor balance. May have fine motor difficulties, such as problems with handwriting or tying shoes, compared to others at the same developmental level.

2.5

3 **Moderately abnormal body use.** Currently displays *any* unusual body posture or stance, hand or finger mannerism, flapping, self-directed aggression, picking at body, rocking, spinning, or toe-walking. Fine motor difficulties or obvious handwriting difficulties are present, which may result in resistance to writing tasks.

3.5

4 **Severely abnormal body use.** Intense or frequent movements of the type listed above are signs of severely abnormal body use.

5. Object Use in Play

This rating includes the person's interest in and use of objects. In addition to the traditional issues related to repetitive play with parts of objects, the focus of this item also includes the degree to which the person engages in imaginative symbolic play and the degree to which toy figures are used as agents. For older persons, the rating may need to be based on the parent interview. Any obvious inappropriate or repetitive use of objects or obvious interest in parts of objects as opposed to the whole should be rated 3 or higher, depending on the persistence.

1 **Appropriate interest in, and creative use of, toys and other objects.** Able to spontaneously use toys in age-appropriate imaginative symbolic play and able to use objects to represent something else. He or she shows interest in a variety of toys and leisure materials.

1.5

2 **Mildly inappropriate interest in, or use of, toys and other objects.** Play or imaginative themes tend to be repetitive or appear to reflect things seen in movies or on TV. Some use of toy people as agents, for example, has an action figure or doll use other play materials. Some make-believe play or use of objects to represent something else. Responds to others' attempts to engage him or her in pretend play, but limited spontaneous initiation of imaginative play. Interests may be unusual in intensity or inappropriate for age. No obvious repetitive or inappropriate use of objects, such as twirling or spinning, or interest in parts of objects at this level.

2.5

3 **Moderately inappropriate interest in, or use of, toys and other objects.** Limited imaginative creative play, either spontaneously or in response to others. People typically not used as agents, and limited use of objects to represent other things. No original themes in play. May show some repetitive, inappropriate use of objects or interest in parts of objects. Interest in play or novelty materials restricted to a few items and may be inappropriate for age or of an unusual intensity.

3.5

4 **Severely inappropriate interest in, or use of, toys and other objects.** No creative play. Toys or other novelty items are used in repetitive or inappropriate manner.

6. Adaptation to Change/Restricted Interests

This item includes difficulty coping with change, ritualistic behaviors, and restricted special interests. The rating is based on the most severe level of difficulty in any one specific area.

1 **Age-appropriate response to change/variety of interests.** May notice or comment on changes in routines, but accepts these changes without undue stress. Shows a wide variety of interests, with no single interest or theme predominating.

1.5

2 **Mildly abnormal adaptation to change/variety of interests.** Unusually quick to develop new routine or, when others try to change task, the person may continue the same activity or use the same materials, though he or she can be directed to change if needed. *OR*, person shows preference for specific activities or toys or topics of conversation, though can be directed to other topics.

2.5

3 **Moderately abnormal adaptation to change/variety of interests.** Has definite special interests or preferences for specific activities, toys, objects, or topics. Adult needs to actively work to engage him or her in other topics or activities. Shows displeasure and may resist change or try to maintain routine. May become distressed by attempts to interrupt or change topic or activity. May have rituals or routines that have to be done in a particular way. May report subjective feelings of distress about change or interruptions, or may become overly fixed on schedule, checklist, or timing of events.

3.5

4 **Severely abnormal adaptation to change/variety of interests.** Has definite special interests or preferences, or has severe reaction to change. Reacts with extreme anxiety, anger, or resistance to attempts to change activity or topic or routine.

7. Visual Response

This item covers use of vision in three areas: visual fascinations, the ease with which the person can shift visual attention, and the degree to which the person's eye contact is integrated with actions and communication.

1 **Age-appropriate visual response.** Visual behavior is normal and appropriate for his or her age. Eye contact is good and integrated with verbal and nonverbal communication skills. Easily shifts visual attention.

1.5

2 **Mildly abnormal visual response.** May stare inappropriately at others. Eye contact is not consistently integrated with verbalizations. Included at this level is any inconsistency in eye contact, regardless of the proportion of time he or she makes eye contact. May show more interest than is typical in describing small details in room or in looking at specific objects, such as moving parts, lights, or mirrors.

2.5

3 **Moderately abnormal visual response.** Eye contact is not integrated with verbalizations. Obvious visual fascination with objects, lights, mirrors, spinning toys, and so on. May use peripheral vision to look at things. Obvious difficulty shifting visual attention from high-interest items.

3.5

4 **Severely abnormal visual response.** Persistent avoidance of eye contact. Excessive interest in looking at specific objects or in looking at objects in a peculiar way.

8. Listening Response

This rating is based on the person's response to sounds and how the listening response is coordinated with the use of other senses. The person's response to his or her own name is scored on this item. Emphasis is placed on unusual over- or underinterest in sounds, as opposed to distractibility. Older individuals should be asked directly about this item.

1 **Age-appropriate listening response.** Listening behavior is normal and appropriate for his or her age. Listening is used together with other senses; for example, child looks toward person who is speaking. Person responds to name.

1.5

2 **Mildly abnormal listening response.** Some difficulty responding to verbalizations when background noise present. Responds to name after repeated attempts to get attention. There may be some lack of response or mild overreaction to certain sounds. Atypical listening responses are apparent either in direct observation or by report from outside witness, but not both.

2.5

3 **Moderately abnormal listening response.** Responses to sounds or verbalizations are inconsistent. May show marked reaction to some sounds or complete disregard for others. Seldom responds to name as a means of getting attention. Unusual responses are obvious across settings, based on some combination of direct report of person, witness report, and direct observation.

3.5

4 **Severely abnormal listening response.** Overreacts or underreacts to sounds to an extremely marked degree. Is noticeably less responsive to verbalizations than to noises made by objects. Does not respond to repeated attempts to get his or her attention by calling his or her name. Unusual responses are evident across settings.

5

Appendix G: Parenting Stress Index, 4th Edition, Short Form

Answer Sheet

SHORT FORM

Name _____ Gender _____ Date of birth ___/___/___

Ethnic group _____ Marital status _____ Today's date ___/___/___

Child's name _____ Child's gender _____ Child's date of birth ___/___/___

SA = Strongly Agree	A = Agree	NS = Not Sure	D = Disagree	SD = Strongly Disagree

1.	I often have the feeling that I cannot handle things very well.	SA	A	NS	D	SD
2.	I find myself giving up more of my life to meet my children's needs than I ever expected.	SA	A	NS	D	SD
3.	I feel trapped by my responsibilities as a parent.	SA	A	NS	D	SD
4.	Since having this child, I have been unable to do new and different things.	SA	A	NS	D	SD
5.	Since having a child, I feel that I am almost never able to do things that I like to do.	SA	A	NS	D	SD
6.	I am unhappy with the last purchase of clothing I made for myself.	SA	A	NS	D	SD
7.	There are quite a few things that bother me about my life.	SA	A	NS	D	SD
8.	Having a child has caused more problems than I expected in my relationship with my spouse/ parenting partner.	SA	A	NS	D	SD
9.	I feel alone and without friends.	SA	A	NS	D	SD
10.	When I go to a party, I usually expect not to enjoy myself.	SA	A	NS	D	SD
11.	I am not as interested in people as I used to be.	SA	A	NS	D	SD
12.	I don't enjoy things as I used to.	SA	A	NS	D	SD
13.	My child rarely does things for me that make me feel good.	SA	A	NS	D	SD
14.	When I do things for my child, I get the feeling that my efforts are not appreciated very much.	SA	A	NS	D	SD
15.	My child smiles at me much less than I expected.	SA	A	NS	D	SD
16.	Sometimes I feel my child doesn't like me and doesn't want to be close to me.	SA	A	NS	D	SD
17.	My child is very emotional and gets upset easily.	SA	A	NS	D	SD
18.	My child doesn't seem to learn as quickly as most children.	SA	A	NS	D	SD
19.	My child doesn't seem to smile as much as most children.	SA	A	NS	D	SD
20.	My child is not able to do as much as I expected.	SA	A	NS	D	SD
21.	It takes a long time and it is very hard for my child to get used to new things.	SA	A	NS	D	SD
22.	I feel that I am: (Choose a response from the choices below.)		2	3	4	5

1. a very good parent.
2. a better-than-average parent.
3. an average parent.
4. a person who has some trouble being a parent.
5. not very good at being a parent.

23.	I expected to have closer and warmer feelings for my child than I do, and this bothers me.	SA	A	NS	D	SD
24.	Sometimes my child does things that bother me just to be mean.	SA	A	NS	D	SD

SA = Strongly Agree	A = Agree	NS = Not Sure	D = Disagree	SD = Strongly Disagree

25. My child seems to cry or fuss more often than most children. ..... SA A NS D SD
26. My child generally wakes up in a bad mood. ..... SA A NS D SD
27. I feel that my child is very moody and easily upset. ..... SA A NS D SD
28. Compared to the average child, my child has a great deal of difficulty in getting used to changes in schedules or changes around the house. ..... SA A NS D SD
29. My child reacts very strongly when something happens that my child doesn't like. .. SA A NS D SD
30. When playing, my child doesn't often giggle or laugh. ..... SA A NS D SD
31. My child's sleeping or eating schedule was much harder to establish than I expected. SA A NS D SD
32. I have found that getting my child to do something or stop doing something is:

(Choose a response from the choices below.) 1 2 3 4 5

1. much harder than I expected.
2. somewhat harder than I expected.
3. about as hard as I expected.
4. somewhat easier than I expected.
5. much easier than I expected.

33. Think carefully and count the number of things which your child does that bothers you. For example, dawdles, refuses to listen, overactive, cries, interrupts, fights, whines, etc.
(Choose a response from the choices below.) 1 2 3 4 5

1. 1-3
2. 4-5
3. 6-7
4. 8-9
5. 10+

34. There are some things my child does that really bother me a lot. ..... SA A NS D SD
35. My child's behavior is more of a problem than I expected. ..... SA A NS D SD
36. My child makes more demands on me than most children. ..... SA A NS D SD

Appendix H: Parenting Sense of Competence Scale

ID: _____ Date: _____

On this questionnaire are 16 items relating to your feelings about being a parent. Please read each item carefully and rate whether you feel it applies to you, by circling a number from 1 (strongly agree) to 6 (strongly disagree) on the scale.

The rating scale is as follows:

1 Strongly agree
2 Agree
3 Mildly agree
4 Mildly disagree
5 Disagree
6 Strongly disagree

1.	The problems of taking care of a child are easy to solve once you know how your actions affect your child, an understanding I have acquired.	1	2	3	4	5	6
2.	Even though being a parent could be rewarding, I am frustrated now while my child is at his/her present age.	1	2	3	4	5	6
3.	I go to bed the same way I wake up in the morning – feeling I have not accomplished a whole lot.	1	2	3	4	5	6
4.	I do not know what it is, but sometimes when I'm supposed to be in control, I feel more like the one being manipulated.	1	2	3	4	5	6
5.	My mother/father was better prepared to be a good mother/father than I am.	1	2	3	4	5	6
6.	I would make a fine model for a new mother/father to follow in order to learn what she/he would need to know in order to be a good parent.	1	2	3	4	5	6
7.	Being a parent is manageable, and any problems are easily solved.	1	2	3	4	5	6
8.	A difficult problem in being a parent is not knowing whether you're doing a good job or a bad one.	1	2	3	4	5	6
9.	Sometimes I feel like I'm not getting anything done.	1	2	3	4	5	6

10.	I meet my own personal expectations for expertise in caring for my child.	1	2	3	4	5	6
11.	If anyone can find the answer to what is troubling my child, I am the one.	1	2	3	4	5	6
12.	My talents and interests are in other areas, not in being a parent.	1	2	3	4	5	6
13.	Considering how long I've been a mother/father, I feel thoroughly familiar with this role.	1	2	3	4	5	6
14.	If being a mother/father of a child were only more interesting, I would be motivated to do a better job as a parent.	1	2	3	4	5	6
15.	I honestly believe I have all the skills necessary to be a good mother/father to my child.	1	2	3	4	5	6
16.	Being a parent makes me tense and anxious.	1	2	3	4	5	6

Appendix I: Eyberg Child Behavior Inventory

Construct: Conduct Problems

Scale Name: Eyberg Child Behavior Inventory (ECBI)

Developers: Eyberg, S.

Items:
Below are a series of phrases that describe children's behavior. Please (1) circle the number describing how often the behavior currently occurs with your child, and (2) circle either "yes" or "no" to indicate whether the behavior is currently a problem.

How often does this occur with your child?

Never Seldom Sometimes Often Always								Is this a problem for you?	
1. Dawdles in getting dressed	1	2	3	4	5	6	7	Yes	No
2. Dawdles or lingers at mealtime	1	2	3	4	5	6	7	Yes	No
3. Has poor table manners	1	2	3	4	5	6	7	Yes	No
4. Refuses to eat food presented	1	2	3	4	5	6	7	Yes	No
5. Refuses to do chores when asked	1	2	3	4	5	6	7	Yes	No
6. Slow in getting ready for bed	1	2	3	4	5	6	7	Yes	No
7. Refuses to go to bed on time	1	2	3	4	5	6	7	Yes	No
8. Does not obey house rules on own	1	2	3	4	5	6	7	Yes	No
9. Refuses to obey until threatened with punishment	1	2	3	4	5	6	7	Yes	No
10. Acts defiant when told to do something	1	2	3	4	5	6	7	Yes	No
11. Argues with parents about rules	1	2	3	4	5	6	7	Yes	No
12. Gets angry when doesn't get own way	1	2	3	4	5	6	7	Yes	No
13. Has temper tantrums	1	2	3	4	5	6	7	Yes	No
14. Sasses adults	1	2	3	4	5	6	7	Yes	No
15. Whines	1	2	3	4	5	6	7	Yes	No
16. Cries easily	1	2	3	4	5	6	7	Yes	No
17. Yells or screams	1	2	3	4	5	6	7	Yes	No
18. Hits parents	1	2	3	4	5	6	7	Yes	No
19. Destroys toys and other projects	1	2	3	4	5	6	7	Yes	No
20. Is careless with toys and other objects	1	2	3	4	5	6	7	Yes	No
21. Steals	1	2	3	4	5	6	7	Yes	No
22. Lies	1	2	3	4	5	6	7	Yes	No
23. Teases or provokes other children	1	2	3	4	5	6	7	Yes	No
24. Verbally fights with friends own age	1	2	3	4	5	6	7	Yes	No
25. Verbally fights with sisters and brothers	1	2	3	4	5	6	7	Yes	No
26. Physically fights with friends own age	1	2	3	4	5	6	7	Yes	No
27. Physically fights with sisters and brothers	1	2	3	4	5	6	7	Yes	No
28. Constantly seeks attention	1	2	3	4	5	6	7	Yes	No
29. Interrupts	1	2	3	4	5	6	7	Yes	No
30. Is easily distracted	1	2	3	4	5	6	7	Yes	No
31. Has short attention span	1	2	3	4	5	6	7	Yes	No
32. Fails to finish tasks or projects	1	2	3	4	5	6	7	Yes	No
33. Has difficulty entertaining self alone	1	2	3	4	5	6	7	Yes	No
34. Has difficulty concentrating on one thing	1	2	3	4	5	6	7	Yes	No
35. Is overactive or restless	1	2	3	4	5	6	7	Yes	No
36. Wets the bed	1	2	3	4	5	6	7	Yes	No

Appendix J: Parent Training Knowledge Questionnaire

In the first column, please rate how knowledgeable you are in each of these areas as it relates to your child's primary behavioral problem. In the second column, please rate how much your knowledge increased as a result of this experience. For both columns, please use the following scale:

	How much do I know about this?				**How much has my knowledge increased?**			
	Not Much			Very Much	Not Much			Very Much
1. My child's characteristics of autism.	1	2	3	4	1	2	3	4
2. How behavioral strategies can help address my child's autism characteristics.	1	2	3	4	1	2	3	4
3. How different clinicians and treatments may impact the way my child learns.	1	2	3	4	1	2	3	4
4. How and why my child may think or behave in certain ways.	1	2	3	4	1	2	3	4
5. How to determine the reasons or motives behind my child's behavior.	1	2	3	4	1	2	3	4
6. How to decrease negative behavior in my child.	1	2	3	4	1	2	3	4
7. How to increase positive behavior in my child.	1	2	3	4	1	2	3	4
8. How to use visual supports to increase my child's understanding of expectations.	1	2	3	4	1	2	3	4
9. How to identify and implement reinforcements to improve my child's behavior.	1	2	3	4	1	2	3	4
10. How to identify environmental challenges that will interfere with my child's behaviors and use prevention strategies.	1	2	3	4	1	2	3	4
11. How to explain to others what supports help my child perform their best.	1	2	3	4	1	2	3	4
12. How to explain to others what environmental challenges will interfere with my child's behaviors.	1	2	3	4	1	2	3	4
13. How to utilize effective commands with my child to improve compliance.	1	2	3	4	1	2	3	4
14. How to utilize consistency with my child.	1	2	3	4	1	2	3	4
15. How to assess possible causes of my child's problem behaviors (ABC's of behavior).	1	2	3	4	1	2	3	4
16. How to develop a behavior plan to address my child's problem behaviors.	1	2	3	4	1	2	3	4
17. How to use data to monitor my child's progress and re-evaluate goals.	1	2	3	4	1	2	3	4
18. How to teach new skills to my child.	1	2	3	4	1	2	3	4

Appendix K: *Treks* Telehealth Satisfaction Survey

	Excellent (4)	Good (3)	Fair (2)	Poor (1)
1. The quality of using telehealth (the *Treks* mobile app).	☐	☐	☐	☐
2. The video quality of using telehealth (the *Treks* mobile app).	☐	☐	☐	☐
3. Your personal comfort in using telehealth (the *Treks* mobile app).	☐	☐	☐	☐
4. The length of time spent on the *Treks* mobile app.	☐	☐	☐	☐
5. The explanation of your treatment by the consultant during your Zoom consultation session.	☐	☐	☐	☐
6. The thoroughness, carefulness, and skillfulness of the consultant during your Zoom consultation session.	☐	☐	☐	☐
7. The courtesy, respect, sensitivity, and friendliness of the consultant during your Zoom consultation session.	☐	☐	☐	☐
8. How well your privacy was respected.	☐	☐	☐	☐

9. Overall, how satisfied were you with the way telehealth service (the *Treks* mobile app) was provided?

☐ Very satisfied (5)
☐ Somewhat satisfied (4)
☐ Neither satisfied nor dissatisfied (3)
☐ Somewhat dissatisfied (2)
☐ Very dissatisfied (1)

10. Please provide any additional comments or feedback below.

Appendix L: Acceptability, Appropriateness, and Feasibility of Implementation

Response Scale:
1 = Completely disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Completely agree

Scoring Instructions: Scales can be created for each measure by averaging responses. Scale values range from 1 to 5. No items need to be reverse coded.

Acceptability of Intervention Measure (AIM)

1) [Triple P/Implementation Strategy] meets my approval.
2) [Triple P/Implementation Strategy] is appealing to me.
3) I like [Triple P/Implementation Strategy].
4) I welcome [Triple P/Implementation Strategy].

Intervention Appropriateness Measure (IAM)

1) [Triple P/Implementation Strategy] seems fitting.
2) [Triple P/Implementation Strategy] seems suitable.
3) [Triple P/Implementation Strategy] seems applicable.
4) [Triple P/Implementation Strategy] seems like a good match.

Feasibility of Intervention Measure (FIM)

1) [Triple P/Implementation Strategy] seems implementable.
2) [Triple P/Implementation Strategy] seems possible.
3) [Triple P/Implementation Strategy] seems doable.
4) [Triple P/Implementation Strategy] seems easy to use.

Note: The bracketed areas that read [Triple P/Implementation Strategy] was replaced with "The *Treks* app."

Appendix M: Fidelity of Consultation Session

Date of session:

Length of session: _____ min

Consultants (list all names):

Which and how many parents were present?

Which condition were they randomized to? Circle one: TH or CC

---

1. How many of the stated evidence-based principles for the session did the consultants(s) review?

# of principle met/ # of principles total = _____ / _____

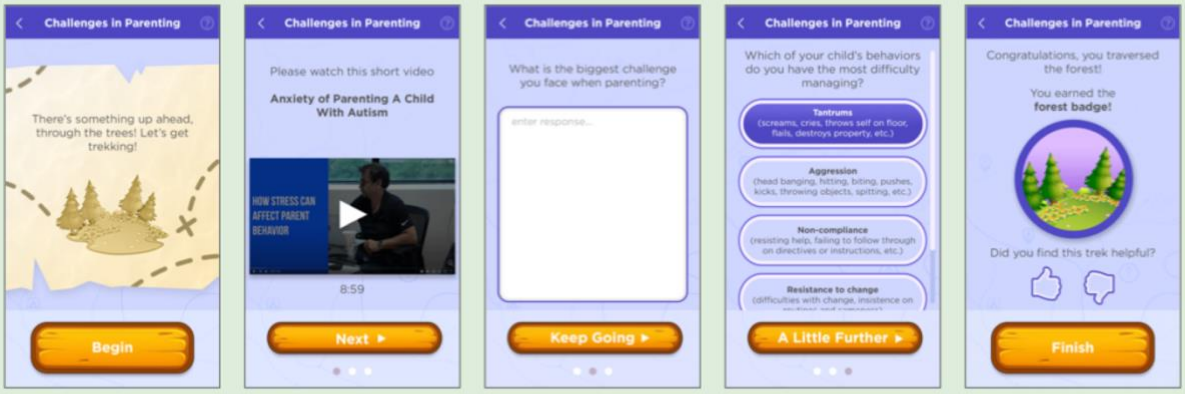
2. Did the consultant(s) explain or preview the session agenda at start of session?
   0 = NO
   1 = YES

3. Did the consultant review the *Treks* app (TH) or the *Treks* web page (CC) with the family?
   0 = NO
   1 = YES

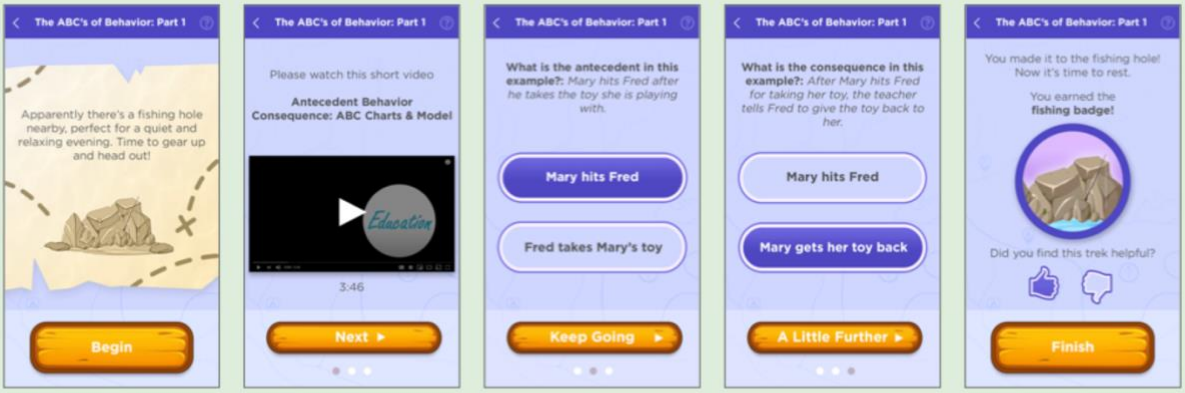
4. How would you describe the engagement between the parent (s) and the consultant during the session?
   1 = Very poor (e.g., no responding to questions or materials that are posed)
   2 = Less than ideal (e.g., partial responding to questions that are posed)
   3 = Average (e.g. responds to questions that are posed, seem to understand concepts covered)
   4 = Good (e.g., parent asks at least one question or provides elaboration or example, brings up new information or content)

Appendix N: *Treks* Application Platform Samples

Sample Trek
Challenges in Parenting



Sample Trek
The ABC's of Behavior: Part 1



Sample Trek
Recap of the ABC's

Appendix O: Consent Form

Title of Research Study: Providing Telehealth Support for Parents of Children with Autism Spectrum Disorder (ASD) Using A Mobile App (IRB-20-676)

Principal Investigators: Angela Dahiya, M.S., Department of Psychology, Virginia Polytechnic Institute and State University; email: avdahiya@vt.edu

Angela Scarpa, Ph.D., Department of Psychology, Virginia Polytechnic Institute and State University; phone: (540) 231-2615; email: ascarpa@vt.edu.

Key Information: The following is a short summary of this study to help you decide whether or not to be a part of this study. More detailed information is listed later on in this form.

Why am I being invited to take part in a research study? We invite you and your child to take part in a research study by Angela Dahiya, M.S. and Angela Scarpa, Ph. D. from the Department of Psychology at Virginia Tech and the Virginia Tech Autism Clinic & Center for Autism Research (VTAC/CAR). You and your child were selected because you indicated that your child has a diagnosis of Autism Spectrum Disorder (ASD) and that you are seeking behavioral support for him/her.

What should I know about being in a research study?

- Someone will explain this research study to you
- Whether or not you take part is up to you
- You can choose not to take part
- You can agree to take part and later change your mind
- Your decision will not be held against you
- You can ask all the questions you want before you decide

Why is this research being done? ASD is a neurodevelopmental disorder that presents many challenges for parents and service providers while impacting a child's developmental trajectory across several domains, including disruptive behaviors. Unfortunately, due to limited access and affordability of care, especially during the COVID-19 pandemic or other situations that require people to stay at home, in-person treatment is not always feasible. Additionally, rural or underserved communities may face additional access barriers, such as geographic isolation and lack of ASD-specific resources. Accessibility of ASD treatment may be expanded through the use of telehealth supports, such as the use of mobile applications to supplement therapy or parent consultation. Furthermore, when implementing parent-focused telehealth supports for children with ASD, the ability to decrease child problem behaviors while improving parent competence, knowledge of behavioral management techniques, and parenting stress are crucial.

How long will the research last and what will I need to do? The proposed study aims to adapt a behavior consultation mobile application to improve telehealth support for parents of children with ASD (from ages 3-13 years), and investigate the feasibility of using this application. Participants who consent and complete the 30-min phone screen will undergo an intake appointment via HIPPA-compliant Zoom (lasting about 1-1.5 hours) to confirm their child's ASD diagnosis and presence of behavioral difficulties and will also be asked to complete a brief set of baseline surveys. The participants will be randomly assigned to a one-session telehealth consultation via HIPPA-compliant Zoom (lasting 2-3 hours) with the enhancement of a mobile application over the course of 28 days or the one-session telehealth consultation via HIPPA-compliant Zoom (lasting 2-3 hours) with access to a mobile application with behavioral management resources over the course of 28 days. We expect that full participation (including the screening/intake process) in this research study will last up to 6 weeks total.

Is there any way this study could be bad for me? Risks are no more thank would be expected in everyday life. More details about the risks of this study can be found under, "**Is there any way being in this study could be bad for me? (Detailed Risks)**

Will being in this study help me in any way? We cannot promise any direct benefits to you or others from your taking part in this research. However, the hope is that the use of the mobile application will be received positively by parents and will improve pre- to post- child and parenting outcomes, which are possible benefits.

What happens if I do not want to be in this research?

Participation in research is completely up to you. You can decide to participate or not to participate. There are no alternative options to participation in this study.

Detailed Information: The following is more information about this study in addition to the information listed above.

Who can I talk to?

If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at (540) 231-2615 or email autism@vt.edu.

This research has been reviewed and approved by the Virginia Tech Institutional Review Board (IRB). You may communicate with them at (540) 231-3732 or irb@vt.edu if:

- You have questions about your rights as a research subject
- Your questions, concerns, or complaints are not being answered by the research team
- You cannot reach the research team
- You want to talk to someone besides the research team to provide feedback about this research

How many people will be studied?

In total, we plan to include about 20 children and their parent(s) in this research study.

What happens if I say yes, I want to be in this research and what are my responsibilities if I take part in this research?

If you take part in this research, you will be responsible to do the following:

Complete a brief set of baseline surveys and an intake appointment to confirm ASD diagnosis: If and when you electronically sign this consent form, you will then be directed to complete surveys online after reviewing this consent form, which will ask about you and your child, as well as medical and developmental history. These measures will be used as a screener to confirm your child's ASD diagnosis, in addition to a 1-1.5 hour intake appointment via HIPPA-compliant Zoom. We will also have you complete surveys to gather information about your child's behaviors as well as your knowledge and feelings as it relates to your ability to manage their behaviors. These surveys will take about 30-45 minutes to complete.

Complete a behavioral consultation session: Once your child's ASD diagnosis is confirmed, we will schedule a 2-3 hour consultation session via HIPPA-compliant Zoom to discuss common evidence-based practices from established interventions that target problem behaviors. The principles reviewed will include the following: the ABCs of behavior, prevention, strategies, visual schedules, reinforcement, planned ignoring, replacement behaviors, compliance training, teaching techniques, and generalization and maintenance of behaviors.

Post-consultation surveys: After the consultation session, you will be asked to complete another set to surveys to gather information about your child's behaviors as well as your knowledge and feelings as it relates to your ability to manage their behaviors These surveys should take about 20 minutes to complete.

Complete a one-month telehealth support program: We will randomly select parents of children who are eligible for the study to be in one of two groups (1) one month (28 days) of telehealth support with the *Treks* mobile application, using established evidence-based principles or (2) one month of access to a *Treks* mobile application with an overview of the evidence-based principles that are included in *Treks* application.

Post-telehealth support program surveys: You will complete a final set of surveys that will once again gather information about your child's behaviors as well as your knowledge and feelings as it relates to your ability to manage their behaviors. We will ask you to complete a telehealth satisfaction questionnaire to report your thoughts about using the telehealth platform. This should take about 30 minutes to complete.

The type of telehealth program/group you get will be chosen by chance, like flipping a coin. Neither you nor the study investigator will choose what program you get. You will have a 1 in 2 chance of being given the (1) telehealth support with the *Treks* mobile application, using established evidence-based principles or (2) access to a *Treks* mobile application with an overview of the evidence-based principles that are included in *Treks* application.

What happens if I say yes, but I change my mind later?

You can leave the research study at any time, for any reason, and it will not be held against you. Parents and children have the right not to answer any questions or respond to any part of this study. If you decide to stop being in the research study, you may request to have your identifiable data removed from our database.

Is there any way being in this study could be bad for me? (Detailed Risks)

There are no more than minimal risks involved for you and your child to participate in this study. Some of the potential risks include:

i. Parents might feel discomfort and stress about their child's behaviors. Parents are encouraged to reach out to the clinic to ask questions and talk about any concerns.

ii. Children may become upset or frustrated while working on the behavioral strategies with their parents.

iii. Participating in this study requires the time to complete the telehealth mobile application with brief daily tasks the course of 28 days.

iv. Researchers must report questions of child abuse, thoughts of self-harm, or thoughts of harming others to the police or Child Protective Services.

What happens to the information collected for the research?

We will make every effort to limit the use and disclosure of your personal information, including research study and medical records, only to people who have a need to review this information. We cannot promise complete confidentiality. Organizations that may inspect and copy your information include the IRB, Human Research Protection Program, and other authorized representatives of Virginia Tech.

All telehealth support will be conducted by graduate student clinicians and will be supervised by Dr. Angela Scarpa. As such, some sessions will be video recorded for training and supervision purposes. Upon entry into the study, you and your child will be given a unique confidential code number. Information from surveys, behavioral data, and videos will be kept in a de-identified format (i.e., with the code number). No identifiable paper documentation will be stored by the study staff at their homes. During the initial consultation session, digital records will be temporarily stored on an online secure server. Once we can safely return to the university, digital recordings and all data will be transferred to a password-protected computer at VTAC/CAR on a secure server. Unless otherwise specified, only staff working directly with subjects will have access to individually identifiable private information or the link between identifiable information and your code number. The link between any identifiable information and research code number will be destroyed when this study is closed.

Any information obtained during this research that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Situations where confidentiality must be broken due to mandated reporting include: 1) if a previously unreported incident of child abuse is known or strongly suspected or 2) if a participant is believed to be a threat to him/herself or others. In these cases, the investigator must notify appropriate authorities, and you will be informed of the need to report. The authorities would be provided the information about the possibility of harm to the child or others that was obtained during the research.

Video-recordings of all visits will be kept by VTAC/CAR indefinitely for training purposes. Any video recordings may be temporarily stored on a secure online server, from which study staff cannot download files to local computers, until the study staff is allowed to return to the clinic to

store them on the university server. Information from this study will not be released to anyone without your written consent, except under the conditions listed above. Results may be published, shared, or presented for scientific purposes, but your or your child's identity will not be shown in any description or publication of this research.

If identifiers are removed from your private information or samples that are collected during this research, that information or those samples could be used for future research studies or distributed to another investigator for future research studies without your additional informed consent. The results of this research study may be presented in summary form at conferences, in presentations, reports to the sponsor, academic papers, and as part of a thesis/dissertation.

The sponsor, monitors, auditors, the IRB, the FDA will be granted direct access to your medical records to conduct and oversee the research. By signing this document you are authorizing this access. We might publish the results of this research. However, we will keep your name and other identifying information confidential.

In compliance with the National Institute of Health (NIH), a description of all clinical trial study procedures and study results will be posted publicly on ClinicalTrials.gov, but will not include your personal information.

_____ Parent/legal guardian initials here indicate consent to be contacted about future research opportunities at Virginia Tech. If you consent to be contacted, please provide an email address for this purpose: _____

Can I be removed from the research without my OK?

The person in charge of the research study can remove you from the research study without your approval. Possible reasons for removal include not meeting the study's eligibility criteria. In these cases, you will be notified.

What else do I need to know?

This research is funded by the Cross Destination Area Grant through the Office of the Provost for Learning Systems Innovation and Effectiveness (LSIE) at Virginia Tech.

Any expenses accrued for seeking or receiving additional medical or mental health treatment will be your responsibility and not that of the research project, research team, or Virginia Tech.

If you agree to take part in this research study, you will receive monetary compensation of $50 in two payments when you complete the baseline ($25) and post-telehealth support surveys ($25).

Your participation is completely voluntary. If you choose not to be in this research study, there are no alternative choices to the telehealth support program.

Signature Block for Capable Adult

As a parent or legal representative, your electronic signature documents your consent for yourself and your child to take part in this research. At our first session, a study staff member will review this information with you and confirm that you still wish to participate in the study, and will provide their signature at that time. At your request, we will provide you with a signed copy of this form for your records.

Typed Name of Child

Typed Name of Parent or Legal Guardian

Electronic Signature of Parent or Legal Guardian

Date

Typed Name of Study Staff Obtaining Confirmation of Consent

Electronic Signature of Study Staff Obtaining Confirmation of Consent

Date

Appendix P: Child Assent Form

Title of Research Study: Providing Telehealth Support for Parents of Children with Autism Spectrum Disorder (ASD) Using A Mobile App (IRB-20-676)

Investigators: Angela Dahiya, M.S., Department of Psychology, Virginia Polytechnic Institute and State University; email: avdahiya@vt.edu

Angela Scarpa, Ph.D., Department of Psychology, Virginia Polytechnic Institute and State University; phone: (540) 231-2615; email: ascarpa@vt.edu.

Explanation of Research to Child

We are going to spend some time talking today so we can learn how we can work with families through the computer. We will ask you to do a few activities such as looking at pictures, playing, talking, and telling stories. We will also videotape these activities, and this is to make sure I am doing my job correctly. If you don't want to do any of the activities, it is your choice and no one will be mad. Also everything you say here is confidential, which means it's a secret and we would not talk to anyone else about it unless it is something that can hurt you or someone else.

Asking for Child's Verbal Assent

How does this sound to you? Would you like to continue?

Witness Affirmation

The child verbally or nonverbally (e.g., head nod) agreed to participate in this research study.

_____

Child's name

_____

Signed Name of Study Staff Obtaining Confirmation of Consent

_____

Date