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ORIGINAL PAPER

COMPASS for Hope: Evaluating the Effectiveness of a Parent Training and Support Program for Children with ASD

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Abstract
Despite the growing number of studies that demonstrate the importance of empowering parents with knowledge and skills to act as intervention agents for their children with autism spectrum disorder (ASD), there are limited examples of parent-mediated interventions that focus on problem behaviors. Additionally, access to ASD-trained clinicians and research supported delivery options for families in rural areas is severely limited. COMPASS for Hope (C-HOPE) is an 8-week parent intervention program that was developed with the option of telehealth or face-to-face delivery. Parents who received C-HOPE intervention reported a reduction in parenting stress and an increase in competence. Parents also reported significant reductions in child behavior problems, both when compared to pre-intervention levels and to a waitlist control condition.

Keywords Parent intervention · Autism spectrum disorder · Problem behavior · Telehealth · Parent-stress · Parent efficacy

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that presents many challenges for parents as well as teachers, therapists and other professionals, often in part because of challenging problem behavior (Crone and Mehta 2016). These problem behaviors are secondary to, or exacerbated by, the core symptoms of ASD [Centers for Disease Control and Prevention (CDC), 2012]. Common problem behaviors include tantrums (76%), aggression (56%), stereotypy (14%), and self-injury (11%) (Horner et al. 2002).

The presence of problem behaviors impact both children and their families. For children, they experience fewer community outings, less positive interaction with peers, and less access to intervention and education (Anderson et al. 1992; Matson and Nebel-Schwalm 2007). For parents, they report a greater sense of helplessness compared to parents of neurotypical children (Pisula and Kossakowska 2010). A meta-analysis conducted by Hayes and Watson (2013) suggests that the overall level of problem behaviors accounts for the most variance in explaining parent stress when compared to other child factors, such as IQ, autism severity, and adaptive skills, a finding confirmed by others (Krakovich et al. 2016).

The magnitude of behavior problems and their impact on parents point to a clear need for evidence-based parent training and support. Rigorous evaluation over the past 30 years (Barkley 1997; Kazdin 2005; Lundahl et al. 2006; Reyno and McGrath 2006; Zisser and Eyberg 2010) demonstrates that parent training is an effective vehicle of change for decreasing challenging behaviors in typical children. More than 35 years ago, Schopler and Reichler (1971) proposed that parents of children with autism could serve as "cotherapists" for their children. Parent education programs for parents of children with autism have consistently indicated positive outcomes for both parents and children (Bearss et al. 2015; Brookman-Frazee et al. 2006). For parents, training has direct impact on knowledge, skills, and performance and concomitant effects of decreased stress and marital conflict (e.g., Cann et al. 2003; McConachie and Diggle 2007). For children, positive effects are observed for both language and behavior change (Aldred et al. 2004; Green et al. 2010; Hsieh et al. 2011; Kasari et al. 2010).

Despite research that demonstrates the positive effects of parent training, in a recent review we found very few

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studies of parent-mediated interventions that target problem behavior and also utilized a group format (Childres et al. 2012; Pillay et al. 2011; Sofronoff et al. 2004; Whittingham et al. 2009). Of these studies, all reported positive results on at least one child outcome, and effect sizes for decreased child disruptive behavior ranged from −0.24 (Pillay et al. 2011) to −0.73 (Whittingham et al. 2009). Notably, there were also a wide range of dropout rates reported, ranging from 9.1 (Whittingham et al. 2009) to 48.5% (Pillay et al. 2011). Most of the studies reviewed lacked a randomized controlled design (with the exception of Sofronoff et al. 2004; Whittingham et al. 2009), and outcome variables typically focused only on child outcomes, with a lack of specificity of behaviors unique to ASD (e.g., Chen et al. 2009). Additionally, none of these studies incorporated both parent competency and parent stress as outcomes.

Although many parents of children with ASD find it difficult to access quality services, greater challenges are often experienced by families in rural areas (Chen et al. 2007; Mandell et al. 2005). In our southeastern state of Kentucky, this issue is paramount in several portions of Eastern Kentucky that lie in Appalachia (U.S. Census Bureau 2015). While parents in both rural and non-rural areas express a high need for social skills training and speech language therapy services, parents in rural areas report behavior management services as one of their highest unmet needs (Murphy and Ruble 2012). Further, when "in home" behavior supports are recommended to parents by clinicians, rural families are often unable to follow through, citing lack of availability in their area. (Mello et al. 2016). One possible solution is the use of telehealth technology (Dudding 2009; Turner 2003) to address families' unmet needs for behavior management and support intervention (Hetizman-Powell et al. 2014). Telehealth technology allows for specialized services, in real time, over a geographical distance and permits interactive and individualized learning, while also providing standardized service delivery models that can be implemented with fidelity (Baggett et al. 2010; Wainer and Ingersoll 2015). Further a comprehensive review and meta-analysis found that the effect size for internet based therapies is 0.53 which is similar to face-to-face therapies (Barak et al. 2008).

To address the need for more research-supported, parent-mediated interventions that have the option of telehealth or face-to-face delivery, we developed and tested a parent behavior training and support intervention program called COMPASS for Hope (C-HOPE). C-HOPE is based on an existing framework known as the Collaborative Model for Promoting Competence and Success (COMPASS; Ruble et al. 2012). COMPASS is an ASD-specific evidence -based school consultation intervention that is manualized and proven to improve child educational outcomes for children between the ages of 3–8 years in two RCTs (Ruble et al. 2010, 2013). COMPASS provides the conditions for informed collaborative and authentic assessment, personalized goal setting, and individualized intervention development with input from the people who have the most interactions with the child—caregivers and parents of children with autism and teachers (Ruble et al. 2012). Based on an evidence-based practice in psychology framework (McGrew et al. 2016), COMPASS emphasizes clinical decision-making based on the three elements of child preferences and strengths, parent and family resources, and evidence-based practices. The assessment then results in personalized teaching plans that take into account the transaction between the child's personal and environmental challenges and supports. COMPASS prioritizes measurable goals and outcomes in social development, communication, and learning skills—pivotal areas of learning for children with ASD. The intervention includes follow-up coaching for successful implementation of intervention plans. After consulting with teachers for less than 10 h over the 9-month school year, children attained educational goals at a significantly higher level compared to children who received services as usual ($d = 1.5$; 1.4 for each RCT respectively). The second RCT demonstrated efficacy for web-based video conferencing compared to services as usual ($d = 1.1$) (Ruble et al. 2013). Importantly, a recent report on data from 79 parents who participated in school-based COMPASS showed concomitant effects of decreased child-related stress for parents whose children's teachers received COMPASS (Krakovich et al. 2016).

The primary purpose of the current study was to describe the results of C-HOPE that was developed as an outpatient, group and individual therapy intervention for parents and caregivers of children with ASD. In contrast to the school-based COMPASS, which maintains the goal of improving educational outcomes for children with ASD, the goal of C-HOPE is to promote positive parent and child outcomes, including decreased problem child behavior, decreased parent stress, and increased parent competency. Rather than focusing on the teacher as the primary recipient of the intervention, as in COMPASS, parents are the primary intervention targets in C-HOPE. Through positive parent-therapist collaboration, utilizing the COMPASS framework, direct training and support are provided in order to facilitate parent-implemented behavior intervention plans. Thus, the primary research question for the present study was whether the C-HOPE intervention produced decreased child problem behavior and parent stress, and increased parenting competency when compared to pre-test scores and a control condition. A secondary research question was to examine the effectiveness of C-HOPE using a telehealth delivery model to support families from underserved, rural communities while also considering factors of parent satisfaction and group alliance.

Methods

Design

An iterative pretest–posttest control group design was used to explore the effects of C-HOPE on variables of child problem behavior, parent competency, parent stress, group alliance and parent satisfaction. The study occurred over an 18-month period conducted at four locations, including two university sites and two rural sites. After parents were recruited, a random number generator was used to assign parents or caregivers to either a treatment condition [face-to-face (FF) or Telehealth (TH)] or a wait list control (WLC) condition. Figure 1, clarifies assignment and method of intervention over the 18-month period at the different sites. All participants received pre- and post-assessments. Following the post-assessment, WLC participants received the intervention. In the FF condition, C-HOPE was delivered at two university sites by two therapists (first two authors), who are licensed psychologists, and a trained doctoral student in School Psychology. Parents met with both clinicians for the group sessions and with one clinician for the individual sessions. In the TH condition, parents met at a clinic located either at a university site or a regional healthcare center that had access to a secure videoconference transmission, where the clinicians joined from a separate location. TH transmission was supported by the respective divisions of telemedicine located at the two university sites. The individual sessions in the TH condition were provided via teleconference. Parents in the treatment conditions (FF or TH) received hard copies of the C-HOPE manual after recruitment. They received hard copies of handouts and other assessment forms at each session directly from the therapist in the FF condition or from staff located at the TH sites. The two rural sites were in eastern and southeastern Appalachia and roughly at a distance of 120 miles to specialized autism services. Participants in the treatment condition could contact their respective clinician if needed between sessions.

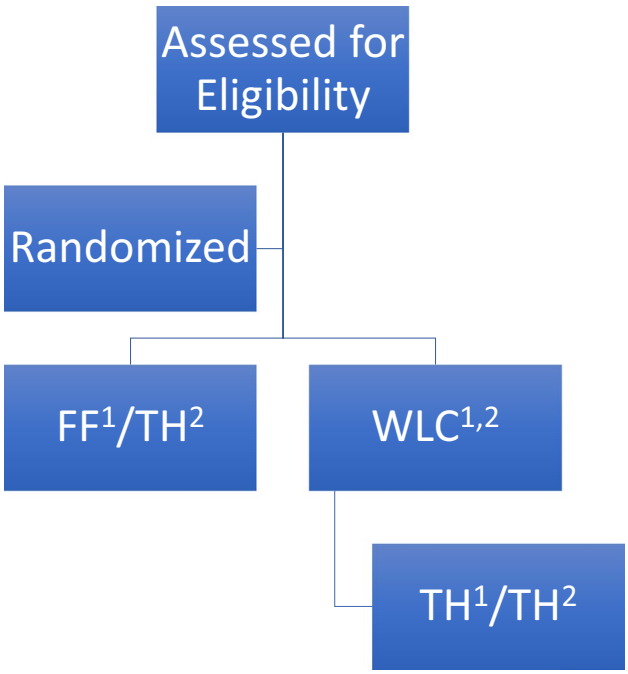

Fig. 1 Study activities following randomization based on location. *Note*: [1]represents university location; [2]represents rural location. The university location participants were randomized into a FF or WLC condition. Following the completion of the C-HOPE FF condition, the WLC then received C-HOPE TH. The rural location participants were randomized to TH or WLC. Following completion of the C-HOPE TH condition, the WLC then received C-HOPE TH

Participants

Families were recruited through several means, including flyers posted at the two university sites, parent support group websites, and personnel associated with the Kentucky Autism Training Center. Participants were eligible to participate if they: (a) had a child between the ages of 3 and 12 years with a DSM-IV/5 diagnosis of autism (APA 2013), as verified with the Autism Diagnostic Observation Schedule, 2nd edition (ADOS-2) by the research team and with no other primary sensory deficit such as deafness or blindness; (b) had a child eligible for special education services under the category of autism; (c) nominated a target problem behavior; (d) agreed to be randomly assigned to a condition; (d) agreed to be audiotaped; (e) agreed to commit to activities related to condition assignment (e.g., time for consultation, completion of forms, being observed); and (f) had no plans to move for the duration of the study. Ineligible families were those who: (a) had another child already in the study or (b) were not comfortable with the assessments or intervention conducted in English. Two screeners were used in the recruitment process. If the child met the cutoff scores on the Modified Checklist for Autism in Toddlers (M-CHAT) or Social Communication Questionnaire (SCQ), a follow up appointment was scheduled to confirm the Autism Diagnosis. After recruitment, participants were randomly assigned to one of three conditions. In the end, the parents completed the waitlist control (WLC; $n = 10$), C-HOPE delivered via telehealth (TH; $n = 10$), and C-HOPE delivered face-to-face (FF; $n = 13$). The measures were administered to parents after recruitment and following confirmation of the ASD diagnosis and prior to group assignment. All pre-post assessments and diagnostic clarifications were conducted by Licensed Psychologists (PIs) or trained doctoral students in School Psychology. The outcome measures were repeated after conclusion of the final treatment session for both treatment and WLC groups. The mean age

of children in the sample was 8 years and 2 months. Both single and two parent families participated in this study: 44% of participants represented single parent families. The Institutional Review Boards of the two collaborating universities approved this study (#13-0926-F4S), and all participating parents provided written informed consent prior to inclusion in the study.

Measures

Child Measures

Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al. 2001)

The Modified Checklist for Autism in Toddlers is a 23-item questionnaire used to screen for autism in children with a mental age of less than 2 years. This screener was administered to parents who have children age 4 and under. Studies have estimated its sensitivity to be as high as 0.92 and its specificity to be as high as 0.93 with telephone follow-up (Dumont-Mathieu and Fein 2005; Snow and Lecavalier 2008).

Social Communication Questionnaire (SCQ; Rutter et al. 2003)

The Social Communication Questionnaire is composed of 40 yes/no questions assessing communication skills and social functioning in children who may have an autism spectrum disorder. This screener was administered to parents who have children age 4 and older. The recommended cutoff score of 15 has a sensitivity of 0.85 and specificity of 0.75 for detecting the presence of a possible ASD (Berument et al. 1999; Snow and Lecavalier 2008).

Autism Diagnostic Observation Schedule 2 (ADOS-2; McCrimmon and Rostad 2014)

The ADOS-2 evaluates social interaction, communication skills, play skills, and repetitive behaviors. Interrater agreement in diagnostic classification ranged from 92 to 98%, sensitivity ranged from 60 to 95%, and specificity ranged from 75 to 100%. Sub scores and overall total scores had correlations ranging from 0.68 to 0.92 in Modules 1 through 3 (McCrimmon and Rostad 2014).

Description of Services

This form provided information of concurrent treatments (including medication, behavioral or educational) received by the children during their participation in the current study. The middle portion of Table 1 summarizes the types of services received by children by condition. As evident in Table 1, participating children received multiple services concurrent with their participation in the current study.

Parent Measures

Parental Stress Index—Fourth Edition Short Form (PSI-4-SF; Abidin 1995)

The PSI is a 36-item standardized parent report questionnaire designed to obtain the level of stress experienced by parents of children ranging in age from 1 month to 12 years. Abidin (1995) reported test–retest reliability coefficients of the total stress score to be 0.84. Internal consistency estimates for the current study were 0.94 at pre-assessment and 0.92 at post-assessment.

Eyberg Child Behavior Inventory (ECBI; Eyberg and Pincus 1999)

The ECBI is a 36-item parent-report measure of conduct-problem behavior in children between the ages of 2 and 16 years. The 36 items are rated on two scales: (a) the Intensity Scale and the (b) Problem Scale. The Intensity scale was used for this study which asks for a frequency occurrence rating for each behavior item. Multiple studies (Colvin et al. 1999; Funderburk et al. 2003) have shown the test retest reliability to be high (above 0.75) and internal consistency (alpha) of the two scales is high (alphas > 0.90). In the current sample, ECBI scores had alphas of 0.90 at pre-assessment and 0.87 at post-assessment.

Being a Parent Scale (BPS; Johnston and Mash 1989)

The BPS is a 16-item questionnaire measuring parents' views of their own competence as parents. Dimensions include satisfaction with their parenting role (reflecting the extent of frustration, anxiety, and motivation) and feelings of self-efficacy as a parent (reflecting competence, problem solving ability, and capability in parenting role). Items that comprise the two factors, Satisfaction (9-items) and Efficacy (7-items), are scored on a 6-point Likert scale (*Strongly agree* to *Strongly disagree*). High levels of internal consistency for the *Total Score* ($\alpha = 0.82$) have been reported (Whittingham et al. 2009). In the current sample, total score reliability estimates at pre- and post-assessment were 0.85 and 0.87, respectively.

Table 1 Demographic and baseline variables of participants by treatment condition

Variable	WLC ($n=10$)	TH ($n=10$)	FF ($n=13$)	F	χ^2	p
Child age (in months)				1.83		0.18
M	101.80	82.30	104.62			
SD	35.35	26.78	25.88			
Min	39.00	43.00	50.00			
Max	153.00	122.00	148.00			
Child gender					0.74	0.69
Male	2	3	2			
Female	8	7	11			
Child race/ethnicity					3.37[b]	0.19
White	7	10	10			
Black	2	0	3			
Asian/Pacific	1	0	0			
Services/therapies received by child[a]						
Speech	7	10	5		9.70	0.01
Occupational therapy	5	9	7		3.84	0.15
Physical therapy	1	1	4		2.68	0.26
Behavior	2	2	9		8.80	0.01
Medical	3	4	5		0.43	0.71
Household income (in $)					4.63	0.80
< 10,000	1	0	0			
10,000–24,999	2	2	2			
25,000–49,999	2	4	4			
50,000–99,999	4	3	4			
100,00 or more	1	0	2			
Missing	0	0	1			
Mother's years of education				0.64		0.53
M	15.63	14.67	15.69			
SD	2.00	2.06	2.43			
Min	12.00	12.00	12.00			
Max	18.00	18.00	19.00			
Father's years of education				0.90		0.42
M	14.75	13.33	14.55			
SD	2.60	1.73	2.73			
Min	12.00	12.00	10.00			
Max	18.00	16.00	19.00			
Child baseline ADOS-2 scores				0.84		0.44
M	7.30	8.40	7.90			
SD	2.87	1.50	1.12			
Min	2.00	6.00	6.00			
Max	10.00	10.00	10.00			
Child baseline vineland adaptive scores (standard score)						
Communication				0.32		0.73
M	72.80	74.00	70.00			
SD	14.38	14.04	8.23			
Min	53.00	50.00	59.00			
Max	97.00	87.00	85.00			
Daily living skills				0.36		0.70
M	71.70	70.89	63.22			
SD	10.59	11.55	11.01			
Min	59.00	61.00	58.00			
Max	87.00	93.00	81.00			

Table 1 (continued)

Variable	WLC ($n=10$)	TH ($n=10$)	FF ($n=13$)	F	χ^2	p
Socialization				0.10		0.91
M	63.80	68.46	61.85			
SD	14.61	12.68	7.56			
Min	40.00	48.00	53.00			
Max	88.00	81.00	75.00			

WLC waitlist control, *FF* face-to-face, *TH* telehealth

[a]Multiple responses are possible

[b]Race/Ethnicity was collapsed into two categories for this analysis (White vs. Black or Asian/Pacific)

Vineland Adaptive Behavior Scale, 2nd edition (VABS-II)—Parent/Caregiver Rating Form (Sparrow et al. 2005)

The VABS-II measures adaptive behavior for children between the ages of 3 and 21 years of age and was used to classify children's adaptive functioning across 4 domains: communication, daily living skills, socialization and motor skills. Interrater reliability across the domains/subdomains ranged from 0.71 to 0.81 and average concurrent validity with the Adaptive Behavior Assessment System-Second Edition (ABAS-II) was 0.70 (Sparrow et al. 2005). The VABS II was administered to ensure consistency between treatment groups after randomization. Note, in current study, motor skills were not used since this subscale was not consistently collected across all child participants.

Consultation Satisfaction Questionnaire (CSQ; Ruble et al. 2010)

Consultee satisfaction was assessed using a multiple-item satisfaction questionnaire. Ratings were based on a 4-point scale (1 = strongly disagree, to 4 = strongly agree) and each questionnaire was unique to the individual session, ranging from 10 to 11 questions on each form. Sample items include: "I felt involved during the session and able to express my views"; "The therapist's communication skills were effective"; "The therapist was knowledgeable about autism." This questionnaire was completed by parents after each session and scores were averaged across each treatment group. An internal consistency (α) of 0.90 has been found for the CSQ as reported in Ruble et al. (2012). Sample internal consistency in the current study ranged from 0.92 to 0.96 across sessions.

Group Session Rating Scale (GSRS; Duncan and Miller 2007)

The GSRS, adapted from the Session Rating Scale, is a 4-item visual analogue scale, designed to be a brief clinical tool to measure group-therapy alliance. The GSRS was completed by each participating caregiver at the end of each group session, to determine the quality of group alliance depending on treatment condition. The items are based on a response using a ten-centimeter line. The 'relationship' aspect is assessed on a continuum of 'I felt understood, respected, and accepted by the leader and the group' to 'I did not feel understood, respected'. The 'goals and topics' aspect is assessed on a continuum of 'We worked on and talked about what I wanted to work on and talk about' to 'We did not work on or talk about what I wanted to work on and/or talk about'. The acceptability of the approach used in the group is assessed on a continuum of 'The leader and group's approach is a good fit for me' to 'The leader and/or group's approach is not a good fit for me'. A sense of overall fit is assessed on a continuum ranging from 'Overall, today's groups was right for me - I felt like a part of the group' to 'There was something missing in group today—I did not feel like a part of the group.' Scores are summed out of a total possible score of 40 and averaged over the 4 group sessions for each participant and averaged across each treatment group per session. The GSRS shows evidence of concurrent validity, correlating with other individual alliance measures with coefficients ranging from 0.41 to 0.61 and Cronbach alphas ranging from 0.86 to 0.90 over four sessions (Quirk et al. 2013). In the current study, reliability for the GSRS across the four sessions ranged from 0.82 (group session 1) to 0.96 (group session 3).

Parent-Completed Fidelity Form

To assess group leader adherence delivering C-HOPE, parents completed a checklist following each session and endorsed completed activities from a list of intended activities for that session. The number of items endorsed varied by session because each session was different. The number of items for each questionnaire ranged from 15 to 20 items. Percentage of endorsed activities was calculated for each parent and averaged across each treatment condition per session.

Description of the C-HOPE Intervention

The C-HOPE curriculum included activities that supported parent-to-parent interaction as well as parent knowledge

and skill. Prior to the start of the treatment sessions, parents completed the COMPASS profile (see Ruble et al. 2012). The profile guided the discussion for the first individual session and assisted with clarifying the problem behavior and possible underlying communicative intent behind the behavior. As mentioned, C-HOPE was provided using both group (4 sessions) and individual formats (4 sessions; see Table 2). Group sessions were about 2 h in duration and individual sessions lasted about 1 h. The goal of group sessions was to provide basic information on ASD and to help parents understand learning differences specific to ASD, as well as how these learning differences impact behavior, socialization, and communication for their child. Theories such as central coherence (Happe et al. 2001; Happe and Frith 1996), executive dysfunction (Pennington and Ozonoff 1996) and theory of mind (Baron-Cohen et al. 1985, 2000) were discussed and specific attention to the influence that these ways of thinking and learning can have on problem behaviors was considered. Parent knowledge also included understanding of evidence-based approaches for problem behaviors such as functional behavior assessment including antecedent manipulation, changes in instructional context, differential reinforcement, and self-management strategies (Braithwaite and Richdale 2000; Buggey 2005; Frea et al. 2001; Keeling et al. 2003; Schilling and Schwartz 2004).

After developing a common understanding and language (e.g., joint attention, antecedents, consequences), parenting skills such as encouraging positive child behaviors and how to use supports proactively to decrease challenging behaviors were written into the behavior plan. Emphasis was placed on using positive behavior supports (i.e., environmental manipulations) that were designed to promote prosocial skills that are effective in reducing disruptive behaviors for children with ASD (Buschbacher and Fox 2003; Iovannone et al. 2003; National Research Council 2001; Turnbull et al. 2002). Behavior plans included understanding the antecedents or causes of behavior, making the behavior ineffective, teaching replacement skills that result in desired outcomes for the child, and rewarding positive skills. Individual sessions primarily focused on developing, implementing, and fine-tuning a unique individualized behavior plan, that targeted the identified problem behavior(s) and replacement skills for each child.

In addition to the content described above, group sessions also targeted parent stress and coping skills. A variety of coping strategies for parental stress were presented and parents were asked to identify what strategies they found helpful and what new strategies they would consider using in the future. Coping strategies included general stress reduction techniques, mindfulness based interventions, and relaxation strategies that have been shown to have long-term positive effects on stress levels and psychological well-being of parents of children with ASD (Cachia et al. 2016).

Data Analysis

Prior to the data analysis, missing data (i.e., dropout and missing item responses for primary outcomes) were examined. No participants were lost in the FF and WLC conditions, but four participants dropped out of the TH condition after the intervention began. All analyses were conducted from an intention-to-treat (ITT) perspective. Analyses were

Table 2 Overview of C-HOPE session content

Session number	Session type	Focus of each session
1	Individual	Overview of C-HOPE and its goals, assessment and initial goal identification using the COMPASS profile
2	Group	Introduction of parents and their child to the group based on an assessment of social, communication, and other behaviors. Discussion of unique and common characteristics of each child. Overview of cognitive theories of autism (central coherence, theory of mind, executive function) and how these relate to behavior, and local autism services and resources. The session is concluded with introduction of a relaxation strategy
3	Group	Direct education on principles of behavior and learning as well as proactive and reactive strategies
4	Individual	Development of the child's personalized behavior plan using the COMPASS framework. Once the disruptive behavior is identified (behavior to decrease), the replacement skill(s) is generated (behavior to increase)
5	Group	Discussion of teaching strategies, positive behavior approaches to prevent disruptive behaviors, teach new skills, and respond effectively
6	Group	Discussion of parents and caregivers as essential "environmental supports" for the child and the emotions associated with the diagnosis, parenting expectations, and transitions. A "wellness" package of activities designed to identify strategies for self-care and relaxation is reviewed
7	Individual	Review of the individual behavior plan and how well it is working. Modifications to the plan may occur based on data tracking the child's problem behavior and new skills
8	Individual Session	Pertinent skills from previous sessions are reviewed. Progress toward the goals is examined and any modifications needed are implemented. Anticipated barriers that might arise related to the implementation of the behavior plan are discussed as well as possible proactive strategies to overcome these issues following the intervention

also conducted using only those who completed the study (completers; $n = 29$) to arrive at a comprehensive picture of results from those who completed the study versus those who intended to seek treatment (i.e., be part of the conditions in the study; ITT). Given the pretest–posttest partially clustered design, a multilevel modeling approach for handling partial nesting (MLM-PN) multiple imputation (k = 20 imputed data files) was conducted using therapy group membership as the cluster variable. The multilevel MLM-PN multiple imputation method and pooling method was based on joint modeling (Asparouhov and Muthén 2010; Schafer and Yucel 2002) as discussed and implemented (with sample code) using Mplus 7.4 (Muthén and Muthén 1998–2015) in Enders et al. (2016). Given that missing values existed at the item level (item-level missing data ranged from 0 to 20.7% ($M = 3.9\%$) for completers) multiple imputations were conducted at the item level. Also, since the design was not fully clustered, multiple imputation was conducted using the multiple group option in M*plus* using treatment condition (2 dummy variables), autism severity scores (ADOS-2), gender, and age as auxiliary variables in the imputation phase.

Finally, non-independence of parenting competency (measured with the BPS), child behavior (measured with the ECBI), and parenting stress (measured with the PSI-4-SF) scores within therapeutic modality clusters in the TH and FF conditions was addressed as a 'Type = Complex Two Level' model in M*plus* by declaring therapeutic group as the clustering variable, which then provided unbiased parameter estimates, standard errors, and statistical significance tests. Thus, consideration was placed on analyses of participant level outcomes. While initially analyses were conducted using MLM-PN, due to unstable parameter estimates in the conditional models, including pretest scores as a covariate, which came about because of the limited number of clusters per condition (3–4) and few cases per cluster (2–3), focus was placed on single-level analyses while correcting for the non-independence (as group therapy was viewed as violating the assumption of independence) using the Type = Complex option in M*plus* to get unbiased estimates of the inferential statistics. Of note an unconditional MLM-PN was estimated for each outcome, but only by collapsing across treatment arms [i.e., face-to-face and telehealth; (FF + TH) were examined as one group].

Results

Comparison of Demographics and Baseline Variables After Randomization

Table 1 summarizes demographic and baseline variables after randomization for all study participants as a function of condition. The results from these analyses highlight the statistical similarity across the conditions with respect to child age, gender, race/ethnicity, concurrent services received, household income, mother and father's education, and child ADOS-2 and Vineland standard scores. It is important to note that although some differences were found between conditions with respect to two concurrent services received during the study (i.e., speech and behavior therapy), these differences should be interpreted with caution given the large family of significance tests conducted on selected demographic and baseline variables. In this sample, problem behaviors ranged from tantrums involving aggressive behaviors (51%), Stereotypy (17%), noncompliance and escape behaviors (13%) each and inappropriate initiations (6%).

Does C-HOPE Improve Child and Parent Outcomes?

The primary research question asked if C-HOPE decreased child problem behavior and parent stress, and increased parent competency. Results indicate that when considering all participants ($N = 33$), even those participants in the WLC that received treatment, significant pre-post treatment gains were found in child problem behavior scores from pretest ($M = 133.48$, $SD = 29.32$) to posttest ($M = 118.58$, $SD = 29.90$), Wald $(1) = 14.08$, $p < .001$, $d = 0.18$. When considering parent outcomes, we also found pre-post treatment gains in parent competency scores ($M = 64.22$, $SD = 13.77$); ($M = 67.79$, $SD = 10.90$), [Wald $(1) = 5.11$, $p = .02$, $d = 0.12$]; and in parent stress scores ($M = 103.78$, $SD = 23.90$) ($M = 95.72$, $SD = 17.66$), Wald $(1) = 13.46$, $p < .001$, $d = 0.13$.

Is Telehealth C-HOPE Effective?

The secondary research question asked if telehealth C-HOPE was effective. Analysis of differences on outcomes based on therapeutic modality was conducted with planned comparisons. Table 3 summarizes the results from the planned comparisons on child and parent outcomes as a function of condition (WLC, FF, TH) after using pretest scores as a covariate (centered at the grand mean). When considering the child problem behavior outcome (ECBI), results showed those in the TH treatment condition had significantly lower adjusted child problem behavior posttest scores (ECBI) than those in the WLC condition, mean difference = −25.06, $p < .05$, 95% CI [−42.66, −7.45], with a large effect size ($d = 0.99$). However, no other planned comparison was statistically significant and effect sizes for non-significant planned comparisons ranged from 0.46 (small) to 0.71 (moderate).

Further planned comparisons by treatment modality did not show significant differences on either parent outcome (parent competency and parent stress). Effect sizes for parent competency planned comparisons ranged from 0.16 to 0.32

Table 3 Planned comparisons for key child and parent outcomes as a function of condition, using pretest scores as a covariate

Comparison	Mean difference	ITT ($N=33$) 95% CI	d	Mean difference	Completers ($N=29$) 95% CI	d
Child problem behavior (ECBI)						
WLC vs. TH	−25.06*	[−42.66, −7.45]	0.99	−29.52*	[−54.98, −4.06]	1.19
WLC vs. FF	−10.47	[−23.62, 2.68]	0.46	−12.02	[−25.85, 1.82]	0.52
TH vs. FF	14.59	[−1.16, 30.34]	0.55	17.51	[−6.35, 41.37]	0.66
WLC vs. TH + FF	−17.09*	[−30.36, −3.82]	0.71	−18.10*	[−33.45, −2.74]	0.75
Parenting competency (BPS)						
WLC vs. TH	4.06	[−5.80, 13.93]	0.32	5.48	[−4.85, 15.81]	0.47
WLC vs. FF	1.84	[−5.81, 9.44]	0.16	1.39	[−6.57, 9.36]	0.12
TH vs. FF	−2.25	[−10.31, 5.82]	0.25	−4.08	[−12.68, 4.51]	0.52
WLC vs. TH + FF	2.86	[−4.97, 10.69]	0.23	2.81	[−5.20, 10.81]	0.24
Parent stress (PSI)						
WLC vs. TH	−11.01	[−25.92, 3.90]	0.56	−11.68	[−29.53, 6.17]	0.67
WLC vs. FF	−5.71	[−14.47, 3.04]	0.33	−5.83	[−14.60, 2.95]	0.33
TH vs. FF	5.31	[−7.47, 18.08]	0.31	5.85	[−10.75, 22.46]	0.40
WLC vs. TH + FF	−8.25	[−18.62, 2.12]	0.44	−8.09	[−18.64, 2.47]	0.46

ITT intent to treat analyses wherein missing data was handled appropriately for those who did not complete all measures at both pre and post assessments, *Completers* analyses based on those who completed all measures and cases with missing data were deleted, *WLC* waitlist control, *FF* face-to-face, *TH* telehealth, *d* Cohen's d

*$p < .05$ or wherein the 95% CI did not capture the null value, zero

(small), whereas effect sizes for parent stress ranged from small to medium (0.31–0.56; Cohen 1992).

Are There Differences in Therapeutic Alliance Across Modality?

With regard to therapeutic alliance, mean GSRS scores of parent-therapist relationship between FF ($M=9.17$, $SD=0.53$) and TH ($M=9.35$, $SD=0.53$) were high on the 10-cm scale. When comparing the two modalities with respect to therapeutic alliance, preference for overall approach/method and feeling of being part of the group revealed no differences between FF and TH modalities in the areas measured, $t\,(18)=0.74$, $p=.23$.

How Satisfied were Parents with C-HOPE?

Table 4 summarizes the mean parent report of clinician satisfaction and fidelity as a function of FF and TH conditions. Overall, parents were very satisfied (based on a 4-point Likert-type scale) with the FF ($M=3.7$, $SD=0.27$) and TH ($M=3.7$, $SD=0.21$) approaches. Moreover, results showed no differences in satisfaction ratings across the two conditions, $t\,[(14])=0.00$, $p=.99$. Moreover, ratings of fidelity were 80% or better for both conditions (FF and TH), indicating that the manualized treatment could be reliably implemented across different modalities.

Table 4 Mean Parent report of clinician fidelity and satisfaction as a function of treatment

Session	Face-to-Face ($n=13$)		Telehealth ($n=20$)	
	Satisfaction	Fidelity	Satisfaction	Fidelity
Individual-1	4.0 (0.0)	80.0 (10.2)	4.0 (0.0)	85.2 (11.3)
Group-1	3.6 (0.3)	100.0 (0.0)	3.3 (0.4)	91.2 (9.5)
Group-2	3.2 (0.4)	94.7 (7.9)	3.6 (0.7)	96.5 (3.6)
Individual-2	3.9 (0.1)	99.3 (5.1)	3.6 (0.7)	90.6 (15.8)
Group-3	3.8 (0.3)	100.0 (0.0)	3.7 (0.5)	100.0 (0.0)
Group-4	3.8 (0.0)	93.3 (12.8)	3.7 (0.4)	99.0 (2.2)
Individual-3	4.0 (0.0)	97.1 (5.8)	3.9 (0.4)	97.8 (7.5)
Individual-4	4.0 (0.0)	100.0 (0.0)	3.8 (0.4)	98.9 (2.2)
Mean	3.7 (0.3)	95.5 (6.8)	3.7 (0.3)	94.9 (5.3)

Satisfaction ratings could possibly range from 1 to 4. Fidelity ratings could range from 0 to 100

Individual individual therapy session, *Group* group therapy session

Discussion

The current study is unique compared to previous group-implemented parenting interventions for families with a child with ASD because the targeted outcomes included three major areas relevant to parents–child problem behavior, parent competency, and parent stress. It is also the only study, to the authors' knowledge, that has examined

utilization of a group format that included telehealth technology. Although preliminary, results support the feasibility and efficacy of C-HOPE, as a manualized 8-week intervention for parents of children with ASD that targets challenging behaviors and can be delivered face-to-face or via telehealth. Results showed significant pre-post treatment gains on key outcomes of child problem behavior, parenting competency and parenting stress.

A secondary question was the efficacy of C-HOPE delivered via telehealth. Results were promising given the significant pre-post changes and comparisons to the control, especially for child problem behavior. Further, the effect sizes, while preliminary, compare favorably to other studies that targeted the same primary outcomes −0.24 (Pillay et al. 2011) to −0.73 (Whittingham et al. 2009).

Results from just completers in prior studies mimicked estimates and inferences based on the ITT analyses that used all cases and handled missing data using multiple imputation. This is important because telehealth technology can be used to access rural, underserved communities and address important parent reported needs in the area of problem behavior in ASD (Murphy and Ruble 2012; Wainer and Ingersoll 2015).

Analysis of parent perceptions of C-HOPE was also favorable. Assessment of group alliance, which is conceptualized as a collaborative experience characterized by an agreement on treatment goals, methods used to obtain those goals, and the relational bond between client and therapist (Bordin 1979), was rated high and similarly by parents across both modalities. In group therapy, alliance is influenced by the multiplicity of relationships that each individual develops within the context of other group members and the therapist (MacKenzie 1998; Yalom and Leszcz 2005). It was surprising that alliance was preserved in the TH group and rated similarly to parents in the FF group despite the therapist not physically being present. It can be concluded from these ratings that while the C-HOPE experience differed based on modality, therapeutic alliance was not significantly impacted. Further, similar to group alliance, parent ratings of fidelity and satisfaction were not impacted by modality. Overall, parent ratings indicated satisfaction with the intervention and high fidelity. Above all, it appears that C-HOPE as evidenced in most group formats provided a platform for parents of children with ASD to come together and share their unique struggles and challenges and mitigate their feelings of isolation in that they are not alone (Yalom 1995). Thus, regardless of therapeutic modality, parent response to therapy was preserved as indicated in the parent satisfaction scores across both groups. This was also noted in other studies that have used TH and examined satisfaction and fidelity (Ruble et al. 2013; Vismara et al. 2012).

Because dropout rates reported from other studies ranged widely from 5.1 to 48.5% (Whittingham et al. 2009; Pillay et al. 2011), for comparison purposes, the dropout rate for the current study was also evaluated. In the current study the dropout rate fell within the lower range of 12.12%, and occurred in the TH groups that were primarily provided to parents in Appalachia. A number of reasons were provided by these families for their inability to attend all sessions; including lack of child care services while the parent or caregiver attended the training session, distance to travel to the TH site, and preference for child focused therapies over a parent-delivered intervention. These data provide crucial information concerning the barriers to effective treatment identified by parents in the current study. In future studies, these barriers need to be considered and addressed prior to conducting research or providing TH services in rural areas. For example, solutions for how to provide child care, how to minimize travel to clinical sites, and how to enhance parental understanding of parent-delivered interventions as a means for changing child behavior must be considered for future dissemination, implementation, and sustainability of the intervention. Despite these challenges, it should be noted that overall, parents in TH group, i.e. those families living in more rural and under-served areas, still reported high satisfaction for the program (mean score = 3.7).

Study Limitations

Despite significant strengths to the study methodology, including randomization, the use of multiple outcome measures, the monitoring of treatment fidelity, the assessment of group alliance, the use of telehealth technology and the inclusion of rural participants—some significant limitations to the study must also be acknowledged. First, although a waitlist control group was utilized, 10% of the sample ultimately could not be randomized due to parent scheduling constraints (i.e. some parents could only participate at one specific time due to family or work conflicts). These concerns were mitigated by the lack of group differences on pretest measures. Second, the small sample was relatively homogeneous based on race and ethnicity. The sample of children did include a range of severity scores across the spectrum and the parents came from wide socioeconomic backgrounds, but the encouraging results are tempered by the sample size and results should be interpreted with caution. Third, only parent report measures were used for outcome assessment. This may have influenced parents and caregivers who were not blind to their treatment status and could have been influenced by the placebo effect (Whittingham et al. 2009). Future research may implement evaluators who are independent of the research team or are unaware of group assignment.

Future Research

Several possibilities for future research are offered. First, research using a large-scale randomized control trial with a more diverse sample that includes follow-up independent assessment would be a logical next step to the current study. Second, testing evidence-based interventions for rural and other underserved populations that are culturally responsive (West et al. 2016) remain an area for significant growth and development for ASD-intervention research. Lastly, developing interventions that utilize potential advantages of technology for parents and children with ASD who face practical access barriers is important. For example, studies that evaluate the benefit of parents videotaping their child's behavior or their attempts to implement behavioral strategies for consultation purposes could potentially be meaningful. Another possibility for C-HOPE would be to develop web-based modules in place of group training that maximize convenience and could be followed up with individual sessions using other technology platforms (e.g., discussion boards, web conferencing, webinars) to provide interventions in a virtual group format.

In conclusion, our findings provide preliminary evidence that C-HOPE can be an effective intervention, delivered either in-person or using telehealth technology, to rural families who have a child diagnosed with ASD.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975 as revised in 2008. The Institutional Review Boards of the two collaborating universities (University of Louisville and University of Kentucky) approved this study (#13-0926-F4S).

Informed Consent Written informed consent was obtained from all individual participants included in the study.

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