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Clinical Effectiveness of Early Intervention via a Hybrid Teletherapy Model: Children with
Autism Spectrum Disorder

By:

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A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the
Sally McDonnell Barksdale Honors College.

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ABSTRACT

Purpose: The purpose of the present study was to evaluate the efficacy of Early Intervention (EI) provided via a hybrid model of teletherapy and traditional face-to-face therapy for children with Autism Spectrum Disorder (ASD) compared to children without ASD.

Methods: In total, 10 children were evaluated receiving early intervention via a hybrid model of teletherapy and traditional face-to-face therapy. The children were divided up into two groups. Group 1 consisted of 5 children with ASD and Group 2 consisted of children without ASD. All children were assessed using the Rossetti Infant-Toddler Language Scale (RITLS).

Results: After 20 early intervention sessions, children with ASD demonstrated improvement in all skill areas, but the improvement was not statistically significant. In contrast, children without ASD showed a significant improvement in language expression ($p = .041$). In addition, children without ASD showed a significant improvement in the areas of pragmatics ($p = .034$) and language expression ($p = .035$) compared to children with autism.

Conclusion: The current study supports previous research suggesting that children with ASD may need more intervention sessions in order to fully master new communication skills as compared to children without ASD. Additionally, incorporating traditional 1:1 treatment may illicit visual focus on the SLP and stimulate social attention in order to further develop expressive and receptive skills.

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LIST OF ABBREVIATIONS

EI	Early Intervention
ASD	Autism Spectrum Disorder
SLP	Speech-Language Pathologist
COVID-19	Coronavirus Disease 2019
RITLS	Rosetti Infant-Toddler Language Scale
ASHA	American Speech-Language-Hearing Association
CDC	Centers for Disease Control and Prevention
WHO	World Health Organization
EIBI	Early Intensive Behavioral Intervention
ABA	Applied Behavioral Analysis
PMI	Parent Mediated Intervention
NMRC	North Mississippi Regional Center
IRB	Institutional Review Board
SPSS	Statistical Package for the Social Sciences

INTRODUCTION

Autism Spectrum Disorder

The prevalence of autism spectrum disorder (ASD) continues to rise and currently affects 1 in 54 children (Centers for Disease Control and Prevention [CDC], 2016). ASD is considered to be a developmental disorder, which is commonly characterized by persistent challenges in social interaction and communication, as well as restrictive or repetitive patterns of thought and behaviors (American Speech-Language Hearing Association [ASHA], n.d). In general, the symptoms of social and communicative dysfunction associated with ASD vary in severity from case to case and have the ability to diminish the individual's quality of life (Clark et al., 2015). As a result, there is an increased need for professional specialists to provide effective treatments to individuals with ASD.

Specifically, speech-language pathologists (SLPs) can provide therapy services to those with ASD to help build communication skills, such as social, play, receptive and expressive skills (ASHA, n.d). Although various therapies can help alleviate the symptoms of ASD, it is important that ASD is diagnosed and treated as early as possible in order to improve and maintain development (Woods and Wetherby, 2003). Therefore, infant screening is used to identify risk factors of ASD in children as young as 18 months of age (K et al., 2017). Once an ASD diagnosis is confirmed, intervention may be incorporated into the child's daily routines as soon as possible to improve their communication, motor speech, behavioral, and social skills. Although there is currently no cure for ASD, successful early interventions can minimize the negative symptoms of the disorder (ASHA, n.d).

Language Development in Children with ASD

One of the challenges with social communication and interaction for children with ASD is building a receptive and expressive vocabulary. For example, typically developing children are able to display much larger receptive vocabulary than expressive vocabulary (McDaniel et al., 2018). In contrast, children with ASD exhibit varying degrees in magnitude and growth in their receptive and expressive vocabulary (McDaniel et al., 2018). Understanding the factors that influence the variability in the development of receptive and expressive vocabulary might help incorporate relevant intervention techniques to improve the atypical development. In addition, children with ASD often lack joint attention, eye-contact, and focus on the speaker when listening and/or communicating. In a study conducted by Chawarska, Macari, and Shic (2012), the relationship between visual attention to a speaker and the child's receptive and expressive language skill discrepancies were evaluated. Furthermore, as stated by the speech attunement theory, the lack of attention to a speaker is likely to reduce the listeners receptive capabilities (McDaniel et al., 2018). As for children with ASD, their ability to focus on a speaker is significantly reduced when compared to typically developing children. Additionally, visual access and attention to the speaker was positively correlated with their language development for children with ASD (Chawarska et al., 2012). The results of this study indicate that children with greater deficits in receptive and expressive language were less likely to look at the speaker's face, eyes, or mouth. Although, these findings cannot claim that increased eye-contact results in greater receptive and expressive vocabulary, SLPs are encouraged to incorporate visual attention into their intervention for children with ASD (McDaniel et al., 2018).

Early Intervention

Early intervention (EI) is a system created to provide support to children and their families when the child is at a high risk of experiencing developmental delays and/or disabilities, such as children diagnosed with ASD (Paul & Roth, 2011). The primary purpose of EI, when provided by SLPs, is (1) to maximize the child's ability to effectively communicate their wants and needs and (2) to increase the child's social interaction skills. Ultimately, the SLP is responsible for making observations relative to the child's communicational skills, recording useful information, and coaching the parents during the assessment and intervention process in order for them to understand how to incorporate the most effective techniques into their daily routines to support their child's development (Paul & Roth, 2011). To maximize the benefits of EI, it is important to begin services as early as ASD risk factors are identified. More specifically, Woods & Wetherby (2003) assert that when children with ASD receive EI services before the age of three, they experience greater improvements in communication skills than when EI services are not provided until after the age of five.

The first step to providing successful EI services is to educate the family, which creates the foundation for an effective and family-oriented intervention. Family-oriented intervention is different for each family, depending on the family's goals, concerns, routines, and interests (Paul & Roth, 2011). Furthermore, EI services are typically child-directed, meaning the child is provided with communication opportunities within their natural environment. According to federal guidelines, EI services delivered in the child's natural environment include settings such as a home, and community environments where children without disabilities interact (IDEA, 2004, § 634(4) (G)). Thus, the child's natural environment may include the family home, an immediate or

distant family member's home, childcare and educational facilities, playgrounds, as well as other community settings (Paul & Roth, 2011).

Successful EI therapy sessions are essential in order to ensure that the child is provided with opportunities to grow their communication skills. Paul and Roth (2011) assert that successful and effective EI services are: (1) family specific and dependent on cultural and linguistic needs, (2) encourage the child's developmental process and equip the child with skills to engage in communication in their natural environment, and (3) comprehensive, coordinated, and team based. These fundamental principles are often incorporated into three different approaches, which include behavioral, functional, and naturalistic techniques (Stahmer and Aarons, 2009). Behavioral techniques may be structured in either a one-on-one setting or through educational programs that focus on improving communication or behavioral difficulties. Similarly, according to Stahmer and Aarons (2009), functional approaches also use structured environments but incorporate visual cueing, routines, and other strategies to enable the child to independently navigate their own environment. Lastly, naturalistic programs are implemented in the child's natural environment, typically at home or in the classroom. This approach aims to promote child-directed intervention, which allows the child to feel comfortable and confident in their natural environment in hopes that they will begin to initiate conversation with the adult who is leading the EI session (e.g., SLP, parent, etc.). After the child's initiation, the adult follows the child's lead and adds to the conversation by asking open-ended questions, engaging in storytelling, and incorporating play (Woods and Wetherby, 2003). In some cases, this form of intervention is conducted in the family's home and is led by the parents and/or caregivers. Overall, research supports the naturalistic, child-directed intervention as an effective strategy that allows the child to make communicational gains (Woods and Wetherby, 2003).

While previous research supports the early identification of high-risk children, research also supports the early implementation of intensive intervention in order to maximize the child's ability to improve their communication skills. For example, Peters-Scheffer et al. (2011) conducted a meta-analysis to examine the effectiveness of Early Intensive Behavioral Intervention (EIBI) based on Applied Behavior Analysis (ABA) for children with ASD. Results revealed that the children included in an experimental group received an average of approximately 13 to 39 hours of EIBI for 10 months to two years. In contrast, children with ASD were also included in a control group received no more than 10 hours of "treatment as usual", such as parent-directed ABA, school-based intervention, and/or nursery provisions. Overall, results of the meta-analysis suggest that EIBI intervention is successful in improving adaptive behavior, communication, motor skills, and socialization. Taken together, these results support the effectiveness and need for EIBI therapy as a tool to provide EI to children with ASD.

Barriers of Early Intervention

Unfortunately, there are several potential pre-existing barriers that prevent children from receiving intervention in a timely manner. For example, the high prevalence of ASD inevitably creates a high demand for EI services and the clinicians who provide them (Simacek et al., 2017). This lack of health services is more prominent in rural communities in which there are limited number of clinicians available to provide services in a timely manner. In many of these situations, children will be placed on a waitlist, potentially for several months, before they are seen by an SLP (Simacek et al., 2017).

The Covid-19 Pandemic as a Barrier to Early Intervention

In addition to the established barriers that limit access to in-person EI services is the recent outbreak of a respiratory disease, COVID-19. The virus traveled efficiently, and the first 14 cases were identified in the United States by February 26th, 2020, likely due to international travel. Within the span of five months, cases in the U.S. rose exponentially, and the number of cases continues to rise. Transmission of the virus happens most often through human-to-human contact, primarily through respiratory droplets (World Health Organization [WHO], 2020). In order to slow the spread of COVID-19, a new preventative practice called social distancing was put in place. Social distancing is defined by the CDC as a way of keeping a safe distance (six feet) between yourself and other people who are not from your household in order to prevent the spread of COVID-19 (CDC, 2020). Therefore, health services were limited to essential services, such as emergency surgeries, services related to reproductive health, services for vulnerable populations, immunization services, and basic diagnostic imaging and blood bank services (World Health Organization [WHO], 2020). As a result of these limitations and precautions, teletherapy has become more widespread and accepted as the new delivery model of care in order to protect the health and safety of health care providers and patients.

Teletherapy

The rapid transmission of COVID-19 established a need for contactless health care as an essential form of service delivery. This resulted in the increased use of teletherapy. Teletherapy refers to the application of communication technologies, such as video conferencing and phone calls, to allow specialists to consult and deliver healthcare services, including EI services, in real time over a geographic area. (Boisvert et al., 2010). Thus, the use of teletherapy allows health care providers to administer services while adhering to CDC-recommended social distancing

guidelines. Not surprisingly, teletherapy has been incorporated into many healthcare clinics and practices, including those that employ SLPs. More specifically, teletherapy allows SLPs to provide EI services to children with ASD when in-person services are not possible.

The primary principles of EI services are incorporated into teletherapy through the use of family coaching strategies, whereby the SLP teaches parents various techniques that they can incorporate into their daily natural routines (Pellecchia et al., 2020). According to Cole et al. (2019), EI teletherapy provides several benefits, including flexibility, access to providers and more family engagement. In addition, participants of EI teletherapy report high levels of parent empowerment, self-efficacy, and positive child outcomes (Little et al., 2018; Vismara et al., 2012; Wainer & Ingersoll, 2015). In a study conducted by Cole et al. (2019), surveys were used to evaluate parents and provider's perspectives towards teletherapy. Survey responses revealed several common themes, including (1) increased access to care for families residing in rural communities, (2) increased flexibility to provide or receive services, (3) increased family involvement. However, one drawback of teletherapy was the prevalence of technology barriers. Altogether, prior research indicates that teletherapy is both a useful and effective alternative to service provision when in-person services are not an option.

Parent Engagement and Satisfaction

In many forms of EI therapy, the family, specifically parents or caregivers of children with ASD, plays a significant role as they can implement EI techniques even when their child is not in an active EI session. This technique is often referred to as parent-mediated intervention (PMI), which involves the clinician coaching parents on proper intervention techniques so that they can incorporate them into their household and daily routines. The use of PMI is an efficient way to

increase the child's number of hours of intervention and has even been recognized as a critical component of effective intervention for children with ASD (Ingersoll & Berger, 2015). Furthermore, parent engagement is often considered an important contributing factor of the child's ability to improve their communication skills. With that being said, it is important to examine the factors that may limit or encourage parent engagement in EI teletherapy sessions. For example, Ingersoll & Berger (2015) identified various factors that potentially impact the efficacy of EI teletherapy, such as (1) access to internet/technology, (2) treatment acceptability (i.e. acknowledging the given treatment plan is acceptable, fair and potentially effective), and (3) overall knowledge and education of the treatment.

Current Study

There is some research on the efficacy of early intervention provided through teletherapy for children with ASD. Included in this body of research is a study conducted by Boisvert et al. (2010), which supported teletherapy as a useful tool in providing services to children with ASD. However, there is limited research evaluating the impacts of teletherapy to the several different pre-verbal and verbal aspects of communication and interaction, in this specific population. The current study administered a hybrid model of teletherapy and traditional face-to-face therapy to address the following research questions:

Research Question 1: How effective is the administration of a hybrid model to provide speech-language services to children with ASD compared to children without ASD?

Hypothesis 1: We hypothesize that children with ASD will make communicational gains but at a significantly slower rate than their peers without ASD.

Research Question 2: What is the effect of 20 speech-language therapy sessions provided via a hybrid model on the individual pre-verbal and verbal areas of the *Rosetti Infant-Toddler Language Scale (RITLS)* for children with ASD?

Hypothesis 2: Based on prior research that indicates atypical deficits in expressive and receptive vocabulary, we hypothesize that children with ASD will make progress in pre-verbal skills but require more therapy sessions to improve both receptive and expressive language skills.

METHODS

This study was approved by The University of Mississippi Institutional Review Board (IRB), and all caregivers provided informed consent.

Participants

All participants were recruited by Mississippi First Steps Early Intervention Program, who determined their need of services. In total, 10 children and their families participated in the study and completed 20 sessions of EI therapy. The main group consisted of five children with ASD, aged 21-32 months ($M = 26.8$), who received a combination of in-person and teletherapy services (hybrid model). The control group included five children without ASD, aged 19-27 months ($M = 23.8$), who also received a combination of in-person and teletherapy services (hybrid model). A description of the participant demographics is provided in Table 1 (see appendix). Both groups received a varying number of in-person services and teletherapy services. Table 3 (see appendix) explains the number of in-person and teletherapy services each participant received.

Procedures

General. The initial and final assessments, as well as the EI in-person therapy, took place at the North Mississippi Regional Center (NMRC) or the participant's home. Videoconferencing, using Zoom or similar platforms, were used to administer EI through teletherapy. Initially, the participants were assessed to establish their baseline and ceiling scores in all developmental areas using the *RITLS*. Baseline scores represented their mastered skills while ceiling scores referred to their developing skills. Following the initial assessment, each participant took part in the study for a five-month period and completed early intervention four times a month in 45-minute sessions, for a total of 20 sessions. Additionally, early intervention was strongly focused on parent training. After the twentieth session, the clinician reassessed the participants baseline and ceiling scores in all developmental areas to determine therapy progress.

The Rosetti Infant-Toddler Language Scale. A common comprehensive tool to assess the pre-verbal and verbal aspects of communication and interaction in children is referred to as the *RITLS*. This language scale assesses six developmental areas of communication and they are evaluated and scored by the clinician (see Table 2 in appendix for a description and example of the skills evaluated in each developmental area). The *RITLS* can be used to identify language delays in children from 0-36 months of age. Additionally, the *RITLS* classifies infant-toddler development into 3-month age intervals (e.g., 0-3 months, 3-6 months). In order for a child to master a particular developmental age level, the child must accurately demonstrate every skill for each of the six developmental areas. The highest completed developmental age level is considered the "baseline", and this is documented for each developmental language area. In the case the child does not master each task, the child's skills will be considered emerging in that developmental age

range. The earliest developmental age where the child has failed all skills from the developmental area will be considered the child's "ceiling", which is also documented for each developmental area. The achieved skills within the developmental areas directly under the child's established ceiling are referred to as "emerging skills". The *RITLS* is criterion referenced rather than a standardized assessment and prior research has effectively used the *RITLS* as a tool to assess language development in children. For an example, a study conducted by Dettman et al. (2007), used the *RITLS* as a communication assessment for children with profound bilateral hearing loss who received cochlear implants younger than 12 months of age. Overall, the *RITLS* is an efficient, easy to use, tool for EI specialists as it evaluates all areas of language through one examination (Crais, 2011).

RESULTS

Statistical analyses were undertaken using IBM SPSS Statistics 26. A lack of homogeneity in group variance and non-normally distributed data was found across both groups. Accordingly, a decision was made to use non-parametric statistics for all analyses. For all between-group comparisons, the Mann-Whitney U Tests were used to determine if there were differences in (1) interaction attachment, (2) pragmatics, (3) gesture, (4) play, (5) language comprehension, and (6) language expression between children with ASD (main group) and children without ASD (control group) before and after EI services (20 therapy sessions). An exact sampling distribution for U was used, with an alpha level of .05 (2-sided). For all within-group comparisons, Wilcoxon Signed Rank Tests were run to explore improvement in all six skill areas after 20 EI therapy sessions. Asymptotic significances were used, with an alpha level of .05 (2-sided). The results are presented according to specific group and task comparisons.

Group Comparison (Children with ASD vs. Children without ASD)

Before Early Intervention. No significant differences were found between groups for interaction attachment ($p = .140$), pragmatics ($p = .070$), gesture ($p = .077$), play ($p = .292$), language comprehension ($p = .172$), and language expression ($p = .108$) skills.

After Early Intervention. The median pragmatic score was statistically significantly higher in children without ASD (Mdn = 36 months) than in children with ASD (Mdn = 9 months), $p = .034$. The median language expression score was statistically significantly higher in children without ASD (Mdn = 21 months) than in children with ASD (Mdn = 6 months), $p = .035$. No significant differences were found between groups for interaction attachment ($p = 1.000$), gesture ($p = .054$), play ($p = .335$), and language comprehension ($p = .136$) skills.

Task Comparison (Children with ASD)

Interaction Attachment. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in interaction attachment in four participants, whereas one participant saw no change. This difference was not statistically significant, $p = .063$.

Pragmatics. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in pragmatics in three participants, whereas two participants saw no change. This difference was not statistically significant, $p = .102$.

Gesture. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in gesture in three participants, whereas two participants saw no change. This difference was not statistically significant, $p = .109$.

Play. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in play in four participants, whereas one participant saw no change. This difference was not statistically significant, $p = .068$.

Language Comprehension. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in language comprehension in two participants, whereas three participants saw no change. This difference was not statistically significant, $p = .180$.

Language Expression. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in language expression in three participants, whereas two participants saw no change. This difference was not statistically significant, $p = .102$.

Task Comparison (Children without ASD)

Interaction Attachment. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in interaction attachment in one participant, whereas four participants saw no change. This difference was not statistically significant, $p = .317$.

Pragmatics. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in pragmatics in three participants, whereas two participants saw no change. This difference was not statistically significant, $p = .109$.

Gesture. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in gesture in two participants, whereas three participants saw no change. This difference was not statistically significant, $p = .157$.

Play. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in play in four participants, whereas one participant saw no change. This difference was not statistically significant, $p = .066$.

Language Comprehension. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in language comprehension in three participants, whereas two participants saw no change. This difference was not statistically significant, $p = .109$.

Language Expression. Of the five participants recruited to the study, the 20 early intervention therapy sessions elicited an improvement in language expression in all five participants. There was a statistically significant median increase in language expression (9 months) from pre-intervention (9 months) to post-intervention (21 months), $p = .041$.

DISCUSSION

The purpose of the present study was to evaluate teletherapy as a means of delivering EI services to children with ASD. Research question 1 aimed to evaluate and compare the efficacy of a hybrid model of EI for children with and without ASD. Research question 2 aimed to evaluate the individual effects of hybrid EI services on the individual pre-verbal and verbal skills for children with ASD.

Research Question 1: Efficacy of Teletherapy for Children with ASD

The results of the current study indicate that prior to receiving intervention services, there was no statistical difference in all the pre-verbal and verbal skills between the two groups. This finding indicates all participants started hybrid EI therapy at the same skill level based on the initial *RITLS* assessment. After receiving 20 sessions of hybrid EI therapy, children with ASD showed no significant improvement in pre-verbal and verbal skills. However, this study did reveal improvement of skills in all pre-verbal and verbal areas of the *RITLS*, demonstrated by an increase of emerging skills. Although, the improvement was not statistically significant, this improvement is promising as children with ASD typically demonstrate delays in language acquisition and communication skills when compared to typically developing children (Talbot et al., 2020). Thus, despite these expected delays, the children in this study still managed to acquire new skills and progress throughout the hybrid therapy. This prevalence of emerging skills suggests EI through a hybrid model did benefit the group with ASD to some degree. However, the minimal progress in baseline scores and significant growth in ceiling scores suggest that children with ASD may need more time in therapy to fully master new communication skills (Ingersoll & Berger, 2015). To compensate for the developmental delay children with ASD experience, it may be beneficial to increase the amount of intervention hours (e.g., increase to 30 sessions rather than 20) the child receives to maximize the benefits of EI, especially when delivered through hybrid therapy. For an example, Ingersoll & Berger (2015), found the importance of teaching the parent various intervention techniques that allow them to incorporate EI into their daily routines. This technique effectively increases the number of intervention hours the child receives, which is optimal for children with ASD in order to maximize their potential progress in EI (Ingersoll & Berger, 2015). Overall, the progression of emerging skills is a promising indicator that EI delivered through the

hybrid model is effective in progressing pre-verbal and verbal skills to a degree. However, the child will likely need more intervention hours either with the clinician or implemented at home with the parents (Ingersoll & Berger, 2015). This will give them the extra time they need to fully develop their emerging skills and subsequently, improving their overall language skills.

Research Question 2: Impacts to Pre-verbal and Verbal Skills

Although the ASD group did make progress in emerging skills following the hybrid therapy, the results indicate there was no significant difference when the initial assessment scores were compared to the final assessment scores in skills related to expressive and receptive language. Additionally, after 20 EI hybrid sessions children without ASD showed significant improvement in the areas of pragmatics and language expression as compared to children with ASD. More specifically, children without ASD showed a statistically significant median increase in language expression from pre-intervention (9 months) to post-intervention (21 months). This finding is consistent to prior research indicating typically developing children are consistently able to display much larger receptive vocabulary than expressive vocabulary (McDaniel et al., 2018). In contrast, children with ASD exhibit severe deficits and abnormal variance of development in expressive and receptive vocabulary (McDaniel et al., 2018). These deficits are typically the result of decreased joint attention skills including lack of eye contact, social attention and/or focus. Tenenbaum et al. (2014) assert that typical developing children begin responding to joint attention (i.e., the ability to share attention between two individuals on a specific object) between the ages of six to twelve months, whereas children with ASD show impaired joint attention throughout toddlerhood. It is important to understand and recognize the various factors, such as joint and/or social focus, that influence the child's ability to acquire expressive and receptive language in order

to implement effective therapy. For example, in a study conducted by Chawarska et al. (2012), they found when facilitating therapy to children with ASD, the child made the most improvement when they had visual access and attention to the clinician. Thus, suggesting EI for children with ASD is most effective when the client is face-to-face with the child, encouraging eye-contact and social and/or joint attention (Chawarska et al., 2012). Unfortunately, when EI is provided through teletherapy, the child may not be able to connect with the clinician and practice behaviors that impact the acquisition of expressive and receptive language. Overall, the results of the current study are consistent with previous research and support our hypothesis that children with ASD will make progress in pre-verbal skills but may require more therapy sessions, specifically 1:1 in person sessions, to maximize their progress in receptive and expressive language skills (Chawarska et al., 2012). Additionally, when this population is provided hybrid therapy, the 1:1 in-person sessions would be best utilized to practice their visual focus on the SLP, stimulate social attention, and eye-contact in order to further develop expressive and receptive skills (McDaniel et al., 2018). However, the clinician conducting the EI sessions did anecdotally note that the children with ASD seemed more attentive over teletherapy than when in-person. Thus, the lack of attentiveness in-person could be directly related to the lack of social and communication skills of this population (McDaniel et al., 2018). The results of the current study indicate that providing EI through hybrid therapy for children with ASD may not be sufficient to address the expressive and receptive deficits commonly observed in this population. However, it might be beneficial to continue with a hybrid model of teletherapy and in-person services in combination with an overall increase of therapy sessions.

Limitations and Future Directions

The greatest limitation of this study is the small sample size ($n = 10$). The small sample size may have been the result of COVID-19, as many parents were hesitant to participate in the study and for that reason the population was limited. Additionally, COVID-19 resulted in a varying number of sessions for each type of service delivery for all participants in the study. This was caused by (1) the varying number of sessions that were completed before COVID-19 and (2) the inability to travel to homes due to public safety issues after the stay-at-home orders were lifted (WHO, 2020). Nonetheless, because of the teletherapy component of hybrid service delivery, participants were still able to receive services despite national shutdown (WHO, 2020). Regardless, a large-scale replication of this study would be necessary to fully evaluate the efficacy of hybrid therapy for children with ASD. An additional limitation was the timing of the study. The study was conducted during the COVID-19 pandemic, which was and still is an unprecedented and unpredictable time period. Also, the study did not account for the stress that the participants and their families may have experienced during the pandemic. In general, recommended EI services for children with ASD typically involve naturalized, routine-based techniques (Simacek et al., 2017). However, due to COVID-19 many of the participants experienced abnormal and unfamiliar routines, which may have increased stress or distractions (Constantino et al., 2020). Lastly, the clinician who administered all of the EI sessions did have adequate experience in delivering in-person services. However, the clinician was inexperienced in delivering teletherapy EI sessions. This inexperience may have also limited the outcomes of our study.

To expand upon the current study, further research could address the variance in the number of sessions delivered in-person and through teletherapy for each participant. A future study

could eliminate this variance by systematically keeping the number of sessions for each service delivery consistent across all participants. Additionally, to address the COVID-19 limitation, a parent-survey could be used to account for any stressors and/or distractions at home caused by the change in routine (i.e., transitioning from receiving in-person therapy to teletherapy) (Constantino et al., 2020). Noting these factors would help control for any outlying variables that may impact the overall efficacy of teletherapy. To further test the first research question, a study comparing progress made after 20 sessions to 40 sessions could determine whether or not children with ASD will need more therapy sessions to fully develop language skills when receiving EI through teletherapy. Additionally, a study of two groups of children with ASD where one group receives teletherapy and the other receives in-person therapy could further evaluate how the various language areas of the RITLS are impacted through delivery methods.

Finally, the target population of the current study were children with ASD. However, further research could be useful in determining if EI hybrid services are effective across all ages and disorders. This would be particularly important considering that there may be existing barriers that hinder all people from receiving the services they need, especially during the COVID-19 pandemic. Therefore, there is an increasing relevance and need of teletherapy and further research could determine its efficacy across multiple populations.

Clinical Implications

Despite these limitations, the findings of this study highlight the importance of understanding the mechanisms behind social communications for children with ASD (McDaniel et al., 2018). More specifically, understanding the relationship between joint attention and expressive and receptive language could help identify crucial targets of intervention to children

with ASD (Chawarska et al., 2012). Additionally, when SLPs provide hybrid EI therapy to this specific population, the in-person sessions would be better utilized to address the receptive and expressive delays as the SLP can directly target eye-contact and joint-attention (Chawarska et al., 2012). Furthermore, additional SLP training and education on how to target these skills through teletherapy would also be beneficial.

Although this current study cannot determine the efficacy of EI hybrid services for children with ASD, the results can provide insight to SLPs when they provide teletherapy services. Based on these current results, SLPs can expect children with ASD to require increased amount of intervention hours than children without ASD. Additionally, they can expect progress in all pre-verbal and verbal areas, but expressive and receptive language may need to be addressed in-person in order to maximize potential progress. Furthermore, this study will allow SLPs to expand their knowledge and confidence in teletherapy. Increasing confidence and education on this topic is important, especially during the ongoing, COVID-19 pandemic. At this point, due to COVID-19, in-person services are limited, and many children are not able to receive the intervention they need. Increasing SLPs confidence in this form of therapy will likely increase the implementation of teletherapy services and allow SLPs the ability to treat a larger population in need of services.

Conclusion

In the current study, children with ASD demonstrated improvement in all skill areas after 20 early intervention sessions, but the improvement was not statistically significant. Therefore, the results lend further support to previous research, suggesting that children with ASD may need more intervention hours in order to fully master new communication skills compared to children

without ASD. In addition, these children may benefit from a balanced combination of teletherapy and traditional 1:1 services in order to maximize their progress.

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Appendix

Table 1. Participant Demographics

Characteristic	<i>n</i>	Percentage
Sex		
Male	6	60%
Female	4	40%
Age (in months*)		
19-21 Months	2	20%
22-24 Months	1	10%
25-28 Months	5	50%
29-32 Months	2	20%

Table 2. RITLS Description

Developmental Area	Target	Example of Skills
Interaction Attachment	The social connection and attachment between the parent and the child.	Requests assistance from an adult.
Pragmatics	The child's ability to socialize in a communicational way.	Uses vocalizations and words during pretend play.
Gesture	The child's ability to communicate through the use of gestural motion.	Pretends to write or type.
Play	The individual and interactional use of play to establish the use of their thoughts and creativity.	Uses most toys appropriately.
Language Comprehension	The extent the child can understand verbal language and meaning with and without nonlinguistic cues.	Points to four action words in pictures.
Language Expression	The child's ability to use both preverbal and verbal mechanisms to communicate their thoughts.	Imitates two numbers or unrelated words upon request.

Table 3. Service Delivery Breakdown

Participant	Face-to-Face	Teletherapy
Group with ASD		
1	6	14
2	0	20
3	4	16
4	0	20
5	7	13
Group without ASD		
1	5	15
2	9	11
3	9	11
4	1	19
5	10	10